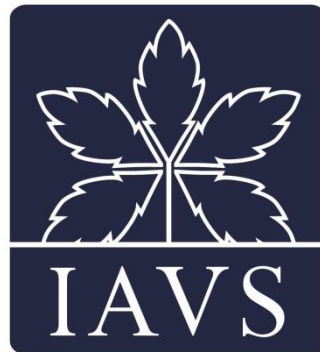IAVS 2016

59th Annual Symposium of the International Association for Vegetation Science

Conservation of Plant Communities: From Environmental Drivers to Ecosystem Services
12—17 June 2016, Pirenópolis, Brazil

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Abstracts

Index

Session: Climate change and plant communities

Session: Communication for vegetation scientists

Session: Community assembly and species diversity

Session: Concepts in ecological stability

Session: Conservation of plant communities: from science to policy

Session: Fire and grazing in non-forest vegetation

Session: Functional and phylogenetic patterns in plant communities

Session: Historical human legacy in vegetation

Session: Linking vegetation to ecosystem services

Session: Multivariate methods in vegetation ecology

Session: Plant community invasion

Session: Plant strategies and disturbance

Session: Restoration of subtropical and tropical grasslands and savannas

Session: Underground processes in plant communities

Giselda Durigan, Instituto Florestal, Assis, SP, Brazil

Biosketch
Giselda Durigan has a degree and MsC in forestry by ESALQ-USP, PhD in Plant Biology by UNICAMP, and a pos-doc at the Royal Botanic Garden Edinburgh, Scotland. She is a researcher at Instituto Florestal de São Paulo, colaborating in postgraduate courses of Forest Science (UNESP-Botucatu) and Ecology (UNICAMP), and is a member of the Editorial Board of the journal *Restoration Ecology*. Her researches have been focused on Ecology, Conservation and Restoration of Cerrado and Atlantic Forest.

Title
Cerrado ecology, ecosystem services and management decisions

Abstract
The Brazilian Cerrado is the dominant vegetation of Central Brazil, originally covering c. 2 million km^2, representing about 25% of the land surface of the country. Cerrado is the moistest and richest savanna regions of the world, and, like other savannas, is highly flammable during the dry season and therefore typically subject to frequent fires. Most of the soils in the Cerrado region are well-drained and dystrophic, and this was the reason why the region was neglected for agricultural expansion until five decades ago. Technological advances, such as irrigation, and genetic improvement in the last decades, however, provided that more than half of the total area of the Cerrado domain has been converted to arable cultivation, pasture or forest plantations (provisioning ecosystem services), and the remainder faces huge challenges for conservation. Among these are fragmentation of natural areas, biological invasions and inadequate fire management. Increase in fire frequency and intensity, as well as the extreme opposite of total fire suppression, have jeopardized Cerrado biodiversity in different ways, requiring urgent actions. A recent and unexpected additional threat has been faced by the Cerrado and other savannas in the world: the afforestation programs aiming at carbon sequestration. Based on the premise that tropical ecosystems without trees are degraded, these programs, already ongoing, are based on planting trees in high density over extensive areas of tropical grassy ecosystems in the whole extension of the savanna biome, including the Cerrado. These attempts to offset the devastation of tropical forests in the past (true deforestation) through afforestation of the grassy biomes will simply worsen biodiversity losses and further compromise ecosystem services, such as water and energy supply. The poor knowledge on the nature and relevance of ecosystem services provided by the Cerrado, the neglect of the non-arboreal biodiversity and the lack of effectively sustainable management alternatives have made the biome as a whole highly vulnerable to conversion to other land uses at an alarming rate compared to other savannas of the world.

Marcelo Tabarelli, Universidade Federal de Pernambuco, Brazil

Biosketch
Marcelo Tabarelli is an Associate Professor in the Department of Botany at the Pernambuco Federal University, Brazil. He is interested in plant ecology and conservation in the context of neotropical biotas, with special attention to key concepts such as biotic homogenization and impoverishment, secondarization, and biodiversity-friendly landscapes. He is member of the Association of Tropical Biology and Conservation. At federal level he has frequently served in deliberative and consultancy committees at CNPq, CAPES and Conservation International of Brazil (CI-Brazil), with contribution to scientific public policies and initiatives, such as the Brazilian Program of Long-term Ecological Research (PELD-CNPq), in which he has been involved since 2008.

Title
Chronic anthropogenic disturbances in tropical forests: negative impacts from population to ecosystem level

Abstract
Tropical forest biotas have been rapidly converted into human-modified landscapes with unanticipated consequences for biodiversity persistence, ecological services and rural sustainability. In addition to habitat loss and fragmentation, remaining forest habitats are exposed to collection of forest products such as firewood, forage for livestock and bush meat. Such a regular extraction of forest biomass was recently defined as chronicle anthropogenic disturbances (CAD), triggering an increasing interest for this unappreciated topic. A preliminary overview of available literature, particularly that addressing evergreen and dry forests in Brazil, Mexico and India, supports interesting working hypotheses: CAD represent a key feature of those socioecological systems consisting of low-income rural populations devoted to subsistence activities (agriculture + livestock). It implies that a reasonable portion of tropical biodiversity and hundreds of human populations are exposed to CAD effects. Although CAD are frequently measured by proxies, they potentially result in a myriad of direct and indirect effects on multiple levels of biological organization (from individual to ecosystem level) and multiple spatial scales, including population collapse and species extinction, biological invasion, proliferation of disturbance adapted species, biological homogenization, arrested succession, and desertification. Growth of human populations, climatic changes and extreme climatic events are likely to increment the need for forest products and agricultural lands, speeding up CAD-mediated degradation with drastic implications for sustainability. In this perspective, a consistent theoretical and methodological framework is required to move research forward.

William Bond, Emeritus Professor at the University of Cape Town, SAEON, National Research Foundation, South Africa and Department of Biological Sciences, University of Cape Town, Rondebosch, South Africa

Biosketch

William Bond is Chief Scientist of the South African Environmental Observation Network and an Emeritus Professor in Biological Sciences at the University of Cape Town. He is an ecologist with broad interests in the processes most strongly influencing vegetation change in the past and present, including fire, vertebrate herbivory, atmospheric CO_2 and climate change. He has also worked on plant-animal mutualisms and on plant form and function. He has particular interests in grasslands and savanna ecosystems and in winter rainfall shrublands. He has served on the Boards of the South African National Botanical Institute and of Cape Nature and on the Editorial Boards of several journals. He has published some 200 papers and has co-authored three books. He was elected a Foreign Associate of the National Academy of Sciences, USA, in 2013.

Title

Challenges in the conservation of savanna/forest mosaics

Abstract

Savanna/forest mosaics are common in many tropical and sub-tropical landscapes. Conservation of these strikingly different vegetation types has been a vexed issue in tropical ecology. Savannas have long been perceived to be secondarily derived from forests through felling and burning. However there is diverse evidence for the ancient origins of many savannas indicating that they are far older than human deforestation activities. Many (though not all) savannas require frequent fires to maintain the rich diversity of shade-intolerant plants adapted to grass-fuelled fires. Forests, in contrast, are threatened by fires though forest margin species, where they exist, are resistant to fire damage. Global change is promoting forest colonisation of some savannas, in part because of increased woody plant growth rates due to increasing atmospheric CO_2. Global warming, in contrast, may be increasing the frequency of extreme fire weather promoting fire storms which burn deep into forests. This talk explores the conservation challenges of conserving savanna-forest mosaics where both vegetation states are seen to contribute to overall biodiversity.

José Paruelo, Laboratorio de Análisis Regional y Teledetección, Facultad de Agronomía e IFEVA. UBA y CONICET, Argentina.

Biosketch

José Paruelo is a Professor in the Department of Quantitative Methods and Information Systems at the Agronomy College (UBA, Argentina) in Argentina and in the Institute of Ecology and Environmental Sciences at the College of Sciences (UdelaR, Uruguay). He is a Senior Scientists at IFEVA (CONICET, Argentina). His research focuses on understanding the consequences of human interventions on the structure and functioning of plant communities and ecosystems at different scales, from a single patch to continents. His studies were concentrated in the Patagonia steppes, the Gran Chaco dry forests and the Rio de la Plata grasslands where he analyzed the effects of grazing, agriculture and afforestation on species and functional diversity and carbon and water dynamics. He developed new approaches to characterize ecosystem functioning at regional scales based on remotely sensed data. In 2007 he won the Scopus Award and in 2013 the Konex Diploma. From 2006 to 2014 he was the Chair of the Environmental Science degree at UBA (Argentina). He was associated editor of *Global Ecology and Biogeography and Ecosystems* and now of the *Journal of Vegetation Science* (IAVS) and *Ecosphere* (ESA).

Title

From vegetation science to ecosystem services assessment

Abstract

The assessment of the demand and supply of ecosystem services (ES) became a major issue both at the academic and decision making level. The connection between ES access and human welfare makes its estimation relevant from a social, economical and political perspective. How did vegetation science contribute to ecosystem services assessment? Moreover, how does it may contribute in the future? In this talk I will explore the connection between the structural and functional characterization of plant communities and ecosystems and ES provision. Vegetation science provides the building blocks of "production functions" that connect the structural and functional attributes with Final ES and, ultimately, with benefits. "Impact functions" allow evaluating how these attributes varied along gradients of anthropogenic stress of disturbances.

Daniel Simberloff, University of Tennessee, USA

Biosketch

Daniel Simberloff is a Professor in the Department of Ecology and Evolutionary Biology at the University of Tennessee. His research is mainly on invasion biology and community ecology. He is editor-in-chief of *Biological Invasions*, editor (with Marcel Rejmánek) of the *Encyclopedia of Biological Invasions* (2011), and author of *Invasive Species: What Everyone Needs to Know* (2013). In 2006 the Ecological Society of America named him Eminent Ecologist, and he won the Margalef Prize in Ecology in 2012. He is a member of the U.S. National Academy of Sciences and the American Academy of Arts and Sciences. His research projects are on insects, plants, fungi, birds, and mammals. He studies the large variety of effects invasive species can have on native populations, communities, and ecosystems, as well as management and policy options for dealing with invasions and for conservation of threatened populations and ecosystems.

Title

Invasions of tropical plant communities: Fewer than those elsewhere, or just less studied?

Abstract

A frequently repeated dictum of invasion biology is that the tropics, and tropical forests in particular, are relatively resistant to invasion. Explanations for the claimed pattern include lower propagule pressure, faster recovery from disturbance, and more intense biological resistance because of greater species richness. In fact, this last explanation for the perceived pattern is one of the key observations adduced as evidence for the general ecological argument that diversity begets stability. Recent quantitative data support the pattern for continents but not for islands, at least in terms of numbers of established introduced species, but they do not suggest any particular mechanism and they do not directly bear on impact. Even if some tropical plant communities have been invaded less than temperate communities, they still harbor many non-native species, of which many are invasive, and the numbers are growing. For at least two proposed drivers of the pattern – propagule pressure and disturbance – the rates are growing. Further, many high-impact invasions depend on idiosyncrasies of particular introduced species and recipient native communities that would be captured at best crudely and indirectly by available quantitative data. All these considerations suggest that exclusion and control efforts should be at least as intensive in the tropics as in temperate regions.

Hanna Tuomisto, University of Turku, Finland

Biosketch
Hanna Tuomisto is Senior Lecturer in Biodiversity Research and leader of the Amazon Research Team at the University of Turku, Finland. She is interested in the diversity of Amazonian forests, both in terms of communities and of species. She has especially focused on developing methods to facilitate the identification and mapping of compositional heterogeneity in these megadiverse forests, such as use of satellite images and indicator plant groups. She has also studied the relationships between plant community composition, local edaphic conditions and geological history of the continent to gain understanding on the past and present drivers of community heterogeneity. Her favourite indicator plants are the ferns, and she is studying their ecology, taxonomy and evolutionary history in some detail. She is also interested in numerical ecology and the clarification of important concepts, especially those related to beta diversity.

Title
Diversity in Amazonian rain forests: scaling up from local communities to conservation planning

Abstract
Amazonian rain forests are famous for their extremely species-rich plant communities at the local scale, but not all plant communities within the biome are equally rich. Furthermore, high species turnover has been documented among different plant communities even within uniform-looking rain forests. In many cases, variation in local species richness and species composition is obviously environmentally driven, and there is by now solid evidence that the availability of soil nutrients and moisture are among the important environmental variables in this context. Identifying and mapping such patterns at the broad scale is a crucial step towards informed conservation planning, which needs to be concerned with the overall representativeness of the conservation efforts. Doing so requires the use of broad-scale datasets, the most important of which include satellite images and digital elevation models. These can be used to extrapolate information from restricted field localities to larger areas. This is currently an active field of research, and important advances are being made that have the potential to drastically change how Amazonian forests are viewed in ecological research and conservation planning.

Pille Gerhold, University of Tartu, Estonia

Biosketch

Pille Gerhold is a researcher at the Institute of Ecology and Earth Sciences, University of Tartu, Estonia. She has been conducting research on plants as well as animals in Switzerland (ETH Zürich), Germany (TU Kaiserslautern), the Netherlands (Radboud University Nijmegen) and Brazil (UFPE Recife). She is interested in patterns and mechanisms of biodiversity across organisms and above the species level. She completed her PhD on the effects of forest fragmentation on the trophic web of leaf-cutting ants in the Atlantic rainforest. Since then she is studying phylogenetic diversity of native and invasive plant communities, from 1x1 m plot to below-ground dimensions, on macroecological or Late Glacial scale. Her recent focus is on the question how evolutionary processes have shaped local co-existence in contemporary ecosystems and *vice versa*, and how local assembly processes can result in macro-evolutionary patterns.

Title

Don't put all your eggs in one basket: measuring phylogenetic diversity in ecosystems

Abstract

Phylogenies are becoming available for most organisms on Earth. Phylogenetic relationships are therefore being increasingly used, however, most commonly as proxies to functional patterns in order to infer mechanisms of species co-existence (i.e. community assembly). Specifically, it is assumed that close relatives will coexist in communities (phylogenetic clustering) only when some habitat filter has selected for specific traits. In contrast, it is believed that close relatives will not coexist in a community (phylogenetic over-dispersion) when competition is occurring. This proxy-approach, however, is based on untested assumptions, as for example trait similarity among close relatives, and that phylogenetic structure reflects only local and present-day processes. There is, however, increasing evidence from various groups of organisms that macroecological and evolutionary mechanisms are at least as important as small-scale and contemporary processes in shaping present-day local communities. I will hence discuss in my talk the eco-evolutionary approach of phylogenetic diversity. This approach aims at putting history and evolution into the explanation for current patterns of biodiversity. We can study for example whether local coexistence affects evolution, and, *vice versa*, how evolution affects present-day coexistence, resulting in phylogenetic patterns that cannot be explained by local processes. Therefore some of the following questions are interesting to address: What is the role of biogeographical processes in shaping phylogenetic structure of plant communities in different biomes and continents? Have past environmental conditions shaped contemporary phylogenetic diversity? Does the evolutionary age of a vegetation type influence present-day community phylogenetic structure? What about other trophic levels associated with plant communities: do they "track" their evolutionary habitat, reflecting past processes in vegetation? How is the research on phylogenetic diversity related to nature conservation?

Fabio Rubio Scarano, Brazilian Foundation for Sustainable Development, Brazil and Universidade Federal do Rio de Janeiro

Biosketch

Fabio Rubio Scarano is the Executive Director of the Brazilian Foundation for Sustainable Development (FBDS) since May 2015. He leads the scientific components of the projects undertaken by the Foundation, especially on themes related to biodiversity and ecosystem services, climate change adaptation and sustainable agriculture. Fabio has a degree in Forestry from the University of Brasília, Brazil, and a Ph.D. in Ecology from the University of St. Andrews, Scotland. He has been an Associate Professor of Ecology at the Federal University of Rio de Janeiro, Brazil since 1993. Prior to joining FBDS Fabio worked for private companies in the forestry sector in Brazil. For the Brazilian government, he held positions in the Ministry of Education (2005-2011) and Ministry of Environment (2007-2009), when he was Science Director of the Botanical Gardens of Rio de Janeiro. He has also been a leader at the NGO Conservation International (CI), where he was Executive Director for the Brazil program (2009-2011) and Senior Vice-President for the Americas Division (2011-2015). He has been a lead author in the latest report of the IPCC and is currently coordinating lead author of the IPBES. Currently his main interests are climate change adaptation, sustainability science, sustainable agriculture, communication science-decision making, and biodiversity conservation.

Title
Ecosystem-based adaptation to climate change: an opportunity for Brazil

Abstract

Ecosystem-based adaptation (EbA) to climate change provides a framework that links biodiversity conservation, climate change and human wellbeing from a science-to-policy perspective. It is a term that refers to policies and practices that are based on the premise that ecosystem services protected or restored reduce the vulnerability of society to climate change and promote socioeconomic welfare. In South America EbA practices are increasingly common and include, among others, the effective management and establishment of protected areas, conservation agreements and payment for ecosystem services, community management of natural areas, and forest restoration – whenever such schemes are designed to protect or restore key ecosystem services and improve livelihoods. Brazil plays a leading role in EbA, as recently seen by the Intended Nationally Determined Contributions (INDC) announced by the Brazilian government at the UNFCCC's COP 21. The Brazilian INDC is strongly based on conservation, anti-deforestation, and restoration commitments, all backed up by relevant national legislation. This indicates the country's willingness to launch what is probably the largest EbA initiative in the planet. In this paper, I will: a) present some of the main types of EbA initiatives ongoing in Brazil and give examples; b) discuss the need to integrate vegetation science to other disciplines to monitor and evaluate such types of initiatives so as to inform policy; c) discuss the existing gaps to be filled and how the private sector has an important role to play in this process; d) discuss the potential for south-south collaboration in science and policy applications related to EbA.

Oral and Poster Contributions

Affeld K.

Oral presentation
Using classification assignment rules to assess national and regional biodiversity impacts of land-use change proposals
Session: Conservation of plant communities: from science to policy

Kathrin Affeld[1], Norman Mason[1], Ian Payton[1], Miquel de Caceres[2] & Susan Wiser[1]

[1]*Landcare Research and* [2]*Biodiversity and Landscape Ecology Laboratory, Forest Science Centre of Catalonia*
wisers@landcareresearch.co.nz

Gap analysis uses mapped species and ecosystem distributions to set priorities for biodiversity conservation. Such analyses cannot be conducted, however, when maps of species or ecosystems are non-existent, incomplete or too coarse in their resolution. Here we demonstrate how high quality vegetation plot data can be used to conduct a comparable assessment for a proposal that will destroy natural vegetation of a catchment. This approach answers the questions (i) How well are plant communities to be destroyed represented locally, regionally and nationally; and (ii) How well is the combination of plant communities found in the targeted catchment represented in other catchments regionally and nationally? For local and regional comparisons plant species composition was recorded on 45 objectively located 100m^2 vegetation plots at each of three sites. Plot records sourced from the New Zealand National Vegetation Survey Databank provided the national context for assessing how well individual and combinations of plant communities at the three sample sites are represented nationally. PERMANOVA and PERMDISP analyses tested for differences in the composition and structure of plant communities within and across sites. The fuzzy classification framework of Noise Clustering was used to assign plant composition data to community alliances and associations of a national-scale classification. We found highly significant differences in plant species composition within and among sites, although the level of beta-diversity was consistent across sites. A total of nine alliances and ten associations were present in the study catchment and range from those that are widespread across New Zealand to those that are restricted to few catchments. In the targeted catchment the combination of communities present was unique and the diversity of communities higher than predicted based on catchment size and sampling intensity. The ability to assign plots to a pre-existing national-scale classification provides a valuable tool for assessing the composition and distribution of communities across a wide range of spatial scales and varying levels of resolution. As such it can provide useful information for biodiversity assessments that can help guide the decision making process for conservation and resource managers.

Aleksanyan A.

Oral presentation
Assessment of impacts of climate change on ecosystems with rare and endangered species of (case study of Armenia)
Session: Climate change and plant communities

Alla Aleksanyan & Georgi Fayvush

Institute of Botany of NAS Armenia
alla.alexanyan@gmail.com

Climate change is one of the most pressing environment and development challenges confronting humanity today. Over the past few decades, evidence has mounted that planetary-scale changes are occurring rapidly. In Armenia during the last 5 decades the annual average temperature increased on 1.03°C. These are, in turn, changing the patterns of forcing and feedbacks that characterize the internal dynamics of the Earth System. On a basis of meteorological data and predicted scenarios of climate change in Armenia was carried out vulnerability assessment of certain rare species, included in the Red Book of Armenia, on the basis of the vulnerability of ecosystems in which they are growing. As a basic model for assessing the vulnerability of natural ecosystems and for further forecasting of changes of favorable climatic conditions was used the adapted scheme Holdridge Life Zones for mountainous conditions of Armenia. During assessment of possible impact of climate change on rare and endangered plant species, we've taken into account not only the possible changes in ecosystems and the ecological amplitude of the adaptation of these species, the diversity of habitats in which these species can be conserved, the abundance of their populations, but also other internal and external factors. According to our results, forecasted climate change will cause a change of nearly all ecosystems of Armenia, which will affect on the status of populations and distribution of many plant species. In some cases, these changes will have a positive impact and will contribute to the improvement of the status of populations and the wider distribution of rare species. In other cases, it will have a clearly negative impact. According to our hypotheses from 452 rare species included the Red Book, for 87 species, the climate change is referred as one of the main threats for their existence in the territory of Armenia, for 238 species will have no significant impact, and for 140 species climate change conditions will significantly improve.

Alves R.J.V.

Oral presentation
Underground forests on white-sand: adaptation or local response to extreme conditions?
Session: Plant strategies and disturbance

Ruy J.V. Alves, Alessandra R. Guimarães, Kelly Antunes, Alessandra M. de Paiva, Aluísio J. Fernandes-Junior & Nílber G. da Silva

Universidade Federal do Rio de Janeiro, Museu Nacional, Departamento de Botânica
ruyvalka1@gmail.com

Underground trees are a rare and peculiar growth form known for over a century from tropical savanna vegetation with seasonal droughts and a fire regime, both from Africa and the Brazilian Cerrado province. In this study we describe the structure of vegetation dominated by underground trees belonging to ten sympatric species: *Anacardium humile* A. St.-Hil., *Andira humilis* Mart. ex Benth., *Byrsonima subterranea* Brade and Markgr., *Cordiera humilis* (K. Schum.) Kuntze var. *humilis*, *Duguetia furfuracea* (A. St.-Hil.) Saff., *Erythroxylum deciduum* A. St.-Hil., *Eugenia punicifolia* (Kunth) DC., *Jacaranda decurrens* Cham., *Ouratea floribunda* (A.St.-Hil.) Engl., and *Psidium* cf. *australe* Cambess. Whether this convergent growth form has developed locally as a direct response to environmental variables, or whether it evolved from upright tree ancestors is still a matter of debate. Of the 121 vascular plant species sampled by relevés in the study site, at least 67 species (55%) are geophytes. Such a high proportion with underground systems including as lignotubers, bulbs and corms has never been reported from any Neotropical plant community and was unexpected in shallow white-sand. The underground forest described herein is currently threatened especially by mining and cattle. A brief vegetation description is complemented by floristics and seasonality data for each layer and a discussion of the possible convergent origins of the underground tree life form in several unrelated taxa. This survey is meant to subsidize further vegetation studies as well as measures aimed at the protection of underground forests, currently threatened by mining operations.

Andrade B.

Oral presentation
What are the main drivers that govern grassland vegetation abundance in South Brazilian grasslands?
Session: Classification, structure and dynamics of plant communities

Bianca O. Andrade[1,2], Ilsi I. Boldrini[1,2] & Gerhard E. Overbeck[1,2]

[1]*Federal University of Rio Grande do Sul and* [2]*Graduate Program in Botany*
andradebo@gmail.com

Grassland structure and composition varies in a latitudinal gradient in South Brazilian grasslands coincident with variation in geology and soil properties. There is an urgent need to determine the environmental filters that control grassland species composition to give support to restoration and conservation approaches. Thus, we aimed to determine the relative contribution of climate and soil on grassland community composition, not only the native species but also non-native and ruderal ones. We surveyed plant, soil and landscape characteristics at 56 grassland sites. Multivariate statistical methods were used to explore spatial patterns and driving factors of plant grassland community in all three states of South Brazil (Paraná, Santa Catarina and Rio Grande do Sul), across two biomes: Atlantic Forest (Highland grasslands) and Pampa. Redundancy analysis (RDA) showed non-random concordance between vegetation, soil and climate parameters. This approach enabled us to analyze a complex system with two landscape fragmentation degrees to identify direct and indirect effects that govern vegetation abundance. We found marked differences in the main factors that explained vegetation variance between biomes, as well as, the ones that govern native and non-native species. Variation partitioning, based on partial RDA, revealed that climatic and soil factors played important roles in structuring the vegetation community by explaining together 35% and 23% of total vegetation variation, respectively for Highland and Pampa grasslands. Soil and climate factors together explained a good amount of the variance in plant species composition between and within biomes, in comparison to the pure factors contribution. Concerning to non-native species, soil and climatic factor explained 25% of its variance. The main drivers caught our attention, since are related to soil acidity. We suggest that quantitative evaluation of variability allows conservation and management issues, increasing decision-making efficacy in complex managed landscapes.

Apostolova I.

Poster presentation
From National Vegetation Database to ecosystem services assessment in Bulgaria
Session: Linking vegetation to ecosystem services

Iva Apostolova[1], Desislava Sopotlieva[1], Nikolay Velev[1], Tsvetelina Terziyska[1], Kiril Vassilev[1], Ventzeslav Dimitrov[2], Hristo Pedashenko[1], Yasen Stoyanov [1] & Vassil Vassilev [3]

[1]Institute for Biodiversity and Ecosystem research;[2]Space Research and Technology Institute and [3]Remote Sensing Application Center
iva.apostolova@gmail.com

The growing demands for nature resources accelerate ecosystem services assessment in all countries. Projects for mapping and assessment of ecosystems conditions and their services in Bulgaria started in late 2015 and are funded by EEA Grants through Ministry of Environment and Waters. Nine major ecosystems were selected according to EUNIS Level 2. The aim of all projects is to focus on the territories situated outside NATURA 2000 network, for which less data on country scale exists so far. The target of our project grassland ecosystems. Considering the approved methodology, they were subdivided to dry, mesic, wet and seasonally wet, alpine and subalpine grasslands and inland salt steppes. We used as a major information source the National Vegetation Database (GIVD EU-BG-001) and national records in two other databases (GIVD EU-00-013; EU-00-019) to implement the methodology and achieve the project objectives. Grassland types are spread over the country and comprise ca. 70000 polygons, while vegetation records in the databases are about 20000. Vegetation relevés are used to identify grassland type, species richness, projection coverage, presence of medicinal and rare species, management type and threats. Looking at the percentage of plant functional groups occurrence in the grassland types, there is evidence that the forbs prevail in all types following by grasses. Legumes have high occurrence in mesic and wet and seasonally wet grasslands. Sedges occupy mostly alpine and subalpine and mesic grasslands. Species richness of forbs often exceeds 30 species per relevé in dry and mesic types. Richness of grasses is highest in alpine grasslands, following by inland salt steppes. Legume plants are most diverse in wet and seasonally wet grasslands. Vegetation relevés contain information about presence of alien or ruderal species, which marks the quality of grassland ecosystems.

Arcela V.

Poster presentation
Indicator species of flooded and non-flooded zones in a gallery forest at Brasília National Park, Federal District
Session: Classification, structure and dynamics of plant communities

Vicente Arcela & Cássia B.R. Munhoz

University of Brasília
vic.floresta@gmail.com

In the Cerrado gallery forests are associated with streams located mainly in the valleys. Despite covering only 0.5% of the national territory, gallery forests contain more than 30% of Brazilian phanerogams. In general, studies in the gallery forests of Central Brazil indicate that the tree-layer is dense, rich in species and highly diverse. The aim of this study was to evaluate the floristic composition and structure in the gallery forest of the Bananal river in the Brasília National Park. We installed 86 permanent plots (10 x 10 m each) under different soil moisture conditions. In each plot we sampled trees with a diameter at breast high > 5 cm and measured the soil moisture. Phytosociological parameters, TWINSPAN cluster analysis and indicator species analysis (ISA) were calculated. We found 92 species, belonging to 77 genera and 42 families. Families which most contributed to local richness were Myrtaceae, Fabaceae and Rubiaceae. The most representative species was *Tapirira guianensis*. Density (1,673 ind.ha^{-1}) and basal area (32.03 m .ha^{-1}) of the community are within the range normally found in gallery forests at the Federal District, Brazil. The first division of TWINSPAN separated flooded from non-flooded plots. The second division separated the flooded plots into two groups: plots located on the edges of the fragment that border wet grasslands (group 1) from plots located close to an adjacent small stream (group 2). According to ISA, group 1 was represented by *Lamanonia brasiliensis* Zickel & Leitão, *Magnolia ovata* (A.St.-Hil.) Spreng and *Euterpe edulis* Mart. For group 2, indicator species were *Richeria grandis* Vahl, *Euplassa inaequalis* (Pohl) Engl., *Xylopia emarginata* Mart. and *Mauritia flexuosa* L.f. Plots that predominantly occupy well-drained soil (non-flooded plots - group 3) were represented by *Cordiera macrophylla* (K.Schum) Kuntze, *Cupania vernalis* Cambess. and *Copaifera langsdorffii* Desf. We concluded that the tree-layer of the Bananal river gallery forest is formed by floristic groups and their distributions are largely influenced by soil moisture.

Asadi H.

Oral presentation
Classification of Box tree (*Buxus hyrcana* Pojark.) communities in the Hyrcanian Forests
Session: Classification, structure and dynamics of plant communities

Hamed Asadi & Omid Esmailzadeh

Tarbiat Modares University
h_asadi@modares.ac.ir

The aim of this study was to recognize plant communities of Box trees (*Buxus hyrcana* Pojark.) in Hyrcanian forests, Iran. Between 2010 and 2014, plant communities containing *Buxus hyrcana* were sampled in Hyrcanian forests of Iran following the Braun–Blanquet method. In each stand, relevés were positioned systematically in a 200 and 400 m grid established in what was considered to be an indicator community of *Buxus hyrcana*. However, if the systematically selected relevé was not in a representative *Buxus hyrcana* community, the relevé was located in the nearest *Buxus hyrcana* community by expert knowledge. The resulting dataset consisted of 484 (400 m^2) relevés and 157 species. By using Cocktail method one class, one order, four alliances, and eleven associations were distinguished.

Assis G.B.

Poster presentation
Ecological assessment of different management techniques to control the invasion by *Urochloa decumbens* in the Brazilian savanna
Session: Restoration of subtropical and tropical grasslands and savannas

Geissianny B. Assis[1], Natashi A.L. Pilon[3], Marinez F. Siqueira[1] & Giselda Durigan[2]

[1]Instituto de Pesquisas Jardim Botânico do Rio de Janeiro, ENBT/JBRJ;[2]Floresta Estadual de Assis, Instituto Florestal and [3]Instituto de Biologia, Universidade Estadual de Campinas, UNICAMP
geissianny@gmail.com

African grasses were introduced in Brazil to increase productivity of pastures and turned into a major threat to natural ecosystems and biodiversity conservation. Among these invasive grasses, *Urochloa decumbens* stands out, by modifying the structure and causing biodiversity losses, particularly in open vegetation types, such as the Cerrado grasslands. We evaluated different management techniques to control the invasion by *U. decumbens* and to provide the return of the native vegetation at Santa Bárbara Ecological Station, state of São Paulo, Brazil. We tested six treatments (with five replicates) to eradicate the invasive grass, corresponding to different combinations of prescribed burning, herbicide (glyphosate), and hand weeding. Prescribed burning was applied just once and the other techniques were applied 3 to 5 times with a 4 months interval between operations. All native plants were sampled before and 2 years after treatments. Plant species richness, density and cover by native vegetation (spontaneous recovery) were used as indicators to assess the efficacy of the treatments. The values were compared to the reference ecosystem (non-invaded plots) and with the control plots (invaded plots). All techniques were efficient to control de invasive grass, except the use of fire alone. The native vegetation was damaged by glyphosate. Hand weeding with or without fire provided better results. In these treatments, density of native plants (mostly shrubs and sub-shrubs) had increased three fold and plant species richness was double that previous to the treatment application after two years, both variables reaching the reference level. Hand weeding provided 30% of ground cover by native grasses (doubling the previous), while glyphosate caused a reduction of native grass cover to less than 2%. We concluded that the control of the invasive grass by using herbicides or hand weeding can enhance the regeneration of the native vegetation. However, some functional groups of species, mostly herbaceous plants, do not recover in the short term and the use of herbicides can make the recovery process even slower.

Assis M.

Poster presentation
Intraspecific functional traits variability in plants of Brazilian high-altitude grasslands and its relationships with species distribution range
Session: Functional and phylogenetic patterns in plant communities

Mayara V. Assis & Eduardo A. de Mattos

Federal University of Rio de Janeirro
mayara.assiis@gmail.com

The knowledge about the relationships of intraspecific functional variability (IFV) with environmental heterogeneity and its relations with species niche breadth and the size of geographic distribution of plants is still very limited. In this context, we aimed to understand, how IFV behaves in distinct mountaintop areas. Besides that, we attempted to understand the relationships between IFV and the amplitude of geographic distribution of mountaintop plants. Therefore, we conducted a study in the Brazilian High-altitude grasslands, located in three mountaintop environments of southeastern Brazil. We sampled individuals of 18 species, in three distinct sites (Serra dos Órgãos, Itatiaia and Bocaina National Parks) to measure six foliar functional traits associated to the leaf economic spectrum. We compared populations of these sites using traits mean values and variation coefficients. We also calculated the extent, form and direction of IFV in order to relate them with the distribution size of plants. The three selected sites diverge in edaphic characteristics, like nutrient status, temperature and water content. The populations of all species functionally diverged between mountains at least in one trait. However, we do not note any functional common behavior between populations or sites, evidencing an idiosyncratic IFV behavior. This behavior can be explained by the differences in ecological preferences of species or by random drift. Negative relationship between IFV form (i.e., phenotypic integration) and distribution size was identified ($R^2=0.31$, P=0.009). High phenotypic integration has been associated with a high level of habitat specialization and consequently can be associated with smaller geographic ranges. However, when populations were analyzed, this relationship disappears ($R^2=0.002$, P=0.30). This happened probably due to functional divergence between populations. Yet, the IFV extent was not related to the area size of species occurrence ($R^2=0.11$, P=0.09). We also not observed a clear relation between IFV direction and the distribution size of species. Thus, we concluded that despite local differences in IFV among species and their populations, plants with more restricted geographic distribution showed higher levels of phenotypic integration. Since it is assumed that higher phenotypic integration can limit phenotypic plasticity, endemic plants of High-altitude grasslands might be vulnerable to environmental and climatic changes.

Ataíde M.V.R.

Poster presentation
Recovery of degraded areas due to nickel mining by using native species of Brazilian Savannah, Barro Alto, GO.
Session: Restoration of subtropical and tropical grasslands and savannas

Marcos Vinicius R. Ataíde[1], Bárbara S. Pachêco[1], Leide R. M. Andrade[2] & Fabiana G. Aquino[2]

[1]*Eliseu Alves Foundation and* [2]*Embrapa Cerrados*
fabiana.aquino@embrapa.br

The recovery of degraded areas by mining is a complex process due to the damage that this activity the physical, chemical and biological structure of the soil. The establishment of a native vegetation cover is important to stabilize the bare area guaranteeing a minimum biological diversity. Among this context, the choice of the appropriate native plant species is an important step. The aim of this study was to evaluate the use of native plants in the Brazilian Savannah and legume species, used as ground cover, for recovery of degraded areas by nickel mining in ultramafic complex of Barro Alto, GO, Brazil. The experiment was conducted in a sterile pile slope (2H:1V) in four treatments, in four replicates: N - no seeding; NAT - seeds cocktail of 13 herbaceous and shrub native species (3704 seeds/m^2); LEG - two species of leguminous seeds cocktail (14 seeds/m^2); and NAT+LEG - seed cocktail combination of native species and legume seeds. The seeds were sown in 1.8m^2 plots bounded by a wooden frame and covered with a jute fabric mat, to fix the seeds to the substrate. The substrate had bioavailable levels of Ni=15.7 mg.kg soil; P<1 mg kg; Cr (VI)=273 mg.kg soil; M.O<1%; Ca/Mg=0.11; and silt/clay=0.70. The plots were previously fertilized with appropriate dose of NPK fertilizers. Were applied also 50 ml of inoculant of diazotrophic bacteria. The dynamics of occupation and land cover percentage provided by the species were monitored from January/2013 to May/2015. Throughout this period, there was emergence of eight species: *Aspidosperma* sp., *Bauhinia* sp., *Mimosa claussenii*, *Setaria parviflora*, *Axonopus chrysoblepharis*, *Vernonia megapotamica*, *Hypenia brachystachis* and *Heliotropium salicioides*. The percentage of land cover changed slowly during the two years following the implementation of the experiment. In February/2015 the presence of young individuals of *M. claussenii* was observed, which probably originated from seeds that have been dormant all this time, together with the species *H. salicioides*, *V. megapotamica*, and *H. brachystachis*. The percentage of soil coverage after 860 days was: N=4.2% < LEG=6.5% < NAT+LEG=33.6% < NAT=43.7%, showing that native species and the combination with legumes were essential to begin the process of colonization of the area and of soil covering.

Balogianni V.G.

Oral presentation
Root production in grasslands and forests: the impact of rhizotron sampling frequency
Session: Underground processes in plant communities

Vasiliki G. Balogianni[1], Gesche Blume-Werry[2] & Scott D. Wilson[2,3]

[1]*Departamento de Ecologia, Universidade Federal do Rio Grande do Sul, Ave. Bento Gonçalves 9500, Porto Alegre, Rio Grande do Sul, 91.501-970, Brazil;*[2]*Climate Impacts Research Centre, Department of Ecology and Environmental Science, Umeå University, SE-981 07, Abisko, Sweden and* [3]*Department of Biology, University of Regina, 3737 Wascana Parkway, Regina, Saskatchewan, S4S 0A2, Canada*
vasiliki.balogianni@gmail.com

Despite their critical role in every terrestrial ecosystem, fine root production and mortality have not been well compared among systems due to the practical difficulties of belowground research. Here we identify similarities and differences in fine root production and mortality among five contrasting grassland and forest ecosystems: native and invaded grassland in eastern Montana, USA, aspen forest in southern Saskatchewan, Canada, and birch forest and alpine grassland in northern Sweden. Additionally, we investigated the importance of minirhizotron sampling interval on measures of root production and mortality by comparing measures produced from 1-, 7-, 14- and 21-day sample intervals. Root length and mortality varied significantly among ecosystems, with invaded grassland having the greatest root length (> 2 × than any other ecosystem) and significantly greater root mortality than native grassland (54%). In contrast, there were no significant differences in root production among the ecosystems. Sample interval had no significant influence on root production or mortality. Minirhizotron sampling intervals up to three weeks did not underestimate the measures of root production and mortality in comparison to measures derived from shorter sampling intervals, regardless of the ecosystem studied. The results suggest that among-system differences in root production and mortality are much greater than differences caused by sampling interval.

Barbizan Sühs R.

Oral presentation
The role of *Araucaria* trees in plant community assemblage in Brazilian highlands
Session: Community assembly and species diversity

Rafael Barbizan Sühs, Michele Dechoum & Nivaldo Peroni

Federal University of Santa Catarina
rbsuhs@gmail.com

Positive interactions (facilitation) have an important role in communities' assemblage. In Southern Brazil, the long-living pioneer tree "Araucária" (*Araucaria angustifolia*) increases richness and abundance of other tree species under its crown. The "perch effect" and habitat amelioration (by attenuating high temperatures and vapor pressure deficit and increasing soil nutrients) are the main factors driving this process. It remains unknown, however, whether *Araucaria* trees facilitate in high altitude areas, where abiotic stressors tend to be higher. In addition, which factors, beyond the mere presence of *Araucaria*, can explain variations in richness and abundance of plants? In order to answer these questions, we randomly paired-sampled 62 blocks (under adult Araucarias' crown and nearby area) in two different sites along a 200 m slope in São Joaquim National Park, municipality of Urubici (ca. 1500 m a.s.l.), Santa Catarina state, Brazil. Block size varied according to the crown area of each surveyed *Araucaria*. Number of species (species richness) and abundance of all seedlings with at least 0.30 m high and smaller than 2 m were recorded. Beyond environmental measurements, gender and crown volume of Araucarias as well as the cover area of the shrub species *Baccharis uncinella's* were also recorded. GLMMs were built using richness and abundance as response variables. Site and block were used as random effects. Environmental, *Araucaria* variables (when appropriate) and *Baccharis uncinella's* cover were used as fixed effects. We firstly built models to check for differences between blocks and site. Secondly, models were built to explain which variables affected species richness and seedling abundance under *Araucaria* trees. Model selection was performed through Akaike Information Criterion. Model validation was done through visual residual analysis. Species richness was positively affected by *Araucaria* trees ($p<0.0001$) and patch size ($p=0.01$) and negatively affected by grass volume ($p<0.001$). Abundance was positively affected by *Araucaria* trees ($p<0.0001$) and patch size ($p<0.005$) and negatively affected by grass volume ($p<0.005$) and altitude ($p<0.05$). Within *Araucaria* patches, species richness was positively affected by crown volume ($p=0.01$). Abundance was positively affected by crown volume ($p<0.0001$), whereas grass volume ($p<0.0001$), exposed rock ($p<0.0001$) and *Baccharis uncinella's* cover ($p<0.005$) affected it negatively.

Barbosa da Silva F.H.

Oral presentation
Shrub encroachment influences herbaceous communities in flooded grasslands of a Neotropical Savanna wetland, Pantanal
Session: Fire and grazing in non-forest vegetation

Fernando Henrique Barbosa da Silva, Julia Arieira, Cátia Nunes da Cunha

[1]Universidade Federal do Rio Grande do Sul (UFRGS);[2]Universidade Federal de Mato Grosso (UFMT) and [3]Instituto Nacional de Ciência e Tecnologia em Áreas Úmidas (INCT/INAU)
fernandon18@gmail.com

Increases in biomass or density of woody plants that have been mainly associated to arid and semi-arid ecosystems also occur in wetlands, as has been noticed in historically open habitats, such as grasslands and savannas. The encroachment of woody plants may influence ecosystem and communities properties at different levels and scales, for example decreases in cover and number of herbaceous species. How does the encroachment of a woody shrub affect herbaceous community structure and species composition in seasonally flooded grasslands of a Neotropical Hyperseasonal Savanna wetland ecosystem, the Pantanal in Brazil? We investigated the effect of the encroaching plant *Combretum laxum* on the herbaceous community from seasonally flooded grasslands in the Pantanal wetland using 29 vegetation samples representing encroachment at different spatio-temporal stages. The point quadrat method was used to acquire vegetation data, as plant cover, species richness (S) and Shannon-Wiener diversity index (H'). We evaluated the existence of stages of encroachment related to differences in vegetation structure and species composition using Non-metric Multidimensional Scaling (NDMS) ordination and analysis of similarity (ANOSIM). The response of the herbaceous community to shrub advance was analyzed using linear and quadratic polynomial regression models. Model fitness was tested using the Akaike Criterion Information (AIC). The advance of the woody encroaching plant *C. laxum* over the seasonally flooded grassland occurs in three stages: *grassland stage, shrub islands stage* and *shrubland stage*. The initial advance of *C. laxum* over the grassland, represented by the shrub islands stage was correlated to an increase in species richness and a decrease in important native forage grasses. Critical changes in the herbaceous community were observed when the encroaching plant covered >30% of the periodically flooded grassland, when the richness of herbaceous species dropped from 22 to four. Woody encroachment causes impoverishment and simplification of the herbaceous community. The shift from a grass- to a shrub-dominated state is related to the reduction in important grassland-obligate species, forage resources for herbivore livestock and wild animals, affecting the ecological dynamics and the economy of rangelands. Conservation of these grassland ecosystems depends on rangeland management practices guided by scientific knowledge on the causes and consequences of plant community changes.

Batista W.V.S.M.

Poster presentation
Can environmental filtering explain the distribution of epiphytic bryophytes in the Atlantic Forest?
Session: Classification, structure and dynamics of plant communities

Wanessa V.S.M. Batista, Thamara R. Reis & Nivea D. Santos

Federal University of Pernambuco
wanessa.vsm@hotmail.com

Epiphytic bryophytes are a characteristic structural component of tropical forests. Different vegetation types can act as filters in the distribution of regional bryoflora along the mountains. Still, local existing filters in phorophytes species (eg pH and roughness of the bark) also have a modulating influence. This study aimed to analyze the bryophyte communities in three vegetation types of the Atlantic Forest and the influence of local filters (phorophytes) and regional (vegetation types) on the distribution of species. The study was conducted in the Serra do Mar State Park, Ubatuba, Brazil, in plots located in the vegetation types of Restinga Forest, Lowlands and Submontane. Four species of phorophytes were selected with three to seven replications each. For collections of bryophytes, the line intercept method (totaling 100 cm) was applied in each host tree in the northern cardinal position. They were measured via the diameter at breast height (DBH), pH and trunk texture of each host tree. Multivariate analysis was used to correlate species distribution with environmental filters. 71 taxa, 39 liverworts and 32 mosses were identified. The composition in relation to vegetation types and phorophytes was different than one would expect by chance, but did not form cohesive or isolated groups (MRPP to phyto physiognomies A = 0.063, t = -13.005, P <0.001; phorophytes A = 0.076; T = -12.657; p <0.001). Among the environmental filters, only the PAD was correlated with bryophytes cover (F = 11.37, gl = 1, p <0.001). Regarding the influence of local filters on the species' composition, low variance was accumulated in the first two axes of Canonical Correspondence Analysis (6.6%), however the axes were significant on the Monte Carlo test (p = 0.005 and p = 0.01, respectively). The pH was the most variable correlated with axis 1 (-0.89), highlighting the phorophytes of *Euterpe edulis* Mart., While the roughness was associated with axis 2 (-0.9), which are grouped phorophytes of Cyatheaceae, ie, those variables partially explain the composition of species of bryophytes present in these phorophytes. Other unmeasured environmental filters and dispersion-based processes may be relevant to the distribution of species in the Atlantic Forest.

Battisti C.

Poster presentation
Mapping natural disturbances and human-induced threats: conceptual tools and approaches
Session: Applied mapping for conservation and management

Corrado Battisti[2] & Franco Pedrotti[1]

[1] *University of Camerino, Camerino (Macerata), Italy;* [2]*University of Roma 'Torre Flavia' LTER (Long Term Ecological Research) Station, Servizio Aree protette – parchi regionali, Città Metropolitana di Roma Capitale, via Tiburtina, 691, 00159 Rome, Italy.*
c.battisti@cittametropilitanaroma.gov.it
franco.pedrotti@unicam.it

Disturbance/threat mapping may allow us to provide spatial information related to factors and events which can affect environmental targets of ecological and conservation concern. Maps used to spatially explicit natural disturbances and human-induced threats can provide information about localization, distribution, extent, shape, contiguity, dispersion, connectivity of these events, assigning specific magnitude and severity scores. Such information can be combined with the spatial data collected from local biodiversity (occurrence, distribution, composition, density, cover, biomass, richness or diversity of specific targets). The procedure can allow us to understand which areas are more sensitive, vulnerable, critical and in need of priority interventions. For example, they can determine sites where the highest severity and magnitude values are accompanied by the highest values of target density, cover and diversity (Wilson *et al.* 2005). Mapping information about threats can also enable us to identify the areas of high conservation priority (*problem areas*, Latour and Reiling 1994; Reyers 2004). Not all threats can be represented on a map in the same way. However, a precise representation can be given of those characterized by unmovable structures, spread on defined surfaces with a high level of detail, and whose regime is known with little uncertainty. Other events are more difficult to be mapped, such as those characterized by dynamic, inconstant, uncertain and unpredictable distribution or other shifting regime characteristics. Data can be directly mapped or it can be decided to use indirect information through the use of proxy indicators, when it is difficult to gather direct information on the threats (Burton 2007). The data utilized must be solid and representative of an appropriate temporal scale in order to be reliable and to provide a suitable explanation of the characteristics of the phenomenon. Practitioners should always be aware that a difference exists between the information mapped and the real world. Very often, the information reported on the map derives from extrapolation/interpolation processes carried out on original point-shaped data. Finally, maps allow us to compare past, present and future situations (ascertained, potential or predicted by different scenarios; diachronic maps; Salafsky *et al.*, 2008; Battisti *et al.*, 2016; Pedrotti *et al.*, 2016).

Bello F. de

Oral presentation
Decoupling phylogenetic and functional diversity
Session: Functional and phylogenetic patterns in plant communities

Francesco de Bello[1,2], Petr Šmilauer[3], José Alexandre F. Diniz-Filho[4], Carlos Pérez Carmona[1], Zdeňka Lososová[5], Tomáš Herben[6] & Lars Götzenberger[2]

[1]*Department of Botany, Faculty of Sciences, University of South Bohemia, Na Zlate Stoce 1, 370 05 České Budějovice, Czech Republic;*[2]*Institute of Botany, Czech Academy of Sciences, Dukelská 135, 379 82, Třeboň, Czech Republic;*[3]*Department of Ecosystem Biology, Faculty of Science, University of South Bohemia, Branišovská 1760, 370 05 České Budějovice, Czech Republic ;*[4]*Departamento de Ecologia, Instituto de Ciências Biologicas, Universidade Federal de Goiás, Campus II 74670-970 Goiânia, Brazil;*[5]*Department of Botany and Zoology, Masaryk University, Kotlářská 2, 611 37 Brno, Czech Republic and* [6]*Institute of Botany, Czech Academy of Sciences, Zámek 1, 252 43 Průhonice, Czech Republic Department of Botany, Faculty of Science, Charles University, Benátská 2, 128 01 Praha, Czech Republic*
lars.goetzenberger@gmail.com

Traits and phylogeny both offer information about biological differences between species. Such differences are used to assess community diversity, i.e. how different species are within assemblages and how this reflects mechanisms of community assembly. Initially often studied in isolation, functional and phylogenetic diversity are now increasingly used in combination. However, traits and phylogeny are often related due to trait evolution and therefore can contain redundant information in terms of biological distances between species. It is therefore desirable to adequately decouple their unique and overlapping contributions. We propose a conceptual and mathematical framework that solves this challenge, producing a set of meaningful measures of ecological differences between species. We test the approach with simulated data as well as a large dataset of Central European meadows to show that decoupling trait and phylogenetic information uncovers signals of otherwise hidden mechanisms underlying plant species coexistence. Both traits and phylogeny indicated coexisting species to be evolutionary and functionally more similar than expected from the regional species pool, especially when combined without decoupling. In contrast, decoupling traits and phylogeny revealed the importance of local ecological differentiation for species coexistence, particularly within lineages. Decoupling traits and phylogeny provides an avenue for connecting macro-evolutionary and local factors affecting coexistence.

Bergamin R.S.

Poster presentation
Linking beta diversity with spatial conservation planning: lesson from the Southern Atlantic Forest
Session: Conservation of plant communities: from science to policy

Rodrigo S. Bergamin[1], Vinícius G. Bastazini[1], Eduardo M. Vélez[1], Vanderlei Debastiani[1], Kátia J. Zanini[1], Rafael D. Loyola[2] & Sandra C. Müller[1]

[1]*Universidade Federal do Rio Grande do Sul and* [2]*Universidade Federal de Goiás*
rodrigo.bergamin80@gmail.com

Comprehending the driving processes of beta diversity patterns might be an important tool for conservation planning, helping with decisions like the number and spatial distribution of protected areas (PAs). Beta diversity is defined as the variation in species composition between sites and can be decomposed in two components: 1- species turnover, the replacement of species by others resulting in a low proportion of shared species; 2- species nestedness - the result of differences in species richness, when a poorer community is a subset of species from a richer community. The Atlantic Forest Biome (AFB) includes distinct forest types, which are among the most threatened tropical forests in the world. Despite having the largest number of PAs in South America, only a small proportion is actually under legal protection and studies evaluating the efficiency of current reserve networks for the AFB are lacking. We aim to evaluate the beta diversity and the PAs network spatial patterns of the southern AFB in each type: Atlantic Forest *sensu strictu* (AF), Araucaria Forest (ArF) and Seasonal Forest (SF). Data were obtained from 77 published checklists of woody species in southern AFB. We decomposed the beta diversity of communities into species turnover and nestedness. For each forest type, we used multiple-site index to estimate the total beta diversity, which was then partitioned into additive components that represent the pure spatial turnover and nestedness components. Beta diversity was mainly caused by species turnover (mean=0.857), with only a small contribution of nestedness (0.046) in all three forests types. The outstanding rate of species turnover in each forest in relation to nestedness leads us to new insights about the current spatial arrangement of PAs in southern AFB. As turnover brought the larger contribution to beta diversity, additional conservation efforts must target a large number of PAs in different sites in each forest type to maximize the number of protected woody species. Most of the PAs are currently limited to the east region and prioritize the AF. Thus ArF and SF should deserve priority in new conservation actions, as they also contain high levels of species turnover.

Birnbaum C.

Oral presentation
Experimental warming alters rhizosphere fungal composition of two dominant shrubs in Mediterranean-type ecosystem
Session: Climate change and plant communities

Christina Birnbaum[1], Anna Hopkins[2], Joe Fontaine[1] & Neal Enright[1]

[1]1School of Veterinary and Life Sciences, Murdoch University, 90 South Street, Western Australia, 6150, Australia and [2]2Centre of Excellence for Climate Change, Woodland and Forest Health, School of Veterinary and Life Sciences, Murdoch University, 90 South Street, Western Australia, 6150, Australia
C.Birnbaum@murdoch.edu.au

Climate change will likely impact both the biotic and abiotic drivers in ecosystems and the response of plants and soil microbial communities to these changes. Mediterranean type ecosystems (MTE) are exceptional biomes to test how microbial communities will respond to future drier conditions as MTEs are predicted to experience increased drought and low rainfall. Our aim was to test how increased temperatures and decreased rainfall will impact rhizosphere fungal composition of two dominant shrubs in south-western Australia across different topographies and treatments. Specifically, we were interested to elucidate how the functional diversity of these fungi (i.e. mutualists vs saprophytes) may be altered following experimental warming and how they may impact the host plant fitness in view of these future environmental changes. Experimental infrastructure was built in 2010 and was designed to create changes in rainfall (reduction by 30%) and temperature (increase by ~2.8°C) that were in accordance with projected climate change scenarios for southwest Australia (Williams, 2014). Two common species in these shrublands, *Beaufortia elegans* and *Melaleuca leuropoma* (Myrtaceae), were chosen as host species. Rhizosphere soil samples were collected across two topographies (i.e. dune vs swale), treatments (i.e. drought, temperature and control) and host species (and away from host), giving total N=65. Next generation sequencing was used to identify the rhizosphere fungal composition. Overall, 454 sequencing results revealed that there was a significant interaction between site and host species suggesting that host species accumulate different rhizosphere fungi depending on whether they grow on dune or swale. Furthermore, treatment had a significant effect on rhizosphere fungal composition suggesting that fungal composition differs between drought, increased temperature and control treatments. OTU richness was marginally lower in dunes as compared to swales and significantly lower away from the host species. In conclusion, our results suggest that climate change is very likely to impact rhizosphere fungal composition that may feedback to aboveground plant composition under future drier conditions.

Bombo A.B.

Poster presentation
Morphoanatomical strategies of underground organs in Cerrado: a case study of four Aldama species
Session: Plant strategies and disturbance

Aline B. Bombo[1,2] & Beatriz Appezzato-da-Glória[1]

[1]*University of Sao Paulo and* [2]*University of Campinas*
aline_bbombo@hotmail.com

Aldama species chosen to this study occur mainly in Cerrado areas in Brazil. The predominance of Asteraceae species with bud-bearing thickened underground systems is a striking feature in the Cerrado biome because they allow these plants to resprout quickly after fire events. Underground organs from *A. bakeriana, A. discolor, A. grandiflora* and *A. squalida* were analyzed considering their morphology and anatomy, in order to point out some adaptive traits to the environmental conditions. Anatomical structure of the underground systems was similar among the species. The underground stem occurs in upper soil layers and is responsible for producing all the roots. It is formed by a set of articulate swollen remaining bases of aerial stem branches. Each branch originates from axillary bud of the remaining base of the branches of the previous period of development. This process increases the anatomical complexity of the organ because the stem base of aerial branches self-grafts, originating a horizontal structure. The root systems consist of tuberized adventitious roots, which exhibit non-tuberized and tuberized portions, and their lateral roots. Both organs present stratified cork as covering tissue; the tuberization process in the roots is due to the increase of vascular cylinder mainly through cell divisions of the medullary parenchyma. Secretory spaces, which produce mainly essential oils rich in terpenes, are observed distributed along all the underground structure. Fructans were observed as the reserve carbohydrate in the roots and were located at medullary parenchyma cells and, especially, near the phloem and xylem conducting cells; they were also found in the vascular parenchyma in the underground stem, although they are not typical reserve structures. Fire events that are common in Cerrado areas seem to be very important for underground stem development, once they stimulated the sprout of axillary buds found in the swollen base of the remaining carbonized branches. Also, the presence of the stratified cork and the fructans accumulation as a reserve carbohydrate, are strictly associated to the water loss control and adaptation to the adverse conditions in Cerrado.

Bonani N.

Poster presentation
How is fire affecting the germination of legume species? The study of Cerrado and forest species
Session: Fire and grazing in non-forest vegetation

Nathalia Bonani, L.Felipe Daibes & Alessandra Fidelis

Universidade Estadual Paulista, Dep. Botânica, Rio Claro, SP, Brazil
nbonani@hotmail.com

Regeneration from seed is an important strategy for plant population persistence in fire-prone environments. Since Fabaceae is an important family in the tropics, commonly showing impermeable seeds, we aimed to elucidate the role of fire in the germination of legume trees, comparing species from Cerrado and forest. We expected seeds from Cerrado (fire-prone) to be fire-resistant and have their dormancy broken, whereas forest seeds would have their viability reduced with heat shocks. We tested: forest species (5), typical Cerrado (3) and species occurring in both environments (4). We performed heat shock treatments (100°C for 1' and 3', 200°C for 1', and control – no exposure to high temperatures), using 20 seeds/replicate (5 replicates/treatment/species). Seeds were put to germinate for 30 days (27°C, 12/12hs light), and viability of non-germinated seeds was assessed by a tetrazolium solution. We performed ANOVA using randomization tests to compare treatments for each species. Forest species with > 60% of permeable seeds were less resistant to fire. A significant decrease in germination when exposed to 200°C ($P \leq 0.05$) was observed, decreasing up to 60% in germination (e.g. *Anadenanthera colubrina*). However, forest species with high percentage of impermeable seeds had low germination and high viability (>70%) and they were not affected by high temperatures, even after 200°C. Cerrado species and all those occurring in both environments had a high percentage of permeable seeds (>75%) and the exposure to high temperatures did not decreased neither germination nor viability, showing thus to be fire-resistant. However, there was an exception for *Plathymenia reticulata*, which had a decrease in germination and viability when exposed to 200°C ($P=0.02$), being thus fire-sensitive. Legume trees from Cerrado showed to have a high percentage of permeable and fire-resistant seeds, which is an important trait in fire-prone ecosystems. Forest species with permeable seed coat showed to be fire-sensitive, while species with impermeable seed coats were fire-resistant and fire did not enhance germination.

Bonari G.

Poster presentation
Mediterranean coastal pine forests: distinctiveness or species cauldron?
Session: Classification, structure and dynamics of plant communities

Gianmaria Bonari[1], Alicia T.R. Acosta[2], Alessia Nucci[1] & Claudia Angiolini[1]

[1]University of Siena and [2]University of Roma
gianmaria.bonari@gmail.com

This study focuses on coastal pine stands dominated by three different pine species: *Pinus pinea*, *P. pinaster* and *P. halepensis*. The role of coastal forests, although planted, has always been to actively defend coasts by marine aerosol and soil consumption. These forests, with a declining trend in conservation status, are ascribed to Habitat Directive 92/43/EEC as priority habitat 2270 wooded dunes with *P. pinea* and/or *P. pinaster*, also comprehending *P. halepensis* forests. The present study examines relationships between plant species assemblages and forests dominated by different pine species using multivariate procedures. In order to reveal hidden floristic distinctiveness of Mediterranean coastal pinewoods, we aim at answering the following questions: i) Does vegetation associated with different pine dominated stands form a distinct, identifiable, species pool? ii) Are some plant species more likely to be related to one type of pine forests than others? iii) What is the relationship between pine assemblages and environmental factors such as distance to coastline? In an attempt to answer to these questions, we sampled 167 relevés in Peninsular Italy. Results of MRPP and NMDS suggested that forests dominated by different pines species may be characterized by distinct vegetation assemblages. Nevertheless, when dominant pine species were cut off from analyses an unclear pattern was revealed and weak differences in community composition were found. Besides, INSPAN showed that more than half of indicator species were typical of other habitats (shifting and fixed dunes herbaceous vegetation, holm-oak forests, annual grasslands) revealing the fact that an unspecific species pool occurs in coastal pine forests. Hybrid RDA showed that sea distance acts as a significant driving factor on coastal pine forest plant assemblages, in agreement with species distribution pattern in coastal habitats. Thus, the possibility to group these forests into one single habitat was due mainly to dominant pine species. However, Mediterranean coastal pinewoods, can be considered a "Matrioska Habitat", which provide ecological functions, benefits and that hosts a high plant biodiversity.

Botta-Dukát Z.

Poster presentation
Which generalization of replication principle is suitable to define beta-diversity considering differences among species?
Session: Functional and phylogenetic patterns in plant communities

Zoltán Botta-Dukát

MTA Centre for Ecological Research
botta-dukat.zoltan@okologia.mta.hu

However calculating functional beta-diversity may help to understand community assembly processes, there is no consensus on the formula should be used. It is widely accepted that Hill-numbers should be used for diversity calculation, because they allows partitioning gamma diversity into independent alpha and beta components. Hill's diversity formulas are deduced from the replication principle. Thus this principle should be generalized to considering differences among species. Two such generalizations have been proposed, first by Leinster and Cobbold in 2011 (Ecology, 93:477-489) and by Chiu and Chao in 2014 (PLoS One 9: e100014). The two different generalizations lead to different formulas. In the presentation their properties will be compared. The most important finding is that formulas by Chiu and Chao does not satisfy the so-called twinning rule, thus replacing all species with another species having same properties leads to maximal beta-diversity. The research was supported by OTKA K83595 research project.

Bottin M.

Oral presentation
Borrowing tools from neighbors? Insight into vegetation classification from graph and information theories.
Session: Data analysis methods in vegetation ecology

Marius Bottin[1,2], Marion Walbott[1,2], Emmanuel Corcket[1,2], Marie-Lise Benot[1,2], Mathieu Reveillas[1,2], Jean-Claude Abadie[3], Anthony Le Fouler[3] & Didier Alard[1,2]

[1]*University of Bordeaux, UMR 1202 BioGeCo;*[2]*INRA, UMR1202 BioGeCo and* [3]*Conservatoire Botanique National Sud-Atlantique*
marius.bottin@u-bordeaux.fr

Defining groups of vegetation based on their composition has always been a central issue in vegetation science. This approach allows the delineation of "plant community types", which constitute integrated biological scales and represent suitable units to study plant assemblages. Moreover, clustering vegetation is a crucial step to define habitats, which serve as elementary units for conservation ecology and for describing ecosystem services. Usual classification methods in vegetation science require numerous subjective methodological choices (i.e. classification algorithm, dissimilarity measure, number of groups) and they do not allow for testing of significance (nor the robustness) of the aggregated structure of data into clusters. Such drawbacks may weaken the interest of such tools for ecology. Since delineating groups of similar objects is important in numerous sciences, mathematicians, statisticians and information scientists have developed different tools that may reveal useful for clustering vegetation data. Although it is illusory to look for an inclusive mathematical solution, it is worth looking at methodological practices used in other disciplines to obtain validated robust classification of observations. Based on three vegetation datasets representing different spatial scales, we explored the possibilities offered by modularity measures from graph theory, and by entropy measures from information theory. The first dataset consists of a quadrat sampling of a salt march zone on a regular grid (676 relevés on c.a. 200 ha), the second dataset consists of phytosociological relevés in calcareous grassland (600 relevés at a regional scale), and the last dataset consists of phytosociological relevés of beech forest understory assemblages (767 relevés at the national scale). Whether as validation methodologies for previous classifications, or as complete methods to define groups of vegetation from our data, both methodologies provided precious information on the structure of vegetation data. They allowed us to measure the effect of heterogeneous relevés (in terms of species' ecological niches) on the results of classifications. We will discuss the possibilities offered by these methods depending on the sampling scheme, the structure of environmental drivers (gradients or habitat mosaics), and the scale of the study.

Boutin C.

Poster presentation
Assessment of upland/wetland vegetation communities near oil sand mining in Northern Alberta, Canada
Session: Restoration of subtropical and tropical grasslands and savannas

Céline Boutin & David J. Carpenter

Environment and Climate Change Canada
celine.boutin@canada.ca

The boreal forest in northern Canada extends from the Yukon in the West to Newfoundland in the East and covers over 50% of the country. It is characterized by an abundance of coniferous, and some deciduous trees. The boreal forest is interspersed with numerous lakes and vast wetlands comprising a distinctive native flora and fauna. In fact, wetlands encompass 30% of the Canadian boreal ecosystem. Canada's boreal region is also extensively exploited for timber products, as well as for mineral and energy resources, including oil sand activities in Northern Alberta. The objectives of this work were to assess plant communities in wetlands and uplands situated in the vicinity of oil sand mining areas and to consider the potential for revegetation from the seedbank. Twenty-two sites were selected from 56.53996 to 58.0582 latitude and -110.2263 to -112.87983 longitude. Sites were chosen in three locations: near (OS, n=7), to the west (n=7) and t the east (n=8) of oil sand mining. A vegetation survey and a seedbank study were conducted along a wetland-upland gradient at each site. Plants were identified using taxonomic keys or DNA sequencing. This study revealed that the integrity of the boreal forest (including associated wetlands) in the vicinity of oil sand extraction activities was impacted. Species richness and species composition of the above and belowground compartment differed significantly between the three locations. Sites situated at greater distances from oil sand mining activities with no road access remained quite pristine in terms of their vegetation composition and richness, with the majority of these sites having none or few introduced plant species. The gamma diversity was very high with 290 plant species identified in the region (261 and 153 in vegetation and seedbank, respectively), of which over 85% are considered strict perennial species. Dissimilarity in the seed bank and the corresponding vegetation was found in our sites which can be expected in forest and wetland communities. It was concluded that the seedbank would be less useful for restoration purposes in impacted sites.

Box E.O.

Oral presentation
Vegetation mapping by computer -- from the early years to today
Session: Applied mapping for conservation and management

Elgene O. Box

University of Georgia
boxeo@uga.edu

Vegetation mapping has a long history, but this talk concerns only computerized mapping and how it developed, through advances in vegetation concepts, data availability, and mapping techniques, such as Geographic Information Systems (GIS), which originated in the 1950s. The first computer maps were produced in the 1960s, by various spatial interpolation algorithms. In particular, SYMAP (synagraphic mapping, from Harvard University) permitted simultaneous modeling and mapping within a single computer run. The first maps were local and printed on mainframe line printers, but this basic technology permitted many applications. The first large-area, model-driven computer map was probably the "Miami Model" (1971) of terrestrial net primary productivity predicted from temperature and precipitation. Related software for map overlaying, combination, planimetry and volumetry provided a computerized proto-GIS. This and coupling with large, geo-referenced (climatic) data-bases permitted early estimates of many components of the global carbon budget and other biosphere processes. In those years, computer mapping treated vegetation more ecologically than botanically. The first maps of types (e.g. vegetation units, taxa, ecological plant types) came with the advent of envelope modeling, in the latter 1970s. By the early 1980s, global satellite coverage led to the next big mapping advances, namely pixel mapping (in color). Coupling with satellite data and more complex models permitted mapping of seasonal patterns and multi-year dynamics, as for biomass accumulation and vegetation development up to equilibrium. One drawback with fancier mapping techniques was the loss of software to produce gray-scale isoline maps of acceptable "modern" quality, despite a continuing need for basic contour mapping in many fields. Envelope modeling and mapping followed growing concern with global climate change, in order to predict biotic range shifts and changes in ecological function. More dramatic was the effect of modern GIS methods for mapping vegetation, including pixel clustering algorithms and automated "boundary" recognition. Today vegetation mapping is done largely by modern GIS, with sophisticated mapping algorithms, functional models, and large geo-referenced data-bases – warts and all.

Brock J.M.

Oral presentation
Tree ferns as common pioneers in early forest succession in New Zealand
Session: Classification, structure and dynamics of plant communities

James M. Brock & Bruce R. Burns

School of Biological Sciences, University of Auckland
j.brock@auckland.ac.nz

Current forest succession models in New Zealand are based on a pioneer community dominated by small trees of the Myrtaceae (e.g., *Leptospermum scoparium, Kunzea robusta*). Particularly in North Island, however, many pioneer communities are dominated by tree ferns in the canopy and/or subcanopy, and it is unclear how the trajectory of succession might be influenced by this neglected component. Of the NZ tree fern species, *Cyathea medullaris* is unusual in that it colonises relatively hot, dry and exposed habitats, commonly dominating recent areas of disturbance such as after a landslide or forest clearance, but not after fire. We specifically investigated under what abiotic conditions and disturbances such stands eventuate and their influence on successional trajectories. Data on vegetation composition were analysed for 106 vegetation plots identify community trends associated with tree fern dominated systems compared to those dominated by *Kunzea robusta*. In terms of successional trajectory, *C. medullaris* stands led to stands dominated by fleshy-fruited angiosperms e.g., *Beilschmiedia* spp., *Vitex lucens*, whereas *K. robusta* stands led to stands dominated by conifers, e .g. *Agathis australis, Phyllocladus trichomanoides*. Analysis of both biotic and abiotic data indicated that both environment and the presence of tree ferns strongly influenced community composition. The analysis revealed that *C. medullaris* is not only a pioneer species, but that tree fern dominated communities are instrumental in changing the direction of the successional trajectory of forest communities in New Zealand. *C. medullaris* might be useful for forest restoration projects alongside the current *K. robusta* planting schemes, which seek to mimic pioneer communities.

Broiero X.A.

Poster presentation
Are above and belowground functional syndromes coupled across different species? An empirical test in the subtropical seasonally dry forests of central Argentina
Session: Functional and phylogenetic patterns in plant communities

Ximena A. Broiero[2], Kowaljow Esteban[1] & Georgina Conti[1]

[1]*Instituto Multidisciplinario de Biología Vegetal (IMBIV-CONICET) and* [2]*Universidad Nacional de Córdoba, Argentina*
georconti@gmail.com

The functional approach has proved to be a powerful framework to analyze relationships between abiotic factors, community functional composition and ecosystem processes. Across contrasting floras, the existence of a leaf economic spectrum (LES) has been extensively evidenced given by the association between leaf traits values, and reflecting a fundamental trade-off between plant resource acquisition and conservation. Although the existence of this trade-off has been mainly reported in studies focused on leaves, it has been hypothesized the existence of an integrated whole-plant strategy, including stem and roots tissues. In the present work, we examined the relationship between 16 above and belowground functional traits from 5 species (including trees, shrubs and grasses) in the subtropical seasonally dry Chaco forests of Argentina, to test (i) if the widely supported LES also exists for root traits values (RES), and (ii) if they are coordinated, defining a whole-plant economic spectrum. We found significant differences between species in almost all traits, revealing the differential occupation of functional space in the economic spectrum. Aboveground traits values showed different orthogonal axis for structural and leaf traits, which follow the LES, as expected. Across the LES, the C4 grass was in the most acquisitive extreme, while the C3 grass occupied the most conservative extreme. Regarding roots traits, we did not find a clear economic continuum, in comparison with the LES, where specific root length and nitrogen root content followed opposite directions in the multivariate distribution. Across the multivariate space, belowground traits showed higher variation, with no clear position across a single axis. Although most individual pairs of associated leaf and root traits showed univariate coordination, chemical traits did not show significant relationships across leaf and root tissues, and so the LES and RES were weakly coupled across the sampled species. Our results indicate that other ecosystem processes could drive functional diversity and resource use belowground, where soil matrix is complex and spatially heterogeneous. The extent to which above and belowground functional strategies are coordinated is important to understand plant species distributions and functioning and so, the impacts of land-use and climate change on ecosystem processes and services.

Bruelheide H.

Oral presentation
Global trait-environment relationships revealed by sPlot, the global vegetation plot database
Session: Functional and phylogenetic patterns in plant communities

Helge Bruelheide[1,2], Jürgen Dengler[3,2], Oliver Purschke[2,4], Milan Chytrý[5], Florian Jansen[6], Stephan Hennekens[7], Ute Jandt[1,2], Borja Jiménez-Alfaro[5], Jens Kattge[8,2], Jonathan Lenoir[9], Valério D. Pillar[10], Brody Sandel[11], Marten Winter[2] & the sPlot consortium[12]

[1]*Geobotany and Botanical Garden, Institute of Biology, Martin Luther Unversity Halle Wittenberg, Am Kirchtor 1, 06108 Halle (Saale), Germany;*[2]*German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig, Deutscher Platz 5e, 04103 Leipzig, Germany;*[3]*Plant Ecology, Bayreuth Center of Ecology and Environmental Research (BayCEER), University of Bayreuth, Universitätsstr. 30, 95447 Bayreuth, Germany;*[4]*Department of Computer Science, Institute of Informatics, Martin Luther University Halle Wittenberg, Von-Seckendorff-Platz 1, 06120 Halle (Saale), Germany;*[5]*Department of Botany and Zoology, Masaryk University, Kotlářská 2, 611 37 Brno, Czech Republic;*[6]*Institute of Botany and Landscape Ecology, University of Greifswald, Soldmannstr. 15, 17487 Greifswald, Germany;*[7]*Alterra, Wageningen UR, Droevendaalsesteeg 3, 6708 PB Wageningen, Netherlands;*[8]*Max Planck Institute for Biogeochemistry, Hans-Knöll-Str. 10, 07745 Jena, Gemany;*[9]*Ecologie et Dynamiques des Systèmes Anthropisés, Université de Picardie Jules Verne, 1 Rue des Louvels, 80000 Amiens, France;*[10]*Department of Ecology, Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, 91501-970, Brazil;*[11]*Department of Bioscience, Aarhus University, Ny Munkegade 114, 8000 Aarhus C, Denmark and* [12]*(worldwide)*
helge.bruelheide@botanik.uni-halle.de

The trait composition of plant communities is determined by climatic and edaphic factors, as well as by successional stage and disturbance regime. However, the relative strengths of macroclimate and local environmental factors in explaining global trait distributions at the scale of communities still remain unclear. Global studies typically focus on either sets of individual geo-located records or coarse-grain species assemblages, while the fine-grain functional composition of plant communities is only available for very limited local spatial extents. However, environmental factors act on the trait composition of communities through biotic interaction namely at this fine scale. So far, we lacked a comprehensive global database with a spatial resolution corresponding to the community scale at which individuals varying in functional traits co-exist. Meanwhile, the new sPlot 2.0 database holds 1.1 million vegetation plots from more than 100 databases worldwide (see talk of Jürgen Dengler). More than 60% of the most frequent species are represented by at least one trait from the TRY 3.0 trait database, and gap-filling techniques have been used to estimate trait values for these most frequent species. For all plots, we calculated the community weighted mean (CWM) and functional diversity (FD) for 18 traits. We used resampling strategies to achieve a representative stratification of plots in global climate space. Using regression techniques we related CWM and FD to the bioclimatic variables. Our results revealed global patterns that only partly confirm patterns found in coarse-grain species data. For example, traits related to the leaf economics spectrum reflecting stand productivity show an unimodal rather than a linear dependence on latitude. In general, global patterns based on species co-occurrences may lead to stronger or weaker relationships to environmental variables than approaches based on traits of species assemblages averaged at coarse spatial grain, depending on how strongly macroclimate acts through biotic interactions. Apart from shedding light on global fine-grain patterns, the sPlot platform does also allow addressing many other questions of biogeography and global ecology, such as the links between functional and phylogenetic patterns in communities or relationships to ecosystem functional properties (e.g. water use and productivity).

Carlucci M.B.

Oral presentation
Trade-offs in functional traits within and across communities along gradients
Session: Functional and phylogenetic patterns in plant communities

Marcos B. Carlucci[1,2], David D. Ackerly[3], Nathan J.B. Kraft[4,5], Rodrigo S. Bergamin[2], Valério D. Pillar[2] & Leandro D.S. Duarte[2]

[1]*Universidade Federal de Goiás;*[2]*Universidade Federal do Rio Grande do Sul;*[3]*University of California at Berkeley;*[4]*University of California at Los Angeles and* [5]*University of Maryland at College Park*
marcos.carlucci@gmail.com

Given that traits may vary both within and across communities in response to biotic interactions and environmental gradients, we expect to observe trait-based trade-offs that occur within communities (alpha trade-offs), as well as trade-offs that occur across communities (beta trade-offs). Identifying whether trade-offs occur within or across communities may be a first step for studies that aim to discriminate trade-offs related to neighbor coexistence from trade-offs related to species sorting along gradients. We examined both within community (alpha) and across community (beta) trait-based trade-offs along a replicated forest to grassland gradient. We surveyed juvenile woody plants of a total of 137 species found in five sites consisting in forest-grassland mosaics in southern Brazil. We measured the following functional traits: specific leaf area (SLA), leaf dry matter content (LDMC), and individual leaf area index (LAI_{ind}, a proxy for foliage density). We partitioned trait variation at the species level into within (alpha) and across community (beta) components. We then evaluated the correlation between alpha and beta traits to assess alpha and beta trade-offs, respectively. We found that the trade-off between SLA and LAI_{ind} resulted from their correlation across the gradient, while the trade-off between SLA and LDMC arose at the within-community scale. The results for SLA- LAI_{ind} indicate the presence of a beta trade-off between light capture and foliage density that may influence the performance of juveniles under different light conditions across the forest-grassland gradient. The results for SLA-LDMC are consistent with an alpha trade-off between light acquisition and carbon conservation in leaves, which might mediate species coexistence at the neighborhood scale. Our study shows that functional trade-offs can originate both within and across communities. Future studies should examine (1) whether alpha trade-offs mediate interspecific resource partitioning stabilizing species coexistence, and (2) the relationship between beta trade-offs and environmental filtering, competitive exclusion along gradients, andplastic responses of plants to varying abiotic conditions.

Carmona C.P.

Oral presentation
Functional trait dissimilarity rather than trait hierarchies determine competitive interactions in a pool of Mediterranean annual species
Session: Functional and phylogenetic patterns in plant communities

Carlos P. Carmona[1], Cristina Rota[2], Francesco de Bello[1,3], Francisco M. Azcarate[2] & Begoña Peco[2]

[1]*Department of Botany, Faculty of Science, University of South Bohemia, České Budějovice, Czech Republic;*[2]*Terrestrial Ecology Group, Department of Ecology, Autonomous University of Madrid, Madrid, Spain and* [3]*Institute of Botany, Czech Academy of Science, Trebon, Czech Republic*
perezcarmonacarlos@gmail.com

It is widely assumed that interspecific differences in functional traits promote species coexistence. However, this assumption and its dependence on environmental conditions have not been explored in depth. Here we present an experiment using eight Mediterranean annual species typical from grasslands of central Spain encompassing a range of functional traits values to test the hypothesis that interspecific competition should be minimized between functionally different species. We sowed six replicates of all possible pairwise combinations of the species, including conspecifics, in pots under two levels of fertilization. After two months, we measured above and belowground vegetative traits and total biomass of the focal individuals, also grown with intraspecific competition and alone. We analyzed the relative decrease in biomass of the focal individuals –compared to the average biomass of the conspecifics without competition– by means of linear models. We considered alternative models for each species, consistent with two potential mechanisms regulating the outcome of interspecific competition: competitive hierarchies or trait dissimilarity. Competitive hierarchies occur when the relative effects of the competitor species are directional and proportional to their relative position along the trait axis, increasing with trait distance in a given direction (e.g. taller plants have competitive advantage). On the other hand, under the trait dissimilarity hypothesis, competitive effects decrease as trait distance increases, irrespective of the direction. Overall, we did not found differences between the two levels of fertility in the relative effect of competition. However, competition effects depended on the fertility level on 7 out of 8 species. In general, trait dissimilarity between species was a more important determinant of the outcome of competition than trait hierarchies (8 vs. 3 cases, considering the two fertility levels), with competition decreasing as dissimilarity increased. Functional trait differences were particularly important in conditions of low fertility, whereas in high fertility conditions traits did not significantly affect biomass reduction of the focal individual in 5 of the considered species. Our experiment shows that niche differentiation, rather than competitive hierarchies, shaped the interactions in our pool of annual species. However, the relative importance of this mechanism is highly dependent on environmental conditions.

Casella C.

Poster presentation
Floristic assessment in a dry tropical altitudinal gradient in the Serra do Cipó, Minas Gerais, Brazil
Session: Classification, structure and dynamics of plant communities

Camilla E. Casella, Julio A. Lombardi, Soizig Le Stradic, Maria Gabriela G. Camargo, Bruno G. Luize, Thiago S. F. Silva, L. & Patrícia C. Morellato.

Universidade Estadual Paulista Julho de Mesquita Filho
casellace@gmail.com

Tropical mountains are rich in plant species and endemisms, a result from the combination of environmental heterogeneity through the altitude range, large-scale climatic stability and old geological history. The Serra do Cipó region comprises the southern part of the Espinhaço Mountain Range, in Brazil, and is composed by a complex mosaic of vegetation physiognomies, including Cerrados, mountain grasslands, rocky outcrops and semi-deciduous forests. Knowledge regarding the floristic richness and the plant species turnover due to environmental variation is necessary to understand the establishment of this vegetation mosaic. The present study will answer the following questions: what are the regional and local species richness patterns of the dominant rupestrian grasslands ("campo rupestre") vegetation in the Serra do Cipó region (Minas Gerais, Brazil)? What is the relative importance of edaphic and climatic variability in determining the floristic composition and species turnover across the "campo rupestre" altitudinal range? We defined five locations along the altitudinal range, sampling four edaphic habitats within each location (sandy and rocky grasslands, rocky outcrops, and waterlogged grasslands). We are now producing an improved floristic checklist (species pool) for the region, as well as quantifying local richness and beta diversity along the altitudinal gradient. Preliminary results have yielded a floristic list of approximately 950 species Results from already sampled habitats along the gradient show a stronger edaphic effect on floristic composition, with a minimum of 32 species for waterlogged grasslands and a maximum of 111 species for sandy grasslands, while climatic variability along the altitudinal gradient did not reveal any particular pattern. Future work will include a more comprehensive sampling of each combination of altitude and habitat, and determination of species turnover and beta diversity among locations, and an evaluation of the importance of endemic and rare species to the diversity of the biodiversity hotspot of Serra do Cipó.

Chaves C.J.N.

Poster presentation
How host traits affect the abundance and distribution of atmospheric bromeliads?
Session: Classification, structure and dynamics of plant communities

Cleber J.N. Chaves[1], Júlio C. Dyonisio[2] & Davi R. Rossato[2]

[1]*Universidade Estadual Paulista - Campus Rio Claro and* [2]*Universidade Estadual Paulista - Campus Jaboticabal*
cleberchaves@gmail.com

Atmospheric bromeliads are known as highly specialized epiphytes, due to their complete independence from the nutrition from the substrate, acquiring water and nutrients directly from fog and suspended aerosols, through absortive leaf trichomes. Due to this characteristic combined with others, as CAM photosynthesis, small size, and high succulence, atmospheric bromeliads can survive and reproduce massively in quite dry canopies, including in anthropogenic environments. Thus, communities dominated by atmospheric bromeliads could be an interesting model to study metacommunities, and the present study is the first of a series that will address the four paradigms of this theory (i.e. "species-sorting", "mass-effect", "patch-dynamic" e "neutral-model"). Here, we hypothesize that stochasticity alone can not explain the presence and abundance of atmospheric bromeliads on host trees, since host traits could have a greater influence on the establishment of these bromeliads. We used secondary and reforested seasonal forests and three distinct silvicultures to test whether species richness, phylogenetic diversity and functional diversity of trees can predict the differential presence, abundance, and distribution of atmospheric bromeliads on hosts. We compared the observed parameters of their assemblage to null models and performed successive hierarchic partitions of the variance of abundance and distribution of the assemblage to detect the influence of multiple traits of the tree hosts. Our results do not indicate direct relationships between the abundance of atmospheric bromeliads to phylogenetic or functional diversity of trees, but instead indicate that bromeliads occurred on fewer tree species than expected by chance. We distinguished functional tree patterns that can improve or reduce the abundance of atmospheric bromeliads, and change their distribution on branches and trunk. While individual tree traits are related to increased abundance, species traits are related to the canopy distribution of atmospheric bromeliad assemblages. A balance among these tree functional patterns drives the atmospheric bromeliad assemblages in the forest patches.

Chiarucci A.

Poster presentation
Does the climate determine plant canopy occupancy?
Session: Classification, structure and dynamics of plant communities

Alessandro Chiarucci[1], Sara Landi[1], Dino Torri[3], Maia Mistral[2] & John B. Wilson[2]

[1]*University of Bologna;*[2]*University of Otago and* [3]*CNR - IRPI*
alessandro.chiarucci@unibo.it

Space is one of the limiting resources of plants. Terrestrial vegetation can be visualized as a 3dimension structure. However, this canopy volume is largely made by empty space. Canopy Occupancy (CO) is defined as the percentage of filling of such a volume by plant organs and it has been reported to be remarkably low. This paper aims to test the effect of climate on CO, to contribute to the plant community theory. Data were collected in sixteen sites in Italy and New Zealand, 8 shrublands and 8 grasslands, each sampled by a 20m x 20m plot and five 1m x 1m therein. Canopy volume was measured. The vegetation was then cut at ground and the volume of plants measured by water displacement. CO was then calculated as the ratio between volume of plants to the canopy volume. OLS were used to detect the relations between CO vs plant community features and climate. Multiple regression and two-way ANOVA were used to test the importance of the various factors on CO. CO values showed how plants constantly occupy a very limited proportion of the space available in the vegetation structure, and most of the space is basically empty. The proportion of space occupied by plants (CO) was found to be independent by country, community type, and community features. Temperature and rainfall were significant predictors of the CO. So, climate appears to control vegetation filling by plants (colder climate, higher values of CO, more arid, lower CO values); the independence of CO from community features confirms that CO is a general feature of plant communities independent from geographical or physiognomical variation. The study of CO demonstrated that this under-investigated feature of plant communities is predicted by climate, across countries, vegetation types and other community features. This provides useful insights for development of a general theory of plant communities and can used for applied topics such as fire management and hydraulics in open channels.

Chytrý M.

Oral presentation
Steppe-tundra in southern Siberia: a relict of the Pleistocene mammoth steppe
Session: Climate change and plant communities

Milan Chytrý[1], Michal Horsák[1], Jiří Danihelka[1], Nikolai Ermakov[2], Dmitry A. German[3], Michal Hájek[1], Petra Hájková[1], Martin Kočí[1], Svatava Kubešová[4], Pavel Lustyk[1], Jeffrey C. Nekola[5], Věra Pavelková Řičánková[6], Zdenka Preislerová[1], Philipp Resl[7] & Milan Valachovič[8]

[1]*Department of Botany and Zoology, Masaryk University, Kotlářská 2, 611 37 Brno, Czech Republic;*[2]*Central Siberian Botanical Garden, Russian Academy of Sciences, Zolotodolinskaya 101, 630090 Novosibirsk, Russia;*[3]*South-Siberian Botanical Garden, Altai State University, Lenina 61, 656049 Barnaul, Russia;*[4]*Department of Botany, Moravian Museum, Hviezdoslavova 29a, 627 00, Brno, Czech Republic;*[5]*Biology Department, University of New Mexico, 87131 Albuquerque, New Mexico, USA ;*[6]*Department of Zoology, Faculty of Science, University of South Bohemia, Branišovská 31, 370 05 České Budějovice, Czech Republic;*[7]*Institute of Plant Sciences, NAWI Graz, University of Graz, Holteigasse 6, A-8010 Graz, Austria and* [8]*Institute of Botany, Slovak Academy of Sciences, Dúbravská cesta 14, 845 23 Bratislava, Slovakia*
chytry@sci.muni.cz

Steppe-tundra, also called mammoth steppe, has been defined as a hypothetical ecosystem of the cold and dry phases of the Pleistocene. To get insight into ecology of the full-glacial ecosystems, modern analogues of the steppe-tundra have been sought, especially in Beringia. However, modern Beringian steppe-tundra lacks many plant and animal species of southern steppes found in full-glacial fossil record from many parts of Europe and Siberia. Based on new data on flora, terrestrial snails and mammal fauna we demonstrate that probably the best modern analogue of the Pleistocene steppe-tundra occurs in the mountain systems on the border between southern Siberia and Central Asia. We studied ecology of a steppe-tundra landscape in the south-eastern Russian Altai. It is a heterogeneous mosaic of different habitat types including low-productive desert-steppe and steppe, alpine grasslands and scrub, wet and saline grasslands along streams and in wet depressions, and patches of open woodland at moister sites. Habitat pattern, primary productivity, nutrient content in plant biomass and species diversity of the steppe-tundra reflects mainly precipitation pattern across broader area and topography-dependent distribution of soil moisture at a landscape scale. Distribution of glacial relict species of plant and snails across the Altaian steppe-tundra landscape suggests that both dry low-productive and more mesic grasslands with higher productivity were components of the full-glacial steppe-tundra with loess sedimentation in Europe. A mosaic of various grassland and scrub habitats and shallow winter snow cover support a diverse community of mammalian herbivores, many of them typical of the Pleistocene ecosystems.

Closset-Kopp D.

Oral presentation
From the geographic space to the cognitive space: mapping forest vegetation, biodiversity and related ecosystem services
Session: Applied mapping for conservation and management

Deborah Closset-Kopp[1], Pieter De Frenne[2], Alicia Valdès[1], Emilie Gallet-Moron[1], Frederic Roulier[1], Kris Verheyen[2] & Guillaume Decocq[1]

[1]*Unité de Recherche "Ecologie et Dynamique des Systèmes Anthropisés" (EDYSAN, FRE 3498 CNRS), Jules Verne University of Picardie, 1 rue des Louvels, F-80037 Amiens Cedex, France and* [2]*Forest & Nature Lab, Geraardsbergsesteenweg 267, B-9090 Melle-Gontrode, Belgium*
deborah.closset-kopp@u-picardie.fr

In many agricultural landscapes, forest is highly fragmented and consists of small patches of various age and size. These forest patches undergo a huge pressure from adjacent human activities and some are cleared into croplands. Yet these small forest patches often deliver a number of ecosystem services to human societies, whose nature and intensity can be related to the biodiversity they host. Mapping plant diversity in forest metacommunities embedded in agricultural lands can be a first step towards the mapping of (i) multi-diversity of biota, (ii) various ecosystem services at the landscape scale, and (iii) how these small forest patches are actually perceived by the landscape users. As an example, we focus on various agricultural landscapes of Western Europe into which all forest patches were surveyed for plant communities and a set of ecosystem services were measured. Further, we implemented cognitive mapping of the landscape via semi-directed interviews. When all biodiversity indicators and all intermediary ecosystem services are merged into single multidiversity and multifunctionality indices, we found that patch size was the best predictor of multidiversity, which itself was strongly positively related to multifunctionality. Through this mapping approach, we show that conserving and creating patches of a minimum size (>3ha) with structurally diverse woody layers appear the best strategy to meet both conservation and ecosystem service delivery objectives. However, the cognitive mapping suggests a highly distorted spatial perception of small forest patches, the existence of small and/or poorly accessible ones being even ignored. Overall, this study demonstrate that maps of biodiversity and related ecosystem services can be useful tools for landscape management and planning, and give a baseline for policy makers. To promote biodiversity conservation in small forest patches, bigger and/or older ones should be targeted in priority.

Coetzee A.

Oral presentation
The importance of Proteaceae species richness in providing nectar resources
Session: Conservation of plant communities: from science to policy

Anina Coetzee[1], Phoebe Barnard[2,3], Anthony G. Rebelo[4] & Anton Pauw[1]

[1]Department of Botany & Zoology, Stellenbosch University, South Africa;[2]Birds & Environmental Change Programme, Climate Change and BioAdaptation Division, South African National Biodiversity Institute, South Africa;[3]DST/NRF Centre of Excellence at the Percy FitzPatrick Institute of African Ornithology, University of Cape Town, South Africa and [4]Applied Biodiversity Research Division, South African National Biodiversity Institute, South Africa
coetzeeaninaz@gmail.com

Many animals depend on plant resources and therefore it is important to understand the patterns of plant distribution and diversity. Due to phenological cycles, the availability of some plant resources, such as nectar from flowers, show strong fluctuations across time and space and may differ between plant species. The landscape scale patterns, and consequences, of this variability are still understudied due to the difficulties of data collection at large scales. Nectar-feeding birds, which depend on floral resources, are highly mobile organisms and capable of tracking resource changes at landscape scale. However, the profitability of resource tracking depends on the spatial variation of resource availability. This study investigated the spatio-temporal floral patterns of bird-visited species of the Proteaceae in the Cape Floristic Region, South Africa, and determined whether plant resource abundance or diversity is most important to nectar-feeding birds. Two extensive databases were used from the Protea Atlas Project and the second Southern African Bird Atlas Project. Very similar temporal patterns of floral abundance were found throughout the region: all subregions show a winter floral abundance peak. This suggests that the profitability of tracking resources across subregions is low. However, the floral abundance of *Leucospermum* and *Mimetes* species peak in the dry summer months when *Protea* resources are low. Thus, a subregion with high Proteaceae diversity may possibly sustain bird populations throughout the year. Geographically weighted regressions were used to determine whether the abundance of nectar-feeding birds are best predicted by the plant abundance, floral abundance or species richness of bird-visited Proteaceae. The bird abundances were most strongly related to Proteaceae species richness, which may be due to the complementary flowering of species of the different genera. This makes a strong case for the conservation of Proteaceae diversity across the whole region because of its importance in sustaining nectar-feeding bird populations. These birds, in turn, provide pollination services to these Proteaceae species and contribute to their population survival.

Conti G.

Oral presentation
Long-term forest use results in community plant functional trait convergence in a subtropical seasonally dry forest
Session: Functional and phylogenetic patterns in plant communities

Georgina Conti[1], Lucas Enrico[1], Dries Huygens[2,1] & Sandra Díaz[1]

[1]Instituto Multidisciplinario de Biología Vegetal (IMBIV-CONICET), Argentina and [2]Ghent University, Belgium
georconti@gmail.com

A debate exists around the effect of forest use on processes and societal benefits provided by these ecosystems. Functional traits– the biological attributes of organisms - is expected to have important effects on these processes and also determine the community responses to environmental factors. Subtropical seasonally dry forest from South America has been experiencing accelerated land-cover changes in the last few decades. Over large areas, forests have been replaced by shrublands, as a result of historic logging and grazing. Here, we analyze changes in plant community functional diversity (including variety and identity) in response to long-term forest use in dry forests of central Argentina. Specifically, we addressed the following questions: (i) How does historic forest use affect plant community functional diversity (in terms of variety and identity)? (ii) How does historic forest use modify community assembly rules of these communities? With that aim, we sampled 8 functional key traits of 30 dominant species across 16 sites resulting from different past and present land-use regimes (mainly selective logging and grazing). Our results showed that functional identity (i.e., the community weighted means of functional traits) remains mostly unchanged, except for architectural traits (height and wood density) that were reduced across sites as a result of historic forest extraction. Although changes in functional identity were not strong, functional variety, in terms of both multivariate indices (RaoQ and FDisp) and univariate indices (FDvar), tracked changes in nutrient availability and forest structure as a result of historic forest use. These results indicate that community functional variety is reduced across the historic forest use gradient, with functional convergence being an important component of community assemblage. Under the assumption (untested in this work) that a wider variety of functional traits should support a higher number of ecosystem benefits to people, our results suggest that forest management at relatively low intensities could provide several ecosystem benefits without risking their long-term provision. We also advocated the inclusion of different components of functional diversity as an important resource in the analysis of the impact of global changes in these subtropical dry forests, at present being seriously transformed.

Conti L.

Oral presentation
Species phenotypic responses to invasion: changes in native species traits following invasion by Carpobrotus spp.
Session: Plant community invasion

Luisa Conti[1], Tommaso Jucker[2], Marta Carboni[3] & Alicia T. R. Acosta[1]

[1]Dipartimento di Scienze, Università degli Studi di Roma Tre, V.le Marconi 446 - 00146 Roma, Italy.;[2]Department of Plant Sciences, University of Cambridge, Downing Street, Cambridge CB2 3EA. UK. and [3]Laboratoire d'Ecologie Alpine Universite Joseph Fourier / CNRS Grenoble BP 53, 2233 Rue de la Piscine, 38041 Grenoble Cedex 9, France.
luisa.conti@gmail.com

Invasive species are known to alter the native communities they invade according to the native species' traits. Nevertheless little is known of how the competitive effect of the invader is actually affecting these traits. In this work we aim to test whether native species respond to the competitive effect of the invader by phenotypically shifting their trait values. To evaluate this we used as a model system the invasion of one of the most invasive plant species world-wide, *Carpobrotus* spp., in coastal dune plant communities. Along the Lazio coast (Italy) and in 3 coastal habitats (shifting dunes, stable dune grasslands and dune scrub), field sampling was carried out through paired-plots of 2 x 2 m, with and without the presence of *Carpobrotus* spp. In each plot we recorded the species' list and cover. Moreover, Height, Specific Leaf Area (SLA) and Seed Mass (SM) were measured for 11 coastal native species (commonly co-occurring with *Carpobrotus* spp.) in invaded and not invaded plots. We then calculated for each species in each paired plot the percentage trait displacement between the measurements in the invaded plot and not invaded plot. Through Linear Mixed effect Models (LMM) we modelled the relationship between each trait displacement and the percentage cover of *Carpobrotus* spp. in the invaded plot, in interaction with the habitat and adding species identity as a random slope and intercept factor. Our results suggest that the invader had a different effect on the trait displacement along the different habitats. Both positive (towards higher values of the trait) and negative (towards lower values of the trait) displacement were observed depending on the trait and the habitat analyzed. Our findings offer a first insight on the effects of *Carpobrotus* spp. invasion on native species' phenotypic variability, they might suggest that species undergo different trait displacement in order to favour coexistence with this highly invasive species. However, further research is needed in order to assess whether these changes are due to micro-evolutionary processes or are the result of phenotypic plasticity.

Cousins S.A.O.

Oral presentation
Grasslands coming up
Session: Classification, structure and dynamics of plant communities

Sara A.O. Cousins & Alistair G. Auffret

Stockholm University
sara.cousins@natgeo.su.se

There has been a long, still ongoing, debate on where species associated to species-rich semi-natural grassland communities were in the pre-agricultural landscape in Europe. Naturally open areas such as flood plains, chalk uplands or semi-open forest grazed by large herbivores have been suggested to be important habitats for past grassland communities. Another potential habitat is shore meadows. Since the last glaciation coastal areas of the Baltic Sea are subjected to land uplift, caused by isostatic rebound. Shore displacement along stretches of relatively flat shorelines would have created temporarily natural grassland areas, until trees could colonize, for grazing wildlife and later for domestic livestock and hay-making. In this study we model how much potential meadow habitat that emerged due to land uplift during the last 4000 years in a 23000 km^2 large region along the coast of south-eastern Sweden. We also compare species composition and richness in 11 managed with ten unmanaged shore meadows today, focusing on alpha and beta-diversity. We estimate that 7900 km^2 new land emerged in the study area during the last 4000 years. For each 100-year interval we identified potential natural grassland habitat as areas with a flat topography (slopes of zero to 1-2 degrees) that had emerged. In total 2400-3400 km^2 potential meadow habitat emerged, with between 50 and 150 km^2 each century. Analysing species richness in currently managed and unmanaged shore meadows we found that although alpha diversity increase with plot age the effect of grassland management was stronger. Total species richness, alpha diversity within managed meadows and beta diversity between managed meadows was higher compared to unmanaged meadows. We found that meadows subject to grassland management experienced a more effective build-up of species over time compared to unmanaged areas. Today there is only 1000 ha (mean size 6 ha) managed coastal grasslands left in the region. By modelling large-scale landscape development we might better understand the magnitude of grasslands prior to historical maps, and the development of species-rich grassland communities. This is important knowledge for future restoration and conservation efforts but also to understand the mechanisms behind species responses to landscape change.

Craven D.

Oral presentation
Biodiversity enhances resistance of ecosystem productivity to climate extremes
Session: Concepts in ecological stability

Dylan Craven[1,2], Forest Isbell[3], Nico Eisenhauer[1,2] & STABILITY sDiv working group[1]

[1]German Centre of Integrative Biodiversity Research (iDiv);[2] Leipzig University and [3]University of Minnesota
dylan.craven@idiv.de

The extent to which biodiversity buffers ecosystem responses to increasingly frequent climate extremes is unclear. While biodiversity has been found to stabilize productivity in grasslands over time, it is not yet known whether it does so by providing resistance during climate events, recovery (i.e. resilience) following climate events, or both. To address this, we compiled data from 46 grassland experiments across Europe and North America that manipulated plant diversity and measured aboveground productivity to test whether biodiversity provides resistance during and resilience after climate events. Defining climate events using a standardized drought index, we show that biodiversity increased resistance to a wide range of events, including wet or dry, moderate or extreme, and short or prolonged. In contrast, resilience was not dependent on biodiversity. Our results suggest that biodiversity mainly stabilizes productivity by increasing resistance to climate events. Anthropogenic environmental changes that drive biodiversity loss appear likely to decrease stability by reducing the resistance of productivity to climate events.

Dadalt L.

Poster presentation
Assessing the influence of anthropization on exotic plant species richness in North America
Session: Plant community invasion

Leticia Dadalt[1], Valério D. Pillar[1] & Michael W. Palmer[2]

[1]*Universidade Federal do Rio Grande do Sul and* [2]*Oklahoma State University*
ldadalt@gmail.com

Exotic species invasions pose a threat to biodiversity worldwide. Exotic species are not randomly distributed, though. Large urban centers tend to harbor more non-native species than their surroundings. Exotic species richness is also controlled by environmental conditions and disturbance, like native species richness. In general, studies show a negative relationship between the number of exotic species and the number of natives at fine scales and roughly the opposite at broader scales, indicating spatial dependence. In this study, we assess whether we can identify human impacts expressed at the landscape level, such as urbanization and agriculture, as drivers of a higher proportion of exotic plant species in terrestrial ecosystems and whether the relationship persists across different scales. For that, we analyzed data from the 1900 floras from North America north of Mexico (a subset of the FloraS of North America Project dataset, where exotic species were present) and data from the Global Human Footprint Index (an aggregate index of human activity, combining data on human population, land transformation, and density of electric power and transport infrastructure), along with other variables known to be important determinants of plant species richness, at four grains (spatial scales). Our preliminary results indicate a strong positive association between human impacts and the exotic species, where mostly anthropized areas presented floras with a higher number of non-native species, and that relationship was constant across scales, varying slightly in intensity. Exotic species richness responded similarly as native species richness to the latitudinal gradient at broader spatial scales. Elevational range (a measure of environmental heterogeneity) was associated with higher numbers of non-native species at all spatial scales, while higher mean elevation had a negative effect. Longitude, which in North America can represent a gradient of precipitation, had a positive effect of moderate strength at all spatial scales, indicating a stronger presence of exotic species towards the east coast. Overall, we were able to confirm the trend of exotic species being prominent in anthropized areas, but further analyses are need to address the complex relationship between exotic and native species richness, and how it responds to spatial scale.

Daibes L.F.

Oral presentation
Fire effects in survival and germination of legume seeds from Cerrado: an experimental field approach
Session: Fire and grazing in non-forest vegetation

L. Felipe Daibes[1], Talita Zupo[1], Fernando A.O. Silveira[2] & Alessandra Fidelis[1]

[1]Universidade Estadual Paulista, Dep. Botânica and [2]Universidade Federal de Minas Gerais, Dep. Botânica
luipedaibes@gmail.com

Field experiments may elucidate the role of fire in driving vegetation and plant responses to disturbance. We performed field experiments in open savanna in Central Brazil, aiming to evaluate fire effects in survival and germination of seeds from Cerrado. We tested fire on buried seeds and at the soil surface. The buried experiment consisted of placing seeds of two shrub species, *Mimosa leiocephala* (impermeable seed coats) and *Bauhinia dumosa* (permeable seed coats), 1cm belowground (10 seeds/species/replicate) in three different fuel load manipulation treatments (2x2m plots, 12 replicates/treatment): low, average, and high fuel load. The soil surface experiment consisted of placing seeds of four legume shrubs (*M. leiocephala*, *Harpalyce brasiliana*, and *Senna corifolia*, impermeable coats, and *B. dumosa*, permeable) under tussocks of native grasses during the mid-dry season fires (July), and seeds of *M. leiocephala* and *H. brasiliana* both under tussocks and in gaps (safe-sites) during late-dry season fires (October). For the soil surface experiments, we placed three aluminum dishes filled with local sand containing 8-10 seeds of each species in four 25x15m plots (3 subsamples x 4 replicates =12 dishes/treatment). For all experiments, control consisted of non-treated seeds. After treatments, seeds were set to germinate under optimal conditions and viability of the non-germinated was assessed by tetrazolium test. Data analysis was performed using randomization tests (Euclidian distance between sampling units, 10,000 iterations). Seeds of *M. leiocephala* and *B. dumosa* survived fire when buried, independent of fuel load treatment, with high viability (>70%), and germination of *M. leiocephala* was enhanced in the high fuel load treatment (28%, control=5%). Direct application of fire reduced drastically the viability of the four study species. Safe sites significantly reduced mortality for *M. leiocephala* seeds in relation to fire under the tussocks, but *H. brasiliana* seeds did not survive, neither in tussocks nor in gaps. Thus, seeds incorporated into soil seed banks have greater chances of survival, independently of fire intensity, leading to the persistence of its population and possibly breaking dormancy. However, if seeds are newly dispersed, they may be dependent on gaps in the vegetation for survival, since direct fire kills most of them.

Dalotto C.

Poster presentation
Control of plant community dynamics by soil microbial communities
Session: Classification, structure and dynamics of plant communities

Cecilia E. S. Dalotto[1], Tânia T. Castellani[1], José A. Morillo[2], Nivaldo Peroni[1], Francisco I. Pugnaire[1,2]

[1]*Departamento de Ecologia e Zoologia, Centro de Ciências Biológicas, Universidade Federal de Santa Catarina, Campus Universitário s/n, Córrego Grande, 88040-900, Florianópolis, Brazil;* [2]*Estación Experimental de Zonas Áridas, Ctra. de Sacramento s/n, 04120 La Cañada, Almería, Spain*
ceciliaesd@gmail.com

Soil microbial communities (SMC) play a critical role in plant community dynamics as soil microbes influence processes such as facilitation, competition and succession, and select plant functional traits and plant species composition in a community. We evaluated the role of soil microorganisms and microclimate in seed germination and seedling establishment in a costal sand dune system (*restinga*) in SE Brazil. We hypothesized that plant establishment would be limited by SMC, as soil communities in complex forest patches would be more diverse and functionally different than SMC from isolated, simpler plant patches. To test these hypotheses we selected *Guapira opposita*, a colonizer shrub species that forms fertility islands after disturbance in sandy coastal systems which also forms forest patches eventually leading to continuous forest. Ten *G. opposita* individuals forming isolated patches and 10 growing in forest patches were selected for a translocation experiment where we moved two soil blocks from the understory of isolated patches to forest patches and vice versa, leaving two additional soil blocks under each shrub as control. One block in each pair received soil extracts from its own soil and the other one extracts from the opposite habitat. We measured plant performance at the end of the growing season and SMC structure using a *shotgun* metagenomic analysis with Illumina technology. SMC controlled germination rates so that soil extracts from forest patches increased plant abundance, species richness and biomass in both, fertility islands and forest patches, while understory microclimate had a secondary role. SMC had different structure in both soil types, being bacterial diversity higher in forest than in isolated patches. Proteobacteria and Bacteroidetes were more frequent in isolated patches and Actinobacteria and Acidobacteria in forest soils. Regarding the fungal community, Basidiomycota were more abundant in isolated patches and Ascomycota in forest. These results show how SMC select which plant species establish in each habitat, and highlight the important role SMC play in plant community dynamics and overall ecosystem functioning.

Damasceno E.

Poster presentation
How much does Caatinga restoration cost? a cost / benefit analysis method for ecological restoration
Session: Restoration of subtropical and tropical grasslands and savannas

Edjane Damasceno, Adriana Manhães, Adriana Carvalho & Gislene Ganade

Universidade Federal do Rio Grande do Norte, Department of Ecology
edjanesd@hotmail.com

Restoration projects are urgently needed for the Brazilian semiarid tropical forest, called Caatinga. Many areas of Caatinga are constantly threatened by desertification due to its extreme climatic conditions, periodic droughts and high temperatures, allied with high anthropogenic degradation. Nevertheless, current methods used for vegetation recovery during Caatinga restoration have low economic viability due to high seedling mortality. In this study, we aimed to compare 20 methods for Caatinga ecological restoration using a cost-benefit analysis (CBA). We combined five field treatments (irrigation, litter coverage, irrigation + litter coverage, agroforestry and control) with four plant shapes (SrSs, SrLs, LrSs and LrLs, where Sr= small root (~30cm); Ss= small shoot (20-40cm); Lr= large root (100cm) and Ls= large shoot (> 40cm). We estimated restoration costs by using the economic analysis of replacement cost, valuing the natural and human capital involved in all steps of restoration. The benefit was estimated using average plant height one year after planting. CBA was calculated dividing the proportional value of cost by the proportional value of benefit ($C/B = c_i/c_{max} / b_i/b_{max}$, where c_i and b_i are the cost and benefit of each method, c_{max} and b_{max} are the highest values of the benefit and cost estimated from all methods, respectively). The cost of different methods ranged from U\$ 55.95 per plant (control/SrSs) to U\$ 242.36 per plant (irrigation + litter coverage/LrLs). Lowest values of C/B ratio were found in methods that used transplants with large roots and large shoots without irrigation, with litter being added or not. Highest values of C/B were generally found for methods that used irrigation combined with small roots and small shoots. Large transplants with large roots have the advantage to access deeper soil moisture during drought periods and store more water in their tissue. Additionally, the litter cover might have improved nutrient levels and decreased soil evaporation. Water is a limiting resource in arid and semi-arid environments. This work shows that the use of transplants with large roots increases seedling growth with low cost-benefit as the use of irrigation was no longer required.

Damasceno G.F.

Poster presentation
Impact of invasive grasses on Cerrado open physiognomies
Session: Plant community invasion

Gabriella F. Damasceno[1], Elizabeth Gorgone-Barbosa[1], Paula Z. Giroldo[2], Vänia R. Pivello[2], Lara Souza[3] & Alessandra Fidelis[1]

[1]Universidade Estadual Paulista;[2]Universidade de São Paulo & [3]University of Oklahoma
fariadamasceno@hotmail.com

Biological invasions are one of the most important threats to biodiversity across the world. The impacts of invasive species on community level are associated to declines on biodiversity, shifts in species composition, by the gains and losses of species altering the identity and relative abundances of organisms. Cerrado (Neotropical Savanna) is threatened by biological invasions, particularly by the C_4 African grasses *Melinis minutiflora* and *Urochloa decumbens*. We calculated the impact (Coenh's D index) of invasive species on a Cerrado open physiognomy under natural regeneration by comparing invaded and non-invaded communities. Our hypothesis was that the invaders' impact would negatively affect native graminoids, leading to changes on native plant community structure/composition. We sampled 120 1m plots (40 plots per community type × 3 communities: non-invaded, invaded by *M. minutiflora*, and invaded by *U. decumbens*) 4 × each year to track changes in plant communities due to seasonality. Invaded and non-invaded communities were compositionally dissimilar (P=0.013); with invaded communities different from each other (P=0.004). These C_4 African species negatively affected negatively all native groups (except palms), while promoted the total dead biomass. Graminoids and native total biomass were the most affected by these grasses. *M. minutiflora* had greater impact than *U. decumbens* on total dead biomass (P=0.009). In plots invaded by *M. minutiflora* the total gaminoids varied according to the rainy or the dry season (P=0.014), probably due to the high amount of biomass produced by this grassin the wet season. In the Cerrado open physiognomies, available sites created after disturbances could lead to a state dominated by invasive grasses. Our results show the negative impact of two of the most aggressive invasive grasses in Cerrado and thus, we propose an urgent need to develop techniques to control these species.

Deák A.J.

Oral presentation
Landscape-level and local vegetation patterns in the Danube-Tisza Interfluve and its possible use for the modification of geographical microchors with the synthesis of habitat mappings, geographical data bases and historical maps
Session: Applied mapping for conservation and management

Áron József Deák

University of Szeged, Department of Physical Geography and Geoinformatics
aron@geo.u-szeged.hu

The share of Hungarian geographical microchors hasn't been changed since 1967, however actual geological, geomorphological, agrotopographical soil maps, the use of first, second ordnance surveys, META- and own-made habitat maps make possible its revision. The sample area, Danube-Tisza Interfluve lays in the centre of the Great Hungarian Plain in Hungary and Northwestern Vojvodina, Serbia. Its northern and centre part is a sand covered Pleistocene alluvial cone of river Danube where higher elevated middle parts (Kiskunság Sand-ridge and Illancs with larger dunes) are dominated by dunes with open sand grasslands with low proportion of salt vegetation and fens in the depressions. They are surrounded by microchors with closed sand steppe covered flat sand sheets with significant percentage of blow-out depressions with fens and solonchak salt vegetation in the northeast (Pilis-Alpár Sand-ridge), southeast (Dorozsma-Majsa Sand-ridge), the southwest (Baja Sand-ridge) and in the west sides (Túrján-land). Sand landscapes are bordered by loess-covered alluvial cones and loess-plateaus where vegetation survived on verges, loess-valleys and in salt areas. Upper Bácska Loess-ridge differs from other microchors due to the presence of loess covered sand-dunes with extinct vegetation. It contains an isolated transboundary sand landscape (Csikéria Sand-ridge) with few remains of sand vegetation as well. The narrow Érsekcsanád-Császártöltés Loess-plateau is an isolated loess-vegetation dominant microchor on the border of the Danube's floodplain and Illancs. Scattered, significant loess covered alluvial cones exist in the eastern part of the Danube-Tisza Interfluve (Kiskunság Loess-ridge, Gerje-Perje-, Szeged-, Kanjiza-plains) with loess steppes on loess-ridges and salt vegetation in (Puccinellia and annual salt pioneer swards on solonchak soils surrounded by salt meadows on solonetzic meadow soils) and around (Artemisia salt steppes on solonetz soils) the saline lakes formed in Pleistocene river-beds. The loess covered alluvial cone and the edge of the Mezőföld loess-plateau was eroded by the river Danube being chopped into loess-lag-surfaces in the Solt-plain containing significant salt vegetation. This microchor differs significantly from the low floodplain of Danube (Csepel-, Dunaújváros-Paks-, Gemenc-Mohács-floodplains) as well as from the Kalocsai-Sárköz, which has floodplain vegetation with fens and moors in the abandoned river-beds. The floodplain of South-Tisza-valley borders the eastern part of the Danube-Tisza Interfluve.

Dechoum M.S.

Oral presentation
Factors controlling grassland occupancy by shrubs in montane systems in Southern Brazil
Session: Climate change and plant communities

Michele de Sá Dechoum[1], Pedro Cavalin[1], Nivaldo Peroni[1] & Francisco I. Pugnaire[2]

[1]*Programa de pós graduação em Ecologia, Universidade Federal de Santa Catarina, Brazil* and [2]*Estación Experimental de Zonas Áridas, Consejo Superior de Investigaciones Científicas, Almería, Spain*
mdechoum@gmail.com

The existence of permanent ecotones between forests and grasslands has been explained based on competition, demographic bottlenecks, climate or disturbance regimes, including fire and herbivory. However, shrub and tree encroachment in grasslands has been recorded throughout the world in the last decades, in a process that can lead to irreversible ecosystem changes and jeopardize provision of ecosystem services. Factors such as overgrazing, fire, changes in soil moisture and nutrients, and climate change have been linked to shrub encroachment. However, it is still controversial how each factor may contribute to this process. We wanted to assess the effects of temperature rise and neighbor removal on growth and physiology of juveniles of *Baccharis uncinella* shrubs in a montane grassland in Southern Brazil. We hypothesized that removal of neighbor grasses and increased air temperature would enhance *B. uncinella* growth. A factorial experiment was carried out from August 2014 to September 2015 using air temperature and competition as factors with two levels each resulting in four different treatments with 10 replicates. Air temperature was increased with acrylic open-top chambers (OTC) and competition reduced by removal of neighbors. Height increment, annual growth, Fv/Fm, LDMC and SLA were measured and analyzed with two-way ANOVA. Plants with OTCs were taller than control plants and, when neighbors were removed, there was a tendency for plants to grow less and to have larger SLA. However, there was not much influence of OTCs and/or neighbor removal on physiological parameters, most likely because temperature only slightly increased with our treatments (by 0.3-0.9°C daily mean). These data suggest, however, that an increase in temperature may enhance encroachment by *B. uncinella*. Counterintuitively, grass removal also decreased shrub growth, suggesting that factors other than competition may explain the persistence of montane grasslands in Southern Brazil.

Dechoum M.S.

Oral presentation
Guidelines for management based on scientific evidence: the case study of *Hovenia dulcis* in seasonal deciduous forests in Southern Brazil
Session: Plant community invasion

Michele de Sá Dechoum[1], Tânia T. Castellani[1], Sergio M. Zalba[2] & Marcel Rejmánek[3]

[1]Programa de pós graduação em Ecologia, Universidade Federal de Santa Catarina, Brazil;[2]Universidad Nacional del Sur, Bahía Blanca, Argentina and [3]Department of Evolution and Ecology, University of California, Davis, USA
mdechoum@gmail.com

Hovenia dulcis is a deciduous, zoochorous tree native to East Asia, described in scientific literature as a pioneer species. Our general goal was to investigate key factors of the invasion ecology of the alien species *H. dulcis* across successional stages in seasonal deciduous forests (SDF) in Southern Brazil in order to generate guidance for practical management. Seed germination, seedling survival and growth were assessed experimentally. The seed germination and seedling establishment processes were observed in all successional stages studied, which provided evidence that the species tolerates shade in the seedling phase, characterizing the species as a potential invasive even in forests with scarce canopy openness. An assessment of the effectiveness of control measures of *H. dulcis* in reducing propagule pressure on non-invaded sites was also carried out. Felling *H. dulcis* trees was effective to reduce propagule arrival in non-invaded sites, as it resulted in smaller numbers of seeds in seed traps in felled plots compared to control plots. Considering that *H. dulcis* is capable of colonizing and invading secondary forests in different successional stages, we concluded that the current condition of the SDF forests are an ideal setting for the species invasion. It is therefore recommended that this species is banned from use in environmental restoration projects, as well as from planting for any purpose in protected areas and their buffer zones. We recommend a minimum distance from forest fragment borders that should be considered a priority for elimination of *H. dulcis* individuals, as well as continuous monitoring and control activities, in order to reduce the intensity of seed arrival in protected areas and in other sites of high conservation value. Fostering the use of indigenous species to replace *H. dulcis* through public policies and incentive programs is essential for the conservation of remaining fragments of SDF in Southern Brazil.

Decocq G.

Oral presentation
Remnant artificial infrastructures in a self-healing nature: former human land use impacts biodiversity for centuries to millennia
Session: Historical human legacy in vegetation

Guillaume Decocq & Déborah Closset-Kopp

Unité de Recherche "Ecologie et Dynamique des Systèmes Anthropisés" (EDYSAN, FRE 3498 CNRS), Jules Verne University of Picardie, 1 rue des Louvels, F-80037 Amiens Cedex, France. guillaume.decocq@u-picardie.fr

Historical human activities are increasingly recognized by ecologists as important drivers of modern vegetation patterns and ecosystem functioning, but the length of time these legacies persist is still poorly known. We studied three types of human artefacts currently located into a forest matrix, namely former feudal mottes dating back from the Middle Ages, former Roman villae, and a former Roman road. We determined whether these artificial infrastructures have left a long-lasting imprint in the current forest vegetation. We compared soil chemical properties, canopy conditions, actual vegetation and (in the first two cases only) soil seed bank patterns between these archaeological artefacts and paired control sites located in the same forests. Usually, soil from the archaeological sites contained more stones, organic matter, carbon, nitrogen and phosphorus, and their pH was higher than for controls. Species richness and diversity of either vegetation or seed bank differ between sites and controls were not systematically different, but species composition was in all cases, with more calciphilous and eutrophic species on the artifacts. In the case of the former Roman road, there is strong evidence that, besides representing an insular habitat within the forest, it acted as a corridor for some species immigrating from outside a long time ago, possibly including invasive species; some of these species may have established nearby within the forest thanks to a "spill-over effect". We conclude that centuries after their reclamation and forest colonisation, Roman and medieval artificial infrastructures still generated particular soil conditions that are reflected by an original floristic composition compared to the surrounding understories of the lowland forests in which they occur. This long-lasting imprint may be partly due to the building material and associated recruitment limitations, rather than dispersal limitation of forest species. Current local species pools likely have been enriched in the past thanks to the corridor effect such artificial structures may have played centuries ago.

Dee J.R.

Oral presentation
Annual rings in herbaceous species correlate to climate in similar ways to nearby trees within the U.S. oak savannah grassland
Session: Climate change and plant communities

Justin R. Dee

Oklahoma State University
jrdee@okstate.edu

Understanding of how site and climatic history has influenced annual growth of resident savannah species in previous years could be central in forecasting future possible compositional shifts in these forest-grassland ecotones. In this study, I combined the disciplines of herb-chronology and dendrochronology to investigate the effects of prior fire history, annual temperature, and precipitation on the annual growth of neighboring perennial forbs and oaks in two separate representative locations of the North American oak savannah. A total of 2 herbaceous and 2 oak species were studied, one per life form per site. For each site, one located in the southern oak savannah of Oklahoma and the other in the northern part of the oak savannah in Minnesota, herbaceous species had moderate responses towards yearly climatic conditions (positive correlations with spring precipitation and negative correlations summer temperatures) with little to no pattern towards fire history. Regarding pairwise correlations amongst individuals and their yearly variation in annual ring increment per site, I found moderate evidence for population mean sensitivity towards environmental conditions (interseries correlation = 0.35, averaged between both sites) for the herbaceous species. Northern and southern oaks, on the other hand, had disparate responses in their ring patterns towards climate. Southern savannah oaks had strong interseries correlations ($r = 0.57$), concomitant with strong mean sensitivity that showed surprisingly similar correlative responses to yearly climate in relation to neighboring forbs. However, the northern savannah oak study species were not as strongly responsive to climate and showed relatively low interseries correlation ($r = 0.33$) and mean sensitivity for a tree population. Both oak species were not responsive to fire history. Upon deeper investigation, species (regardless of life form) that responded the most to climate through annual ring patterns were ones who were at the edge of their geographic range. This study suggests the importance of species tolerances to physiological conditions brought on by local climate and how, depending on these ranges and the composition of the forest-grassland ecotone in question, a shifting climate could affect annual growth that may eventually lead to a change in species composition.

Dell N.D.

Oral presentation
Assessing the robustness of clustering methods for classification of vegetation data
Session: Data analysis methods in vegetation ecology

Noah D. Dell & Peter R. Minchin

Southern Illinois University Edwardsville
nodell@siue.edu

Many numerical clustering methods have been proposed for use in classifying vegetation. While much research has been done on the use of clustering methods in vegetation classification, most research is based on real data. Few studies have utilized simulated data with a known clustering structure that allow for objective measures of performance. Furthermore, published studies compare only a limited number of methods. My research uses both simulated vegetation data with a known ecological structure and several real data sets to assess which of many clustering methods are most robust to variation in the generating model. Model parameters varied include beta diversity, alpha diversity, number of clusters, cluster size, shape, density, and distinctiveness, presence of outliers, presence of generalist species, false absence of species, and misidentification of species. Methods tested include agglomerative hierarchical clustering (complete linkage, Ward's method, Lance-Williams flexible beta), divisive hierarchical clustering (TWINSPAN), nonhierarchical clustering (K-means, Noise Clustering, FANNY, Isopam), and optimization methods (optimal silhouette [Optsil]). Clustering performance is assessed by external and internal cluster validation statistics, including the corrected Rand index (ARI), Dunn index, and silhouette width. Preliminary results indicate most consistent cluster recovery by the nonhierarchical methods Isopam, FANNY, and Noise Clustering (mean ARI=0.954, 0.928, and 0.902, respectively). Agglomerative hierarchical clustering by Ward's method using chord distance (ARI=0.823) and the Lance-Williams flexible beta method with Bray-Curtis dissimilarity (ARI=0.881) also perform well. Optsil offers slight improvements to cluster recovery using clustering results from other methods as an initial configuration (ARI=0.924 for Optsil starting from flexible-beta results), however it can decrease performance in some models with obscure cluster boundaries. TWINSPAN, a popular hierarchical divisive method, performs well with data that have few clusters and outliers (ARI=0.959) but not when data have many outliers or clusters (ARI=0.738, compared to 0.918 for Isopam). I anticipate that these preliminary results will change after including mixed cluster size and shape models. Though it could be argued that the iterative processes of nonhierarchical methods should favor robustness, many are K-means based methods that search for spherical groups of similar sizes and may be less successful when clusters vary in size and shape. Consistent classification of vegetation types is essential for classifications to be useful for both fundamental research on the factors that determine vegetation patterns and dynamics and for applications in the management, conservation, and restoration of vegetation. Users of numerical clustering for vegetation classification will benefit from an understanding of which methods work best given the properties of the data analyzed.

Dengler J.

Oral presentation
sPlot 2.0 – the first global vegetation-plot database offering novel opportunities for ecological research
Session: Functional and phylogenetic patterns in plant communities

Jürgen Dengler[1,2], Stephan M. Hennekens[3], Oliver Purschke[1,4], Milan Chytrý[5], Florian Jansen[6], Ute Jandt[1,7], Borja Jiménez-Alfaro[5], Jens Kattge[1,8], Jonathan Lenoir[9], Valério D. Pillar[10], Brody Sandel[11], Helge Bruelheide[1,7] & the sPlot consortium[12]

[1]*German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig, Deutscher Platz 5e, 04103 Leipzig, Germany;*[2]*Plant Ecology, Bayreuth Center of Ecology and Environmental Research (BayCEER), University of Bayreuth, Universitätsstr. 30, 95447 Bayreuth, Germany;*[3]*Alterra, Wageningen UR, Droevendaalsesteeg 3, 6708 PB Wageningen, Netherlands;*[4]*Department of Computer Science, Institute of Informatics, Martin Luther University Halle Wittenberg, Von-Seckendorff-Platz 1, 06120 Halle (Saale), Germany;*[5]*Department of Botany and Zoology, Masaryk University, Kotlářská 2, 611 37 Brno, Czech Republic;*[6]*Institute of Botany and Landscape Ecology, University of Greifswald, Soldmannstr. 15, 17487 Greifswald, Germany;*[7]*Geobotany and Botanical Garden, Institute of Biology, Martin Luther University Halle Wittenberg, Am Kirchtor 1, 06108 Halle (Saale), Germany;*[8]*Max Planck Institute for Biogeochemistry, Hans-Knöll-Str. 10, 07745 Jena, Gemany;*[9]*Ecologie et Dynamiques des Systèmes Anthropisés, Université de Picardie Jules Verne, 1 Rue des Louvels, 80000 Amiens, France;*[10]*Department of Ecology, Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, 91501-970, Brazil;*[11]*Department of Bioscience, Aarhus University, Ny Munkegade 114, 8000 Aarhus C, Denmark and* [12]*Worldwide*
juergen.dengler@uni-bayreuth.de

We present sPlot, the first global vegetation-plot database, which aims at collecting vegetation-plot records (relevés) through a community-driven approach and recently has become a research platform at the German Centre for Integrative Biodiversity Research (iDiv). Community-driven means that databases around the world can join sPlot, provided they meet our technical requirements and agree with the sPlot Governance and Data Property Rules. Contributing databases remain the property of their owners and data in sPlot are only available to members of the sPlot Consortium. Typically, large national (and sometimes regional) databases join the Consortium, but in case of Europe and tropical Africa, we cooperate with the European Vegetation Archive (EVA) and the Tropical African Vegetation Archive (TAVA) as intermediate "data aggregators". The sPlot database is compiled and managed with a prototype of the software TURBOVEG 3. With the release of sPlot 2.0 in January 2016, the database contains 1,115,705 vegetation-plot records from 110 member databases, 130 countries and all seven continents. All plots are geo-referenced, albeit with varying precision, and many have additional plot-scale structural or environmental data. The species data in sPlot are standardised to a common taxonomic backbone and matched with a gap-filled version of the global plant trait database TRY 3.0. Unlike other vegetation-plot databases, sPlot is published in fixed versions every 1-2 years to reduce efforts of data homogenisation and to ensure that series of papers are based on exactly the same data. The unique quality of sPlot is to provide fine-grain species co-occurrence data in a comprehensive manner for the maximum possible extent, that is, the globe. This offers novel opportunities for vegetation ecologists to seek for generalities in community assembly, diversity and invasion patterns across the world's biomes while macroecologists can get much closer to underlying drivers of global patterns than previously with coarse-grain species distribution data. We will present the content of sPlot 2.0, discuss its outstanding properties and provide some glimpses on analytical avenues the sPlot Consortium is currently following. In a related contribution by Bruelheide *et al.*, sPlot-based findings on functional composition of plant communities will be shown in more detail.

Dhusia K.

Oral presentation
Exercising biodiversity informatics to examine functional and phylogenetic traits in global ecosystems
Session: Functional and phylogenetic patterns in plant communities

Kalyani Dhusia & Pramod W. Ramteke

Department of Computational Biology and Bioinformatics, Sam Higginbottom Institute of Agriculture, Technology and Sciences
kalyanidhusia.bhu@gmail.com

Amplified taxonomic diversity in a community has great benefits and is a major cause of improvement in biodiversity. However, phylogenetic and functional trait diversities often outclass the known taxonomic models. Functional traits can differ both intra and interspecifically which in turn is an important difference with species richness. The collection of functional traits in a community can greatly affect ecosystem function and, also functional traits are dependent on phylogeny. To investigate the relationship between phylogenetics, functional traits and ecological performance, various computational and statistical methods are applied and Biodiversity informatics is the science that deals with these issues. Biodiversity informatics tends to focus more on the interaction of different organisms and their place in the environment. Functional diversity and phylogenetic diversity have been proposed as superior methods to measure the ecological potential of communities. To investigate the relationship between phylogenetics, functional traits and ecological performance, various computational and statistical methods are applied. Biodiversity informatics is the science that deals with these issues. Biodiversity informatics tends to focus more on the interaction of different organisms and their place in the environment. Here we use data from a databases of Biological sequences (both flora and fauna) and compare the extent to which conservation and preservation of amino acid which further explains several types of community metrics of functional variation such as a) species richness, b) variation in individual traits, c) functional group richness, d) a distance-based measure of functional diversity, e) a hierarchical multivariate clustering method, and f) a phylogenetic diversity measure, summing phylogenetic branch lengths connecting flora and fauna communities together and be the major cause for ecological differences. Further, a statistical model that included the presence of conserved domains, mutations and phylogenetic diversity gives a better explanation of community productivity than other models. Studies suggest species identity explained a small fraction of the variation in extinction risk (12%), independently of each species' evolutionary history. Fusing basic biodiversity information with ecological information in the form of sequences of flora and fauna is very common these days. Our study helps illustrates the importance of disentangling the patterns of community assembly among lineages to better interpret the ecological role of phylogeny and hence functional traits. It also sheds light on studies reporting absence of variation in individual and community traits, and opens new perspectives on the analysis of niche and trait conservatism across lineages.

Didukh Y.

Poster presentation
Nitrogen as an indicator of ecosystem stability and development
Session: Climate change and plant communities

Yakiv Didukh

M. G. Kholodny Institute of Botany NASU
ya.didukh@gmail.com

The theoretical aspects of ecosystem stability and dynamics, which are based on the laws of thermodynamics, synergetics, and non-linear equations (Elton, 1958; Odum, 1953, Whittaker, 1967; May, 1973; Hacken, 1975; Brooks, Wiley, 1986; McCann et al., 1998; 2000; Neutel et al., 2002; 2007; Rooney et al., 2006; Townsed, 2009 et al.) are developed in details. Despite that, the complexity of functioning and organization of ecosystems needs further development of such methods of their assessment, which would depict these complicated interrelations in a simpler form. In contrast to the species, ecosystems provide the accumulation of energy in different blocks, which are a kind of the regulatory mechanisms for the processes of functioning and dynamics. The conducted research and calculations have revealed that in the forest ecosystems the regulatory mechanism is located in the aboveground part (energy equivalent $360*10^6$ J/m^2), and the serai passage is determined by the changes in the tree species. In the steppes, it is located in the underground part, as, on the one hand, the energy parameters of the underground biomass ($22,1*10^6$ J/m^2) are exceeding the aboveground components in 3-5 times, and, on the other hand, black earth soils have significant stocks of humus ($330*10^6$ J/m^2). It is well known that the energy stocks correlate with the carbon parameters, but the nature of its transformation is indicated on the base of nitrogen molecular entities (Didukh, 1998), which are decomposed to the gaseous state. On this stage they are inaccessible for the assimilation by the best part of plants. Thus, the significant value has the development of scales, which reflect the relation of species to the nitrogen in soils (Ellenberg, 1979; Landolt, 1977; Tsyganov, 1983; Zarzycki,1984). There was developed (Didukh, 2011) an 11-point scale for the 3800 species of vascular plants of Ukraine. It allows, basing on the geobotanical descriptions, to assess the place of phytocoenoses in a relation to the changes of this factor, and also to determine the nature of correlation between the values of the other factors. There was determined a direct relationship between the changes of nitrogen level and the soil humidity, the crioregime and thermoregime. The inversed relationship is indicative for the soil regime, pH, carbon level, and ombroregime, which has significant value for the prediction of ecosystem development in the conditions of the climate change. It was proved that the direct impact of climate change has lower effect on ecosystems than the indirect impact through the changes of edaphic parameters of soil. It determines the non-linear nature of such changes and makes the prediction of possible consequences more complicated.

Diekmann M.

Oral presentation
A comparative study of the impact of invasive plant species on phytodiversity in North-western Germany
Session: Plant community invasion

Martin Diekmann, Hannah Effertz, Lea Doobe, Monika Baranowski & Cecilia Dupre

University of Bremen
mdiekman@uni-bremen.de

In the framework of a screening of invasive plants and their effects on species richness and composition in North-western Germany, we studied the two annuals *Impatiens glandulifera* and *I. parviflora* as well as the perennial *Fallopia japonica*. Using a space-for-time substitution approach and data from a wide range of communities, invaded plots were compared with adjacent, environmentally similar uninvaded plots, based on the assumption that the latter represent the situation prior to an invasion. In *Impatiens*, species richness in the invaded sites was only weakly reduced (*I. parviflora* - on average 5.9%, *I. glandulifera* - 7.4%), and also the community composition had only marginally changed. Invaded and uninvaded plots in general showed similar habitat conditions. However, both *Impatiens* species occurred in slightly shadier sites compared to the uninvaded surrounding, and the plots invaded by *I. parviflora* tended to have higher nutrient contents. The relatively low impact of *Impatiens* on the vegetation is most likely caused by the annual life strategy of the species: while *I. glandulifera* shows large fluctuations in numbers between years and has a later phenological development than most other species in its habitat, *I. parviflora* establishes preferably in dark and acidic, often disturbed woodlands where it competes with few other species. In plots invaded by *Fallopia japonica*, species richness was reduced by on average 77%, and also the community composition changed notably compared to the uninvaded plots. Here, the measured environmental variables did not differ between invaded and uninvaded sites. We conclude that the paired approach is suitable for assessing and quantifying the impact of invasive species, despite the fact that dense populations of invading species may often be found at particular microsites. The results further suggest that the effects of annual invasives are often minor compared to rhizomatous species.

Dubyna D.

Poster presentation
Pyrogenic vegetation changes of the Northern Black Sea region (Ukraine) floodlands
Session: Fire and grazing in non-forest vegetation

Dmytro V. Dubyna & Tetiana P. Dziuba

M.G. Kholodny Institute of Botany, National Academy of Sciences of Ukraine
tdziuba2014@gmail.com

Burning influence on plant cover of floodland ecosystems in the last two decades becomes an urgent issue of investigation. Mostly, the pyrogenic factor is a stimulator for plant species development. After fire, seed germination of many plant species is promoted, and their vegetative reproduction also stimulated. In the Northern Black Sea Region floodlands, burning is traditionally used as a management instrument of mire vegetation (*Phragmito-Magno-Caricetea* class). To improve the vegetation state, these communities are historically burned in winter when under ice cover or without any high water level, at intervals of two to four years. Where burning of mire vegetation had been prohibited by nature conservation, the accumulation of organic substances has been taken place. This caused an accelerated degradation of vegetation with relative changes in the groups of heterotrophic organisms. In the some areas, *Phragmitetum communis* communities were degraded and replaced by floristically less rich communities, not seldom with halophyte participation, where specific wealth of fauna is respectively decreased almost ten times. Experimental burning of mire vegetation at sites not included into nature conservation projects resulted in the recovery of floristic community composition. At sites with periodical inundation, the number of vegetating stems of *Phragmites australis var. altissima* is increased 3.1-fold at sites with a regular inundation –2.8-fold. Increase of stem height (by 36% and 15% as compared with control) and diameter (by 59% and 15%, accordingly) occured. *Phragmites australis* var. *flavescens* was characterized by a slight decrease of stem number. Height of plants increased by 53%, and diameter by 37%. Both species of *Phragmites* are specified by growth of phytomass (by 26.7% and 79.0% relatively) and number of generative stems. In the experimental plots, individuals of *Phragmites australis* harmed by insects were almost absent, whereas at control sites 3 to 7 specimens per 1 m^2 were found. As for the wood and shrub vegetation, the burning is expedient only to conserve rare plant species and to prevent overgrowth by bushes. Prolonged absence of burning (almost 30 years) of mire vegetation (lower reaches of the Kiliyan Arm of the Danube Delta) resulted in the formation of *Salicetum albae, Salicetum albo-fragilis, Salicetum cinereae* thickets.

Enrico L.

Poster presentation
Predicting forage quality from Functional Diversity in a subtropical seasonally dry forest of Argentina
Session: Linking vegetation to ecosystem services

Lucas Enrico[1,2], Georgina Conti[1], María L. Lipoma[1], Loreta C. Facciano[2] & Sandra Díaz[1,2]

[1]*Instituto Multidisciplinario de Biología Vegetal (IMBIV), National Scientific and Technical Research Council (CONICET) and* [2]*Facultad de Ciencias Exactas, Físicas y Naturales, Universidad Nacional de Córdoba, Córdoba, Argentina.*
lenrico@unc.edu.ar

Natural fodder and the secondary productivity derived from it are among the ecosystem provisioning services most valued by the inhabitants of the semi-arid Chaco region of Argentina. Under different land use regimes, plant communities and their associated ecosystem processes can vary considerably. These changes may be determined either by changes in the identity of the dominant species, or by changes in their relative abundances. Under the mass ratio theory (Grime, 1998) it is expected that those communities dominated by plant species of a higher quality for herbivores, as reflected by plant attributes positively related to consumption rates, would result in higher-quality fodder. Considering this, we aimed to analyze changes in the community weighted means for a number of traits related to species potential for trophic transfer to herbivores. We sampled vascular plant communities corresponding to three different land use types: Secondary Forest, Closed Shrubland and Open Shrubland). We measured the relative abundances of the ten dominant species, and analyzed five leaf traits: Specific Leaf Area (SLA), Leaf Dry Matter Content (LDMC), Leaf Toughness (LT), Leaf Nitrogen (LNC) and Phosphorus Content (LPC). Based on the relative abundances and attributes of the dominant plant species, we obtained the Community Weighted Mean (CWM) for each trait, under each land use type. Open shrublands showed a significantly lower leaf phosphorus content CWM than secondary forests and closed shrublands, higher LDMC CWM than Secondary Forests, and a lower value of SLA CWM than Closed Shrublands. We found no significant difference in leaf toughness or leaf nitrogen content CWMs. Therefore open shrublands are inferior than secondary forests or closed shrublands in terms of forage quality.

Escobar D.F.

Oral presentation
A seasonal-transient soil seed bank of the Cerrado tree *Miconia chartacea* (Melastomataceae)
Session: Underground processes in plant communities

Diego F. Escobar & Victor J. Cardoso

Universidade Estadual Paulista, Departamento de Botanica
barescoesco@gmail.com

In Neotropical savannas the establishment and growth of seedlings is heavily constrained by water availability in the soil, limiting germination to the onset of the rainy season. This restriction in germination results in selective pressures favouring seed dormancy and soil seed banks. The aim of this study was to determine the germination syndrome, seed longevity and capacity to form a seed bank of *Miconia chartacea*, a widely distributed tree in Brazil and highly abundant in the Cerrado. To test seed longevity we stored seeds in laboratory conditions (dry storage at 7°C and 25°C) and in the field, removing seeds every month for a period of 1 year. Seeds where then put to germinate for 90 days at 25°C in light. To determine the species seed bank we tested seed viability from soil samples collected from 20 different points both in the beginning and end of the rainy season. Our results suggest that *M. chartacea* seeds form a transient soil seed bank in the Cerrado. Its seeds can be classified as orthodox, where seed longevity can be prolonged when they are stored in cold and dry conditions. In our study, seed life span was favoured in soil-stored seeds in comparison with dry storage at 25°C. *M. chartacea* seeds are dispersed during the dry season and germinate during the next rainy season, and are thus classified as having an intermediate–dry germination syndrome. Seeds of this species are dispersed in the Cerrado when temperatures and soil moisture are relatively low, which favours the formation of a soil seed bank, considering that seeds tolerate desiccation and their longevity is prolonged by low temperatures. However, the loss of viability in storage at warm temperatures indicates that the species forms a transient seed bank. Increase in temperature coincides with the onset of the rainy season, restricting germination to this period, after which loss of viability hinders germination. Furthermore, transient seed banks are more common in perennial species with high annual seed production that are dispersed under unfavourable conditions for seedling establishment and in seasonally predictable vegetation and, thus, are a widespread trait among Cerrado species.

Euler A.M.

Oral presentation
Classification of plant communities, structure and diversity of forests in Acre, Brazil
Session: Classification, structure and dynamics of plant communities

Ana Margarida Euler[1], Kazue Fujiwara[2], Eugene Box[3] & Raimundo Saraiva[4]

[1]*Embrapa Amapá;*[2]*Yokohama National University;*[3]*University of Georgia and* [4]*FUNTAC in memorian*
ana.euler@embrapa.br

The southwest Amazon (SWA, Brazil) is considered a transitional (vegetation) zone between the Andes Mountains and the Amazon lowlands; it is among the forests with the highest diversity of flowering plants worldwide. Antimary State Forest is a protected area of sustainable use located in Acre state. The objectives of this study are: 1) to improve knowledge on the floristic composition, diversity, and structure of the Antimary forests; and 2) to describe plant communities in SWA using the Braun-Blanquet phytosociological method. Data were collected during two field trips covering a total area of 150 ha within two different forest management units. Classification of plant communities followed the Braun-Blanquet methodology, which is rarely used in the Amazon, if not unique. 48 relevés were recorded in homogeneous stands, and profile diagrams were made. In total, 946 species belonging to 326 genera and 118 families were recognized. Most of the species recorded in the Antimary forests are rare. 49% of the species richness comes from non-tree species, and there are many epiphytes, especially in the Araceae family. Two communities were recognized**:** (1) a *Vitex triflora – Trichilia quadrijuga* community with semi-closed canopy occurring in mesic areas; and (2) a *Metrodoria flavida – Ceiba s.l.* community with more open-canopy forests and unsteady relief crossed by several small creeks (igarapés). There is evidence that this distinction is caused by environmental gradients found across the study sites. Both communities presented high a diversity (H'=4.3 and H'= 5.15) at local scale, and Antimary forests present high ß diversity. The use of the Braun-Blanquet method was successful in the study of Amazonian plant communities and should be applied over more extensive areas. The results from phytosociological study can be used to set up performance criteria for the conservation and monitoring of forest concessions, representing actual and potential natural vegetation for the surrounding areas.

Fagundes M.V.

Poster presentation
Species identity not functional traits predict nurse plant effects: is it time to change the theory?
Session: Functional and phylogenetic patterns in plant communities

Marina V. Fagundes

Universidade Federal do Rio Grande do Norte - UFRN
marvefa@gmail.com

The effect of nurse plants on regenerating species is a key process shaping community structure and diversity. However, several factors can influence the intensity and direction of nurse plants in a given community. The Stress gradient hypothesis (SGH), predicts that positive interactions are more frequent in stressful environments. Conversely, the outcome of interactions can vary with species identity and tolerance to stress, but empirical data is still scarce. Nurse plants with stress tolerant traits are expected to exert positive effects whereas plants with competitive traits should impose negative effects on their neighbors. In order to understand if traits are related to positive or negative interaction outcomes between plants in stressful environments, we conducted a multi-species experiment on the Brazilian semiarid tropical forest. We selected 20 adult tree species as nurse plants and three target species. One seedling of each target species was planted under and far from nurse plant canopy (5 replicates). Morphological and physiological water-related traits were collected for each nurse species. Growth and survival of the 600 seedlings were monitored for 275 days. Subsequently the interaction intensity index (RII) was calculated for each adult-seedling pair as a measure of nurse net effect on seedlings. To test if nurse traits predict their effects on seedlings, we ran a phylogenetic regression with RII as response variable and nurse traits as explanatory variables. Contrary to the expectations, we found that water-related traits are not good predictors of plant interaction outcomes. Instead, both stress-tolerant and competitive plant strategies might influence seedling establishment in the same manner. Moreover, pairwise interactions varied with variables measured (growth or survival), a nurse plant can exert positive effects on survival but negative effects on growth for the same target species. This study provides strong experimental evidence that nurse plants show highly species-specific effects on target species regardless of their functional traits. Thus, contrary to current theory, nurse traits are not strong predictors of their effects on target species. To fully understand the outcome of plant-plant interactions, new studies should evaluate how the match between target and nurse traits simultaneously modulates the outcome of plant-plant interactions.

Fedrigo J.K.

Oral presentation
Restoration of overgrazed natural grassland of South Brazil by grazing deferment
Session: Restoration of subtropical and tropical grasslands and savannas

Jean K. Fedrigo, Carlos Nabinger, Julio Azambuja, Pablo Ataide, Ana Carolina Saraiva & Gabriela Maia de Azevedo

Universidade Federal do Rio Grande do Sul
jean@zootecnista.com.br

Herbivory on natural grasslands has a prominent role in driving vegetation dynamics, determining changes in vegetation structure, biodiversity patterns and primary and secondary productivity. These changes, which generally contribute to the ecosystem's sustainability at moderate grazing intensities, can cause environmental degradation when the stocking rate used is higher than the pasture's carrying capacity. The objective of this study was to evaluate the efficiency of temporary grazing exclusion to restore botanical composition, forage biomass, sward height, light interception and soil seed bank from a natural grassland degraded by overgrazing based on a reference area. Three treatments based on seasonal grazing exclusions (spring deferment, autumn deferment and continuous stocking) with three replications were applied simultaneously in areas managed for a long period with two grazing intensities: severe and moderate (used as reference area). The pasture managed under severe grazing showed a rapid change in botanical composition and diversity patterns in response to grazing exclusions. After two years of temporary grazing exclusions, grass functional groups of the established vegetation and soil seed bank from overgrazed pasture changed toward the characteristic species of plant community under moderate grazing. This shifts in community structure led to changes in aboveground biomass, sward height and light capture, mainly when grazing exclusion was applied during spring. Further, many important grasses for livestock production composed the soil seed bank in excluded areas. The deferment periods showed similar response patterns within each grazing intensity with higher magnitude for spring deferment. These results reveal the importance of grazing exclusion as a tool for the recovery of degraded pastures by overgrazing.

Fidelis A.

Oral presentation
Regeneration strategies after fire in Cerrado: the importance of resprouting and the bud bank
Session: Plant strategies and disturbance

Alessandra Fidelis, Talita Zupo, Mariana N. Rissi & Elizabeth Gorgone-Barbosa

Departamento de Botânica, Universidade Estadual Paulista
afidelis@rc.unesp.br

A great part of the Brazilian territory is covered by tropical savannas and grasslands. These savannas, which are called Cerrado, are a hotspot of biodiversity and more than 55% of its original area was already changed into other land uses, such as plantation of exotic forests. As most of the savannas, Cerrado has a long history of fire occurrence (back to at least 4 million years) and plants present several traits related to fire. However, less is known about the regeneration strategies of plants after fire in Cerrado. Although with less importance, germination events occur, but the importance of the seed bank is until unclear: few seeds are found in the seed bank in comparison to other ecosystems. In experimental plots located in Central Brazil, we carry out prescribed burnings, in areas of open savannas (*campo sujo*), in different fire seasons to try to understand responses of vegetation to fire seasons. So far, nearly all species can resprout after fire, independently of season. Also, when we clipped and burned four shrub species, we observed that plants regenerated faster and with more shoots after the fire experiments. Moreover, we found three resprouting strategies, according to the location of buds: belowground, on the surface and aboveground. Usually, all forbs and graminoids resprouted from belowground and surface buds. Most shrubs had their epicormic buds damaged after fire and thus, resprouted from buds located mostly belowground. However, trees showed the most interesting strategy: some species, such as *Hymenaea stigonocarpa* (Fabaceae) and *Casearia sylvestris* (Salicaceae) could resprout from epicormic buds located along the trunk and shoot, and from buds located both on the surface and belowground, showing active bud banks below-and aboveground after fire. However, other species such as *Caryocar brasiliensis* (Caryocaraceae) resprouted only from belowground buds, whilst *Qualea* sp. reprouted from aboveground buds. Further studies about bud protection should be carried out in Cerrado species in order to understand regeneration strategies in this fire-prone and species-rich ecosystem.

Filartiga A.L.

Poster presentation
Testing CLO-PLA database: is it suitable for belowground organs of tropical plants?
Session: Plant strategies and disturbance

Arinawa L. Filartiga[1], Jitka Klimešová[2] & Beatriz Appezzato-da-Glória[1]

[1]*Luiz de Queiroz College of Agriculture, Universidade de São Paulo and* [2]*Academy of Sciences of the Czech Republic*
arinawa@gmail.com

The understanding of a role of bud bearing organs in resprouting after disturbance and in vegetative spreading over large geographical gradients comes with an unified classification, such as that one used in CLO-PLA trait database for Central European flora. The standardization of plant traits and databasing are not available for all regions and all plant traits. In some ecosystems, as tropical grasslands, plants traits are being underrepresented due to the difficulty to assessment of bud bank and evaluation of clonal growth. The two aims of this work was: (i) to test if Brazilian morphological traits of belowground organs can be translated into categories used in CLO-PLA database and (ii) to test the applicability of clonal and bud bank traits standardized in CLO-PLA database for Brazilian *Aldama*. A total of 165 Asteraceae species, including herbs, subshrubs and shrubs of 37 genera from different Brazilian ecosystems were evaluated. Among these species, 29 *Aldama* (147 specimens) were analyzed in detail. The translation of traditional Brazilian morphological categories into CLO-PLA traits was not fully successful and resulted in lower number of categories and loss of information about plant morphology. For example, the occurrence of secondary thickenings is frequent among belowground organs of Brazilian plants, especially those subjected to fire, but it is not considered in CLO-PLA classification, since it is less often present in plant from Central-Europe which grow in more humid areas. Furthermore, we succeed only partially when assessing clonal and bud bank traits for *Aldama*, encountering difficulties when dealing with traits based on seasonal development like lateral spread per season, production of offspring shoot per mother shoot per year and shoot lifespan. Nevertheless, we considered the initiative to test the methodology of CLO-PLA database by using Brazilian species as an important step to improve the tropical flora evaluation. The results are promising for future comparative studies across ecosystems and biomes for which common trait standardization is necessary. However, it is clear that further research is needed on functional morphology of clonal and bud-bank traits in tropical regions.

Fischer F.M.

Oral presentation
Plant species richness and functional traits affect community stability after a flood event
Session: Concepts in ecological stability

Felícia M. Fischer[1], Alexandra Wright[2], Nico Eisenhauer[3,5], Anne Ebeling[4], Christiane Roscher[6,5], Cameron Wagg[7], Alexandra Weigelt[3,5], Wolfgang W. Weisser[4] & Valério D. Pillar[1]

[1]*Federal University of Rio Grande do Sul, Department of Ecology;*[2]*FIT, Department of Science & Mathematics;*[3]*Leipzig University, Institute of Biology;*[4]*Friedrich Schiller University Jena, Institute of Ecology;*[5] *German Centre for Integrative Biodiversity Research (iDiv);*[6]*UFZ, Helmholtz Centre for Environmental Research, Physiological Diversity and* [7]*University of Zürich*
feliciafischerster@gmail.com

Climate change is expected to increase the frequency and magnitude of extreme weather events. It is therefore of major importance to identify the community attributes that confer stability in ecological communities during such events. In June 2013, a flood event affected a plant diversity experiment in Central Europe (Jena, Germany). We assessed the effects of plant species richness, functional diversity, flooding intensity, and community means of functional traits on different measures of stability (resistance, resilience, and raw biomass changes from pre-flood conditions). Surprisingly, plant species richness decreased community resistance in response to the flood. This was mostly because more diverse communities grew more immediately following the flood. Raw biomass increased over the previous year; this resulted in decreased absolute value measures of resistance. There was no clear response pattern for resilience. We found that functional traits drove these changes in raw biomass: communities with a high proportion of late-season, short-statured plants, with dense, shallow roots and small leaves grew more following the flood. Late growing species likely avoided the flood, while greater root length density might have allowed species to better access soil resources brought from the flood, thus growing more in the aftermath. We conclude that resource inputs following mild floods may favour the importance of traits related to resource acquisition and be less associated with flooding tolerance.

Franci L.C.

Poster presentation
Seasonally alternating light or water shortages in a Neotropical semideciduous forest induce trade-offs along the ontogeny of a light-demanding emergent tree species
Session: Classification, structure and dynamics of plant communities

Luciana C. Franci[1], Luciano Pereira[2], Ricardo S. Machado[3], Claudia RB Haddad[4] & Fernando R. Martins[4]

[1]*University of Campinas/Ecology Graduate Program;*[2]*University of Campinas/Plant Biology Graduate Course;*[3]*COMPLANT interprise and* [4]*University of Cammpinas/Dept Plant Biology*
fmartins@unicamp.br

Plants face a drought-light trade-off in Tropical Seasonal Semideciduous Forests (TSSF), where water or light shortage alternates in dry and rainy seasons, respectively. Our main goal was to understand the life history and survival strategies of emergent trees while dealing with this trade-off across ontogeny. We studied the abundant and widespread Neotropical species *Astronium graveolens* Jacq. (Anacardiaceae). We collected the data in 100 random plots (10 × 10 m each) in a TSSF fragment in southeastern Brazil. In the field, we took notes on the plants' external traits to identify ontogenetic stages and measured height and diameter to conduct allometric analysis; and in a greenhouse we conducted photosynthetic and gas exchange responses to drought and shade experiments. We identified six ontogenetic stages (seedling, infant, juvenile-I, juvenile-II, immature, and adult) and the following possible trade-offs: increment in height, diameter or leaf number implied smaller leaves, and height growth led to production of less leaves in the juvenile-II; increment in height or diameter implied no branch production in immature. No biomechanical model fitted the population, as indicated by diameter-height SMA regression (n = 927, slope = 1.19, intercept = 0.01, r = 0.86), suggesting a growth pathway between the geometric and the elasticity similarity models encompassing characteristics of both pioneer and canopy species. Biomechanical stability was pervasive across the stages, and the safety factor decreased with height. We found an evident asymptotic height in adult, indicating strong water limitation. We found evidences of a trade-off between shoot and root growth under shadow. Our results indicate that a light-demanding emergent TSSF tree deals with the trade-offs caused by seasonally alternating water or light shortage through morphological and physiological strategies.

Frangipani M.A.

Poster presentation
Patterns of functional composition and diversity of the Pampa forests in Southern Brazil
Session: Functional and phylogenetic patterns in plant communities

Marcelo A. Frangipani & Sandra C. Müller

Federal University of Rio Grande do Sul
marcelo.frangipani@gmail.com

Community ecologists aim at identifying patterns of species abundance and distribution along regions and environments. Two complementary approaches rule community assembly: limiting similarity and environmental filters. While the first predicts that species within a community should be distinct in traits to avoid competition (divergence), the second expects a high similarity between co-occurring species (convergence), since they are filtered out to occur under certain environmental conditions. Functional diversity can give us an idea of the proportion of divergence and convergence in the structure of communities, while the functional composition might indicate the direction of trait responses to the environmental filters. Grasslands predominantly cover the southern Brazilian Pampa, and the forests are restricted to riparian zones and hillsides. Flooding is a common pressure on riparian forests, but they are also vulnerable to desiccation by evapotranspiration and winds. In contrast, slope forests are more shaded and humid. We aimed at characterizing functional diversity and composition of these forest environments. We expected trait convergence for riparian forests because of the harsher environmental conditions. We established 18 sampling units of 250 x 10 m in three regions of the Pampa, nine for each forest type. All trees with at least 5cm DBH were measured. The regions represent a gradient in precipitation and temperature. Six traits were assessed: leaf area, specific leaf area (SLA), leaf dry matter content (LDMC), plant height, dispersal mode, and fruit size. Functional diversity and standardized effect size (SES) were estimated for each region and forest. Functional composition was analyzed through community-weighted mean of traits (CWM), with further variance analysis to verify differences between forests and regions. CWM of leaf area and zoochory were always lower in riparian forests, while fruit size, SLA and LDMC were only influenced by the region. SES of functional richness varied according to the interaction between both factors, and for two regions the values were higher in riparian forests. The results, contrary to our expectation, are indicating trait divergence for riparian forests and convergence for slope forests. Both forest environments differ in terms of functional composition, irrespective of the region, which might are indicating distinct ecosystem functions.

Gallego F.

Poster presentation
Ecosystem functioning changes between condition states of two grassland communities in Uruguay: an approach from remote sensing
Session: Linking vegetation to ecosystem services

Federico Gallego[1], Santiago Baeza[1], Felipe Lezama[1], Fabiana Pezzani[1], Marcelo Pereira[2], Alice Altesor[1] & José Paruelo[3,1]

[1]Universidad de la República;[2]Instituto Plan Agropecuario and [3]Universidad de Buenos Aires
fgallego@fcien.edu.uy

To make compatible livestock production and natural grasslands conservation is a major challenge, particularly in the context of the accelerated transformation of natural habitats observed in South America. The State and Transition Model (STM) is a powerful tool to represent the dynamic of complex systems. As part of a larger project and based on an extensive filed survey of structural attributes of the vegetation, we identified four condition states for the two main communities (grasslands on deep and shallow soils) of the Cuesta Basáltica, the region with the highest percentage of natural grasslands in Uruguay. Over an area of 28000 km^2, we randomly select 100 study sites dominated (more than 80%) by one of the two communities. The area of the sites corresponded to a MODIS pixel (250x250m). In this study we characterized the ecosystem functioning of each grassland condition states of the two floristic units. Functional characterization was based on the seasonal dynamics of the Enhanced Vegetation Index (EVI) for the period 07/2014 to 06/2015 (dates of sampling field). This index was calculated from the spectral reflectance in the red, blue and infra-red bands provided by the MODIS sensor and it is a descriptor of Net Primary Production. We compared EVI values among grassland condition states using repeated measures in time ANOVA and Tukey post hoc comparisons. In the shallow soils floristic unit, the 4 states identified did not differ in terms of annual average EVI (an estimate of annual productivity) (F=1.346; d.f.=3; p=0.27), but they did differ in their monthly dynamics (F=1.666; d.f.=36; p<0.01). The 4 states corresponding to the deep soil floristic unit showed significant differences both in annual (F=4.069; d.f=3; p<0.01) and monthly EVI (F=2.419; d.f.=24; p<0.001). Our results showed how structural differences associated to past management within floristic units translated into changes in C gains dynamics, a critical determinant of ecosystem services provision, from C sequestration to forage availability.

Ganade G.

Oral presentation
New methods for ecological restoration of semiarid lands
Session: Restoration of subtropical and tropical grasslands and savannas

Gislene Ganade

Universidade Federal do Rio Grande do Norte
gganade@gmail.com

Programs for restoration of native vegetation cover in semiarid lands have the challenge to overcome harsh conditions and intense plant mortality due to drought. In the Brazilian semiarid tropical forest called Caatinga, restoration programs frequently face as much as 70% mortality of transplants. This study investigates new restoration methods involving different soil and plants shape treatments to overcome such lower rates of restoration success. An experiment was conducted in a 5 ha degraded area at the National Forest of Açu, Rio Grande do Norte, Brazil. Soil and plant shape treatments were applied in a split-plot design with five replicated blocks. In each block, the following soil treatments were randomly assigned in five 12 x 12 meters plots: control; litter addition; irrigation; litter+irrigation; agroforesty (irrigation+crops). Inside each soil treatment, six native tree species were planted with the following plant shapes: small root +small shoot; small root + large shoot; large root + small shoot; large root + large shoot and seeds. As expected survival and growth were higher in treatments that received water, however, plants with large roots and large shoots had significantly higher growth and survival even in treatments where water was not applied. Large plants with large roots have the advantage to reach deeper water sources in the soil during dry periods, while their large body size allows for high water storage in plant tissue. The seed sowing treatment was not successful due to the harsh conditions that impair germination. Plant growth and survival were very successful when restoration was joined with agroforestry techniques. This work indicates that restoration programs in dry lands should avoid expensive irrigation methods by transplanting large plants with large roots in degraded areas. However, in cases where irrigation is available, native plants could be planted together with crops using agroforestry techniques.

Gomes de Moraes M.

Oral presentation
Temporal variation of non-structural carbohydrates in two herbaceous species from the cerrado rupestre evidences their ecophysiological roles
Session: Plant strategies and disturbance

Moemy Gomes de Moraes, Taiza Moura Silva, Viviane Ovídio de Almeida, Maria Angela Machado de Carvalho & Rita de Cássia Leone Figueiredo-Ribeiro

Departamento de Botânica, Universidade Federal de Goiás, Instituto de Ciências Biológicas I, Goiás, Brasil
moemymoraes@gmail.com

Cerrado Rupestre is a physiognomy of the Cerrado Biome, in which plants grow on rocky outcrops, with acidic and nutrient-poor soil, seasonal water scarcity and fire. Species growing in these habitats have distinctive features that enable them to survive these constraints. The herbaceous and subshrub species have a great proportion of their biomass in thickened underground organs bearing buds and accumulating non-structural carbohydrates. These characteristics are essential to sustain resprouting after adverse environmental conditions. Fructans are the main storage carbohydrates in some groups of plants, like the Asteraceae family, which is a highly diverse family in the Cerrado ground layer. These carbohydrates are known to protect plants against several strains, including drought. Starch is the major storage carbohydrate widely distributed in plants. We compared water content and carbohydrate levels in the underground organs in two herbaceous species co-occurring in cerrado rupestre, over one year. One, *Dimerostemma vestitum* (Asteraceae), accumulates fructans in xylopodia. The other, *Trimezia juncifolia* (Iridaceae), stores mainly starch in corms. Both species have higher water content and water-soluble oligosaccharides during sprouting and vegetative growth. In the fructan accumulator, fructo-polysaccharides contents exceed fructo-oligosaccharides at the end of dormancy and after flowering. In the starch-accumulator, starch levels increase with the vegetative growth. The results evidence the role of these reserves to support the phenological events and environmental disturbances.

Gorgone-Barbosa E.

Oral presentation
Can fire be used as a management tool to control invasive grasses in Cerrado?
Session: Plant community invasion

Elizabeth Gorgone-Barbosa[1], Vânia Pivello[2], Lara Souza[3] and Alessandra Fidelis[1]

[1]*Universidade Estadual Paulista;*[2]*Universidade de São Paulo and* [3]*University of Oklahoma*
elizabethgorgone@gmail.com

Fire regimes can be modified by the presence of invasive species and on the other hand, changes in fire regime can affect the invasive species in a new environment. In the Cerrado, fire is an important ecological factor and therefore, we used prescribed burns, understand how fire affects the African invasive, *Urochla brizantha*, and the native community, in order to evaluate if fire could be used to manage this species. From 2012 to 2014 we applied the following fire treatments: Annual, Biennial and Control (no fire), in two seasons Mid-Dry (MD) and Late-Dry (LD, 4 replicates x treatments, total of 24 plots). We estimated plant cover in 10 subplots (1 × 1 m) and collected six subplots (0.5 × 0.5 m) of biomass, which we separated into the following categories: dead *U. brizantha*, dead native species, *U. brizantha*, graminoids, forbs, and shrubs. We performed analyzes comparing the fire frequencies in each season. We used linear mixed effect models to analyze the effect of the treatment in biomass/cover and permutational multivariate metrics to verify community composition structure in each treatment. Independent of the frequency and season, fire led to the decrease of dead biomass of *U. brizantha*. Moreover, the major difference between burned and Control communities was the amount of dead biomass. Biennial Late-Dry fires tended to reduce the cover of live *U. brizantha*, but not the biomass, whilst, Biennial Mid-Dry fires showed a positive feedback with *U. brizantha*. The non-invaded communities were not affected by any treatment, except for the cover of graminoids, which were lower in all burn treatments when compared to the Control. Fire alone, probably, will not control the invasive species. However, Late-Dry fires could help in reducing dead biomass, avoiding thus, wildfires and enhancing some native groups. However, it is important to highlight that the Late-Dry fires are also more intense and more dangerous, therefore it application should be cautious. Our study brings new insights and knowledge to understand and predict the assembly of vegetation communities (invaded and non-invaded) and their post-fire regeneration to guide management strategies for conservation of the open areas in Cerrado.

Guarino E.S.G.

Poster presentation
Impacts of climate change and species distribution modelling: future scenarios to endangered species in South Brazil
Session: Climate change and plant communities

Ernestino S.G. Guarino[1], Márcio Verdi[2], Alexander Vibrans[3] & Fernando S. Rocha[4]

[1]*Embrapa Acre;*[2]*Centro Nacional de Conservação da Flora (CNCFlora), Instituto de Pesquisa Jardim Botânico do Rio de Janeiro (JBRJ);*[3]*Universidade Regional de Blumenau, FURB and* [4]*Embrapa Cerrados*
fernando.rocha@embrapa.br

Earth climate has changed significantly in the last century and the different models indicate that it will continue to change over the next decades, even if the emission of greenhouse gases stop immediately. These changes have impact on different plant populations, as well as in the actual distribution of several species. As plants, in general, have a smaller capacity of dispersion compared with the animals it is likely that they will suffer the impacts of the climate change more intensively. To evaluate possible impacts of the different climate scenarios expected by the Intergovernmental Panel on Climate Change (IPCC) in the potential distribution of tree species at risk of extinction in South Brazil we modeled the actual potential distribution (baseline) for six species: a pteridophyte (*Dicksonia sellowiana* Hook., Dicksoniaceae), a gymnosperm (*Araucaria angustifolia* (Bertol.) Kuntze, Araucariaceae), three basal angiosperms (*Ocotea catharinensis* Mez, *O. odorifera* Rohwer, and *O. porosa* (Nees & Mart.) Barroso, Lauraceae), and a palm (*Euterpe edulis* Mart.). Additionally, we simulated the impact of five global climate models (GCMs: CCSM4, HadGEM-AO, HadGEM-ES, MIROC5, MRI-CGCM3), and four representative scenarios of greenhouse gases concentration (+2.6, +4.5, +6.0 e +8.5 W/m) in the potential distribution of these species at the 2050 year using the presence/absence data of the Floristic and Forest Inventory on Santa Catarina State (IFFSC). The adjusted models have discrimination capability between presence/absence higher than expected by random guess (AUC>0.5), ranging from 0.73 ± 0.004 (*O. odorifera*) to 0.93 ± 0.002 (*E. edulis*). The general impact of the climate scenarios in the distribution of the target species is the significant decrease of the potential occurrence area, excepting *D. sellowiana* that showed tendency to expansion of the area of occurrence in the most optimistic greenhouse gases concentration scenario (+2.6 e +4.5 W/m). As these species are listed as endangered in Brazil we suggest the monitoring of these species population in the areas of environmental protection and assess the need for relocating them to new habitats if necessary.

Guido A.

Poster presentation
Invasive species removal: assessing community impact and recovery from invasion
Session: Plant community invasion

Anaclara Guido &Valério D. Pillar

Department of Ecology, Federal University of Rio Grande do Sul
anaclara.guido@ufrgs.br

The spread of invasive species on natural ecosystems is one of the most important causes of biodiversity loss. To disentangle the real impact of an invasive species it is important to implement appropriate sampling and experimental designs, which will enable correct interpretation of results and lead to right decisions for management. In this context, combining observational and experimental data is crucial for inferring causal effects of invasions on natural communities. We examined South Brazilian natural grasslands invasion by *Eragrostis plana*, the currently most problematic invasive plant in the region. We assessed *E. plana* impacts on vegetation, evaluated community response to its removal and discussed the effectiveness of different removal methods through an experiment on invaded and removed communities, with combined observation of non-invaded communities. Fifty permanent 1 x 1 m plots were sparsely placed in a natural grassland site that had been partially invaded by *E. plana*. Removal was done annually from 2012 to 2015 and consisted in five treatments (n=10): (i) clipping aboveground biomass at once; (ii) clipping aboveground biomass periodically; (iii) herbicide application and (iv) hand-pulling, plus a (v) control treatment with no-removal. Additionally, 10 plots located in an adjacent non-invaded area were monitored. Vegetation surveys were done before treatment application (2012) and one (2013), two (2014) and three years (2015) after annual removals. All removal treatments reduced *E. plana* cover across years without differences in effectiveness, but neither one was enough to locally eradicate it. Our results revealed not only differences in observational comparisons between invaded and non-invaded communities, but also a positive effect of *E. plana* removal on native species richness and cover. These results reinforce the hypothesis that invasive plants replace native species in the communities they invade. Invasive species removal turned communities different from invaded ones, but not resembling non-invaded references, which indicate that community recovery may require other restoration strategies. We demonstrated the impact of the most important invasive species on South Brazilian grasslands' native richness and cover, highlighting the importance of including observational and experimental comparative studies between invaded, invasive removal and non-invaded communities in ecological invasion research for inferring causal effects.

Haidar R.F.

Poster presentation
The role of environmental and spatial gradients on the tree community assembly of seasonally dry tropical forests in the Brazilian Cerrado
Session: Classification, structure and dynamics of plant communities

Ricardo F. Haidar[1], Gabriel Damasco[2], Washington L. Oliveira[1], Aldicir Scariot[3] & Renata D. Françoso[1]

[1]*University of Brasília (UnB);*[2]*University of California, Berkeley and* [3]*Embrapa Genetic Resources and Biotechnology (CENARGEM)*
ricardohaidar@yahoo.com.br

Despite Seasonally Dry Tropical Forests (SDTF) have a confined and fragmented distribution throughout the Brazilian Cerrado, they represent a large portion of the total plant diversity in the Neotropics. There is an intriguing debate about the origin of plant lineages and the habitat classification of STDF. Some authors consider these forest fragments as external immersions from other Brazilian biomes (e.g. Caatinga, Atlantic Coast) into Central Brazil, but others state that STDF flora and its habitat types originally belong to the Cerrado domain. This study aims to fill the gaps about the beta-diversity and biogeography of STDF habitat types (Deciduous, Semi-deciduous and Evergreen) and evaluate how environmental and spatial filters could help us to differentiate and classify those forest fragments. Our study plots encompasses STDF from Central Brazil and ecotone regions between the Cerrado and Caatinga and the Atlantic Coast. We used cluster analysis to better define habitat into discrete groups. Then, we used MNDS to reduce the floristic composition and partitioning the explained variance in order to observe the contribution of spatial distance and abiotic factors on the floristic composition (DBH > 5 cm) and vegetation structure of 84 SDTF fragments. Climatic variables were extracted from Worldclim database and soil fertility was accessed through chemical analysis. Tree species' distribution across all Brazilian biomes was obtained at the SpeciesLink database. Our results suggested a high species turnover among eight SDTF floristic groups, whose geographic boundaries coincided with the biogeography of savannah tree species in Central Brazil (cerrado *sensu stricto*). Environmental and spatial variables jointly explained 13% of the floristic variation among SDTF plot, whereas spatial distance and soil distance alone explained 9% and 5%, respectively. Soil texture and fertility is the strongest factor shaping the compositional structure of SDTF in Central Brazil, followed by the climatic variables (mean annual precipitation, mean annual temperature, seasonality and altitude). Most of the floristic groups (6 out of 8) had indicator species centered along Caatinga, Amazonia and Atlantic Coast domains. In contrast, only two groups had indicator species centered in Central Brazil.

Hédl R.

Oral presentation
Forgotten but present: the legacy of historical coppicing in the forest herbaceous vegetation of central Europe
Session: Historical human legacy in vegetation

Radim Hédl[1,2], Péter Szabó[1], Martin Macek[1,3], Jan Šipoš[1,4], Jana Müllerová[1], Martin Kopecký[1], Jakub Houška[1,6,7], Silvie Suchánková[1], Markéta Chudomelová[1,5] & Ondřej Vild[1,5]

[1]*Institute of Botany, Czech Academy of Sciences;*[2]*Palacky University, Olomouc;*[3]*Charles University, Prague;*[4]*Ostrava University, Ostrava;*[5]*Masaryk University, Brno;*[6]*Czech University of Life Sciences, Prague and* [7]*Mendel University, Brno*
radim.hedl@ibot.cas.cz

Coppicing has been abandoned in central Europe nearly a century ago. Once a prevalent forest management system in many European landscapes from the medieval times till the 19th century, coppicing is a typical example of a forgotten driver of vegetation composition and structure. Biodiversity conservation concerns have recently led to small-scale coppicing reintroduction in several European countries. However, the historical legacy of coppicing in vegetation can be fairly complex and variable across regional and larger scales. Our aim was to quantify the coppicing legacy along a wide gradient of conditions in Moravia (eastern Czech Republic), a historical land comprising 28,000 km^2. Focus was on the response of species richness and compositional variability of the current forest herbaceous vegetation on the 19th century coppicing management. Effects of climatic, substrate, topography and land cover variables were subtracted from the overall variability. Over 4,000 vegetation relevés recorded in 1980 to 2015 were included in this analysis. They were limited by size (100 to 500 m^2) and to vegetation types ranging from alluvial forests to beechwoods, while vegetation dominated by conifers was excluded as it has never been coppiced. Information on the historical coppicing was based on an extensive analysis of primary resources. Presence or absence of coppicing was established within 3,000 civil parishes covering the study area. We found that the historical coppicing had a significant influence on today's species richness. It constitutes an important driver of compositional variability. It is largely correlated mainly with climate and substrates, but also partly independent from these variables. We found a large variation in the response to historical coppicing among selected species groups of herbaceous species defined according to their affinity to forest vegetation types. This indicates that not only diversity and composition, but also forest vegetation units responded divergently to the past coppicing. In sum, our study provides a rare evidence of persistent large-scale legacy of the historical forest management in the present vegetation.

Hegazy A.K.

Poster presentation
Effect of the domestic grazing animals on spinescense and resource allocation of
Acacia tortilis **subsp.** *tortilis* **in arid regions of the Middle East**
Session: Fire and grazing in non-forest vegetation

Ahmad K. Hegazy[1], Saud L. Al-Rowaily[2], Lesley Lovett-Doust[3], Jon Lovett-Doust[4],
Hanan F. Kabiel[1], Abdelaziz M. Assaeed[2] & Sanad M. Al-Sobeai[5]

[1]*University of Cairo;*[2]*King Saud University;*[3]*Nipissing University;*[4]*University of Windsor and*
[5]*Shagra University at Sajar*
akhegazy@yahoo.com

Nowadays, pastoralism in arid regions is experiencing heavy ecological stress as manifested by the progressive deterioration of the grazing lands and the keystone tree species. *Acacia tortilis* (Forssk.) Hayne subsp. *tortilis* is an important and preferred local fodder all year-round in arid lands for domestic camels, goats and sheep. This study aims at testing the hypothesis that spinescense, dry matter allocation and phenology are dependent on both grazing intensity and grazing animals. An open grazed population of *A. tortilis* in central Saudi Arabia was monitored. Only individual trees having clear grazing stratification zones were measured. The camels browse the top stratum twigs with mostly hooked spines, while goats and sheep nibble for leaves and fruits from the densely branched shoots in the lower strata with hard straight spines. Our results showed that *A. tortilis* trees are armed by traits compensating for plant organs lost due to combined camel browsing, and goats and sheep grazing by altering the canopy shape through creating compact and irregular forms, increased branching, shift towards production of hard straight spines and decreased hooked spines, variable dry matter allocation and reproductive phenology. Dry matter allocation to foliage and reproductive organs was higher in the unbrowsed and camel browsed shoots than in the nibbled shoots by goats and sheep. Alternatively, the dry matter allocation to hard straight spines was higher in the grazed shoots than in the browsed and unbrowsed shoots. The flowering of grazed shoots is sporadic and flower later than the ungrazed and browsed shoots which have peak flowering in spring. The increased spinescense of hard straight spines prevent the goats and sheep from reaching the foliage in the inner canopy of the overgrazed shoots, an important asset for tree survival during dry seasons.

Herrera M.

Oral presentation
Functional and phylogenetic diversity turnover in coastal sand dunes of Southwest Europe
Session: Functional and phylogenetic patterns in plant communities

Mercedes Herrera, Juan A. Campos, Idoia Biurrun, Itziar García-Mijangos, Javier Loidi & Marta Torca

University of the Basque Country/EHU. Spain
meme.herrera@ehu.es

Disentangling the patterns underlying community assembly is one of the main questions of plant ecology. In this context it is important to take into account different approaches such as functional and phylogenetic diversity. Different studies have recently focused on the functional and phylogenetic diversity of Mediterranean coastal dunes (Carboni *et al.* 2013). We studied the Atlantic coastal dunes of Southwest Europe from the South of France to the South of Galicia in Spain, which means 750 km of study area covered. In 2014 and 2015 twelve localities were sampled in $10m^2$ plots to record species presence and abundance on embryo, mobile and fixed dunes. We have analyzed three traits: Specific Leaf Area (SLA), seed mass and plant height. Traits were measured in the field when possible or completed using available bibliography. To measure functional diversity we have calculated two indexes: Community Weighted Mean (CWM) and Rao's index. For phylogenetic diversity Mean Pairwise Distance (MPD) has been used. Furthermore, to look for relations between phylogeny and traits we have tested the presence of phylogenetic signal, which is the tendency of related species to resemble each other more than species drawn at random from the same tree (Blomberg and Garland 2002). As coastal dunes show a clear environmental sea-inland environmental gradient followed by a turnover in species composition we expect to find changes in functional and phylogenetic diversity. First results show differences in functional diversity between dune zones for the three traits. On the other hand, looking at the geographical range, differences of functional diversity between localities appear in fixed and mobile dunes but not in embryo one.

Hiiesalu I.

Oral presentation
Arbuscular mycorrhizal fungi in the arid Himalayas
Session: Underground processes in plant communities

Inga Hiiesalu[1], Martin Macek[2], Martin Kopecký[2], Jan Altman[3], Pierre Liancourt[3], Ondrej Mudrak[3] & Jiri Dolezal[3]

[1]*University of Tartu, Department of Botany, Lai 40, Tartu, Estonia;*[2]*The Czech Academy of Sciences, Institute of Botany, Zamek 1, Pruhonice, Czech Republic and* [3]*The Czech Academy of Sciences, Institute of Botany, Dukelska 135, Trebon, Czech Republic*
salix@ut.ee

One of the most common mutualistic plant-fungal association is formed between arbuscular mycorrhizal fungi (AMF) and the majority of terrestrial plants, where the fungus receives plant-synthesized carbon in exchange for nutrients. Little is known about AMF diversity and distributional patterns in high altitudes and in very cold or dry habitats characterizing high elevations. Existing studies on AMF diversity patterns along elevational gradients mostly cover relatively short differences in altitude or include a limited number of plant hosts. Our aim was to describe diversity patterns of AMF along an elevational gradient and to determine the abiotic and biotic factors shaping the richness and community composition of AMF. Our study area is situated in Ladakh, on the dry flanks of NW Himalayas. In total, we sampled fine roots of 344 plant individuals (ca 200 species) in 85 sites across a range of 1940-6100 m asl. The sites were located in six major habitat types (from lowest to highest): forests, cold deserts and steppes, alpine grasslands, screes, lower and upper subnival zones. DNA-based virtual taxa (VT) of AMF were identified using 454-sequencing of the SSU rRNA gene. Climatic and abiotic factors measured include air and soil temperature, relative air humidity, soil moisture content, snow cover, length of the growing period, bedrock type and age. Biotic factors include host plant functional traits such as plant height, biomass, LDMC, leaf C, N and P concentrations, root N and P concentration, and content of non-structural carbohydrates. In total we detected 101 AMF VT (mean 5.6; range 0-27 VT per sample) spanning across nine Glomeromycota genera, most common of them being Glomus (66 VT), Acaulospora (10 VT) and Diversispora (7 VT). There was a significant negative relationship between AMF VT richness and altitude (P<0.001; Spearman rho=-0.27), with highest richness around 2200 m and 4300 m asl corresponding to forest and alpine grassland habitat types, respectively. The most important abiotic and biotic factors determining AMF richness and composition will be discussed during the presentation. The results of this study will significantly advance our understanding of microbial, and specifically AMF diversity patterns and their underlying mechanisms at multiple spatial scales across a range of habitat types.

Huelber K.

Poster presentation
Can environmentally induced phenotypic variation lead to recurrent speciation? - insights from the mountain plant *Heliosperma pusillum* (Caryophyllaceae)
Session: Functional and phylogenetic patterns in plant communities

Karl Huelber[1,2], Clara Bertel[3], Bozo Frajman[3] & Peter Schoenswetter[3]

[1]*University of Vienna;*[2]*Vienna Institute for Nature Conservation & Analyses and* [3]*University of Innsbruck*
karl.huelber@univie.ac.at

Adaptation to different environments via divergent natural selection can generate phenotypic and genotypic differences between populations, which may – in the absence of strong gene flow – lead to the formation of new species. Thereby, the process of speciation is represented by a continuum of divergence, ranging from continuous variation at the onset to distinct species pairs at later stages. Based on their strong morphological and ecological differentiation, *Heliosperma pusillum* and *H. veselskyi* (Caryophyllaceae) were considered as species. However, molecular analyses of population pairs in six regions in the European Alps revealed that *H. veselskyi* populations are more closely related to neighbouring *H. pusillum* populations than to geographically more distant *H. veselski* populations. This suggests multiple origins of *H. veselskyi* driven by morphological adaptation to divergent environmental conditions and provides an excellent opportunity to study mechanisms involved at the early stages of environmentally-induced speciation. We (1) infer the role of ecological conditions in causing phenotypic differentiation and (2) test for the heritability of phenotypic variation in a common garden indicating incipient divergence. We further (3) evaluate the extent and strength of reproductive isolation, which can prevent hybridisation between differentiated populations. To evaluate if the divergent phenotypes are adaptive we (4) relate phenotypic traits to environmental conditions and evaluate fitness and performance of the two species under the ecological conditions of both habitats. The obtained results will provide insights into processes of recent and convergent evolution in response to environmental conditions.

Huelber K.

Poster presentation
The ecological and geographic distribution of ploidy cytotypes – identification and quantification of underlying factors and processes
Session: Functional and phylogenetic patterns in plant communities

Karl Huelber[1,2], Susanne Scheffknecht[3], Henar Alonso Marcos[4], Flavia D. Nardi[4] & Christoph Dobes[4]

[1]*University of Vienna;*[2]*Vienna Institute for Nature Conservation & Analyses;*[3]*University of Natural Resources and Life Sciences and* [4]*Austrian Research Centre for Forests*
karl.huelber@univie.ac.at

Polyploidization is an evolutionarily important phenomenon frequently accompanied by ecological differentiation among the ancestral and derived cytotypes and sudden changes in the reproductive system like the development of apomixis (i. e. asexual reproduction via seeds). Variation in ploidy level and in associated reproductive traits are of high relevance for the spatial distribution of cytotypes, and thus the eco-geography of species. Sexual and apomictic ploidy cytotypes are known to show various degrees of spatial separation mainly driven by migration abilities, habitat preferences or tolerances, and reproductive interaction among cytotypes. However, the relative contribution of these three principal factors has not been assessed for a single model system yet. We addressed this aim in *Potentilla puberula* (Rosaceae) which shows intraspecific differentiation into sexual tetraploid and apomictic penta- to octoploid cytotypes. We found, using variance partitioning, the spatial distribution of the five ploidy cytotypes at 244 sampling sites in the Eastern European Alps located between the southern border and the central parts of the Pleistocene ice-shield to be more affected by the co-occurrence pattern of cytotypes than by abiotic site conditions and the migration distance to the border of the last glacial maximum. In particular, sexual tetraploids were strongly separated from high-polyploid apomicts, while the latter neither attracted nor avoided each other. The following processes, all pertinent to the reproductive system, hypothetically explain the observed strong spatial separation of sexual and apomictic cytotypes: reproductive suppression (i.e., minority cytotype exclusion), reproductive transformation of sexuals by apomicts, and competitive replacement of cytotypes under contrasting ecological conditions. In an ongoing project we aim to uncover the role of these drivers using computer simulations parameterized by empirically and experimentally derived data pertaining to the reproductive system of sexual and apomictic individuals.

Ivchenko T.

Poster presentation
Diversity, spatial structure and dynamics of South Ural (Russia) fen vegetation
Session: Applied mapping for conservation and management

Tatiana Ivchenko[1] & Sergey Znamenskiy[2]

[1]*Komarov Botanical Institute RAS and* [2]*Biology Institute, Karelian Research Center of Russian Academy of Sciences*
ivchenkotat@mail.ru

We considered the range within administrative borders of Chelyabinsk oblast. It includes part of Ural mountains, paeneplain area and neighboring part of West Siberian Plain. Technically it borders both between Europe and Asia and between steppe and forest-steppe geographical zones. Mountain vegetation also has clear altitudinal zonation. The aim of our studies was to reveal the botanical and geographical peculiarities of South Ural fen vegetation spatial structure and dynamics. Totally we investigated 30 fen massifs. We collected 176 sample plots 100 m2 size. 16 peat cores were taken, 220 peat samples were analyzed. The spatial structure of fens was studied using GoogleEarth satellite images. Multidimensional statistical analyses (included NMS ordination and cluster analysis) were performed using PC-ORD 6.18 package. As the result of cluster analysis we described seven groups of fen vegetation combined into six associations on the base of ecological-phytocoenotic approach. Presented syntaxa are dominated either by European and West Asian species (*Carex buxbaumii, C. panacea, Molinia caerulea*) or by Holarctic species (*Carex diandra*). Moss layer is presented either by brown-mosses or by *Sphagnum warnstorfii*. Peat sediments composition analysis demonstrated that vegetation observed has not significantly changed since fen formations until present, only minor changes of dominant species shares in palaeo-communities were registered. At the same time there were more significant participation of species like *Pseudocalliergon trifarium, Meesia triquetra, Equisetum* sp., *Phragmites australis* showing that fen palaeo-environment used to be colder and wetter. The main spatial structures peculiarities are following. The fens of taiga altitudinal belt in mountain part of the range are characterized with developed peripheral zone of forested (spruce or birch dominated) tussock-sedge communities as well as well as oligotrophic and meso-olygotrophic spruce-sedge-undershrub-*Sphagnum fuscum* communities. Forest steppe plain fens are characterized with outer zone of willows and eutrophic sedge species (*Carex juncella, C. omskiana*). The central part of mountain fen massive can be occupied by varying communities while in the West Siberian Plain fens it is quite uniform and presented by single cluster vegetation.

Janišová M.

Oral presentation
Tracing the history based on current vegetation patterns – an example from central-European rocky steppes
Session: Historical human legacy in vegetation

Monika Janišová[1], Norbert Bauer[2], Milan Chytrý[3], János Csiky[4], Jürgen Dengler[5,6], Tomáš Hlásny[7], Carsten Hobohm[8], Eszter Ruprecht[9], Iveta Škodová[1], Wolfgang Willner[10] & David Zelený[3]

[1]Institute of Botany, Slovak Academy of Sciences, Banská Bystrica-Bratislava, Slovakia;[2]Department of Botany, Hungarian Natural History Museum, Budapest, Hungary;[3]Department of Botany and Zoology, Masaryk University, Brno, Czech Republic;[4]Institute of Biology, University of Pécs, Pécs, Hungary;[5]Plant Ecology, BayCEER, University of Bayreuth, Germany;[6]German Centre for Integrative Biodiversity Research, Halle-Jena-Leipzig, Germany;[7]National Forest Centre, Forest Research Institute, Zvolen, Slovakia;[8]Interdisciplinary Institute of Environmental, Social and Human Studies, University of Flensburg, Germany;[9]Hungarian Department of Biology and Ecology, Babeş-Bolyai University, Cluj Napoca, Romania and [10]Vienna Institute for Nature Conservation & Analyses, Wien, Austria
monika.janisova@gmail.com

In accordance with recent paleological studies, we suppose, that *Carex humilis*-dominated rocky steppes were more widespread in Central Europe in the past and their development during the Holocene was strongly affected by forest expansion on the one hand and Neolithic farming on the other hand. While the high-altitude rocky steppes became isolated by gradual expansion of forests to higher altitudes in Middle Holocene, low-altitude rocky steppes remained interconnected within dry lowland regions throughout the Holocene until rather recent fragmentation by intensive agriculture and loss of habitats. We wondered whether the current structure and composition of rocky steppes along an altitudinal gradient reflect their evolutionary history and support our hypotheses. We used a large phytosociological data set to compare the low- (below 500 m a.s.l.) and high-altitude (above 500 m a.s.l.) rocky steppes with regard to i) representation of stenochoric taxa, archaeophytes and habitat specialists; ii) species pool, species richness and beta diversity. We also investigated the roles of geographical distance and environmental (climatic, topographical and geological) variables in shaping current variability of the rocky steppe vegetation. The study area included four biogeographical regions: NW Pannonian Basin, Carpathian Mountains, Transdanubian Mountains and Transylvanian Basin. The large compositional variation in both low- and high-altitude rocky steppes was better explained by geographical distance than by the environment. It might be the result of long-term retreat of rocky steppe vegetation and fragmentation/isolation of their habitats during the Holocene. No differences in species richness and mean species niche breadth were detected among plots from different altitudes and biogeographical regions. We suppose that these parameters are controlled by current site conditions rather than by historical factors. However, low-altitude rocky steppes had larger species pool and higher beta diversity than the high-altitude ones. Moreover, they contained less narrow-range species and had higher proportion of eurychoric species and archaeophytes. We conclude that the indicated differences in floristic composition, chorological structure and diversity between the low- and high-altitude rocky steppes dominated by *Carex humilis* reflect their distinct evolutionary history rather than their current habitat conditions. Financial support: VEGA 02/0027/15.

Kavgaci A.

Oral presentation
Early post-fire vegetation recovery of *Pinus brutia* forests: effects of fire severity stand type and aspect
Session: Fire and grazing in non-forest vegetation

Ali Kavgaci[1], Erdal Örtel[2], Ivan Torres[3] & Hugh Safford[4,5]

[1]*Southwest Anatolia Forest Research Institute;*[2]*Aegean Forest Research Institute;*[3]*Department of Environmental Sciences, Faculty of Environmental Sciences and Biochemistry, Universidad de Castilla-La Mancha;*[4]*US Forest Service Pacific Southwest Region and* [5]*Department of Environmental Science and Policy, University of California*
alikavgaci1977@yahoo.com

This study reveals the effects of fire severity, pre-fire stand type and aspect on the early post-fire recovery of *Pinus brutia* forest. Study site was the area of 2008 Serik-Tasağıl Fire, one of the largest forest fires in Turkish recorded history. The study was carried out at five different sites having different conditions in terms of fire severity, pre-fire stand type and aspect. Sampling was carried out for five years after fire. Changes in floristic composition were assessed using Nonmetric Multidimensional Scaling. Statistical differentiation among sites in terms of diversity and richness was carried out with Repeated Measures ANOVA. First year floristic composition is clearly different from the continuing years and floristic differentiation generally slows by the fifth year. During the five years after fire, species richness declines in young stands and mature stands experiencing crown fire, whereas it is more stable in mature stands experiencing surface fire. The mature stands with different fire severity show significant differences in terms of annuals and obligate seeders while the stands with different pre-fire stand type are differentiated in terms of annuals, Asteraceae and Poaceae. The young stands with different aspects are also significantly differentiated in terms of annuals, obligate seeders and Asteraceae. Each site in the study was dominated by woody plants but no *P. brutia* regeneration was observed in young stands, suggesting that in the absence of direct planting such sites will remain under shrub dominance for some time. Although post-fire recovery in *P. brutia* stands may be broadly characterized as auto-successional, our results show that differences in stand age, fire severity, and topography play an important role in defining the actual direction and velocity of forest recovery. Our findings provide important information for managers and scientists interested in the post-fire restoration of *P. brutia* forests.

Khanina L.

Poster presentation
Spatial hierarchy of plant diversity on abandoned arable lands and pastures in a temperate forest region
Session: Classification, structure and dynamics of plant communities

Larisa Khanina[1], Vadim Smirnov[1] & Maxim Bobrovsky[2]

[1]*Institute of Mathematical Problems of Biology RAS – the Branch of Keldysh Institute of Applied Mathematics of Russian Academy of Sciences and* [2]*Institute of Physico-Chemical and Biological Problems of Soil Science of Russian Academy of Sciences*
khanina.larisa@gmail.com

We studied plant diversity on former agricultural lands abandoned 25 years ago in Central European Russia. The following three types of biotopes have been studied: (1) former arable lands overgrowing without fire, (2) former arable lands affected by fires and (3) former pastures overgrowing without fire. All former fields are closed to old-growth broad-leaved forest co-dominated by *Quercus robur, Fraxinus excelsior, Tilia cordata, Ulmus glabra, Acer platanoides* and *A. campestre* and are being overgrown now by *Betula* spp., *Salix caprea* and other tree and forest herbaceous species in different proportions. Plant diversity at the following hierarchical levels was analyzed: (1) a sample plot of 10x10 m, (2) a former field, (3) a type of the biotope and (4) all former fields as a whole. 134 sample plots were distributed to the levels as follows: from 4 to 16 plots per field; from 5 to 6 fields per biotope and 3 types of biotopes totally. Partitioning of plant diversity into alpha and beta components was performed on the base of the Whittaker's multiplicative approach (alpha × beta = gamma) renewed by Jost (2006, 2007). Three Hill numbers corresponding to the orders q = 0, 1 and 2 were calculated at the each spatial level and the significance of diversity components was tested by constructing the *r2dtable* null model using the R software (R Development Core Team 2015) and the package Vegan (Oksanen et al. 2015) with functions *multipart, oecosimu*. 254 plant species were sampled in all plots totally and the value of the overall beta diversity measured as Jaccard dissimilarity was high (0.82). Alpha diversity at the first level (alpha 1) for the each biotope was higher than expected by the null model. But alpha diversity at the level of fields (the level 2) was less than expected and beta diversity of this level was also less than expected. However, former fields were diverse at the biotope level, so beta diversity was higher than expected for all the biotope that led to positive effect for the total beta (at the level 3). Thus, high species richness of the former agricultural fields is provided by diversity of biotopes and diversity of individual fields within the each biotope at uniformity of vegetation at individual fields.

Klimešová J.

Oral presentation
How to assess bud bank traits in different ecosystems
Session: Plant strategies and disturbance

Jitka Klimešová

Institute of Botany CAS, Czech Republic
jitka.klimesova@ibot.cas.cz

In many ecosystems the bud bank formation and resprouting from it is considered as an important adaptation to severe disturbance shaping the vegetation. Such ecosystems occur in fire-prone areas of the Tropics, Mediterranean or Temperate zone as well as seasonally dry or cold climates. In order to be able to ask questions about general evolutionary routes of plant adaptations to disturbance, we should have a general and evolutionary meaningful framework how to describe bud bank traits. Here I propose that such a tool for the generalized approach to bud bank description lies in understanding plant architecture. Plant architecture determines how a plant body is composed from iterated units (modules) that contain a stem node, an internode, a leaf and a bud in the leaf axil. The modules further compose shoots and shoots compose the whole body of a tree or a herb. During the plant's growth the modules are accumulated and a pool of buds is formed. The buds may be used for branching or stay dormant for occasion of disturbance that would require reiteration of lost body parts. I will talk about main types of plant architecture determining bud bank formation and about the classification used for the distinction of plant organs bearing the bud bank. I will suggest easy-to-follow guidelines for standardizing description of bud bank traits for comparative studies across ecosystems.

Krestov P.V.

Oral presentation
Distribution of vascular plants and vegetation complexes in Northeast Asia: climatic controls and historical background
Session: Classification, structure and dynamics of plant communities

Pavel V. Krestov

Botanical Garden-Institute FEB RAS
pavel.krestov@icloud.com

The development of vegetation on the east of Asia is controlled by polar, boreal and temperate macrobioclimates. Basic variations of climates along the gradient of continentality within a zone depend on the combination of the yearly heat and precipitation distribution and can be classified into climatic types: hyperoceanic, oceanic, suboceanic, maritime, continental, subcontinental and ultracontinental. In the boreal zone, most continental areas are occupied by the deciduous coniferous forests and the areas with lowest continentality – by broadleaved deciduous forests dominated by Ermann's birch. The ombroevapotranspirational index calculated for vegetation orders shows that continental boreal forests of Asia occur in critical conditions of significant moisture deficit, which normally do not support forest vegetation. The most important source of water in dry areas of the boreal zone is melting permafrost. Climatic oceanicity results in formation of a specific vegetation complex composed of humidity-dependent and frost-intolerant species adapted to the short growing seasons. The strong accumulation of snow causes a 2-3 week delay of its melting and a considerable shortening of the growing season. Increasing longevity of deep snow cover leads to vegetation transformation from forests to tall herb meadows through the stage of alder krummholz. At time of late Pleistocene aridification the climate favored intensive migration of Central Asian steppic floristic elements which make up a significant component of the modern flora of south-western and eastern Siberia. Xeric and mesoxeric floral elements with a great number of neo-endemics from the mountains of southern Siberia characterize the Rhytidio-Laricetea. Aridification in the temperate zone led to distinctive separation of insular and mainland vegetation complexes in Northern Asia. The increase in temperatures and humidity caused expansion of larch forests up to the Arctic coast in the period 10000–5000 yrs BP and the formation of the Ledo-Laricetalia characterized by wetland vascular species and bryophytes with circumboreal distribution. Forest retreat at about 3500 yrs BP led to the formation of extensive thickets dominated by shrubby birches, willows and larch woodlands. One of the most important refugia for the humidity-dependent vegetation in the Pleistocene was the north-western coast of Pacific Ocean, which still supports many Tertiary relics.

Kutnar L.

Oral presentation
Short-term response of plant diversity and life history traits to simulated forest disturbances – Forest experiment in *Abies alba-Fagus sylvatica* stands in Slovenia, Europe
Session: Functional and phylogenetic patterns in plant communities

Lado Kutnar[1], Aleksander Marinšek[1,2] and Klemen Eler[3,1]

[1]*Slovenian Forestry Institute, Department of Forest Ecology, Večna pot 2, SI-1000 Ljubljana, Slovenia;*[2]*Higher Vocational College for Forestry and Hunting, Ljubljanska 3, SI-6230 Postojna, Slovenia and* [3]*Biotechnical Faculty, University of Ljubljana, Jamnikarjeva 101, SI-1000 Ljubljana, Slovenia*
lado.kutnar@gozdis.si

Forests of European beech (*Fagus sylvatica*) and European silver fir (*Abies alba*) in the Dinaric Mountains (Southeast Europe) (hereafter Dinaric fir-beech forest) have significant nature-conservation and timber production functions. As being close-to-nature managed these forests are also important part of Natura 2000 area, the most significant nature-conservation network in Europe. With the aim of testing the effects of forest disturbances (e.g. ice storm, wind throw, bark beetle damages) and different management measures on biodiversity and plant life history traits, three sites in Dinaric fir-beech forest range were studied. At the beginning of the forest experiment, the selected forest stands were dense. The plant species composition and abundance were assessed before and after the forest experiment implementing three logging intensities: control plots – no logging; and logging of 50% and 100% of the growing stock on circular plots of 0.4 ha. Before logging, the mean number of plant species per 400 m plots was 48.8, and the mean value of the Shannon diversity index was 2.41. Two years after the logging different magnitudes of plant species turnover were observed. There was no significant change in plant diversity status and vegetation composition in the control plots. However, the cover of the herbaceous layer and diversity parameters increased significantly with an increase in the logging intensity. In the plots where all the trees were removed, the mean number of species was 87.4, and the Shannon index was 3.42. The short-term increase of species richness can mostly be attributed to herbaceous plant species. Larger disturbance intensity and hence larger change in stand and environmental conditions also lead to significant shifts in plant functional composition. The proportions of tall herbs, biennial plants, and plants with scleromorphic leaves, plants with lightweight seeds and plants with overwintering green leaves increased in the plots with 100% and 50% logging intensities. Also the duration of flowering and anemochory importance increased with more intensive logging. Our findings provide new knowledge to managers on short-term effects of forest disturbances and management on plant diversity and life history traits in Dinaric fir-beech and beech forests where close-to-nature forest management is applied.

Lezama F.

Poster presentation
Phytosociology of the Uruguayan grasslands
Session: Classification, structure and dynamics of plant communities

Felipe Lezama[1], Marcelo Pereira[2], Alice Altesor[3] & José M. Paruelo[3,4]

[1]*Facultad de Agronomía, UDELAR;*[2]*Instituto Plan Agropecuario;*[3]*Facultad de Ciencias, UDELAR and* [4]*Facultad de Agronomía and IFEVA, UBA*
flezama@fagro.edu.uy

The Rio de la Plata grasslands are one of the largest areas of temperate humid and sub humid grasslands of the world. A substantial fraction of these natural grasslands is still preserved in Uruguay. These grasslands are the forage base of livestock ranching, one of the main economic activities of the country. Uruguayan grasslands have been indirectly classified using geomorphological and edaphic criteria. An adequate description of its vegetation heterogeneity represents a prerequisite to study its functioning and to design management and conservation strategies. We present a classification of the natural grassland communities of Uruguay based on a wide and comprehensive set of phytosociological relevés. Species x relevés matrix with presence - absence data was classified and ordinated through multivariate analysis. Agglomerative classification based on flexible Beta linkage method and Sorensen distance measure was employed to identify relevés groups. We used non metric multidimensional scaling to find the main floristic gradients. Five main communities were identified; two of them were restricted to the basaltic region of central and northern Uruguay while the other three were distributed through the eastern hills, north eastern sedimentary valleys and southern plains. Three of the units correspond to dense grasslands associated to medium and deep soils. The remaining two unities correspond to open grasslands on shallow soils. We identified 14 communities sub types that were structurally and environmentally characterized. Two primary gradients in floristic composition were identified. The main ordination axis was related to soil and topographical characteristics that controls locally water availability. The second, in turn, was related to the geological substrate, a factor that operates at regional scale. Our results modify the current description of Uruguayan grasslands that simply separated northern and southern campos.

Li C.F.

Oral presentation
Actual map of Montane Cloud forest in Taiwan: a comprehensive application using vegetation database and satellite images
Session: Conservation of plant communities: from science to policy

Ching-Feng Li[1] & Martin Schulz[2]

[1]National Taiwan University and [2]Philipps-Universität
chingfengli@ntu.edu.tw

Montane cloud forest (MCF) is unique among terrestrial ecosystem due to its irreplaceable hydrological cycle. Complex mountain terrain in combination with frequent orographic clouds makes MCF having the highest number of endemic species in the regional scale. However, habitats of MCF are always having valuable timber and suitable climate for the plantation of tea and coffee, too. These attract human's interest and large areas of MCF were deforested during the past centuries. At the same time, the cloud frequency decreased in the recent records, which is supposed to be the result of global change. To conserve the MCFs, one of the most endangered ecosystem, the precise actual MCF distribution map is urgently required. This study chose Taiwan as a study area because of large remnants of MCF in Taiwan and available data set for test. Mapping the actual distribution of MCF is challenged by the lack of informative low cloud frequency layers, criterion of determining the MCF and representative ground truth data. The occurrences of MCF are influenced by succession stages, topography, aspect, soil conditions and the seasonality of cloud frequency. Although the orographic clouds are highly correlated with altitudes, the altitudinal range of MCF in Taiwan differs dramatically at the local scale, caused by Massenerhebung effect, heterogeneous topography and two alternative monsoon systems. In this study, vegetation plots in the National Vegetation Database of Taiwan were used as the criterion of determining the MCF and ground truth data since those plots covered the whole of Taiwan. Training data set was composed of MCF points and not MCF points based on the species composition in a plot. Machine learning method, the random forest, was applied in mapping MCF distribution according to the training data set and informative layers from geographic information system. These layers included the monthly low cloud frequency layers, digital elevation model and the related inputs, and Landsat channel for the pixel texture. The final map showed that MCF area was higher in the eastern and northeastern part of Taiwan than the western one because of the high winter cloud frequency and low human impacts in those regions.

Liberman, M.

Oral presentation
Mapping andean wetlands for sustainble management of grazing camelids in Apolobamba protected area, Bolivia.
Session: Applied mapping for conservation and management

Maximum Liberman

Instituto de Ecología, Universidad Mayor de San Andés, La Paz, Bolivia
sajamaes@yahoo.es

In the Andean tropical mountains in the Cañuhuma community, Apolobamba Protected Area, of Bolivia, we carried out a multi-temporal vegetation map of wetlands or peatlands (local name bofedales) in order to understand their dynamics due the climate change and glacier shrinking using of Landsat images between 1986 – 2014. The wetlands concentrate high levels of plants and animal biodiversity and associated services like carbon storage, water regulation, and camelids livestock production. In Cañuhuma native Aymara peoples are directly dependent upon the peatlands in this region where conditions are so severe. The peatlands from 4,000 to 5,000 m a.s.l., are used for grazing by their domestic herds of alpaca camelids (*Vicugna pacos*), which are the basis of the local indigenous economy. Despite the conditions of fragility and difficult circumstances to live in these heights, families have adapted to the climate and extreme ecological conditions, developing strategies and cultural practices for conservationof biodiversity, natural resources and productive in the course the last 5000 – 6000 years. These indigenous people have advanced, overcoming physical, climatic and biological challenges, generating indigenous technologies and developing a social pastoral herd management organization, to provide highly valued resources. It describes and analyzes the irrigation of surfaces. This paper focuses on the *Distichia muscoides* and *Oxycloe andina* (Juncaceae) – dominated peatlands. We assess the state of current knowledge and focus on identifying factors contributing to their existence and character. As a result of the effects of climate change have led to a retreat of glaciers, decreasing in the study area 50% of its surface during the last 30 years, by the melting of the ice mass, resulting in increased water runoff. The facts mentioned are generating an environmental impact to the high Andean ecosystems and biodiversity of high mountain, and alteration of wetlands where the water is stored and regulates climate.

Liira J.

Oral presentation
An application of meta-pool concept on community response to disturbances
Session: Community assembly and species diversity

Jaan Liira & Ave Suija

University of Tartu
jaan.liira@ut.ee

The conceptual framework of dynamic equilibrium with the multiple stable states would interpret a community's response to man-made disturbances as a natural reassembly supported by various species pools in regional meta-pool. We hypothesized that the long-term alkaline dust pollution should initialize the reassembly of an acidophilous community resulting in the array of community states culminating with the composition and richness resembling a community on alkaline substrate. We addressed lichen communities on pine (*Pinus sylvestris*) located at different distances from the cement factory. Five distant limestone habitats were used as a sample of meta-pool. Understory density was considered as a potential factor having a hidden interaction with bark pH. Along the pollution intensity, we observed bark pH-gradient from 2.4 up to 8.1. We observed a gradation of lichen communities with decreasing species richness towards the estimate of epilithic community, but only in stands with sparse understory the composition began to resemble a community on limestone. We also observed the systematic variation in niche width. We concluded that the long-term pollution did trigger the community's reassembly among alternative states supported by regional meta-pool. Species infiltration success along the gradient depended on the variation of niche width of species and hidden interactions between environmental factors.

Lindgren J.

Oral presentation
Testing habitat amount hypothesis
Session: Community assembly and species diversity

Jessica Lindgren & Sara Cousins

Stockholm University
jessica.lindgren@natgeo.su.se

To identify the most important spatial factors in fragmented landscapes to mitigate species loss is essential to conservation strategies. Land use intensification, habitat destruction but also abandonment threatens many species in semi- natural grassland in Europe. However, with few species-rich habitats left, small remnant grassland habitat, might have an important role for biodiversity and ecosystem functions in intensively used agricultural landscapes. Midfield islets are examples of a small remnant grassland habitat. Midfield islets (area ≤ 0.5 ha) are surrounded by a crop field and have bedrock or stones as a core. These small remnant habitats can work both as refugia and a source of dispersal of plant species, including grassland specialist species. The habitat amount hypothesis, proposed by Fahrig (2013), suggests that the amount of a habitat type is a simplified way of predicting species richness in fragmented landscapes, compared to species area relationship and isolation of the habitat. Species richness in equal-sized samples should increase with the total habitat amount in the closest surrounding. Here, we tested the hypothesis against the spatial variables: habitat size and isolation of the focal habitat, using data on species richness from 133 midfield islets (size between 148-4876 m) in 30 landscapes in eastern Sweden. In total, we found 306 species. Many (74) so-called grassland specialists, i.e. plants associated to semi-natural grasslands with a long continuity of management, still remained on the midfield islets. Mean species richness within sampled area (8 plots of 0.5*0.5 m) was 32 species (± 7.8 SD) and the mean number of grassland specialist species was 7 (± 4.1 SD). Habitat amount was a good predictor of species richness, yet it performed less well compared to habitat size and distance to the nearest habitat patch, which thus were the best combined predictors of species richness.

Lipoma M.L.

Oral presentation
Seedling and sapling banks as sources of resilience in plant communities subjected to land use change in central Argentina semiarid forests
Session: Classification, structure and dynamics of plant communities

María L. Lipoma[1,2] & Sandra Díaz[1,2]

[1]*Instituto Multidisciplinario de Biología Vegetal (IMBIV, UNC-CONICET) and* [2]*Facultad de Ciencias Exactas Físicas y Naturales, UNC, Argentina*
lucrecialipoma@gmail.com

Resilience is known as the capacity of an ecosystem to return to its initial state after a perturbation. One important source of resilience is the existence of reservoirs of juvenile plants belonging to the community that could establish after disturbances. Land use change is one of the main drivers of ecological change in subtropical South American forests. In this study we describe the juvenile plants bank (seedlings and saplings) of woody communities in a semiarid Chaco forest in Córdoba, central Argentina, in order to evaluate their role in the recovery of community composition. Specifically, we asked if different land use intensities had an effect on (a) total density, proportion of seedlings and saplings, richness and floristic composition of juvenile plants banks; and (b) similarity between the juvenile plants bank and the established vegetation. We selected four plant communities subjected to different past and present land use intensities: Primary Forest (PF, no land use), Secondary Forest (SF, low land use intensity), Mixed Shrubland (MS, moderate land use intensity) and Open Shrubland (OS, high land use intensity). We sampled all seedlings and saplings present in two plots of 36m^2 in each plant community. We also carried out censuses of adult woody species in the same plots in order to compare floristic composition of juvenile banks and established vegetation. Density and species richness of juveniles decreased with land used intensity. Similarity in floristic composition between juvenile banks was greater between PF, SF and MS and lower between those communities and OS. Moreover, juvenile bank of SF and MS were more similar to established vegetation of PF than to establish vegetation of communities where these banks belonged. These results suggest that plant communities subjected to long-term low to moderate land use intensities have the potential to recover from the juvenile bank, but the existence of some degree of disturbances could be preventing the further establishment of individuals. In contrast, plant communities under long-term high land use intensity may have lost this source of resilience.

Liu B.

Oral presentation
Dynamics of understory taxonomic, functional and phylogenetic alpha and beta diversity in a Chinese boreal forest
Session: Functional and phylogenetic patterns in plant communities

Bo Liu[1], Jian Yang[1,2] & Han Y.H. Chen[3]

[1]*State Key Laboratory of Forest and Soil Ecology, Institute of Applied Ecology, Chinese Academy of Sciences, Shenyang 110016, China;*[2]*Department of Forestry, TP Cooper Building, University of Kentucky, Lexington, KY 40546, USA and* [3]*Faculty of Natural Resources Management, Lakehead University, 955 Oliver Road, Thunder Bay, Ontario P7B 5E1, Canada*
liubohyy@gmail.com

One most challenging question in community ecology is to clarify the mechanisms of origin and maintenance of biodiversity within and across communities. Analyzing dynamic patterns of taxonomic diversity together with phylogenetic and functional diversity, allow one to infer the underlying ecological processes in community assembly. Here, we provided a comprehensive approach to decouple taxonomic, functional and phylogenetic diversity and infer community assembly processes throughout succession. To do so, we utilized understory species composition, abundance and traits data across 8 successional stages in Chinese boreal forests of Great Xing'an Mountains. We found that there were different dynamic patterns both in alpha and beta diversity components. And beta diversity components inclined to have greater correlations than alpha diversity components. As succession proceeds, understory communities transformed from phylogenetic overdispersion to phylogenetic clustering with competitive exclusion and dispersal limitation converting to environmental filtering and speciation throughout succession. Although there were different processes controlling understory community assembly, the dominant process was environmental filtering.

Loidi J.

Oral presentation
Mapping as a tool for conservation and for biotic documentation: a main task for vegetation scientists
Session: Applied mapping for conservation and management

Javier Loidi

University of the Basque Country (UPV/EHU)
javier.loidi@ehu.eus

Quantifying the natural resources in terms of plant individuals, populations, species, processes, ecosystems and ecological phenomena and expressing the results in spatial form is a relevant task for Vegetation Science. This sort of quantification constitutes a particularly important issue as the spatial distribution of such elemnts becomes central in the daily questioning and demands rising in its work. Three main aspects can be addressed: *Scale*. All geographical scales are possible, each representing different levels of aggregation and having its own limits: from local to world scale. In the local scale they can be represented individuals and populations of different taxa, the functional traits, the distribution of site conditions at detailed scale such as temperature or moisture, or the occurrence of local processes such as successional trends. The medium scales are used to represent more synthetic entities such as vegetation types defined by several criteria such as physiognomy, dominance, species composition, etc. A broader scale permits mapping highly synthetic entities, such as vegetation complexes, landscape units and biogeographic districts or territories defined in different ways. The global scale needs more abstraction in the units represented, being particularly adapted to biogeographical representation, bioclimatology and broadly defined biomas. *Contents*. This is one of the key points for vegetation or plant cartography. According to the scale, contents can be from the most concrete to the most abstract, from the particular situations to the general patterns. The contents use to be limited by the knowledge of the biota of the mapped area as well as by the technical possibilities at hand and the availability of complementary supporting cartography (topographic, geologic, soil, lithologic, climatic, land use, human settlement, historic, etc.). Very often such complementary information is not equally available and that makes impossible to afford making a map with very detailed contents. In any case, for applied purposes the maximal biological content should be pretended, while in case of mapping in a scientific context, the map will contain the required information adapted to the aims of the survey. *Aims*. Basically there can be two groups of aims: 1 inventories for conservation and management and 2 scientific purposes, as a tool for a research involving the need of having a certain type of spatial quantification or as one of the forms of representing a survey which aim is exploring a particular area. Official agencies with conservation and land planning responsibilities use the maps as an ordinary and valuable tool in their work. The cartography in these cases needs to be accurate in order they can apply it in their daily activity.

López-Mársico L.

Poster presentation
Effects of fire and grazing on species richness and vegetation coverage in an Uruguayan grassland
Session: Fire and grazing in non-forest vegetation

Luis López-Mársico, Alice Altesor & Felipe Lezama

Universidad de la República
luislopez@fcien.edu.uy

In Sierras del Este Uruguayan grasslands, the tussock grass *Erianthus angustifolius* Nees cover large areas, decreasing productivity and the effective grazing area. Fire is used as a control management, however its impact on the vegetation has not been evaluated yet. The goal of this study was to evaluate the effect of fire and grazing on plant species richness and coverage of *E. angustifolius* in Sierras del Este, Uruguay. A field experiment with two factors: fire and grazing, and two levels each was installed in October 2014. The four treatments (burned-grazed, burned-ungrazed, unburned-grazed, unburned-ungrazed) consist of large pots of 300 m^2 with three replicates. In each plot, in three small plots permanent of 2 m^2, species richness and coverage of *E. angustifolius* were recorded in three moments: at the experiment starting, at 3 and at 16 months of established. Jaccard similarity index was used to estimate the replacement of species. Throughout the studied area were recorded 140 species. At three months the experiment started, burning generated a decrease of 50% in cover of *E. angustifolius*. In burned plots, there was a species turnover of 67%, explained by an increase of 13.4 species more than at the beginning. Unburned plots showed a species turnover of 57% while the increase of species was on average 5.5 species more than at the beginning. At 16 months the experiment started only the plots burned-ungrazed showed an increase in coverage of *E. angustifolius* with respect to the beginning, although still remain with coverage 25% lower. The species turnover was on average of 70% in all treatments. There is a slight tendency to be greater in burned plots, which showed an increase of 15 species more than at the beginning, while unburned plots showed an increase of 8.5 species on average. Burning is the main factor explaining the differences in species richness due to the decrease in coverage of *E. angustifolius*, encouraging a relaxation in competition for light and favoring the colonization of new species. The effects of grazing are reflected on the composition and still not on species richness.

Luo S.

Poster presentation
Plant niche partitioning mediated by soil microbes drives the positive relationship between plant community species richness and biomass
Session: Functional and phylogenetic patterns in plant communities

Shan Luo, Shixiao Yu

Department of Ecology, Sun Yat-sen University, Guangzhou, 510275 CHN
lssysx@mail.sysu.edu.cn

Why more diverse systems could perform better than less diverse ones has been a question in biodiversity-ecosystem functioning studies. Here, we hypothesized that plants associated with different microbes have preferences for different chemical forms of N. We tested whether soil microbes could drive the positive relationship between species richness and community biomass by mediating plant niche partitioning. By selecting three species with different nutrient acquisition strategies as our model species i.e., arbuscular mycorrhizal (AM), ectomycorrhizal (EM) and N2-fixing tree species, we conducted two experiments. In monocultures we tested whether the species have preferences for different N forms and whether such resource partitioning is mediated by soil microbes. For this, we compared the performance of three species grown individually on three N forms ($NH4+$, $NO3-$ and organic N) in soils with or without microbes. The same set of species was used in a second experiment to assemble plant communities varying in species richness (1, 2 and 3 species). Each community assemblage was grown under three different conditions: (1) soil with microbes and nutrient addition; (2) soil without microbes, but with nutrient addition; (3) soil with microbes, but without nutrient addition. The nutrient added was a mixture of all three forms of N. The results showed that Lithocarpus litseifolius (EM tree species) grew better with organic N forms and Cryptocarya concinna(AM tree species) did better with inorganic N forms. However, both species showed no preference for specific N forms when soil microbes were absent. Ormosia glaberrima (N2-fixing tree species) showed similar performance in organic and inorganic N regardless of the presence or absence of soil microbes. There was a positive relationship between species richness and community biomass in soil with microbes and nutrient addition, whereas this relationship disappeared in soil without microbes but with nutrient addition, and in soil with microbes but without nutrient addition. In summary, nutrient partitioning (organic and inorganic N) between plant species contributed to the positive species richness-community biomass relationship and this depended on the presence of soil microbes. Therefore, soil microbes may drive the positive relationship between species richness and community biomass by mediating plant niche partitioning.

Machado R.E.

Poster presentation
Drought event and soil perturbation facilitate invasibility in native grassland
Session: Plant community invasion

Rafael E. Machado, Anaclara Guido, Lidiane Boavista & Valério D. Pillar

Universidade Federal do Rio Grande do Sul
machado.rem@gmail.com

The invasive species *Eragrostis plana* (capim-annoni) exerts an important ecological and economical impact over native Campos grassland in Brazil by losses of biodiversity and reduction of grazing areas. We conducted a greenhouse experiment to test the hypothesis that perturbation of soil and water deficit increase invasibility in native grassland. The experiment was composed of 40 monoliths (30 x 30 cm) of native grassland in a block design exposed to four treatments: (a) drought (22 days without water supply during summer); (b) soil scarification; (c) drought and soil scarification and (d) no disturbance (control). After the drought event we sowed the invasive species in all communities in a high density (30,000 seed/m^2) and periodically evaluated changes in community composition and germination of *E. plana* seeds in 20 x 20 cm plots. We controlled the amount of biomass keeping 5 cm of community height by regular clipping. The highest number of *E. plana* individuals was observed 15 days after sowing, reaching the maximum germination of 25% of total seeds in (a) and (c), 21% in (b) and, 15% in the control (d), showing significant differences between (a) *vs*. (d) (P=0.003) and (c) *vs*. (d) (P= 0.013). The subsequent surveys showed no differences between treatments and the number of germinated *E. plana* seeds decreased to less than 3% in the 6th month for all the treatments. We observed considerable changes in species composition and colonization in the native communities probably driven by seasonal dynamics but without correlation with the invasive species germination. Changes were also observed in total community cover and significant differences between (a) *vs*. (b) (P=0.016), (b) *vs*. (c) (P=0.004) and (c) *vs*. (d) (P=0.004) with high openness in (a) and (c) (ca. 32%) at 15 days. Subsequently the communities recovered towards the pre-disturbance closed condition. We corroborate the hypothesis and partially attribute the increasing invasibility to the alteration of native community structure by reduction of total cover and release of resources, creating opportunity for colonization of invasive species. The recovery of native grassland will depend on its resilience and the reduction of disturbance pressure.

Maciejewski L.

Oral presentation
Early signs of changes in Natura 2000 habitats linked to climate warming
Session: Conservation of plant communities: from science to policy

Lise Maciejewski[1,2,3], Emilien Kuhn[1,2] & Jean-Claude Gégout[1,2]

[1]*AgroParisTech, ENGREF, UMR1092, Laboratoire d'Étude des resources Forêt-Bois (LERFoB), 14 rue Girardet, CS 14216, F-54042, Nancy Cedex, France;*[2]*INRA, Centre de Nancy, UMR1092, Laboratoire d'Étude des resources Forêt-Bois (LERFoB), F-54280, Champenoux, France and* [3]*Muséum national d'Histoire naturelle, Service du patrimoine naturel, 36 rue Geoffroy Saint-Hilaire, 75005 Paris, France*
lise.maciejewski@agroparistech.fr

The European habitat classification is a tool used to inventory, protect and restore threatened ecosystems at the European scale. But climate changes have induced latitudinal and elevational range shifts in species distribution as well as reshuffling of biotic communities. We investigated if these changes in plant communities have induced changes in the habitats defined by the European Union Habitats Directive. By using 6951 plots classified by experts in the European habitat classification, we defined a temperature index for 17 Forest habitats present in France by averaging the mean annual temperature of plots associated to each habitat. We generated 4561 pairs of plots extracted from forest vegetation databases and located in French temperate and mountainous areas. Each pair was composed by an historical (1914-1987) and a recent (1997-2014) floristic inventory. We used an automatic program based on species composition to classify each plot in the habitat classification. We finally compared the habitat temperature index between the historical and the recent sets of plots. Compared to historical plots, on average the habitat temperature index was significantly higher of 0.05°C for recent plots. For 23.5% of the pairs, the habitat temperature index of the recent plot was warmer than the historical one, whereas it was colder for 19.6%. There were no changes in the habitat temperature indexes for 56.9% of the pairs, because the historical and recent plots have been classified in the same habitat. The average difference in habitat temperature index between the historical and the recent plots was significantly higher in mountainous than in lowlands areas. This is the first evidence that changes in plant communities related to recent climate warming have been strong enough to lead to a change towards warmer habitats for a part of temperate forests of Western Europe. These changes could have consequences on the conservation status of habitats as well as on the perimeters of Natura 2000 sites.

Máguas C.

Oral presentation
Climate, management and resources as key drivers for the ecological impact of *Acacia longifolia* in native ecosystems
Session: Plant community invasion

Cristina Máguas[1], Florian Ulm[1], Christine Hellmann[2], Cristina Cruz[1], Patrícia Fernandes[1], Cristina Antunes[1] & Otília Correia[1]

[1]*Faculdade de Ciencias da Universidade de Lisboa, Centre for Ecology, Evolution and Environmental Changes, Campo Grande, C2, 1749-016 Lisbon, Portugal and* [2]*Experimental and Systems Ecology, University of Bielefeld, Universitätsstraße 25, 33615 Bielefeld, Germany*
cmhanson@fc.ul.pt

Invasive leguminous trees such as *Acacia longifolia* are an increasing problem worldwide. Contrary to Portuguese native plants, *A. longifolia* reveals lower investment in adaptive traits, exhibits high resource allocation and a constant allocation pattern under different conditions, maintaining high growth rates even in nutrient-poor soils and create large amounts of above and belowground biomass, leading to a decline in native vegetation and ultimately to an almost monospecific *Acacia* plant cover. The objective of this study is to understand the physiological response, vegetative growth and reproductive output of *A. longifolia* to different climatic conditions and forest structure, and to evaluate its ecological impact on the endemic shrub *Corema albuma*. The study was conducted at two sites with different climate conditions Osso da Baleia (mesic conditions) and Pinheiro da Cruz (xeric conditions), both occupied by *Pinus pinaster* plantation, with plots with a *P. pinaster* forest canopy and in open areas. We performed leaf water potential (Ψw) and gas exchanges measurements in March, June and July, to evaluate the water balance of *Acacia* and *Pinus*. Additionaly, we studied the spatial impact of *A. longifolia* in the native vegetation. *Corema* showed increased growth rates, higher leaf N and less depleted δ15N signatures closer to *Acacia* but not so to the co-occurring native *Stauracanthus spectabilis* legume. Foliar Carbon (C), Nitrogen (N) and Phosphorus (P) contents of *Corema* growing in proximity to *Acacia* or *Stauracanthus* were measured, as well as mass, C, N, P contents and potential flux rates of major Soil Organic Matter pools underneath each legume (roots, litter, rhizosphere). We can conclude that forest systems with mesic conditions but relative higher biomass and resources competition might be more stressful for understory *A. longifolia*, displaying a lower physiological performance and higher reproductive costs than in the xeric forests systems. Moreover, this study may contribute for a future model that will account climate change scenarios and invasiveness patterns in the Mediterranean region. Moreover, the importance of SOM accumulation underneath the invasive, in conjunction with higher rhizospheric turnover rates and the ability to create tissue with low P content leads to a higher phosphorus use efficiency and increased microbial turnover.

Majekova M.

Poster presentation
Physiological traits and leaf functional traits for studying plants response to water stress
Session: Functional and phylogenetic patterns in plant communities

Maria Majekova[1,2] & Tomas Hajek[1]

[1]*University of South Bohemia and* [2]*Comenius University*
maria.majekova@gmail.com

The leaf water potential at turgor loss (wilting point; πtlp) has been recognized as the most representative and direct physiological determinant of plant response to water stress. Plants with more negative πtlp maintain growth at more negative soil water potential (drier soil). Analogously, plants developing less negative πtlp prefer more humid conditions being more vulnerable to drought stress. Despite the suitability of πtlp for quantifying the adaptation to drought, it has not received much attention in community ecology, mainly because of its time- and instrumentation-demanding nature (construction of pressure–volume curves). We derived πtlp using two methods, pressure–volume curves and alternative approach of Barlett *et al.* (Methods Ecol. Evol. 3: 880–888, 2012) that calculates πtlp from osmotic potential measured at full hydration. We first validated that these two techniques give concordant results for herbaceous species. Then we asked whether commonly measured leaf functional traits and πtlp give concordant responses to water availability and how plastic are species from habitats with different water availability in their osmotic adjustment to changes in water availability. We conducted a greenhouse experiment with (i) dry meadow species, (ii) wet meadow species and (iii) generalist species that commonly occur in both types. We grew them for seven weeks in three watering regimes: (i) drought (ii) very wet conditions simulating flooding and (iii) well-watered but well-aerated soil conditions that served as a control. We measured species survival, growth parameters, specific leaf area, leaf dry matter content (LDMC), leaf δ13C and osmotic potential at full hydration (to calculate πtlp). LDMC and δ13C were significantly negatively related to πtlp. Osmotic and leaf traits adjustment to water availability levels were species specific, with the generalist species being more plastic in their response. Interestingly, species adjusted towards more conservative strategy not only when experiencing drought but also when experiencing very wet conditions. Altogether we demonstrate that it is feasible to use direct physiological traits instead of using leaf traits as proxies for the response of plants to water stress.

Malavasi M.

Oral presentation
Patch vs Plot: which is the best approach when investigating the effect of landscape pattern on plant diversity?
Session: Functional and phylogenetic patterns in plant communities

Marco Malavasi[1], Luisa Conti[2], Maria L. Carranza[3] & Alicia T.R. Acosta[2]

[1]*Department of Applied Geoinformatics and Spatial Planning, Czech University of Life Sciences, Kamycka 129,165 21 Prague 6, Czech Republic;*[2]*Dipartimento di Scienze, Università degli Studi di Roma Tre, V.le Marconi 446 - 00146 Roma, Italy and* [3]*EnviX-Lab. Dipartimento di Biotecnologie e Territorio, Università degli Studi del Molise - C.da Fonte Lappone - 86090 Pesche (IS), Italy*
malavasi@fzp.czu.cz

Many studies investigating the effect of landscape pattern on plant diversity assume that the habitat patch is the natural spatial study unit. This means that for recording and analyzing species richness, abundance or occurrence, each patch represents a meaningful ecological entity. However, some argument may arise from this assumption: the sampling effort is usually scaled to patch size and species richness is reported and analyzed on a per-patch basis, even though the original data are based on sample sites or plots, representing values that may range in size over two or three orders of magnitude. Previous authors claiming that the habitat patch is not exhaustive in recording species richness, suggested to test different approaches, based on the single plot or sample site. With this assumption, in this study we compare the effect of landscape pattern and change on different facets of diversity (taxonomic, functional and phylogenetic) using a classical patch-based approach versus a plot-based one. Relying on multitemporal land cover maps, we computed a set of patch-based metrics and a set of plot-based metrics (for different buffer areas around each plot). We use Mediterranean coastal dunes as model systems. From a database of plant community plots, on functional traits from field measurements and on a dated phylogenetic tree, we calculated taxonomic (TD), functional (FD) and phylogenetic diversity (PD) within each patch and single plot. Diversity measures were then related to the patch and plot-based landscape metrics via linear mixed-effects model. We observed dissimilarities for the two different approaches, where the patch diversity seems to better respond to the related metrics which mostly describe the spatial configuration of habitats. Whereas, the plot diversity is less sensitive to the selected metrics, mostly associated to the habitat amount and loss around the plot. Besides, for both approaches we observed the same remarkable mismatches among the three facets of plant diversity, being TD less affected by landscape metrics than FD and PD. Our results call for caution when selecting the appropriate approach, depending on the major landscape processes occurring across the study area.

Martinelli M.

Poster presentation
Environmental mapping: concepts, methods and case studies
Session: Applied mapping for conservation and management

Marcello Martinelli [2] & Franco Pedrotti[1]

[1]*University of Camerino*, Italy *and* [2]*Universidade de São Paulo, Departamento de Geografia, FFLCH, Universidade de São Paulo, Brasil*
m_martinelli@superig.com.br
franco.pedrotti@unicam.it

Environmental mapping simultaneously takes into consideration all the ecological factors (physical, biotic and anthropic) of a given area in order to create one synthetic cartographic representation of the environment (Martinelli, *Phytocoenosis*, 1999). This cartography is done through the identification of synthetic spatial units, indicated with different denominations, such as landscape unit, environmental unit, territorial unit, today better defined as synthetic spatial sets or landscape types or environment types. The landscape type is a portion of the territory interpreted in a synthetic way for cartographic purposes and relatively homogeneous from the point of view of the physical environment (geomorphology, pedology, climate), of the vegetation (vegetation series) and of the direct or indirect presence of human society. It is possible to place these types in the context of higher systems of classification, distinguishing systems and subsystems, by which the following hierarchic ranking is obtained: landscape type (geomorphologic units with a given type of vegetation and soil use), landscape subsystems (physiographic and lithologic units) and landscape systems (geographic and lithologic units). Mapping of landscape types, that is, their tracing out their concrete borders, is artificial inasmuch as the ecosystems and landscapes are open systems. Even so, for practical reasons, such as planning and management, it is justifiable to choose as criterion of reference the specific natural and crop-related identity of the different types obtained by the synthesis of the physical, biotic and anthropic environment, as well as by their function (Martinelli and Pedrotti, *Revista do Departamento de Geografia, SãoPaulo*, 2001). This work presents the map of the environmental units of the Stelvio National Park (37 types of landscapes united in 4 systems) and the map of the Abruzzo National Park (52 landscape types united in 3 systems), both on a scale of 1:50,000. These two maps served as the foundational documents in developing the management plan of the two parks. In addition, a case of environmental mapping in Brazil is illustrated, namely, synthesis cartography that shows the landscape types of the municipality of São Bento do Sapucaí (São Paulo, Brazil), as the basis for proposing how it should be zoned for touristic use (Martinelli, *Conceptions and practice in nature conservation*, 2006).

Martínková J.

Oral presentation
The root bud bank: ecological significance and implications
Session: Plant strategies and disturbance

Jana Martínková[1], Tomáš Herben[2,1] & Jitka Klimešová[1]

[1]*Institute of Botany, Czech Academy of Sciences, Czech Republic and* [2]*Department of Botany, Faculty of Science, Charles University, Czech Republic*
jana.martinkova@ibot.cas.cz

Disturbance is important factor influencing vegetation by removing plant biomass. Removal of biomass significantly changes competition milieu and affects species population dynamics. Recovery of plant population after disturbance event is dependent on seeds buried in the soil, but also on the bud bank located along plant body. Bud bank is a pool of dormant meristems from which new shoots regrow and removed biomass can be restored. It is typically localized on organs placed out of the reach of disturbance, i.e. belowground or close to the soil surface. The plant organs bearing the bud bank are of two types: stem organs like rhizome, bulb and tuber, and root. While the stem bud bank is frequent, the root bud bank and consequently root sprouting ability is less common and its ecology much less known. Nevertheless, it is know that sprouting from roots has some characteristics, which make it in its ecological implications and different from sprouting based on stem buds. First, roots are usually placed deeper in the soil than rhizomes and thus they are better protected from disturbance. Second, root sprouting is often promoted or conditioned by injury to plant body. Third, as some growth forms lack belowground stems their only ability to form bud bank is employment of roots. On the base of these three characteristics, we hypothesize that plants capable of root-sprouting occur more frequently in habitats with a higher severity and frequency of disturbance than species without this ability, especially when they lack the stem bud bank. Using Central European data, we confirmed the hypothesis as root-sprouters inhabit disturbed habitats more frequently when they don't possess stem based belowground bud bank, contrary to situation when they have both bud bank types at disposal. Moreover, root-sprouters prefer more severely disturbed habitats than non-root-sprouters, but only when they are non-clonal perennial plants. Bud bank on roots and root-sprouting are important tool and mechanism coping with disturbance in plants lacking belowground stems.

Martins L.A.

Poster presentation
Is natural regeneration enough to restore the connection between tropical forest fragments?
Session: Restoration of subtropical and tropical grasslands and savannas

Leonardo Augusto Martins[1], Giselda Durigan[2], Rita Camila Sampaio[1] & Vera Lex Engel[1]

[1]Universidade Estadual Paulista and [2]Instituto Florestal
leonardoamartins@gmail.com

Ecological corridors aim to decrease the effects of ecosystem fragmentation by connecting isolated remnants, favoring faunal fluxes, seed dispersal, and vegetation recovery. However, many corridors are located in former anthropic areas (plantations, forests or pastures), and need to be restored to fulfill their function. Passive restoration can be an effective technique to form these corridors as long as there is potential for natural regeneration. We assessed the potential for natural regeneration of ecological corridors at different distances from fragments of tropical semideciduous forest, in the state of São Paulo, Brazil. The study was carried out in three ecological corridors (50 to 100 m wide and 1 to 2.5 km long), formerly occupied by eucalyptus plantations and abandoned after timber harvesting in 2002. A total of 36 permanent plots of 400 m^2 were randomly distributed at distances ranging from 24 to 790 m from the closest fragment border. In each plot, all individuals taller than 1.30 m were measured (height and diameter) and identified. The variation of species richness, abundance and basal area with distance from the seed source was evaluated through linear regression. All variables analyzed presented significant decrease as the distance increases ($p<0.005$), up to 400 m. Apparently, beyond this distance there is no contribution of the forest remnants to the colonization of the corridors. The great biomass of invasive grasses and likely the low density of the seed rain seem act as ecological filters constraining forest succession. The results indicated that 12 years were not enough to recover the native forest along the corridors by means of passive restoration. Complementary techniques of active restoration will be necessary to accelerate the recovery of forest density and richness, at least in the central sections of the corridors, which are more distant from seed sources.

Medeiros A.S.

Poster presentation
Mycorrhizal communities affected by restoration treatments
Session: Restoration of subtropical and tropical grasslands and savannas

Adler S. Medeiros[1], Bruno T. Goto[2] & Gislene Ganade[1]

[1]Universidade Federal do Rio Grande do Norte. Department of Ecology, Bioscience Center. and [2]Universidade Federal do Rio Grande do Norte. Department of Botany and Zoology, Bioscience Center.
adlersm@hotmail.com

The goal of ecological restoration programs is to restore the functioning of a previously degraded ecosystem. Arbuscular Mycorrhizal Fungi (AMF) are important soil organisms for ecosystem functioning because they are associated with a variety of plant species and directly influence plants nutrient absorption. AMF individuals can be associated to more than one plant at the time, developing an interaction network that affects nutrient distribution for the whole plant community. Re-establishing AMF communities is essential for restoration programs to succeed. Our study investigates how different ecological restoration techniques affect AMF communities in a semiarid Caatinga degraded area. We conduct the study at the National Forest of Açu, Rio Grande do Norte, Brazil. We settled the following soil treatments in a 2 ha degraded area: control (-L-I), litter addition (+L-I); irrigation (-L+I); litter+irrigation (+L+I); agroforesty (+I+crops) and natural regeneration (NR). Restoration treatments also consisted of transplanting 36 individuals from 6 plant species in each treatment, except for NR plots. Treatments were arranged in five replicated blocks consisted of 12x12 m plots established 2 m apart. Additional five conserved area (CA) plots were settled in a 250 m transect inside native forest. We collected five soil sub-samples in each plot, counted overall numbers and richness of glomerospores for all samples and compared treatments using Kruskal-Wallis test. Mycorrhizal species richness was not different among treatments. However, number of spores was different among restoration treatments, where litter transposition had the highest values and control plots the lowest. No restoration treatment reached a number of spores similar to the conserved area plots. Higher number of spores increases the likelihood of association between AMF and plants. Our results shows that litter transposition could be an efficient technique to enhance number of spores and potentially increase the likelihood of plant colonization by mycorrhizal fungi.

Menezes L.S.

Poster presentation
Turnover and nestedness components of beta diversity in Campos Sulinos grasslands
Session: Classification, structure and dynamics of plant communities

Luciana S. Menezes[1,2] & Gerhard E. Overbeck[1,2]

[1]*Universidade Federal do Rio Grande do Sul and* [2]*Graduate Program in Botany*
lu.silva.menezes@gmail.com

Campos Sulinos grasslands are species-rich ecosystems. The Campos Sulinos can be separated into grasslands in the Pampa biome and in the Mata Atlântica biome (highland grasslands). Species pool in the two biomes differ in size: current information with 2150 species in the Pampa and 1620 in the highlands. The Pampa grasslands greatly exceed the highlands in terms of area (176.496 km Brazilian Pampa and 13.740 km highland grasslands) and this richness difference thus is expected from the classic species/area relationship. Beta diversity was originally described as the extent of differentiation of communities along habitat gradients. Beta diversity can be decomposed into the components turnover (accounting for the change of species along sampling units) and the resultant dissimilarity generated by nestedness. As highland grasslands present 530 species less than the Pampa grasslands, even with an area more than ten times smaller, we expect to find higher turnover and higher values for total beta diversity in this region. The Pampa might present a higher level of nestedness due to a more monotonous species composition, when considering the larger area. We used data from plant communities sampled in 108 sites distributed in 12 areas: seven areas in the Pampa and five areas in the highlands. Beta diversity and the components, turnover and nestedness, where calculated by help of 'betapart' package on R. Values obtained for average beta diversity where compared through ANOVA. Average beta diversity for highland areas was $\beta sor=0.70$, while in the Pampa biome it was $\beta sor=0.67$. Values did not differ significantly between biomes. The turnover component corresponded to a slightly higher proportion of beta diversity in the highlands (94%) than in Pampa biome (91%). Resultant dissimilarity due to nestedness represented 6% of the beta diversity in highlands and 9% in Pampa. Unexpectedly, the rate of change among communities did not differ between Pampas and highlands grasslands. One reason might be that highlands species are very habitat specific, highlighted by the number of endemic species in the region (296 spp.). Those species usually will not be included in non-directional sampling effort.

Meyer L.

Poster presentation
Tree species data providing support for conservation decisions in different elevation zones of the southeastern Atlantic semideciduous forest
Session: Conservation of plant communities: from science to policy

Leila Meyer[1,2], Vanessa Leite Rezende[1], Pedro Luiz Silva de Miranda[3], Cecília Valladares Moreira[1], Mariana Fonseca de Magalhães Linhares[1], Ary Teixeira de Oliveira-Filho[1] & Pedro Vasconcellos Eisenlohr[4]

[1]Universidade Federal de Minas Gerais, Departamento de Botânica, Belo Horizonte, MG, Brazil;[2]Universidade Federal de Goiás, Departamento de Ecologia, Goiânia, GO, Brazil;[3]The University of Edinburgh, School of Geosciences, Edinburgh, UK and [4]Universidade do Estado de Mato Grosso, Faculdade de Ciências Biológicas e Agrárias, Alta Floresta, MT, Brazil
leilameyer08@gmail.com

Elevation is one of the major environmental variables driving taxa composition, floristic diversity and structure of forests, thus it can be used to plan conservation strategies. Our aims were to obtain an overview of tree taxa conservation status in the Atlantic semideciduous seasonal forests of southeastern Brazil and check, amongst the floristically consistent elevation zones, which one had the largest number of endemic, threatened and indicator species and the highest taxa richness and taxonomic distinctness. To achieve this, we used species occurrence and geo-climatic data from 222 sites obtained from the 'NeoTropTree' dataset. First, we did non-metric multidimensional scaling followed by an analysis of variance to check which zones were floristically consistent. Then, we evaluated the number of endemics and threatened species, performed an indicator species analysis, estimated species richness and calculated the taxonomic distinctness index for all zones. Our results revealed four floristically consistent elevation zones (F = 83.3; p < 0.005): 'lower plains/upper plains' (0 – 600 m); 'lower highlands' (600 – 1,000 m); 'upper highlands' (1,000 – 1,400 m); and 'montane' (> 1,400 m). We found 2,293 species in the investigated sites, of which 867 (37.8%) were endemic to the Atlantic forest, 772 (33.6%) were endemic to a specific zone, and 1,350 (58.9%) were endemic to Brazil. We identified 249 (10.8%) indicator species and 109 (4.1%) threatened species. The number of endemic and threatened species decreased with increasing altitude, whereas the amount of indicator species for each zone did the opposite. The rarefaction curves showed that species richness was different between elevation zones, besides showing that species richness also decreased with increasing altitude. Only the 'montane' zone was taxonomically distinct from the others (D = 2.92; 2.94 < IC < 2.95). These variations in richness and species composition related to elevation should be considered when planning conservation strategies. Whenever possible, we should also prioritize the maintenance of the whole elevation gradient.

Michaelis J.

Oral presentation
How to handle rareness? Prevention of bias in Huisman-Olf-Fresco models due to unbalanced sampling
Session: Classification, structure and dynamics of plant communities

Jana Michaelis & Martin Diekmann

University of Bremen
jana.michaelis@uni-bremen.de

The analysis of species responses towards environmental gradients is of great theoretical and practical interest to vegetation science. To understand the relationship between plants and their environment is of utmost importance to estimate the impact of global change, to understand the loss of biodiversity or the spreading of invasive neophytes, and to take preventive measures. This is especially true for species that are already rare or endangered. In vegetation science, species responses are often explored with Huisman-Olf-Fresco (HOF) models. These enable us to determine the different shapes of species responses and to extract certain niche attributes, such as niche optimum, width or limits. However, it is known that the choice of the model shape is influenced by properties of the data set, such as the number of plots or the relative frequency of a species in the data set, which is a challenge when working with rare species, which are necessarily rare also in most randomly sampled data sets compared to common species. We assessed how differences in absolute and relative frequencies of species within a data set influence the outcome of the HOF models and the niche parameters extracted from these models, using vegetation plot data and corresponding soil pH measurements from deciduous forests of northern Germany. We critically discuss the results with respect to the outcomes for rare and common species and give advice on how to handle rare species in HOF response modeling.

Mimami Y.

Poster presentation
Influence of volcanic gas and soil condition on vegetation along fumaroles in Northeastern Hokkaido, Japan
Session: Classification, structure and dynamics of plant communities

Yoshinori Minami & Yurina Noguchi

Tamagawa University
yoshi-min@agr.tamagawa.ac.jp

Volcanic activity is one of the natural disturbances on vegetation. A number of studies concerning influence of volcanic activity on vegetation have been done. Although eruption acts destructively, it's only a temporary phenomenon while volcanic gas affect vegetation constantly. Influence of volcanic gas on vegetation may vary from one locality to another volcanic region. The present study addresses a lack of knowledge about volcanic gas action to constrain progress of succession by investigating topographic relief, soil condition and vegetation. This study was conducted in two areas with a lot of fumaroles in eastern part of Hokkaido, northern Japan. The preliminary findings are: The number of species increased in a direction away from fumaroles to the adjacent forest zone and greater number of broadleaf seedlings could be found in the forest margin. Understory vegetation was divided into eight groups by TWINSPAN, and we found roughly three main distribution patterns along the zoning, in forest, forest margin, and grass zones. The lowest pH was detected in bare ground and the highest one in the grass zone. We recognized four soil colours, yellow, gray, white and red. The yellow and gray soil contained high concentration of sulfuric acid, and gray and white soil had higher concentration of aluminium. The results suggested that the increasing species number of species with increasing distance from the fumaroles reflects influence due to soil acidification by fumarole gases and attendant Aluminium ion elution, which is toxic to plant growth.

Minchin P.R.

Oral presentation
Ecology-based thinking for community biostatistics
Session: Data analysis methods in vegetation ecology

Peter R. Minchin

Southern Illinois University Edwardsville
pminchi@siue.edu

It has recently been suggested that "distance-based" ordination should be abandoned in favor of "model-based" methods. Model-based methods, it is argued, allow the error distribution of the dependent variables (abundances of species), including the mean-variance relationship, to be correctly specified. Furthermore, the tools of statistical modeling are available to assess fit, choose between alternative models, identify influential observations, etc. It has been claimed that distance-based methods give false or misleading results. This all sounds familiar. In the 1960s the availability of computers led to the recommendation that ecologists should use "mathematically rigorous" methods such as principal components analysis (PCA), rather than "distance-based" methods. But when ecologists began to assess performance using abundance data simulated from ecologically sensible generating models, they found that PCA performed poorly because its linear response model is not compatible with ecological reality. To paraphrase Ed Beals, they found that PCA was mathematically elegant but ecologically naïve. Proponents of model-based methods are in danger of making the same error, since they have not evaluated their methods against the traditional methods they are theoretically supposed to outperform using data from ecologically plausible generating models. I used simulated data from models in which mean abundances of species are related to ecological gradients by unimodal functions (though truncation at gradient extremes can produce monotonic responses), with appropriate error distributions (quasi-Poisson or negative binomial). Properties of the generating model (beta diversity, alpha diversity, response surface shape, sampling distribution in gradient space, sampling density) were varied in factorial combinations and ten replicate data sets were generated for each combination of model properties. The data were ordinated using non-metric multidimensional scaling (NMDS) and three model-based methods: Gaussian ordination, latent variable models, and finite mixture models. NMDS performed well over the full range of model properties. The model-based methods sometimes produced results as good as or somewhat better than NMDS but sometimes failed to converge to a solution, especially with high beta diversity and low sampling density. Though it has been claimed that NMDS fails when the variance is proportional to the mean, this was not observed. NMDS has been criticized because it does not operate directly on the observed abundance data but on pairwise dissimilarities. This is, in fact, a strength of the approach because it amplifies the ecological signal relative to noise. In many applications of ordination, interest centers on accurately recovering the community trends related to ecological gradients rather than fitting a model to the abundance data *per se*. For this objective, NMDS is a robust method that still has a place in the toolbox of community ecology.

Moreno J.M.

Oral presentation
Short-term post-fire plant responses in a Mediterranean shrubland subjected to experimental drought
Session: Climate change and plant communities

José M. Moreno, Antonio Parra & Daniel Chamorro

University of Castilla-La Mancha
josem.moreno@uclm.es

Mediterranean shrublands are fire-prone ecosystems that undergo a prolonged period of drought during the year. Climate change is projected to cause decreases in rainfall, and a lengthening of the dry period during the year, by concentrating rainfall towards winter and fall. Here, we present results of a manipulative experiment in which rainfall total and patterns were experimentally modified to produce various levels of seasonal drought before (one season) and after (four years) after burning, in an old shrubland in Central Spain. Analyzed plant responses include reproductive output, seed characteristics, including anatomy, and germination under various levels of water stress of the dominant species, the seeder *Cistus ladanifer*, ecophysiological performance of unburned and resprouting/seeding plants of the main seeders (*Cistus ladanifer, Rosmarinus officinalis, Genista scorpius)*and resprouters (*Erica arbora, E. scoparia, Phillyrea angustifolia)*, demography of the main resprouters and seeders, and plant community dynamics, including both shrubs and herbs. We document that reproductive output in *Cistus* was rather resistant to drought, but germination was sensitive to increased water stress. Seed anatomy was also affected by drought. Seedlings and juveniles ecophysiological performance of the main seeders were sensitive to drought, but less than expected, while resprouters were little sensitive to drought, with minor differences among the species. The demography of the main seeders was sensitive to drought, but mainly through germination. In fact, germination was the controlling factor of the population. By contrary, resprouters were insensitive to drought, with virtually no changes in their populations due to it. There was a flush of herbs emerging after fire, which had a differing dynamics depending on the level of drought, being more abundant in the most severe drought treatment. Drought-treated plots maintained higher levels of herbs even four years after fire. Overall we document that drought produces various effects, from the level of plant to the population or community. The herbalization induced by drought can further increase the risk of fire.

Moser P.

Poster presentation
Environmental drivers of tree floristic variation in open rain forests in southern Amazon
Session: Classification, structure and dynamics of plant communities

Pamela Moser[1], Marcelo Brilhante de Medeiros[2], José Roberto Rodrigues Pinto[1], Pedro Vasconcellos Eisenlohr[3] & Marcelo Fragomeni Simon[2]

[1]Universidade de Brasília;[2]Embrapa Cenargen and [3]Universidade do Estado de Mato Grosso
moserpamela2@gmail.com

In the Amazon forest, many studies have shown that environmental factors such as soil fertility and water saturation are the main predictors of plant communities composition, while other studies suggest that the best predictor of floristic variation is space, represented by geographical distance. However, for large areas such as south and southwestern Amazonia, the determinants of floristic patterns are unknown. We investigated the relative contribution of environmental and spatial factors in explaining the floristic variation in mesoscale space in open rain forest areas in southwestern Brazilian Amazon. The inventory was conducted in the upper basin of the Madeira River, Rondônia, following the RAPELD method that considers three size classes: Class 1, individuals with diameter at breast height (DBH) from 1 to 10 cm; Class 2, 10 cm $\leq$ DBH < 30; and Class 3, DBH $\geq$ 30 cm. Total sampling effort in 20 plots for each size class was 1, 10 and 20 hectares, respectively. Floristic quantitative data, geographic distance between plots, and 26 environmental variables (altitude, river distance, slope, number of fallen logs and 22 texture and chemical soil variables) were used in the analyses. Partition of floristic variation was divided into four fractions: (a) environment; (b) spatially structured environment; (c) space; and (d) residue. We sampled 8,501 individuals in 906 tree species. Floristc variation was mainly explained by the environment that retained 14%, 16%, and 12% of the total variance, while space explained just 2%, 3%, and 1% on each of the three size classes respectively. Size classes had similar responses and only the environment was significant. Despite the relative importance of environmental variables in explaining floristic variation, 78%, 68% and 78% of the total variance was retained in residuals, suggesting that stochasticity and unmeasured environmental variables may be playing a rule in community assembly.

Mucina L.

Oral presentation
Vegetation mapping and biogeographic spatial classifications: two sides of the same coin
Session: Applied mapping for conservation and management

Ladislav Mucina

The University of Western Australia
Laco.Mucina@uwa.edu.au

Plant geography (phytogeography) and vegetation science have been conceived by one Father. For some (long) time they have also been used interchangeably as witnessed by one of earlier English names of the International Association for Vegetation Science. Traditionally, since publication of Braun-Blanquet seminal textbooks, the term 'synchorology' was used to conceptualise 'the science of distribution of vegetation types' and, naturally, included vegetation mapping as well. Is there really a fundamental difference between studying distribution of plants (plant taxa) and syntaxa? Why would phytogeographic divisions (spatial classifications) in some parts of the world differ from vegetation maps, while in other regions these maps are strikingly similar? These questions will be elucidated through reviewing the approaches to vegetation mapping in Africa and Australia. Using African experience, I shall demonstrate how a phytogeography-focused map has been adopted as a successful vegetation map, and in case of Australia is shall show how this happened in reversed order. I shall also analyse the ways how phytogeography handles the delimitation of centers (and nested sub-centers) of endemism and biodiversity hot spots, and identify interface where vegetation science (mapping) can help to formalise (render operational) these two important concepts of high value in the world of conservation biology. Last but not least, I shall challenge my Brazilian colleagues to apply these ideas to revisit the identity of cerrado and campos rupestres as biomes and as hot spots.

Mulaudzi N.

Poster presentation
Management of vegetation in a protected area through the use of tree layer profile
Session: Classification, structure and dynamics of plant communities

Ntanganedzeni Mulaudzi & Peter Tshisikhawe

University of Venda
tshisip@univen.ac.za

Tree layer profile in ecological studies is important as it can tell us something about the biological structure of the community, something about interactions between species and how the community functions in gathering the energy and cycling of nutrients. The structure of the plant community determines the animals that can be present, so it is useful in wildlife management. Understanding the importance value of the different tree species forming the tree layer can assist in identifying species that need attention and monitoring in the maintenance of the viable vegetation structure. The aim of the project was to understand the tree layer of the pristine natural vegetation of the Lowveld National Botanical Garden (LNBG) found in South Africa. Point-Centered-Quarter (PCQ) sampling method was used on 33 sampling points to determine the importance value on plants species found on the LNBG's natural vegetation. Only trees that are taller than 2m were considered for sampling and their basal diameter at the base of the stem, height, and their canopy cover were measured. One hundred and thirty-two individuals were sampled through PCQ method represented twenty-five plant species and were found to be distributed within 13 families of which Combretaceae and Fabaceae were the most dominant. The importance value of recorded plant species ranged from 1.82 to 60.35. Plant species such as *Pterocarpus angolensis*, *Lannea schweinfurthii*, *Sterculia murex*, *Combretum molle* and *Combretum collinum* came out as cornerstone species of the LNBG's natural vegetation. Plant such as *Combretum apiculatum*, *Strychnos pungens*, *Heteropyxis natalensis*, *Vangueria infausta* also appeared to be dominant and not endangered as such. However, plant species such as *Terminalia sericea*, *Combretum erythrophyllum* and *Englerophytum magalismontanum* are vulnerable and need some monitoring in order to avoid their extinction in the botanical garden.

Muoghalu J.I.

Oral presentation
Temporal pattern of tree community dynamics in a secondary forest in southwestern Nigeria, 29 years after a ground fire.
Session: Restoration of subtropical and tropical grasslands and savannas

Joseph I. Muoghalu

Department of Botany, Obafemi Awolowo University, Ile-Ife, Nigeria.
jmuoghal@oauife.edu.ng

The study determined the successional replacement model among the functional groups in a secondary rain forest that was ravaged by a ground fire, 29 years ago. The objective was to determine the stand temporal pattern of tree community dynamics in a moist tropical forest regenerating after fire disturbance. Two plots, 0.25 ha each, established in burnt and unburnt parts of the forest immediately after the fire to study community dynamics in the forest were used for the study. In each plot, woody plant species ≥ 1 cm in girth and 1 m and above in height were completely enumerated, identified to species level, labelled with a permanent tag and had girth size measured at breast height (gbh). The number of species, genera and families was established for each plot. The data was used to calculate species diversity indices, basal area, species evenness, density, similarity and dissimilarity indices for the plots. Tree mortality and recruitment rates were calculated using data from this study and from previous studies in the burnt plot in 1983, 1984, 1997 and 2008. Correlation and regression analyses were used to assess whether decadal changes in rainfall and temperature were the major drivers of changes in the forest after calculating decadal temperature and rainfall data for 29 years. The results showed that a total of 380 trees were present in the 0.25 ha burnt plot, representing 63 species, 46 genera and 25 families. Tree stem density decreased from 4332 stem ha^{-1} to 1520 stem ha^{-1} 29 years after the fire. Species diversity (H1) decreased to 2.50 in 2008 and increased to 3.50 in 2012. Species evenness peaked (0.80) in 1997 and decreased to 0.48 in 2012. Basal area that had increased to 20.18 m^2 ha^{-1} in 1997 and had dropped to 14.62 m^2 ha^{-1} in 2008 increased to 21.34 $m^2 ha^{-1}$ in 2012. Tree annual mortality rates that continued to decrease one year after the fire (-2.02% y^{-1} in 1984-1997, -5.16% y^{-1} in 1997-2008) had increased to 25.7% y^{-1} in 2008-2012). The annual recruitment rates continued to decrease since the fire, decreasing to the lowest rate of -25.7% y^{-1} in 2008-2012. There was a non-significant positive correlation between decadal mean minimum temperature, decadal mean maximum temperature and decadal mean annual rainfall and tree density but a non-significant negative correlation between these climatic data and basal area, species richness and species diversity. It was concluded that changes in the floristic, structural character, mortality and recruitment rates were still going on in the forest, 29 years after the fire disturbance. Changes in decadal rainfall and temperature since the fire seemed to be part of the drivers of the changes in the forest.

Nagy E.

Poster presentation
The impact of the hydrological regime and textural features of meadow soils (gleysols) and meadow solonetz (solonetz) soils and their changes due to eluviation and presence of cationic surfactants on the vegetation
Session: Classification, structure and dynamics of plant communities

Edina Nagy[1], Áron József Deák[2], Rita Földényi[3] & István Sisák[1]

[1]*University of Pannonia, Department of Crop Production and Soil Science;*[2]*University of Szeged, Department of Physical Geography and Geoinformatics and* [3]*University of Pannonia, Department of Earth and Environmental Sciences*
nagy.edina22@gmail.com

Meadow soil covered abandoned river-beds with mesotrophic wet meadows or salt meadows and meadow solonetz covered point-bars with *Artemisia* (in primary saline areas) or *Achillea* salt (in secondary saline areas or out-leached places) steppes are widely distributed in loess landscapes and floodplains of the Carpathian-basin appearing often next to each other. Due to the decrease of groundwater and the intensive rain-showers the out-leaching of saline soils was observed influencing the species composition and habitat patterns. These habitats are frequently surrounded by arable lands with intensive use of pesticides, herbicides, fertilizers containing cationic surfactants, which can be washed out and can reach natural areas. Surfactants alter the hydrological regime of soils via the modification of structure of clay minerals, soil grains and porosity influencing the vegetation. The research tried to model the impact of eluviation (equal with 3-day-lasting 48mm/day heavy rainfall) and exposure to surfactants (Cetyl-pyridinium-chloride) on the hydrological regime and texture of meadow and meadow solonetz soils in laboratory via the examination of mechanical composition, capillary water-rise, soil texture, volume mass, hygroscopicity, maximal and minimal water capacity. In meadow solonetz soils exchangeable Na forms a hydrate-coat on soil grains preventing the capillary water rise, but it was much higher at treated and non-treated meadow soils in the first hours. The time curve of the out-washed meadow solonetz was similar to the one of meadow soils showing intermediate values between meadow soils and meadow solonetzes due to residual salt-content. It explains the appearance of plant species (*Alopecurus pratensis*, *Inula britannica*) of salt or mesotrophic wet meadows in *Achillea* and *Artemisia* salt steppes in wet years and the formation of mosaics of salt meadows with dry salt steppes on higher elevated places. Surfactant treated samples showed a bit higher water-rise in the first 24 hours. Washing-out and surfactant treatment resulted the disappearance of differences in volume mass, soil texture, hygroscopicity, maximal water capacity, which can lead to the formation of uncharacteristic habitats and decrease of biodiversity. Minimal water capacity decreased after washing-out and surfactant treatment at meadow soils resulting higher water permeability, while it increased at meadow solonetzes resulting higher water retention.

Nogueira de Sa F.

Poster presentation
Plant secondary metabolites do not play an important role in structuring caterpillar communities in *Byrsonima coccolobifolia* and *B. pachyphylla* (Malpighiaceae)
Session: Plant strategies and disturbance

Flavia Nogueira de Sá[1], Tácito B. Trindade[1], Cintia L. Gonçalves[2], Thayane P. Silva[2], Hanna Pamella A. Rodrigues[2] & Ivone R. Diniz[2]

[1]*University of Brasilia, Faculty UnB Planaltina;* [2]*University of Brasilia, Zoology Department*
fnsa@unb.br

Plant secondary metabolites (chemical compounds not involved in resource acquisition or allocation) are considered the most important plant trait in determining interactions between plants and insect herbivores. Secondary metabolites play a role as agents of selection on herbivores, impacting their fitness as they feed on some plants. In this work, we aimed to investigate if chemical compounds and the community of caterpillars feeding on the leaves of *Byrsonima pachyphylla* and *B. coccolobifolia* differ between rainy and dry seasons, two important climatic seasons in the Brazilian Cerrado. We also investigated if secondary metabolites play a role in structuring the community of caterpillars feeding on these two species. We searched for caterpillars for about 24 months; therefore accessing the community of such herbivores on the two host plants. We collected leaves from both plant species every three months along one year and analyzed the compounds found in leaf extracts by thin layer chromatography (TLC). We found that in terms of chemical composition, *B*. pachyphylla and B. coccolobifolia are 100% similar (Jaccard) in the same season (both rainy and dry), but there is no similarity or it is very low considering the same species in different seasons. There was no significant difference in the amount of compounds detected in both species and in both seasons. Although we did not find any significant difference in the estimated richness of caterpillars found in both species of plants and in the rainy and dry seasons, the composition of communities of caterpillars in each host plant were only about 35% similar (Bray Curtis) in both seasons. This similarity was even lower (about 17%) between communities found in different species of host plants in the same season. In conclusion, we found that despite being closely related and the high similarities of chemicals found in leaves, studied species of Byrsonima host very different communities of caterpillars. Although we recognize the influence of secondary metabolites on herbivores, in this case we do not support that such chemicals are important in structuring the communities of caterpillars.

Nunes J.S.

Poster presentation
How do plants grow in Cerrado? initial growth strategies of *Mimosa* species of frequently burned savannas
Session: Functional and phylogenetic patterns in plant communities

Jessika S. Nunes, L. Felipe Daibes, Talita Zupo & Alessandra Fidelis

Universidade Estadual Paulista, Departamento de Botânica
jessika_silvanunes@hotmail.com

The initial growth of plants can help on the identification of adaptive strategies and responses to disturbance. Therefore, we aimed to evaluate the strategies of initial growth in plants of different growth-forms from an open savanna in Cerrado. We selected three species: *Mimosa kalunga* (shrub), *Mimosa* sp. (new species, tree) and *Mimosa somnians* (forb). They were put to germinate and then transplanted to polyethylene bags (1/2kg) filled with substrate (sand/black soil, 2:1). Seedlings were kept in greenhouse with automatic irrigation. Ten seedlings of each species were randomly selected after 4, 6, and 9 months and their length and dry weight of root and shoot parts were measured. One-way analysis of variance applied to randomization tests (Euclidean distance, 10,000 iterations) were carried out to evaluate differences in root and shoot length for each species over time, as well as differences in biomass (root:shoot ratio) between species at 9 months. Species initially invested in root length (at 4 months), but this measure did not inscrease along time, whilst shoot length continuously increased over 4, 6, and 9 months (P≤0.05). All species showed root:shoot values <1, meaning that they invest more in aboveground parts rather than roots. Nonetheless, *Mimosa somnians* (forb) had a higher root:shoot value (0.64) than the tree (*Mimosa* sp., 0.28, P=0.0002) and shrub species (*Mimosa kalunga*, 0.34, P=0.03), showing that forbs tend to invest more in underground growth when compared to other growth-forms, whilst trees invest more in aboveground parts. Trees should invest more in a rapid growth of aboveground parts, being this an important trait that allows them to escape the fire line and thus, protect their aboveground buds, whilst forbs are in the fire line and thus, investing in underground growth is an advantage in fire-prone ecosystems.

Oliveira M.C.

Poster presentation
Establishment of Cerrado native species after direct seeding on abandoned pasture in the Federal District
Session: Restoration of subtropical and tropical grasslands and savannas

Maria C. Oliveira[1], Jussara B. Leite[1], Roberto S. Ogata[3], José F. Ribeiro[4] & Juaci V. Malaquias[4]

[1]UnB/FUP;[2]UnB/FUP;[3]Projeto Biomas;[4]Embrapa Cerrados and [5]Embrapa Cerrados
mcrisoliveira@unb.br

Direct seeding is one of the techniques that have been showing outstanding results for land reclamation with some Cerrado species due to its relatively low cost and good seed germination rate. This study aimed to evaluate seedling establishment for 36 native tree species in two areas of Neossolo Regolítico on abandoned pasture surrounding the gallery forest of the river Lamarão, at the Entre Rios Farm, PAA-DF, Paranoá, Federal District. Establishment was evaluated after two years of the direct seeding on two areas, one in a gently sloping (area 1) and another in a more tilted and eroded (area 2) area. In each area of 5000 m^2 (100x50m), sowing was carried out in small pits (holes of 0.30 cm diameter and 5 cm in depth), with the addition of commercial substrate for nursery seedling production in order to facilitate initial conditions for germination, emergence and survival of the species seedlings. These small pits, spaced at 1 x 1 m, were distributed in 36 lines of about 100m each, parallel to the gallery forest, totaling 2520 pits. Sowing took place in December 2013. In each pit we sowed up to 10 seeds per specie, depending upon the particular species germination rate. In order to understand species characteristics no strategy to break seed dormancy was performed. Seedling emergence was carried out at 120 days and again emergency and establishment at 1 year, 1.5 years and 2 years after sowing. The better seedlings/establishment rates after two years planting in Area 1 were for: *Hymenaea courbaril* L. (76 seedlings/54.28%), *Inga cylindrica* (Vell.) Mart. (43/20.47%), *Copaifera langsdorffii* Desf. (52/24.76%), *Tabebuia aurea* (Silva Manso) Benth. & Hook.f ex S.Moore (71/33.80%), *Eugenia dysenterica* (Mart.) DC. (96/45.71%) and *Stryphnodendron adstringens* (Mart.) Coville (169/24.14%); and for Area 2 for: *H. courbaril* (69/49.28%) and *E. dysenterica* (67/31.90%). Despite the fact that species establishment rate were apparently low, they are highly significant if we consider the low woody species density and natural carrying capacity of the poor and shallow soil conditions of the Neossolo Regolítico.

Oliveira M.C.

Poster presentation
Population dynamics of *Tachigali rubiginosa* (Mart. ex Tul.). Oliveira-Filho (Fabaceae) (2007-2014) in the Forest Gallery / Ecotone / Campo Sujo transition at Água Limpa Farm, Federal District, Brazil
Session: Classification, structure and dynamics of plant communities

Maria C. Oliveira[1], Daiane R. Gonçalves[1] & Fabiana G. Aquino[2]

[1]*UnB/FUP and* [2]*Embrapa Cerrados*
mcrisoliveira@unb.br

Tachigali rubiginosa (Mart. ex Tul.) Oliveira-Filho (Fabaceae) (carvoeiro-da-mata) is found in Gallery and Dry forests and also in Cerradões of the Central Plateau of Brazil. This species is classified as pioneer due to its relation to light requirements, and water stress tolerance. Population dynamic behavior of this tree species is poorly understood but it is known that it may increase significantly in density in certain environmental situations. Therefore, this study aimed to characterize the population dynamics of *T. rubiginosa* in the Forest Gallery Capetinga, in the Ecotone and in the Campo Sujo from 2007-2014, at Água Limpa Farm, Brasília-Federal District. The hypothesis was that the increment of the population of this species from the forest towards the Campo Sujo indicates that it taking place an expansion of the Gallery Forest. The studied was performed in an area where it was detected presence of young individuals of *T. rubiginosa*. In this place, it was systematically established 20 transects of 5 x 155 m, arranged perpendicular to the Capetinga stream and allocated from inside the Gallery Forest towards the Campo Sujo that surrounds the forest. Each transect was divided into 31 plots of 5 x 5m, corresponding to 620 plots, in the total of 1.55 ha. We sampled 277 individuals in 2007 and 391 in 2014. In 2014 it was found 154 saplings and 40 death individuals, with recruitment and mortality rates of 55.60% and 14.44%, respectively. The spatial distribution pattern of this population was grouped. The diametric structure showed a typical J-inverted curve, suggesting that the population is self-regenerating. It was observed a decrease of 5 (5.26%) individuals in the Capetinga Gallery Forest, an increase of 39 (38.24%) in the Ecotone vegetation and 80 (100%) in the Campo Sujo, showing that an expansion of the population of the pioneer forest species *T. rubiginosa* is taking place from the gallery forest towards the Campo Sujo.

Oliveira R.

Poster presentation
Vascular epiphytes in cerrado gallery forests under different flooding regimes in the Federal District, Brazil
Session: Classification, structure and dynamics of plant communities

Rodolfo Oliveira[1], Bruno Walter[2], Luciano Bianchettii[2] & José Roberto Pinto[1]

[1]*University of Brasilia and* [2]*Embrapa/CENARGEN*
rodolfendas@hotmail.com

The vascular epiphytic community from the *Cerrado* biome lacks studies, in particular the Gallery Forests that have favourable characteristics for epiphyte development. Seeking to investigate community differences, a comparison of two gallery forests – non-flooded and flooded – was carried out in two areas, in a total of 4 sites. The first area studied was *Fazenda Sucupira*/FS (15º 52' to 15º 56' S, 48º 00' to 48º 02') and the second area was *Fazenda Água Limpa*/FAL (15° 56'to 15° 59' S, 47° 55' to 47° 58' W), both in the southeast portion of the Federal District, Brazil. Regarding sampling, for every site, five transects (100 x 5 m each) were randomly allocated, each subdivided in five plots (20 x 5 m each). A total of 1.923 arboreal individuals were identified, and among them 607 (31.6%) behaved as phorophytes. Among the epiphytes, *Orquidaceae*, with 21 species, was the most representative family, followed by *Polypodiaceae* (4), *Bromeliaceae* (3), *Araceae* (2) and *Piperaceae* (2). The flooded environment was richer (34 species) than the non-flooded one (24). *Campylocentrum neglectum*, *Campyloneurum angustifolium* and *Epidendrum avicola* were the only species that were found at all four sites. *Serpocaulon fraxinifolium* and *Vanilla chamissonis* were only present in both flooded stretches. The floodable environment presents higher density of epiphytes and phorophytes, but richness and density in only one phorophyte was superior in the non-flooded environment. The epiphytes displayed preference for colonizing the canopy of the non-flooded environment. As for the flooded one, at the FS site, most epiphytes were present on lower part of the trunk of the phorophytes, and at the FAL site, most epiphytes occupied the canopy and the high part of the trunk of the phorophytes, probably due to the occurrence of fire. The most important epiphyte was *Tillandsia tenuifolia*, mainly due its capacity of colonizing dead individuals. The results point to floristic and structural specificity both in the epiphytic community and in the arboreal one, corroborating floristic and environmental differences of the arboreal component between both woodland environments.

Oliveira W.L.

Poster presentation
Disentangling assembly processes shaping species abundance and recruitment of tree communities in an Amazon landscape
Session: Classification, structure and dynamics of plant communities

Washington L. Oliveira[1], Hans ter Steege[2], Marcelo F. Simon[3], John Hay[4] & Marcelo B. Medeiros[3]

[1]*Programa de Pós-Graduação em Ecologia, Universidade de Brasília;*[2]*Naturalis Biodiversity Center, Leiden, Netherlands;*[3]*Embrapa Recursos Genéticos e Biotecnologia, Brasília-DF and* [4]*Departamento de Ecologia, Universidade de Brasília*
wluisoliveira@gmail.com

Can we predict which and how many species there are in a patch of a determined habitat? What governs the assembly rules of local communities? To try to answer these questions we modelled the species abundance distribution of trees to predict species abundances and to compare communities in *terra-firme* forest, *várzea* and *campinaranas* plots sampled in a landscape at the upper Madeira River basin. We used the parameter *m* from neutral theory, related to immigration, to disentangle effects of environmental filtering and dispersal limitation on recruitment in local communities. We used a routine to simulate theoretical communities from the observed metacommunity species pool. We tested if observed diversity parameters in real plots deviated from "neutrality" through comparison with simulated parameters of the communities assembled in the framework of the neutral models. We modelled theoretical neutral communities assembled in scenarios with different probabilities of immigration from the metacommunity (entire species pool). The *campinaranas* are habitats with strong dominance in species abundance distribution. These communities resemble theoretical neutral communities that undergo independent ecological drift with little influence of the relative abundances of species in the source metacommunity. We can expect higher probabilities of local extinctions of rare species in *campinaranas* after disturbance events and higher monodominance, due to the low migration of new species from the metacommunity pool. There is a negligible difference between inferred recruitment of juveniles and adults in *campinaranas*, indicating that the environmental filter is strong. The environmental filter is also intense for the establishment of trees in *várzea* forests, however less so than in the *campinaranas*, and stronger for trees with DBH > 15 cm, a pattern that was also observed in *terra-firme* forests.

Onipchenko V.G.

Oral presentation
Element concentration in leaves in relation to CSR strategies: alpine plants as an example
Session: Functional and phylogenetic patterns in plant communities

Vladimir G. Onipchenko

Moscow State Lomonosov University
vonipchenko@mail.ru

Proportional adherence to Grime's CSR strategies now can be quantitatively estimated by simple leaf traits (Pierce et al., in press). Strategies are expressed in many different functional plant traits. Here we focus on the accumulation of a number of chemical elements in the leaves. We aimed to estimate the relation between CSR components and elemental chemical composition in alpine plants of two geochemically different regions – the North-West Caucasus (56 species) and High Tatra Mountains (25 species). Proportional adherence to CSR components were estimated on basis of three leaf traits – dry mass, fresh (water saturated) mass and leaf area, according to the Pierce et al. (in press) method. The method is based on the assumption that a large leaf area is a feature of competitors, high dry matter content is typical for stress-tolerators, and high specific leaf area is necessary for ruderals to maintain a high RGR. Concentrations of 16 elements (mainly heavy metals, but also K, Ca, Cl, S) were determined in the leaves of alpine plants. Non parametric correlation coefficients were calculated between the element concentrations and CSR adherences. The strongest differences were obtained between S and R strategies. Proportional adherence to the stress-tolerating strategy had either significant negative (with K, Rb, Cl, Zn, Sr, Sb, S and Ca) or non-significant correlations with element concentrations. Proportional adherence to the ruderal strategy showed either positive (with K, Rb, Cl, Zn, S, Ca, Ti, Mo, Fe) or nonsignificant values. Competitiveness was more various in its relationship with chemical elements. It was positively correlated with K, Rb, Cl, Zn, Sr, S and Ca, but negatively with Mo, Fe, Cr, Ba. Three elements (Mn, Cu, Pb) did not show any significant correlation with CSR components. Plants from different regions (Caucasus and Tatra) showed similar results. Short-lived Brassicaceae plants, which are known as heavy metal accumulators, were typical R plants, but the general pattern of strategy type and chemical composition did not change greatly with or without inclusion of Brassicaceae plants in the analysis. So, chemical composition is a good predictor of plant strategy, at least for alpine plants.

Overbeck G.E.

Oral presentation
Restoration of tropical and subtropical grasslands and savannas: low resilience, but challenges differ widely
Session: Restoration of subtropical and tropical grasslands and savannas

Gerhard E. Overbeck & Sandra C. Müller

Universidade Federal do Rio Grande do Sul
gerhard.overbeck@ufrgs.br

In tropical and subtropical countries, large efforts are undertaken for restoration of forests, which is widely accepted and supported by political mechanisms. The same is not true for grasslands and savannas. Despite more attention towards their conservation recently, at least in science, these systems often remain undervalued in practice, and restoration faces serious challenges, including the lack of adequate techniques or of seeds of target species. The underlying problem is the lack of consideration of the specificities of non-forest systems for restoration in tropical and subtropical countries, where the traditional focus of conservation and restoration has been on forests. Given the need for advances in restoration of grasslands in different regions of the world and the small number of available studies, an important question is up to what extent generalities exist. We here aim at providing a synthesis of experiences with restoration of grasslands and savannas in tropical and subtropical countries. Our basis is an extensive review of the current literature. Our analysis of case studies point out to principal differences between systems under productive and under harsh environmental conditions, with distinct restoration challenges. Threats posed by invasive species or the colonization of undesired trees and shrubs, the speed of vegetation recovery after a restoration intervention and the necessity of management (e.g. by fire or grazing animals) already in early restoration phases may be distinct according to the system's productivity. Nonetheless, low resilience and the lack of seeds for restoration purposes appear as common problem throughout, indicating necessity for research and solution of technical issues. An underlying basic problem is that restoration often still is focused on the woody component of savannas, or that in many regions afforestation is considered as appropriate. Here, advances in the conceptual basis of conservation and restoration are urgent.

Palmer M.W.

Oral presentation
How to write an effective manuscript review in vegetation science
Session: Communication for vegetation scientists

Michael W. Palmer

Oklahoma State University
mike.palmer@okstate.edu

The role of peer reviewer is arguably one of the most important in all of science, yet reviewing manuscripts is an underappreciated task. In this talk, I offer suggestions for writing an effective manuscript review in vegetation science. The talk will be followed by an open discussion including reviewers, prospective reviewers, editors, and authors. Manuscript reviews for IAVS journals fill two functions: to advise the editor on the suitability of publication, and to offer advice to the authors for possible improvement. Editors often send manuscripts to reviewers who are experts in the methods, the questions, or the systems – but also to other vegetation scientists able to assess general interest for the IAVS membership. There are at least as many review styles as there are reviewers, and it is not my intention to provide a template or a proscription. However, I will discuss a number of features effective reviews as well as a number of common mistakes in review writing. I will also outline the general review process for IAVS journals, matters of confidentiality, and the nature of communication between authors, editors, and reviewers.

Pärtel M.

Oral presentation
Determining fuzzy dark diversity from species co-occurrence
Session: Community assembly and species diversity

Meelis Pärtel & Robert Szava-Kovats

University of Tartu
meelis.partel@ut.ee

The species pool concept has been generally accepted among community ecologists: local species assemblages are determined largely by the availability of species at larger scales. This set of potentially suitable species is called the species pool. Rarely is the species pool completely present in a local site; the site is also characterized not only by it local observed richness but also by its dark diversity: the absent portion of the site-specific species pool. Dark diversity cannot be measured directly but can be estimated. Several recent studies have shown advantages of estimating species pools based on species co-occurrence. This approach is also called Beals smoothing, by its developer Edward W. Beals, who in 1984 proposed a technique to "smooth" species – sites data matrices before ordination by replacing zero values with probabilities derived from species co-occurrence patterns. The species pool concept has been criticized for its binary application: thresholds are chosen which either include or exclude species to the pool. It has recently been suggested that summing Beals probability values for absent species delineate probabilistic dark diversity. Such a method might be preferable as it does not rely on thresholds. Here we examine this approach more closely. It has been shown earlier that Beals probabilities are a linear function of the species frequency in totally random communities. We show that many real communities behave very similarly as random communities. Thus, the summing of Beals probabilities to obtain estimates of dark diversity allots high values to absent but otherwise frequent species. This might be reasonable in some cases but in general it is ill-suited to distinguishing species' ecological preferences. We examine options to compare observed Beals values to those expected from randomized communities, or to use other co-occurrence measures, e.g. those based on hypergeometric distribution. In summary we suggest that the already well-established co-occurrence methods can be further improved.

Pausas J.G.

Oral presentation
Plant strategies in fire-prone ecosystems: a global perspective
Session: Plant strategies and disturbance

Juli G. Pausas[1] & Susana Paula[2]

[1]*CIDE-CSIC, Valencia, Spain and* [2]*Universidad Austral de Chile, Valdivia, Chile*
juli.g.pausas@uv.es

Many ecosystems has been subject to high fire recurrence during their evolutionary history; prominent examples are savannas and Mediterranean ecosystems. Plants in these ecosystems have evolved a suit of traits and strategies that allow them to survive and reproduce under recurrent fires. At the global scale, the main strategies allowing fire persistence are related to the accumulation of a fire-resistant bud bank and the accumulation of a fire-resistant seed bank. Here we aim to review the diversity of mechanisms and bud bank structures that have evolved in different ecosystems and lineages, including bud banks in stems (epicormic resprouting), roots, roots collars, rhizomes, lignotubers, xylopodiums, etc. Our hypothesis is that different fire regimes have selected for different strategies in relation to the preexisting structures in each lineage. We will evaluate this hypothesis by reviewing examples from different fire-prone ecosystems worldwide and under an evolutionary framework.

Pedrotti F.

Poster presentation
Mapping the conservation state of vegetation based on its dynamical tendencies
Session: Applied mapping for conservation and management

Franco Pedrotti

University of Camerino
franco.pedrotti@unicam.it

The evaluation of the conservation state of vegetation can be done in two ways: 1) one-time sampling at the scale of plant community to reveal the dynamical tendencies; 2) repeated analysis of vegetation landscape at regional scale in order to calculate the variation in relative cover, fragmentation and other metrics of different vegetation patches. The dynamical tendencies are cyclic (fluctuation, degeneration-regeneration) or directional ecological processes (progressive or regressive successions), along which various stages can be distinguished. Different conservation states are associated with each dynamic tendency. Mapping the dynamical tendencies consists in producing a plant community map and specifying two labels in each patch, i.e. one referring to the vegetation type and another one to the dominant dynamical tendency. The first example of such map was the Map of Bosco Quarto, Gargano (Italy) printed at the scale 1:10,000 (Pedrotti and Falinski, 1990). Although the dynamical tendencies distinguished have been often reported and used since then, their nomenclature has not been sistematised yet. Here I present a study case concerning the vegetation of the drainage basin of Rio Camacho (Bolivia) (1050 km^2) that is composed of six forest communities. Those dominated by *Alnus acuminata* ssp. *acuminata* and *Podocarpus parlatorei* are driven by natural fluctuation, i.e. good state of conservation. All the other communities (dominated by *Tipuana tipu*, *Polylepis besseri*, *P. hieronymi* or *Schinus molle*) are affected by degeneration or regeneration. In Rio Camacho basin the forest vegetation cover is only 4.3%, of which 58.2% driven by fluctuation and 39.8% affected by degeneration. The remaining part (95.7%) is affected by regression which has caused a strong desertification in many spots (communities of *Prosopis laevigata* var. *andicola*, *P. alba*, *P. nigra*, *P. alpataco*, *P. flexuosa*, *Geoffroea decorticans*, *Acacia caven* or *A. aroma*). The same mapping method was used in other areas of Bolivian Andes, as Capinota, 1:50,000 (forests of *Schinopsis haenkeana* and *Aspidosperma quebracho-blanco*, chaparrales of *Acacia macracantha*, matorrales of *Dodonaea viscosa*), Nevado Sajama, 1:130,000 (forests and matorrales of *Polylepis tarapacana*, and secondary vegetation of *Festuca orthophylla*), Isla del Sol in Titicaca Lake, 1:16,000 (matorrales of *Polylepis incana* and secondary vegetation of *Baccharis incarum*).

Pillar V.D.

Oral presentation
Simulating metacommunities from assembly mechanisms and finding convergence and divergence patterns
Session: Functional and phylogenetic patterns in plant communities

Valério D. Pillar[1] & Sergio Camiz[2]

[1]*Federal University of Rio Grande do Sul and* [2]*Sapienza University of Roma*
vpillar@ufrgs.br

Inferring community assembly rules from observed patterns is puzzling since the link between patterns and mechanisms is not univocal if similar patterns can be generated by different mechanisms. In our contribution, we explore this problem by modeling metacommunities (sets of plant communities) based on specified assembly mechanisms. We then analyze the patterns that are revealed in the simulated data. We built a stochastic, individual-based model for simulating communities stepwise from a pool of species and their functional traits. Traits and environmental gradients are specified or simulated from correlation structure. Species colonization and extinction are defined according to the probabilities of individuals arriving, establishing and dying in the community site. These probabilities are determined by the spatial location and by how similar are the traits carried by the individual that arrived in the community to the expected community weighted mean traits obtained from specified responses to the environmental gradients. Further, at each step of the process, the species that make up a given community change the environment of the site based on specified feedback functions. Thus, the environmental conditions of each site can be dynamic according to the community development. This way, interactions between species are modeled indirectly, mediated by the changing of the environmental conditions of the community sites. After a large number of iterations and the observation of relative saturation, the simulated metacommunity data is analyzed and the functional variation patterns compared to the expected ones. Our results indicate that trait divergence patterns, i.e. alpha or beta functional diversity increasing or decreasing along an environmental gradient, can be produced when the specified environmental factors are spatially nested and their interactions are considered in their effects on the expected community trait composition. Otherwise, only trait convergence patterns are generated. Nested, interacting factors are easily observed in nature, and the factors are modified by the plant community. Our modeling results suggest that environmental filtering acting at different spatial scales, and feedback mechanisms being considered can produce trait divergence patterns, and that complex assembly rules, such as limiting similarity, may, in fact, be a consequence of these elementary rules.

Pilon N.A.L.

Poster presentation
Wet grasslands restoration after massive invasion by slash pine and ecological filters involved
Session: Restoration of subtropical and tropical grasslands and savannas

Natashi A L Pilon[1], Flaviana M. Souza[2], Geissianny B. Assis[3] & Giselda Durigan[4]

[1]Universidade Estadual de Campinas;[2]Instituto Agronômico de Campinas;[3]Jardim Botânico do Rio de Janeiro and [4]Instituto Florestal do Estado de São Paulo
natashipilon@gmail.com

Besides their biodiversity, wet grasslands provide highly relevant ecosystem services, such as storing soil carbon and protecting water resources, requiring efforts for their conservation and restoration. Invasion by slash pine – *Pinus elliotti*i Engelm.var. *elliottii*. is among the major threats to wet grasslands in the Cerrado biome. After massive invasion, native vegetation is suppressed by shading and by the thick layer of needles, that persist for years after eradication of the invasive trees. In this scenario, we assessed the effectiveness of the following techniques to restore wet grasslands after eradication of slash pine: 1) control (C), 2) removing the needle layer (R), 3) R + sowing native grasses and 4) R + transplantation. The experiment was conducted at Santa Barbara Ecological Station (Águas de Santa Bárbara, SP, Brazil). Well preserved wet grasslands in the neighborhood were used as reference ecosystem and also as source of plant material for restoration (seed collection and all plants extracted from 1m^2 gaps). We compared ground cover and plant community richness resulting from each treatment and investigated the ecological filters constraining colonization by native species. We also monitored the recovery of the gaps over time to verify whether the wet grasslands are resilient to that disturbance. Simply removing the pine needle layer allowed for vigorous natural regeneration, but transplanting provided a faster recovery and much higher species richness, allowing for the establishment of a set of species not able to spontaneously colonize the degraded area. Seeding native grasses did not contribute to increase richness or cover by the native vegetation. The needle layer proved to be the more severe ecological filter constraining natural regeneration of Cerrado wet grasslands, but for some species there are also limitations of seed dispersal and establishment that require active restoration techniques to be surpassed. The gaps in the native ecosystem were highly resilient after extraction of plant material, recovering the pre-disturbance structure and composition after 12 months. Restoration of wet grasslands after pine invasion requires removing the needle layer. Re-colonization will naturally occur if seed sources are available. Otherwise, restoration can be successful by transplanting native vegetation.

Pivello V.R.

Oral presentation
How invasive species can affect ecosystem services?
Session: Plant community invasion

Vania R. Pivello

Universidade de São Paulo
vrpivel@usp.br

The theme of the 59th IAVS Symposium is "Conservation of plant communities: from environmental drivers to ecosystem services". Therefore, I will open the session "The role of invasive species in the present and future ecosystems" by linking these two timely subjects: invasive species and ecosystem services (ES). Reduction in the richness and abundance of native species are consequences brought by most invasive plants in the invaded communities, however, their impacts on the ecosystem services are not well understood. The search for this understanding represents a growing issue in the scientific literature, given its importance. In order to follow the development of this subject in academia and to check its current state of the art, a survey in the Web of Knowledge (WOK) data-base was carried out, searching for (ecosystem+service*)AND(invasive), both as Topic, for the time interval 1990-2016, and including all WOK literature. A selection by titles and abstracts was then made considering only journal articles (not book chapters) but not editorial material, which related invasive plants to ecosystem services. The material was classified according to: country, invaded habitat, invasive species (or taxonomic or physiognomic group), type of ES affected, and direct or indirect impact. 436 references were found in the WOK search, and the selection excluded 328 references. The 108 resulting articles will be analyzed in detail; however, initial results show the prevalence of negative impacts caused by terrestrial invasive plants, more frequently reported in Europe and South Africa. Papers refer to specific species, physiognomic groups or even are more general. Although the search started in 1990, the oldest paper dated from 1999, and there was a substantial increase in the number of papers in the more recent years. Even though most researches associate invasive species (or groups) to the loss of various ES, some articles report benefits caused by invasives, especially in the case of provisioning ES or conservation benefits, such as providing habitat or food to local species. Therefore, management actions must consider all aspects of invasive plants, and also the indirect effects they may cause.

Poe N.A.

Oral presentation
Herbivory, more than nitrogen addition, alters aboveground grassland ecosystem structure
Session: Fire and grazing in non-forest vegetation

Nicole A. Poe[1], Katharine L. Stuble[1,2] & Lara Souza[1]

[1]*Oklahoma Biological Survey and Microbiology and Plant Biology Department, University of Oklahoma and* [2]*Department of Plant Sciences, University of California Davis*
nicole.poe10@ou.edu

Biotic and abiotic factors alter the structure and function of plant communities. Herbivore communities have declined while nitrogen deposition has increased due to anthropogenic causes changing plant composition globally over time. Understanding how changes in soil nutrients will mediate herbivores guild impacts on plant community structure (richness, evenness, diversity and composition) and function (productivity) is critical. We asked the following questions: (1) What are the main effects of selective herbivores (small rodents) on grassland diversity, composition, and productivity over time?, (2) How do generalist herbivores (insects) influence plant community diversity and productivity in the presence vs. absence of rodents?, (3) How do soil nutrients influence plant community diversity and productivity in the presence vs. absence of rodents?, (4) How do soil nutrients and insects interact to affect plant community diversity and productivity in the presence vs. absence of rodents? To test our questions, we manipulated soil nitrogen (N) and insect herbivory in established rodent access and rodent reduced areas. We tracked plant community structure and function over two years as well as microclimate. Herbivores, and minimal effects of soil nutrients, altered the structure and function. Rodents increased species richness in May 2014 and August 2015 by 13% while N addition increased species richness in the rodent access plots by 13% but decreased richness in the exclosure plots by 17%. Rodent herbivores lowered plant evenness by 14% lowering diversity by 13% alongside with changes in species composition. *Tridens flavus* was more than twice as abundant in exclosure plots as rodent present plots in 2014 and 2015. *Bromus spp.*, *Andropogon gerardii*, and *Commelina* spp. were other species that led to compositional dissimilarity. Insect herbivory impact on plant dominance was dependent upon the presence of rodents. In August 2014, plots with some insect herbivory had 33% lower evenness than plots with full or no insect herbivory, but this effect was gone in the absence of rodents. On the other hand, In May 2015 insect herbivory lowered evenness by 16%, in rodent absent plots having no impacts in rodent present plots. Taken together, rodents mediate biotic and abiotic effects on grassland structure and function.

Pugnaire F.I.

Oral presentation
Plant competition and soil microbial communities
Session: Underground processes in plant communities

Francisco I. Pugnaire[1], Sara Hortal[2], Cristina Armas[1], Yudi M. Lozano[1], Felipe Bastida[3], José L. Moreno[3] & Carlos García[3]

[1]CSIC-EEZA, Almeria, Spain;[2]Hawkesbury Institute for the Environment, University of Western Sydney, Australia and [3]CSIC-CEBAS, Murcia, Spain
fip@eeza.csic.es

There is growing evidence on the critical role soil microbes play in regulating plant communities. Soil microbes compete among them as well, likely leading to the demise of some species and the dominance of others. We hypothesized that the outcome of competition between two plant species would depend on the outcome of competition between microbial communities in their rhizosphere. We used two shrub species from a coastal community in Southern Spain, *Maytenus senegalensis* and *Lycium intricatum*, in a greenhouse experiment where we kept saplings of both species under intra- and inter-specific competition. We measured plant survival and growth and characterized soil microbial enzyme activity and bacterial community composition in the different competition treatments. All *Lycium* individuals and all *Maytenus* individuals survived in the intra-specific treatment. However, half *Maytenus* individuals died when growing with *Lycium*. By the end of the experiment there were significant differences in soil community composition in control, *Lycium* and *Maytenus* soils. However, *Lycium+Maytenus* soils had communities similar to *Lycium* soils, suggesting competitive displacement of *Maytenus* soil communities by *Lycium* soil communities. Microbial activity was depressed when both species were present, compared with intra-specific treatments. These results suggest strong competition between rhizosphere communities that influenced plant competition outcome.

Qian J.

Poster presentation
Response of belowground bud bank to precipitation regimes on the temperate steppe of Inner Mongolia, China
Session: Plant strategies and disturbance

Jianqiang Qian[1,2], Jitka Klimešová[2], Zhengwen Wang[1] & Zhimin Liu[1]

[1]*Institute of Applied Ecology, Chinese Academy of Sciences and* [2]*Department of Functional Ecology, Institute of Botany, Academy of Sciences of Czech Republic*
qianjianqiang@iae.ac.cn

How belowground bud banks of hebaceous vegetation respond to precipitation pattern change is a challenge to vegetation scientists. Understanding the response of belowground bud bank to precipitation regimes is crucial for exploring species distribution pattern and predicting community dynamic and ecosystem functions under future climatic scenarios. We studied the belowground bud bank size and composition (different bud-bearing organs) under stimulated increased precipitation at the local scale on the typical steppe, and explored the changes in bud densities of communities and different bud-bearing organs along a natural precipitation (aridity) gradient at the regional scale on the temperate steppe of Inner Mongolia, China. Our results showed that (1) the stimulated increased precipitation had no significant effects on total bud density, it suppressed the bud densities of grasses (especially for the dominant species *Stipa krylovii*) while facilitated the bud banks of dicots and bulbous monocots, (2) total bud density increased first and then decreased significantly along the mean annual precipitation (*MAP*) and aridty index (*AI*) gradient, with the threshold were *MAP*=260 mm and *AI*=0.33, respectively, (3) along the aridity gradient, bud-bearing organs with long spacers (rhizomatous) was replaced by more compact forms with better protected buds than those found in moist conditions. Our study indicates that the response of belowground bud bank to precipiation pattern change will not only lead to the changes in vegetation composition but also in abilities of community to buffer climatic changes and againt wind erosion on desert steppe due to the low availability of dormant buds.

Rani M.

Poster presentation
Efficient recognition of forest species biodiversity by inventory-based geospatial approach using LISS IV sensor
Session: Classification, structure and dynamics of plant communities

Meenu Rani[1,2,3], Pavan Kumar[2,1,3] & Swati Katiyar[3,1,2]

[1]ICAR-Project Directorate for Farming Systems Research ;[2]Kumaun University and [3]Banasthali university
meenurani2607@gmail.com

Forest ecosystems plays a very significant role in the global carbon cycle. Forests have played a very important role in the economics and civilizing growth of the India. Information on forest cover, forest types, deforestation rate etc. is essential data for forest management. Forest biodiversity refers to all forms of life found in forests, including plants, animals, fungi, and microorganisms, and their roles in nature. It may be the richest of all the terrestrial ecosystems. Tropical forest is one of the immense biodiversity repositories of the world ecosystem. Biodiversity is depleting very rapidly due to change of forests into agricultural or other land use. Here comes the role of biodiversity appraisal and evaluation of spatial data of species to prioritize the conservation purposes. Biodiversity includes diversity within species, between species, and of ecosystems. Conventionally, ground-based plots were used to assess different biodiversity. Later, remote sensing approaches were also incorporated along with field-based studies to quantify the results accurately. Assessment of biodiversity constitutes estimation of various indices that were obtained using ground-based plot or survey. With the advancement of the remote sensing technology, spatial information about tree species was collected, in our case study, using field sample and satellite data and field sample plots within the Ranthambore Tiger Reserve. The relationships among different diversity indices, computed from 10 randomly sampled quadrats, and vegetation classes, obtained by multi-spectral satellite image classification, were used as a strategy for mapping plant diversity in a tropical landscape mosaic. Different diversity indices were calculated like α and β diversity, and others, i.e., Shannon–Wiener index (SR), Margalef index (Ew), and Whittaker's index (H). The multistage statistical techniques, which integrate high spatial resolution and spectral characteristics of satellite data (LISS IV), will help in providing precise information about tree species. Regression analysis provides better results to identify forest species among different bands. A positive correlation has been found in the infrared band, even though negative correlation has been found in other bands, indicated that there is a significant contribution to the diversity of the landscape by those vegetation classes.

Ranta P.O.

Oral presentation
Urban gardening and species pool theory
Session: Conservation of plant communities: from science to policy

Pertti O. Ranta

University of Helsinki
pertti.ranta@saunalahti.fi

Maintenance of biodiversity as a common property of urban landscapes is a major concern of future cities. Can we consider collective urban gardening as a biodiversity tool, because it sustains not only crop plants but also communities of spontaneous plant species unintentionally maintained by the gardeners? Using species pool theory, we set the following questions: (1) How to define the species pool of the surrounding urban landscape which determines the spontaneous species richness at the gardening site? (2) What is the filtering effect of collective gardening compared to gardening in private yards in the same neighbourhood? (3) How is the microsite diversity of spontaneous species dependent on the intensity of gardening, selection of crop species, and the governance system? Our research was conducted near the centre of Tampere, a boreal city in southern Finland, focusing on private yards and a long used gardening site (3 ha with 288 plots of 10x10 m) within a neighborhood of nearly 2000 homes. Based on grid data of habitats and vascular plant flora over the city, we found that the city scale species pool mainly consists of species nowadays thriving on traffic line verges. They include both common and rare species that are most potential at the gardening site. We identified several filtering effects on neighbourhood and site level as well as complementary capacities of private yards and collective gardening to maintain local biodiversity. Several factors at the plot level define the actual species pool of the gardening site. We summarize our findings as a framework that suggests that species pool theory serves as a fruitful research perspective for further studies on the biodiversity capacity of collective urban gardening.

Rapson J.

Oral presentation
Should we be conserving dune wetlands via managerial interventions?
Session: Conservation of plant communities: from science to policy

Jill Rapson, Melanya Yukhnevich & Sylvia Villacis Lozada

Massey University, Palmerston North, New Zealand
G.Rapson@massey.ac.nz

Temporary wetlands of dune slacks along the coast of the Manawatu, New Zealand, are home to communities of small, turf-like plant species <5cm tall, several of which are rare or threatened. Studies of these wetlands suggest the turf-phases last about 20 years, before taller rushland comes to dominate, so that the rare turf species are in decline. Current lack of formation of new, barren wetlands leaves the turf species without habitat, even if they are still able to disperse there, which is in doubt. Past management has consisted of construction of new wetland habitats, which seems to be reasonably successful. Recent studies have investigated the distribution of such wetlands around New Zealand, the habitat requirements of the rare species via experimentation, and the behaviour of wetlands over time, derived from historic aerial photographs. Results are: 1) such dune slack wetlands are infrequent, largely due to lack of potential habitat; 2) the flora of these wetlands varies from place to place throughout New Zealand, and few patterns of occurrence emerge; 3) species' distributions show only weak structuring along habitat gradients, though some species of very wet areas do tend to co-exist; 4) most turf species are adapted to a habitat which has relatively deep water (for their size), and high light regimes; 5) turf plants benefit from added nutrients and are tolerant of some burial by sand; 5) wetlands appear to have formed progressively, but mainly over the last 30 years; 6) wetlands may enlarge in the years after formation, before progressively infilling; 7) wetland centroids usually shift gradually inland, probably in response to the prevailing winds; 8) wetlands are open for about 25-30 years. Conclusions are that wetlands are temporary, and their flora appears to be idiosyncratic. It seems plausible that wetland formation occurs during the progressive stabilisation of a previously mobile sand-sheet, and before that dune stabilisation has eliminated the mobile sand which is essential to wetland formation and survival of turf-species. Thus the wetlands may be completely artificial habitats, arising in response to anthropogenic disturbances, and occupied by available turf species from other habitats. In this context the conservation and on-going construction of wetland habitat seems problematic. Such managerial issues are rare in New Zealand conservation, and development of policy is required.

Ribeiro E.M.S.

Oral presentation
Chronic human disturbances on Brazilian Caatinga wood flora: effects on taxonomic, phylogenetic and functional diversity
Session: Functional and phylogenetic patterns in plant communities

Elâine Maria S. Ribeiro[1], Bráulio A. Santos[2], Víctor Arroyo-Rodríguez[3], Marcelo Tabarelli[1], Gustavo Souza[1] & Inara R. Leal[1]

[1]*Departamento de Botânica, Universidade Federal de Pernambuco;*[2]*Departamento de Sistemática e Ecologia, Centro de Ciências Exatas e da Natureza,Universidade Federal da Paraíba and* [3]*Instituto de Investigaciones en Ecosistemas y Sustentabilidad, Universidad Nacional Autónoma de México*
nanigesbio@yahoo.com.br

Chronic anthropogenic disturbances (e.g. harvesting of timber and non-timber forest products, hunting, livestock in natural remnant forests) are common in developing countries, where rural and traditional human populations use forest resources for subsistence. The Brazilian Caatinga is one seasonal tropical dry forest where these chronic disturbances are frequent but its consequences to biodiversity are poorly investigated, which limit our ability to propose management strategies in order to conciliate the local biodiversity and natural resources multiple use. In this sense, in 2011 we initiated a study which aimed answer how these chronic disturbances affect the diversity of wood plants in distinct ontogenetic stages (seedlings, saplings and adults) addressing the taxonomic, phylogenetic and functional diversity levels. The density of people and livestock (goats and cattle) near the surveyed plots were used as predictors of chronic disturbance, as well as the distances to the nearest urban centre, road and rural property. In general, these disturbance predictors showed negative effects on taxonomic, phylogenetic and functional diversity irrespective to ontogenetic stage. Sites with more influence of these chronic disturbance indicators presented more close related species, which also has attributes as low wood density and low leaf dry matter. Furthermore, we verified a very alarming scenario because seedling and saplings were more negatively affected by these disturbances, committing the future biodiversity persistence and ecosystem services associated. These results demonstrates that chronic anthropogenic disturbance at Caatinga could not continue to be neglected, as it imposes deleterious effects to the taxonomic, phylogenetic and functional diversity of wood plant assemblages. Moreover, this loss of the capital natural menaces the continuity of natural resources use by local populations in the future. Thus, we argue for (1) research and rural programs to support better practices in terms of land use and sustainable collection of forest resources, particularly in terms of livestock management and wood collection, (2) improving governance and law enforcement in order to move forest extractivism towards sustainable standards and (3) expanding the coverage and effective implementation of strictly protected areas; i.e. the elimination of livestock and collection of forest products inside protected areas.

Riccardo G.

Oral presentation
Spatial representation of vegetation and floristic diversity at landscape scale: the Italian experience
Session: Applied mapping for conservation and management

Guarino Riccardo[1], Raimondo M. Francesco[1] & Domina Giannantonio[2]

[1]*University of Palermo, Dept. STEBICEF, via Archirafi, 38 – I 90123 Palermo (Italy) and* [2]*University of Palermo, Dept. SAF, via Archirafi, 38 – I 90123 Palermo (Italy)*
guarinotro@hotmail.com

The application of phytosociology to the analysis of vegetation and landscape diversity has greatly developed in Italy during the past 60 years. The analysis of the scientific production of this period is therefore fundamental for a reflection on vegetation mapping and may be useful to forecast future scenarios of this discipline (Bruno *et al.*, 2003). Many different documents related to the plant species distribution and diversity became available over time from different land units of Italy. In particular, interesting examples of mixed floristic and vegetation maps have been produced in a pilot project for the province of Palermo (Sicily) and used in the diagnosis of environmental heterogeneity, as well as as to streamline the zonation of the Madonie regional park (Raimondo, 2000). After a critical review on the available documents, as well as on the relationship between vegetation maps and floristic maps, the evolutionary trends in the production of this kind of thematic maps will be considered, along with some reflections on the information contents, limits and utility of different approaches at different scales. The hypothesis that landscapes are a geo-botanical (meta-ecosystemic) matrix, in which all organisms (including humans) interact, is at the basis of the current shift from vegetation maps to functional maps, in which the description of landscapes as a patchwork (mosaic) of vegetation units, even though spatio-temporally related and subject to their own dynamic, becomes obsolete and the observed complexity is, instead, expressed in terms of functional diversity and ecosystem services (Farina *et al.*,2005). Along with this semiotic and cognitive process, the progress of technology boosted the current debate on landscape mapping, by making available improved multi-scale sampling techniques (using satellite imagery, aerial photography and field data to stratify landscape units and "keystone ecosystems''), smaller minimum mapping units (< 0.02 ha) in automatized analyses, an unbiased sampling design based on double sampling, improved mathematical models including species-area curves corrected for habitat heterogeneity, and GIS-based ecological models (Stohlgren *et al.*, 1997). To date, despite continued advances in techniques and technologies, the production of new maps on landscape/vegetation/plant species diversity still relies significantly on manual labor and requires great professional skill and sensitivity, particularly when setting, testing and training the automatized analyses, as well as in the evaluation of results.

Riviera F.

Oral presentation
Testing ecological theory and informing restoration practice using temporal patterns in the floristics and functional traits of Kwongan vegetation restored after mining
Session: Classification, structure and dynamics of plant communities

Fiamma Riviera[1], Ladislav Mucina[1] & Mark P. Dobrowolski[2,1]

[1]The University of Western Australia and [2]Iluka Resources Limited
fiamma.riviera@research.uwa.edu.au

One of the challenges recognized in restoration ecology is achieving the synthesis between ecological theory and restoration practice required to obtain sensible (scientific and legal) restoration outcomes (Walker and del Moral, 2003). Restoration ecology is defined as the study of how a community assembles after a disturbance via manifold vegetation-dynamic trajectories, and how this assembly can be directed towards a desired target community in as short a time as possible, given local environmental filters, and species pools and interactions (Halle and Fattorini, 2004; SERI, 2004). The core of our research is the use of theoretical and practical facets of post-mining restoration to produce a coherent tool serving effective, science-based restoration. We use long-term permanent monitoring data to identify the vegetation-dynamic trends for two mining areas in species-rich mediterranean-type shrublands (kwongan) in southwest Western Australia, a biodiversity hotspot of global importance. These datasets consist of botanical data collected over 15 years in permanent transects and plots aged between four and 37 years subject to different restoration practices and fire regimes, as well as botanical data for corresponding reference sites in undisturbed kwongan vegetation. The description of vegetation-dynamic trajectories for these areas is the first step in understanding current restoration outcomes. Comparisons between floristic and functional trait patterns derived from these datasets, and inference of the environmental filters (soil, site-construction and disturbance histories) will assist in identifying the drivers of vegetation changes and aid interpretation of the inferred vegetation recovery patterns. We envisage that our approach will inform not only post-mining vegetation recovery, but will also contribute to the theory of vegetation dynamics in ecologically stressed ecosystems characterized by an extreme low nutrient status and intrinsic long periods of drought.

Rodrigues F.

Poster presentation
The role of dispersive ability on the contribution of environmental and spatial processes of herbaceous plants communities along flooding gradient of Madeira River, Porto Velho
Session: Classification, structure and dynamics of plant communities

Flávio Rodrigues[1,4], Luis M. Bini[1], Renata D. Silva[2], Wellyngton E. Ayala[3], Marcelo F. Simon[4] & Marcelo B. Medeiros[4]

[1]University of Goiás;[2]University of Mato Grosso do Sul;[3] National Institute of research at Amazon and [4] Embrapa Genetic Resources and Biotechnology
frdor85@gmail.com

To assess if the dispersal ability of species determines differences in the responses of herbaceous plants to environmental and spatial component, we conducted a study along the Madeira River. We sampled all monocots and ferns in 22 plots of 375 m along a flooding gradient covering 240 km . For each plot, we measured variables related to texture, soil fertility and water table as environmental indicators and geographical coordinates, as spatial descriptors. We used abundance data and included spatial filters in redundancy analysis (RDA) to deal with spatial autocorrelation. The spatial filters were generated from the geographical coordinates of each plot using Moran's eigenvector maps (MEM's). Subsequently, we selected the significant MEMs by forward selections. After selection of environmental variables and spatial filters for the monocot and fern data, we performed a partial RDA. We found that pteridophytes responded more sharply to environmental variation than spatial variation (20% and 8%, $p < 0.01$ respectively), and so did monocotyledons (12% and 8%, $p < 0.01$ respectively). We suggest that the higher dispersive capacity of ferns allows that environmental filtering exerts a more decisive role in the change in species composition in relation to monocots. Even removing a significant portion of the spatial autocorrelation effect, the results indicate that both monocots as ferns are sensitive to changes in the concentration of exchangeable cations and silt content. We indicate that biological contribution of silt can be directly linked to nutrients carried by Madeira River, as too linked to disturbance caused by flooding.

Rossato D.R.

Poster presentation
Why do typical savanna herbaceous species disappear under tree encroachment? The role of canopy cover and irradiance under fire absence
Session: Fire and grazing in non-forest vegetation

Davi R. Rossatto[1], Luiz Felipe S. Pinheiro[2] & Rosana M. Kolb[2]

[1]*UNESP - Universidade Estadual Paulista, Faculdade de Ciências Agrárias e Veterinárias, Campus de Jaboticabal and* [2]*UNESP - Universidade Estadual Paulista, Faculdade de Ciências e Letras, Campus de Assis*
drrossatto@gmail.com

The savanna vegetation depends on fire occurrence to maintain its structure and diverse plant composition. However, natural fire regimes were suppressed for decades on some areas, which allowed the invasion of tree species from forest environments, promoting losses on species of the herbaceous component. Here we studied how changes in abiotic conditions affected herbaceous communities appearing at a gradient of tree encroachment in Assis Ecological Station, Assis – SP, Brazil, where fire was suppressed for past 50 years. We evaluated species composition using transects and 2 x 10 m plots placed at a gradient of tree encroachment, in where communities possessed distinct degree of tree cover: typical savanna (TS, low tree cover), dense savanna (DS, intermediate tree cover) and forested savanna (FS, high tree cover). We determined leaf area index (LAI) and the total amount of photosynthetic active radiation (PAR) reaching the understory, species richness and Simpson diversity index. Comparisons of variables between studied communities were performed using an ANOVA, followed by Fisher LSD test ($\alpha = 0.05$). To test the effects of the PAR and LAI on the species richness and diversity we utilized a multiple regression analysis. Fifty-two species in 41 genera and 23 families were registered. TS contained the largest number of species (33), followed by DS (26) and FS (19) ($F_{2,12} = 14.46$, $P < 0.01$). Simpson diversity index was higher to TS (0.85) than DS (0.70) ($F_{2,12} = 10.32$, $P < 0.01$). LAI was higher to FS (1.80) than TS (0.90), affecting negatively PAR ($r^2 = 0.84$ $P < 0.01$), with TS showing 800 μmol photons m^{-2} s^{-1} and FS 90 μmol photons m^{-2} $^{s-1}$. PAR, but not LAI, had a positive influence on richness ($r^2 = 0.58$ $P < 0.01$) and in diversity ($r^2 = 0.51$ $P < 0.01$). We concluded that savanna environments under encroachment show great canopy cover and low availability of light resources, which affected community's richness and diversity. This low irradiance may be act as strong filter to the growth and survival of typical savanna plants, which are typically reported as sun plants.

Sabino G.P.

Poster presentation
Tree floristic, richness and diversity in four fragments of Atlantic Forest, São Paulo – Brazil
Session: Classification, structure and dynamics of plant communities

Gabriel P. Sabino[1], Marco A. Assis[1], André A.L.C. Rochelle[2], José A.M.A. Gomes[3], Eliana Ramos[3] & Carlos A. Joly[2]

[1]*Universidade Estadual Paulista "Júlio de Mesquita Filho";*[2]*Universidade Estadual de Campinas and* [3]*Pesquisador autônomo*
gpsabino@gmail.com

The Atlantic Forest is a vast mosaic of tropical ecosystems that is also considered a priority conservation ecoregion, ranked among top five of hotspots in the world. This research is being developed as part of a major Project named ECOFOR: "Biodiversity and Ecosystem Functioning in Degraded and Recovering Amazonian and Atlantic Forests" (NERC/FAPESP). Our investigation was carried out to evaluate the tree floristic, richness and diversity of four fragments with different sizes and connectivity degrees in the Ombrophilous Dense Forest in Serra do Mar region (23°13'S; 45°18'W), eastern São Paulo State. For each fragment, we installed 0,25ha area of plots in a linear transect inside the core area. All trees over 4.8 cm DBH were numbered, measured and identified. Richness, importance index value of species and the diversity index H' were obtained by FITOPAC 2.1 software. The landscape metrics were obtained by ArcGIS v.10.2 (ESRI) and FRAGSTATS v.4.2 softwares. Two of the fragments with a higher connectivity degree (Cf) presented a higher richness than that reported in lower connectivity fragments (If). The four investigated areas revealed the following results: Cf1: 30.3ha area, PROX=291.6, n=71 species in 31 families, main species: *Tibouchina pulchra*, *Croton floribundus*, *Myrcia splendens* and H'=3.248; Cf2: 58ha area, PROX=259, n=95 species in 37 families, main species: *Guapira opposita*, *Tibouchina pulchra*, *Tovomitopsis paniculata* and H'=3.899; If1: 53,4ha area, PROX=zero, n=50 species in 22 families, main species: *Miconia* sp., *Amaioua intermedia*, *Pera glabrata* and H'=2.831; If2: 94,6ha area, PROX=3.6, n=62 species in 28 families, main species: *Piptadenia gonoacantha*, *Croton floribundus*, *Actinostemon concolor* and H'=3.166. The partial data for tree species indicate that there is a positive relationship between richness and diversity to the size and connectivity of studied fragments. These data are supported by results obtained from isolated and connected fragments in which the connectivity explained better the richness and diversity than the fragment size. Thus, our working hypothesis corroborates similar published studies, confirming that larger fragments and higher connectivity usually exhibit greater diversity in tree community compared to smaller fragments with lower connectivity.

Sakio H.

Oral presentation
Are the long-term flowering patterns of *Fraxinus platypoda* synchronized between males and females?
Session: Climate change and plant communities

Hitoshi Sakio

Faculty of Agriculture, Niigata University
sakio@agr.niigata-u.ac.jp

Climate change is affecting the synchrony of plant and animal populations worldwide, and it is driving vegetation shifts in arctic and alpine regions. Synchronous mast flowering is common among tree species and plays an important role in forest regeneration; it is especially important for the pollination of dioecious plants—those that have distinct male and female individuals. However, little long-term, quantitative data that describe this flowering phenomenon in dioecious tree species exist. We therefore examined whether the flowering of *Fraxinus platypoda* Oliv. (Oleaceae), a dioecious tree, is synchronized between male and female individuals, and whether this masting pattern is influenced by climate change. Research took place over the course of 26 years (1990–2015) at three riparian forests dominated by *F. platypoda*; the forests are cool-temperate deciduous forests in the Chichibu Mountains of central Japan. The research plots were composed of natural old-growth forest > 250 years old, secondary forest, and artificial forest. We used binoculars to determine the degree of flowering in *F. platypoda* trees every year, after which we divided this variable into five ranks. We also measured the diameter at breast height of each tree in both 1990 and 2015. We found clear annual fluctuations in flowering among the three populations over 26 years. Mast and lean years occurred at 3-year intervals from 1990 to 1998. During this period, synchronous flowering occurred between females and males in each population. However, the flowering patterns changed in 1998: male trees flowered more consistently, females displayed a shorter flowering cycle, and there was less synchrony between the sexes. No flowering occurred in male trees after 1998, and the degree of flowering increased in female trees. The three populations of *F. platypoda* showed similar changes in flowering patterns over time. We also found that the degree of synchronization between male and female trees was lower in old-growth forests. However, because the ages of the trees differed among the three populations, the post-1998 changes were likely not a result of maturity, but of climate change effects such as temperature increases.

Sampaio A.B.

Oral presentation
Alternative states of Cerrado savannas, their drivers and how they inform restoration-based-on-resilience
Session: Restoration of subtropical and tropical grasslands and savannas

Alexandre B. Sampaio[1], Maxmiller C. Ferreira[2], Daniel LM Vieira[3] & Isabel B. Schmidt[2]

[1]ICMBio/CECAT;[2]Universidade de Brasília and [3]Embrapa
sampaio.ab@gmail.com

The Cerrado vegetation is a patchy combination of grasslands, woody savannas and forests locally distributed in the landscape according to edaphic conditions and disturbances such as fire. The Cerrado has been intensively deforested (>45% – TerraClass 2013 data), mostly due to exotic pastures (~30% of Cerrado area) and crops (~12%). Also, Cerrado remnants are being degraded by exceedingly frequent fires, invasive species (mainly african grasses) and timber harvesting. According to the Brazilian laws more than 12 Mha have to be restored in Cerrado. In order to properly restore and protect Cerrado remnants it is crucial to understand vegetation resilience and dynamics facing natural and anthropic disturbances. In this respect we propose a framework to understand the alternative states and the natural and anthropic drivers of transitions for savannas in Cerrado. The framework explains transitions in between savanna physiognomies due to fire or timber harvesting, considering edaphic constraints. We also suggest the resilience potential and intervention strategies to restore degraded states. The considered anthropogenic states were: poorly managed exotic pastures, intensively managed exotic pastures, agriculture, tree plantations and mining. In poorly managed pastures and tree plantations the root system of native species persists resprouting, but it is still necessary to reintroduce native grasses and forbs and control the invasive african grasses or exotic trees. In order to restore agricultural fields, where the native root system was depleted, it is necessary further tree, shrubs, forbs and herbs seeding or seedling planting. However, in abandoned agricultural fields in which african grasses did not invade yet the restoration might be easier than in pastures, which is an unusual situation because the enriched soils of agricultural fields are extremely susceptible to be invaded. In mined areas where the soil was removed and resilience was lost a viable restoration method is to transpose the topsoil (20-30 cm), with roots and seeds. Up to date most restoration efforts in Cerrado savannas do not consider the local resilience related to the previous disturbance and original vegetation characteristics, and more importantly, they do not consider introducing native forbs and grasses.

Sarapuu J.

Poster presentation
Cut evolution in cut forests? changes in phylogenetic structure of tropical rainforests due to ecological release of leaf-cutting ants
Session: Functional and phylogenetic patterns in plant communities

Joosep Sarapuu[1], Elâine Ribeiro[2,1], Bráulio A. Santos[3], Marcelo Tabarelli[2], Rainer Wirth[4], Inara R. Leal[2] & Pille Gerhold[1]

[1]*University of Tartu;*[2]*Universidade Federal de Pernambuco;*[3]*Universidade Federal da Paraíba* *and* [4]*University of Kaiserslautern*
joosepsarapuu@gmail.com

The destruction of natural habitats has turned into the most important threat to all ecosystems. In tropical regions, this problem is especially pressing, because human interference results in extensive fragmentation of tropical rainforest. One of the most endangered tropical forests, the Brazilian Atlantic rainforest, has been reduced to 2% of its original area during 500 years of destruction. The effects of tropical forest fragmentation on vegetation include the reduction in the number of species, and recently, the impoverishment of phylogenetic diversity was recorded. Phylogenetic impoverishment has far-reaching implications to ecosystems due to the loss of evolutionary history in the extinct lineages. Leaf-cutting ants (LCA) have a huge impact on Neotropical ecosystems because they are the most dominant herbivores in these regions. It has been noticed that LCA strongly respond to forest fragmentation: forest disturbance and/or clearing increases the abundance of LCA colonies. In our present study we focus on the question: does LCA herbivory promote phylogenetic impoverishment or differentiation of tropical forests? We conducted our study in the remnants of the Atlantic rainforest, in the state of Alagoas in NE Brazil. We studied five LCA colonies at the edge (<100 m) and five colonies in the interior of a continuous forest (3500 ha), and identified plant species in the diet of these colonies. We constructed molecular phylogenetic trees of LCA diet species with sequence data from the GenBank database. We calculated phylogenetic impoverishment/differentiation as the difference between phylogenetic beta diversity in the vegetation of both forest habitats (edge vs. interior) and LCA diet in both habitats. Our preliminary findings show exciting interactions of theories and hypothesis: phylogenetic impoverishment/differentiation depends on if LCA generally promote (via e.g. seed dispersal) or control (via detrimental effects of herbivory) their diet species.

Schmidt I.B.

Poster presentation
Fire behavior in different weather conditions during Fire Management Program implementation in the Brazilian savanna
Session: Fire and grazing in non-forest vegetation

Isabel B. Schmidt, Livia C. Moura, Clara Baringo & Maxmiller C. Ferreira

Department of Ecology/University of Brasília
isabelbschmidt@gmail.com

Since 2014, early dry season prescribed burns started being implemented in three Cerrado Protected Areas (PA) within the Integrated Fire Management (IFM) Pilot Program in Brazil. The main objective of the program is to reduce wildfire frequency and its impacts on the vegetation. In the late dry season, generally when wildfires occur, fire tends to behave differently from early dry season fires. Our objective was to compare fire behavior during early dry season (as it is being implemented for management purposes) and late dry season (as in wildfire occurrences). During the early dry season, we characterized fire behavior in 14 fires from May until June of 2014, and 23 fires between May and July of 2015. Additionally, to serve as comparison we simulated 11 wildfires and measured fire behavior in the same PA in the end of the dry season (September) of 2015. To characterize fire behavior we calculated fireline intensities (spread rate and fine fuel consumption), wind speed, air relative humidity and temperature during fires. Prescribed burns conducted in the early dry season were started in mild weather when compared with the ones in the late dry season (average relative humidity 47.6% and 18%; average temperature 32°C and 35.5°C, respectively) and intensity and spread rate were higher in the late dry season (intensity - early dry season from 114 to 6,572 kWm^{-1}; late dry season from 1,304 to 9,096 kWm^{-1}; spread rate - 0.26 m/s and 0.61 m/s, respectively). The average fire effectiveness in consuming biomass fine fuel in the early dry season was 72% and 91% in the late dry season. Highest temperatures were achieved at 1cm height both in the early dry season and in the late dry season burns (766°C and 800°C, respectively), and the highest intensity fire had the longest high-temperature (>60°C) residence time (up to 44 minutes). Our results show that late dry season fires reach higher intensities, longer residence time and are more efficient in consuming fine fuel than early dry season fires.

Schmidt J.M.

Oral presentation
An adapted field mapping approach for monitoring heathland based on remote sensing
Session: Applied mapping for conservation and management

Johannes M. Schmidt, Sebastian Schmidtlein, Fabian Faßnacht & Neff Christophe

Karlsruhe Institute of Technology
johannes.schmidt@kit.edu

As heathland is important for nature conservation in Europe its monitoring is a crucial task. Remote sensing can be useful to support this monitoring, e.g. related to the habitats directive in Europe. Although studies have been dealing with remote sensing based approaches for this purpose, there are still needs for applicability and implementation. The objective of this study was to develop a remote sensing approach that is related to field mapping procedures. Requirements for our study were that the result should be comprehensible and easy to interpret by creating a map that is close to the product required for the monitoring of heathland habitats characterized by *Calluna vulgaris*. In order to obtain a map illustrating the conservation state of *Calluna* habitats we combined three input factors: (1) coverage of *Calluna*, (2) structural diversity, and (3) co-occurring species. The input layers were computed by combining remote sensing data and field samples. The decision space for evaluating the conservation state is expressed by this three-dimensional information and could be mapped continuously. Afterwards, the conservation state was derived by using independent field data. Applying segmentation enables the step from a gradient map to discrete mapping units. The regressions resulted in r -values of 0.77 (*Calluna* coverage), 0.61 (vegetation height), and 0.71 (species index) for the single layers. The decision space for monitoring could be precisely displayed in both manners, spatially and thematically. This illustration enables for observing small-scale gradients of the habitat quality and for identifying endangered zones. The classification of the conservation state based on this map had an accuracy of 71%. We successfully transferred existing field guidelines for mapping *Calluna* habitats to a remote-sensing based monitoring approach. The final product is designed to directly be usable for the required periodic reports in Europe. The operational study design makes it transferable to similar regions with only minor adaptions. However, the method is not meant to replace field mappings. Rather, it should be seen as a valuable supplement improving the efficiency and expanding the obtained information which could be worth for managing heathlands as well.

Schmidt J.M.

Oral presentation
The CSR-fingerprint: a functional signature of vegetation
Session: Functional and phylogenetic patterns in plant communities

Johannes M. Schmidt[1], Sebastian Schmidtlein[1] & Angela Lausch[2]

[1]Karlsruhe Institute of Technology and [2]UFZ Leipzig
johannes.schmidt@kit.edu

Plant strategy types can be used for comparing systems on equal footing as they reduce complexity. We used Grime's CSR-concept to characterize vegetation on the landscape scale. The concept classifies vegetation based on competition, stress tolerance, and ruderality. Plant traits that are linked to the strategies also have an influence on canopy reflectance. Thus, it is possible to create wall-to-wall information via remote sensing. We aimed at deriving functional signatures following the idea of the CSR ternary. The study was conducted in a heathland characterized by areas in different successional stages. Average Grime CSR values of vegetation samples were regressed against hyperspectral data. This resulted in spatial representations of C, S, and R, which were combined in a RGB color map. Based on this we generated 'CSR-fingerprints' by plotting the modelled values into a CSR ternary plot to compare two subareas. The regression resulted in r -values of 0.55 (C), 0.59 (S), and 0.28 (R). Invasion of dominant grasses leads to increase of competitiveness. Calluna-dominated vegetation shows medium competition and stress tolerance. Sparse meadows are home to stress strategists. The same applies to pioneer communities which also feature lowest C-values. Ruderal species are hardly found. Deviations between the subareas are reflected by different shapes of the fingerprint and varying core areas within. In both cases the prevailing strategy is around 'SC/CSR'. Differences are shown by shifts towards 'C/SC' (north) and 'S/CSR' (south). The method involves a strong generalization and therefore loss of information about underlying species pattern. However, exactly this generality allows for functional comparisons of complex landscapes by providing a simple but universal feature space. Using wall-to-wall information enables a more complete representation of CSR strategies than plot-based data alone. The approach can be used for comparisons between systems across time and space.

Schumacher L.

Poster presentation
The effects of fragment size, shape and degree of isolation on the seed dispersal of the endemic Atlantic Forest palm *Astrocaryum aculeatissimum*
Session: Applied mapping for conservation and management

Leticia Schumacher[1], Alexandra S. Pires[2] & Paula K. Lira[1]

[1]*Pontifícia Universidade Católica do Rio de Janeiro and* [2]*Universidade Federal Rural do Rio de Janeiro*
leticia__schumacher@hotmail.com

The Brazilian Atlantic Forest supports one of the highest degrees of species richness and rates of endemism on the planet. Nonetheless, the biodiversity of this tropical biome is severely threatened by habitat loss and fragmentation. Most of the forest fragments are less than 50ha, most of the remaining forest is less than 100m from a forest edge and the average distance between forest fragments is 1,440m. Palms play an important role in the structure and functioning of the Atlantic Forest as the most dominant vascular plants and as a key resource for animals during periods of food shortage. Several palm species rely on animals for seed dispersal and thus for recruitment. Here, we investigated how seed dispersal and seedling recruitment of the endemic Atlantic Forest palm *Astrocaryum aculeatissimum* is affected by fragment size, shape and degree of isolation. Seed removal experiments were conducted in five forest fragments in Rio de Janeiro, Brazil. Groups of five threaded endocarps were placed in 20 experimental stations in each fragment. After 30 days, the fate of every endocarp was recorded as intact, preyed upon by rodents, dispersed but not buried, or scatter-hoarded. Additionally, the number of seedlings in each forest fragment was recorded in 10 50mx10m-plots. To investigate the effects of fragment size, shape and degree of isolation on the proportion of dispersed seeds and on seedling recruitment, were used generalized linear mixed models and generalized linear models, respectively. The proportion of dispersed seeds was higher in large and less isolated forest fragments. The same pattern was observed when considering only the proportion of scatter-hoarded seeds. Finally, seedling abundance was higher in large, compact and less isolated forest fragments. Our results suggest that ineffective seed dispersal may reduce seedling recruitment and thus have a negative effect on the persistence of *A. aculeatissimum* in small, irregular shaped and isolated Atlantic Forest fragments. The future of many palm species in the Atlantic Forest, especially those that rely on scatter-hoarding rodents as *A. aculeatissimum,* may depend on intense management since much of the standing forest is in small and isolated fragments under intense edge effects.

Shimoda M.

Poster presentation
Conservation and restoration of rich flora of wet rice fields
Session: Conservation of plant communities: from science to policy

Michiko Shimoda[1] & Hiroaki Sekioka[2]

[1]*Tokoha University and* [2]*BO-GA Co., Ltd*.
michiko_shimoda@nifty.com

Many natural wetlands were converted into rice fields in Japan. Previously, rice fields were an important habitat for aquatic and wetland organisms. Recently, diversity of rice field flora and fauna has been reduced dramatically by modern agricultural techniques. Previously common rice weed species are now on the Red List. We took part in the planning and implementation of field surveys and a management experiment for the conservation of rice field biodiversity in Nakaikemi, central Japan. Nakaikemi is a 25-hectare basin with deep peat beds cultivated as wet rice fields since the Edo period (1603-1867). Abandoned fields began increasing around 1970 because of its inconvenient environmental conditions for modern agriculture. The traditional wet fields had provided good habitat for aquatic and wetland plants. More than 30 threatened species have been confirmed in the area, half of them once considered harmful rice weeds, such as *Marsilea quadrifolia* and *Monochoria korsakowii*. Diverse flora developed in young abandoned fields and fallow fields plowed but not planted. In the abandoned fields without management, diversity was reduced as tall reedy communities developed. To conserve and restore rice field biodiversity, we conducted experimental management and monitoring in a 4-hectare area in Nakaikemi 1997-2003. Local farmers performed the management tasks following their usual practices. Many threatened species quickly grew in planted fields weeded by hand and in plowed fallow fields. In old abandoned fields dominated by *Phragmites australis*, diverse annual species germinated and flourished after surface vegetation was removed. Our intensive management was effective to control the vegetation, but required manpower and money. Our study was designated to incorporate the conservation of plants and animals into a liquefied natural gas terminal construction plan in Nakaikemi. After the project cancellation, ongoing land management and monitoring have been undertaken by local government and conservation groups. Our case study shows that it is possible to conserve the rich flora of rice fields, and that an effective practical management method, including its expenses and human resourcesis required.

Silva A.C.

Poster presentation
Initial establishment of upper-montane Araucaria forest in grassland areas in southern Brazil
Session: Functional and phylogenetic patterns in plant communities

Ana Carolina Silva, Juliana P. Dallabrida, Pedro Higuchi, Janaína G. Larsen, Guilherme N. Santos, Carla L. Lima, Luiz Carlos Rodrigues Junior, Felipe D. Machado & Edilaine Duarte

Santa Catarina State University
carol_sil4@yahoo.com.br

We aimed to understand the influence of environmental gradients on the demographic patterns of shrub and tree species during their initial establishment in grassland areas, adjacent to Upper-Montane Araucaria Forests, in Southern Brazil. For this, in three grassland areas (Area 1, 2 and 3), in Santa Catarina South Plateau, we allocated a 20 x 100 m transect to each area, subdivided in twenty 10 x 10 m subplots, perpendicular to the edge of a forest fragment, covering a gradient from forest edge to grassland. In each transect, in 2014, after 6-7 years the integral protection of the areas against anthropogenic disturbance (Area 1 = 2007; Area 2 = 2008; Area 3 = 2008), all regenerating individuals greater or equal to 20 cm height and with diameter at breast height (dbh) smaller than 5 cm were sampled; and edaphic variables (soil physico-chemical properties, soil compaction, and topography) determined. In 2015, the demographic rates (mortality, recruitment, net change in number of individuals and turnover) were obtained for the three areas and for the sampled populations. The data were analyzed through Kruskal-Wallis tests, followed by multiple comparison tests, chi-square test, applied to a contingency table, Principal Components Analysis (PCA) and linear mixed models. During 2014-2015 period, the establishment of vegetation was characterized by stems increment, richness stability, no correlation between mortality and recruitment, and recruitment limitation in function of low soil natural fertility and high Al availability. We conclude that in upper-montane grassland areas, the natural regeneration of Araucaria Forest is strongly limited by edaphic conditions, such as low soil fertility and high Al toxicity.

Silva G.H.M.

Poster presentation
The soil seed bank on different grazing intensities: restoration planning study
Session: Restoration of subtropical and tropical grasslands and savannas

Graziela H. M. Silva & Gerhard E. Overbeck

UFRGS
graziela.minervini@gmail.com

O estudo do banco de sementes do solo (BSS) é importante para uma melhor compreensão da dinâmica da vegetação e regeneração de comunidades vegetais após os distúrbios, tais como herbivoria ou incêndio. Pastoreio é um dos principais fatores que determinam a composição e estrutura da vegetação campestre. No entanto, o seu efeito sobre o banco de sementes do solo tem sido pouco investigada. Nós comparar os efeitos de diferentes intensidades de pastejo sobre a densidade total, riqueza e abundância da SSB em campos subtropicais no sul do Brasil. A composição do BSS foi avaliado com base em dez amostras de solo recolhidos a partir de cada um dos quatro tratamentos, utilizando o método da emergência das plântulas. Um levantamento quantitativo da vegetação estabelecida foi realizado para verificar a similaridade do SSB composição com vegetação. Registramos um total de 103 espécies na SSB. Das 162 espécies identificadas na vegetação, 71 também ocorreu na SSB. Densidade da semente foi maior para o tratamento com elevado grau de pastoreio em comparação com aqueles com uma intensidade intermédia ou baixa. Graminoids mostrou uma maior contribuição na vegetação quando comparado com SSB. Espécies cespitosas aumentaram sua proporção no SSB gradualmente com o aumento da intensidade de pastejo. Nossos resultados indicam que a intensidade da gestão não tem um impacto muito grande sobre o SSB ou na semelhança entre SSB e vegetação, embora haja uma tendência de maior densidade e riqueza do BSS em intensidades de pastejo mais elevados. Isto significa que para a restauração por transferência sod, torrões, preferencialmente, deve ser tomada a partir de sites com uma história de pressão relativamente alta de pasto, não a partir de sites com baixa pastagem. Os estudos sobre os mecanismos de recuperação da vegetação após perturbação são necessários para avaliar melhor a dinâmica da vegetação e para fornecer suporte para o desenvolvimento de projetos de restauração.

Silva J.S.

Oral presentation
A digital version of Hueck's vegetation map of South America: a way to incorporate legacy maps into GIS databases
Session: Conservation of plant communities: from science to policy

Jones S. Silva, Heinrich Hasenack, Eliseu J. Weber & Gabriel S. Hofmann

Universidade Federal do Rio Grande do Sul
joneswsilva@gmail.com

The advance of modeling techniques in biological sciences increased the interest on spatial environmental variables for use in GIS, among them climate, elevation, land use and natural potential vegetation data are frequent. On a global scale, there are many vegetation maps available, which do not always contain the desired detail if used on a continental or regional scale. For South America, Hueck's vegetation map is a frequent reference in phytogeographic and biogeographic studies, suggesting that a GIS compatible version could be welcomed. The aim of this study is to elaborate a GIS compatible coverage of Hueck's vegetation map of South America (original scale 1:8,000,000). Kurt Hueck built it based on his 10 years of experience living and traveling in South America and on the work of many of his contemporaries on the continent. He himself stated that "it is not a theoretical and scientific phytogeographic work, but a research of practical value". Published first in 1972, a digital version of the map is available for download on EuDASM's site (European Digital Archive of Soil Maps). The original file does not have georeferencing information, nor the coordinate system used on the paper version. Based on the latitudes and longitudes of the map, a correspondence file using the crossing point of parallels and meridians was generated. Both digitized map and correspondence points file were used with Envi software to generate a georeferenced version of Hueck's map. After testing different fit options, a 5th order polynomial model was chosen, registering a RMS error of ca. 3,100 m. Once georeferenced, the file was used as a backdrop at the on-screen vectorization using Cartalinx software with the map displayed on a scale of at least 1:800,000. The final product is a shapefile, compatible with most GIS software. It contains polygons with the vegetation types according to the original legend of the map. The reference system contains geodetic coordinates, datum WGS84.

Silva T.R.

Poster presentation
Vulnerability of tree species locally rare by anthropic impacts in the Brazilian Amazon
Session: Conservation of plant communities: from science to policy

Tamilis R. Silva[1], Marcelo B. Medeiros[2], José Roberto R. Pinto[1] & Sérgio E. Noronha[2]

[1]*University of Brasilia and* [2]*Embrapa Recursos Genéticos e Biotecnologia (Cenargen)*
tamilisrocha@hotmail.com

Rare populations and their interactions are important in the dynamic and functional balance of communities and biodiversity conservation. However, rare species have specific characteristics that make them more vulnerable towards anthropic disturbances. We evaluated two impacts of changes in the natural landscape over the potential distribution areas of 13 locally rare tree species in the southwest of the Brazilian Amazon: the flooding caused by the Jirau hydroelectric plant in the upper basin of the river Madeira and other impacts due to deforestation for agriculture and livestock, roads, transmission lines and urbanization. The areas of impacts were determined by the classification of LANDSAT8 satellite images. The potential distribution of the species was generated by ecological niche modeling using records of the species collected in the field, the GARP algorithm and 17 environmental descriptors (sand, silt, clay, soil fertility, altitude, slope and 11 scenes from NDVI). The percentages of the losses of the potential distribution areas for each species were calculated by the intersection of the images of the impacts over the potential areas generated by ecological niche models. The impact caused by deforestation for agriculture, livestock, roads, transmission lines and urbanization was higher for 61% of the species. The losses of potential distribution areas for this impact ranged from 3% to 32%. The impact caused by the Jirau dam presented percentages of losses of the potential distribution areas between 1.7% and 14.3%. The losses of potential distribution areas varied for the two impacts from 7.5% to 32.8%, both reaching species occurring in Upland and Lowland forests in considerable percentages. The species with greater vulnerability were *Moronobea coccinea* Aubl, *Hebepetalum humiriifolium* (G. Planch.) Benth. and *Vochysia biloba* Ducke. The results indicate synergism of human impacts in the region and considerable magnitude of these disturbances to rare species.

Silveira F.S.

Poster presentation
Insights on seed dispersal from the analysis of soil litter in southern Brazilian Campos-forest ecotones
Session: Classification, structure and dynamics of plant communities

Fernanda S. Silveira[1,2], Vitor M Rigotti[1,2] & Ronei Baldissera[1,2,3]

[1]*UNIVERSIDADE FEDERAL DO RIO GRANDE DO SUL;*[2]*Department of Ecology and* [3]*Environmental Sciences Master's Program, UNOCHAPECÓ*
okologie_natur@hotmail.com

The expansion of woody vegetation over natural grasslands is a worldwide phenomenon and seed dispersal is a key process to understand it. Nevertheless, there are few studies on the relative importance of seed dispersal syndromes at Campos-forest mosaics of southern Brazil. Therefore, our questions were: (1) What patterns of forest seed dispersal syndromes characterize these gradients? (2) Does seed size of forest species decrease with distance from forest? To answer these questions soil litter was collected from thirteen 1,150 cm^2 plots located in two 120 m transects (60 m from edge towards the grassland and towards the forest) at nine sites in southern Brazil. The soil litter sampling units were dried at 60°C until constant weight and were screened and analyzed with stereomicroscope. We counted the number of seed species (richness), proportion of anemochorous and zoochorous seed dispersal (%), mean seed length and width (mm), and ratio of seed width by length. Analyzes were performed in software Systat v. 11. Plots at 10 to 60 m of forest interior showed high contribution of zoochorous seed dispersal syndrome as forest interior ($F_{12,190} = 8.43$; $P < 0.001$), with anemochorus seed dispersal prevailing at 70-120 m far from forest interior. Nevertheless, seed richness did not vary significantly with distance from forest ($F_{12,190} = 1.25$, $P = 0.252$). Seed attributes also changed along the ecotone. Plots inside the forest had seeds as wide as long ($F_{12,190} = 4.07$; $P < 0.001$), while plots in the grassland farther from the forest edge had seeds longer than large, probably, due to structures related to wind dispersal (e.g. pappus of Asteraceae seeds). These preliminary results show that seed richness is uniform along the ecotone. Regarding dispersal syndromes, the pattern found corroborates previous hypotheses about the exchange of syndromes along these gradients.

Simon M.F.

Oral presentation
Conservation assessment of cassava wild relatives in central Brazil
Session: Conservation of plant communities: from science to policy

Marcelo F. Simon[1], Talita S. Reis[1], Moises Mendoza[2], João B. Bringel[1], Thalyssa K. Martins[2], Sérgio E. Noronha[1], Alexandre B. Sampaio[3], Marcio L. Martins[5], Carlos A. Ledo[4], Marcos J. Silva[6], Eraldo T. Matricardi[2] & Aldicir Scariot[1]

[1]*Embrapa Recursos Genéticos e Biotecnologia;*[2]*Universidade de Brasília;*[3]*Instituto Chico Mendes de Conservação da Biodiversidade;*[4]*Embrapa Mandioca e Fruticultura;*[5]*Universidade Federal do Recôncavo da Bahia and* [6]*Universidade Federal de Goiás*
marcelo.simon@embrapa.br

Crop wild relatives (CWR) are a key component of world's biota since they have the potential to contribute traits for crop improvement. The rich flora of the Cerrado harbours a large number of CWR. However, little is known about their distribution and conservation status. This study focused on the conservation of cassava (*Manihot*) wild relatives in the Cerrado. We performed herbarium and field surveys in order assess the conservation status based on modelled geographic distribution and population density estimates. Niche modelling was used to estimate areas of potential occurrence. We found that the majority of the 61 endemic species of *Manihot* found in the Cerrado are at some level of risk according to IUCN classification (15% vulnerable, 20% endangered, 33% critically endangered), mostly due to narrow geographic range and strong habit specialization. However, most species were found to be locally abundant, ranging from 55 to 1493 mature individuals per hectare. Many of the species recorded are new to science or have been described over the past three years, indicating that the diversity of *Manihot* in the Cerrado is still underestimated. Areas of high species richness and endemism coincided mostly with Cerrado highlands, particularly in northern Goiás. Gap analysis indicates that most diversity of the genus is not adequately represented in protected areas. We believe that the patterns of distribution and conservation status uncovered here for *Manihot* are representative for a number of plant groups that are particularly rich in high altitude areas in the Cerrado. Therefore, it is urged that the network of protected areas should be expanded in order to cover a wider range of environments, particularly those that concentrate rare and endemic species, in order to ensure the effective in situ conservation of CWR present in the Cerrado flora.

Souza M.

Oral presentation
Did fire dynamics or soil quality control savanna types distribution in a amazonian savanna mosaic?
Session: Fire and grazing in non-forest vegetation

Mendell Souza[1] & Susan Aragón[1,2]

[1]*Programa de Pós-graduação em Recursos Naturais da Amazônia (PPGRNA), Universidade Federal do Oeste do Pará (UFOPA) and* [2]*Centro de Estudos Integrados da Biodiversidade Amazônica (CENBAM), Instituto Nacional de Pesquisas da Amazônia (INPA)*
saragongeo@yahoo.com

The region of Alter do Chão is a mosaic of savannas and forest fragments, different types of savanna occur in a very small area. Open savanna, shrub dominated savanna to a dry woodland coexist with semi-deciduous forest and broad leaf forest. The existence of a usually sharp boundary between such different types of vegetation has been a paradox which has intrigued many researches especially in the mesic savannas where no shortage of water occurs. The current paradigm ascertains that it alternate stable state dynamics are responsible for maintaining these different vegetation formations. That is, under the same climatic conditions, two types of states are equally probable to occur driven by stochastic perturbations such as fire. However, lately, disagreement against this prevailing theory has been raised, stating that although fire sharpens the differences between these physiognomy types, it is soil quality which is a deterministic driver of the type of vegetation in these zones of transition. Here we tested the hypothesis that fire alone drives the dynamics of the boundary delimitation and species composition in different types of the savannas. We measured the frequency and intensity of fires in a time series of Landsat images and compared the cover profiles and composition of species in three types of savanna. Preliminary results suggest that although fire seems to occur more frequently in the more open savannas, species composition has not changed.

Stoltenberg K.

Oral presentation
Game of Thorns: historical data reveals community shift in hedgerows
Session: Historical human legacy in vegetation

Kathrin Stoltenberg & Martin Diekmann

University of Bremen
stoltenberg@uni-bremen.de

The usage of historical vegetation data for resurveys is a powerful approach to investigate responses of species communities to a changing environment. We present a resurvey of hedgerows from the "Knick" landscape of eastern Schleswig-Holstein, Germany. The original survey was done by H. E. Weber in 1967 in his comprehensive and pioneering work on hedgerow vegetation, and new data from totally 51 plots was sampled in 2015. Our study reveals a distinct shift in the herbaceous species composition of the hedgerows over the past five decades. To understand the reasons for these changes, we compared the mean Ellenberg indicator values and measured pH values as well as hedge shape parameters of the hedgerows between the recent and the original study. The main driver influencing the species composition appeared to be the increase in nutrient supply. The hedge shape changed as well, indicating an altered hedgerow management. Interestingly, we found a contradictive relationship between measured pH values and mean Ellenberg indicator values for reaction: While the former showed a decrease over time, the latter suggested an increase. Species richness decreased in some groups (shrubs and herbaceous forest species) but increased in others (grass species and arable weed species), with an overall decline in species richness. An analysis of the species' changes in frequency in relation to their Ellenberg indicator values showed that species with higher nitrogen and temperature scores were more likely to have increased. There was also a decline in the number of red-listed species and a slight increase in neophytes.

Stradic S.

Oral presentation
Low resilience of campo rupestre grasslands: implications for restoration
Session: Restoration of subtropical and tropical grasslands and savannas

Soizig Le Stradic[1,2], Andre Jardim Arruda[3], Fernando A.O. Silveira[3], Geraldo W. Fernandes[2] & Buisson Elise[1]

[1]*IMBE - Université d'Avignon, CNRS, IRD, Aix Marseille Université, France;* [2]*Departamento de Biologia Geral, Universidade Federal de Minas Gerais, Belo Horizonte, Brazil and* [3]*Departamento de Botânica, Universidade Federal de Minas Gerais, Belo Horizonte, Brazil*
elise.buisson@univ-avignon.fr

Knowledge on the resilience (i.e. resistance and recovery sensu Hodgson et al. 2015) of ecosystems to disturbance is a major prerequisite for successful restoration because it is needed to identify restoration needs and to assist the recovery process on the desired trajectory. This study was designed to evaluate the natural resilience of degraded campos rupestres, Neotropical megadiverse, montane grasslands in Brazil. First, we evaluated the recovery of campos rupestres by describing soil characteristics and the internal species pool (standing vegetation and seed bank), eight years after a disturbance, in 2010 (i.e. quarrying for gravel exploitation during the paving of highway MG-010), and by comparing this with data from the reference ecosystem i.e. well-conserved campo rupestres grasslands. Six degraded areas representing two kinds of degraded substrate (sandy and stony) and 10 campo rupestre sites were selected at Serra do Cipó, Minas Gerais, Brazil. Eight years after degradation, plant composition and soil composition greatly differed between the degraded areas and the reference ecosystem. The seed banks of the reference ecosystem are extremely seed- and species-poor, while those of the degraded areas are mainly composed of non-target ruderal species; regeneration via the seed bank is therefore highly unlikely. As a second step, in order to evaluate the external species pool reaching the degraded sites, a seed rain experiment was set up. Four degraded areas and four campos rupestres were selected on which six traps of 2 kinds each were set up: sticky traps collecting wind-dispersed seeds and pitfall traps collecting water-dispersed seeds. Seed removal by animals was also studied. Preliminary results show that some species seem to reach the degraded areas with rain water flowing on the sites, but that their establishment may be hampered by sediment burial. Animal activity on degraded sites seems to be reduced. While seed production and dispersal are serious obstacles in the recovery of campos rupestres, future studies have to investigate establishment in more details to improve restoration trials.

Strohbach B.J.

Oral presentation
Making the most out of phytosociological data: extracting suitable information for impact assessment and conservation planning purposes
Session: Classification, structure and dynamics of plant communities

Ben J. Strohbach

Namibia University of Science and Technology
bstrohbach@nust.na

A survey to the vegetation types of Namibia is presently underway, with just under 12,000 relevés being available in the National Phytosociological Database of Namibia through large parts of the country. Classifications and descriptions are published systematically as data sets for specific regions become completed. Surveying follows a standardised Braun-Blanquet approach on 20 x 50 m plots. Next to the regular plant compositional data, data on the environment are also consistently collected. The danger exists that these descriptions become a purely academic exercise, without being applied in land use- or conservation planning, as it was intended. This is due to the fact that the synopsis generally does not contain information suitable for such purposes. To ensure that the vegetation description is of a more practical nature, the synopsis is completed with a description of the structure and the dominant species. In addition, a Sensitivity Index is calculated. The Sensitivity Index consists of two sub-indices, being an index related to various biodiversity indicators (like species richness per unit area and for the entire association, number of protected, endemic and/or endangered species occurring in the association, invasion by alien invasive species) as well as a landscape sensitivity index. As one of the first signs of degradation is the reduction in vegetation cover, the erosion hazard is calculated for each association based on the SLEMSA model. Furthermore, the potential influence a degraded landscape has on adjoining landscape is accessed and included as a second factor in the landscape sensitivity.

Strohbach B.J.

Poster presentation
An update of the Vegetation Survey of Namibia project
Session: Classification, structure and dynamics of plant communities

Ben J. Strohbach[1] & Norbert Jürgens[2]

[1]*Namibia University of Science and Technology and* [2]*University of Hamburg*
bstrohbach@nust.na

The Vegetation Survey of Namibia project was started in 1996, out of the necessity to provide baseline data on the natural resources of the country for land use planning. Only limited descriptions of the vegetation of the country were completed before that time, either on broad biome level, or focusing on the agricultural potential of commercial farming land, or describing the vegetation in isolated nature reserves or national parks. After an initial slow start, the project picked up momentum through collaborative projects, in particular ACACIA, BIOTA, the Desert Margins Project, The Future Okavango Project and at present the SASSCAL initiative. Based on Braun-Blanquet surveys and associated floristic classification of the vegetation types, the project aims at describing and mapping the vegetation and the environmental context at regional level at a 1:250 000 scale. Use is made of small-scale (farm-level) semi-detailed surveys to support the broad-scale reconnaissance level surveys. In addition to the description of the vegetation in terms of plant biodiversity, emphasis is also placed on management-oriented details like the sensitivity of a particular vegetation type to disturbance, as well as the suitability of these vegetation types to livestock-based agriculture. The information derived in this way is to be made available in an easy to understand way to the broad public via a dedicated internet application.

Szwagrzyk J.

Oral presentation
Rates of regeneration of forest communities after severe wind disturbance depend on habitat quality and local species pool
Session: Community assembly and species diversity

Jerzy Szwagrzyk[1], Zbigniew Maciejewski[4], Dorota Dobrowolska[2], Ewa Chećko[3] & Anna Gazda[1]

[1]*University of Agriculture in Kraków;*[2]*Forestry Research Institute;*[3]*University of Warsaw and* [4]*Roztoczanski National Park*
rlszwagr@cyf-kr.edu.pl

We compared the rates of natural regeneration of forest communities in two areas affected by catastrophic blowdowns in Eastern Poland. The first study object was a network of 115 circular sample plots, regularly distributed over a 440 ha complex of poor forest habitats dominated by stands of *Pinus sylvestris*, destroyed by hurricane in 2002. The second study area was a permanent research plot of a size of 0.5 ha, located in a mixed deciduous forest growing in rich and well drained habitat which was hit by tornado in 2008. Despite large differences in stand composition, the overall tree mortality in both study areas was close to 50%. In the rich habitat dominated by deciduous species many damaged trees, especially *Carpinus betulus* and *Acer pseudoplatanus*, not only survived the disturbance, but also produced vegetative offspring. This, combined with the released advanced regeneration of *Fagus sylvatica*, caused a rapid restoration of canopy cover and strongly limited the role of pioneer woody species. Light demanding herbaceous plants, like *Vicia sylvatica* or *Hypericum perforatum*, occurred in large numbers for 1-4 years after the disturbance, but then they disappeared under the fast developing dense canopy of young trees. In poor habitat, vegetative reproduction played a minor role; only deciduous trees produced new stems from uprooted trees. *Betula pendula* got established in large numbers after disturbance and now forms 40% of tall saplings. *Pinus sylvestris* has been producing a new cohort of seedlings every year; its share among seedlings is now 38%, twice as much as among the tall saplings. *Picea abies* had been released from the seedling bank and has now the share of 16% among tall saplings, compared to only 2% among small seedlings. *Quercus robur*, germinating continuously from acorns dispersed by birds, is the second most common species (20%) among seedlings. Despite heavy browsing by deer, it reaches the sapling stage, although in low numbers (3%). Thirteen years after disturbance the canopy is still not closed. The list of herbaceous plants remained unchanged, but the share of grasses, especially *Deschampsia flexuosa* has strongly increased compared to the areas not affected by the disturbance.

Tetsu S.

Poster presentation
Habitat conditions of the endangered species *Veronica ornata* (Plantaginaceae) in the Tango Sand Dune, Kyoto, Japan
Session: Classification, structure and dynamics of plant communities

Shintaro Tetsu[1], Asumo Kuroda[2] & Hiroaki Ishida[2]

[1]Graduate School of Human Science and Environment, University of Hyogo and [2]Institute of Natural and Environmental Science, University of Hyogo
tetsu.violin@gmail.com

Veronica ornata (Plantaginaceae) is a threatened perennial herb, which is endemic to Japan. Distribution of this species is very limited in some parts of Japan. Clarification of the habitat conditions of *V. ornata* is very important for its conservation. However, there are few studies on the habitat conditions of this species. In this study, we aimed to examine the habitat conditions of *V. ornata* on Tango Sand Dune, which is typical habitat of this plant. Tango Sand Dune is a sandy coast located in the Tango Peninsula, Kyoto Prefecture. Tango Sand Dune has the largest population of *V. ornata* in Japan. We set 6 lines from shoreline to inland on study site, and put 84 quadrats on these lines. We surveyed topography and investigated vegetation at each quadrat. Microtopographies on lines were classified into three types: beach type, dune slope type, and dune top type. *V. ornata* occurred mainly in the dune slope type. The results of the indicator species analysis showed that in the beach type, many coastal plants were extracted as indicator species such as *Calystegia soldanella* and *Melanthera prostrata*. These plants have figures to adapt to strong surface disturbance in the beach type such as rhizome and runner. However, *V. ornata* not have these forms. Hence, *V. ornata* is difficult to grow in the beach type. Characteristic indicator species of the dune top type were arbors (e.g. *Neolitsea sericea* and *Machilus thunbergii*) and vine plants (e.g. *Hedera rhombea* and *Kadsura japonica*), and the cover of woody plants was the highest in this topographic type. Strong competitions with these plants occur in the dune top type. So, *V. ornata* is hard to grow in this type. The cover of woody plants in the dune slope type was significantly lower than that in the dune top type. The degree of surface disturbance in the dune slope type was lower than that in the beach type and the dune slope type had low amount of competitor of *V. ornata*. Therefore, the dune slope type is considered to be a main habitat of *V. ornata* in the study site.

Tokarsky V.

Poster presentation
Necessity of protection of original flora and fauna of east Ukraine steppes
Session: Conservation of plant communities: from science to policy

Victor Tokarsky

V. N. Karazin Kharkiv National University, Kharkiv
v.tokarsky@mail.ru

Recently, conservation of the unique steppe vegetation in eastern Ukraine is problematic not only because of small area and patchiness of virgin steppe plots but also because of crucial changes in traditional land use: grazing decrease and/or cessation. Vegetation of chalk outcrops is represented by great number of obligate chalk grassland endemics and relict species. Lately, because of ongoing reduction of steppes areas at chalk outcrops, the issue was raised about necessity of protection of this relic chalk flora. On the basis of study of vegetation of the Oskol river valley in which typical for this region flora is well remained, we organized National Natural Park «Dvorichanskiy», with the area of 3131.2 hectares (Dvorichna district of the Kharkiv region). Currently, work is underway to expand it to 10 thousand hectares. We also propose to recall the Lugansk Nature Reserve with its branches Streltsovskaya steppe, which was organized primarily for the conservation of steppe marmot and Pravalski steppe the Eastern Ukraine. In the beginning of twentieth century in Ukraine the number of elk, wild boar, deer, and beaver reduced to a critical level, these resources have been subsequently managed to recover thanks to the acclimatization measures. While massive steppe species of ungulates: bison, tarpan, saigak, which had a significant habitat-forming role, completely disappeared. Currently, since the 90s, we observe a sharp depression of the steppe marmot population. Reducing the number of families in settlements, reduction in the number of families per unit of area we associate with the decrease of grazing pressure on the steppe marmot habitat (Ronkin, Savchenko, 2000). Significant changes in the nature management and, above all, reduction of the livestock sector and pasturing areas occur everywhere, over the whole area of the European subspecies of the steppe marmot. In our opinion, cattle grazing in combination with ravine and gully relief are a key environmental factor forming the environment for many herbivores steppe species, this affects the size and density of its population. The phenomenon of the revival of the steppe marmot sheds light on the role of large ungulates (in historical times large domesticated ungulates) in the formation and maintenance of steppe ecosystems stability. The study will be extended to other mammals steppe. First of all, attention will be fished biology of small ground squirrel (*Spermophilus pygmaeus*), speckled ground squirrel (*Spermophilus suslicus*) and an ordinary mole rat (*Spalax microphthalmus*), as endangered species introduced in the European Red List. As it is not ironic, but certain features of the biology of this species remain unstudied. This family group, hierarchy, breeding.

Torchelsen F.P.

Poster presentation
What determines the invasibility of grasslands in the Pampa biome, in southern Brazil?
Session: Plant community invasion

Fabio P. Torchelsen[1], Juliano M. Oliveira[2] & Gerhard E. Overbeck[1]

[1]*Universidade Federal do Rio Grande do Sul and* [2]*Universidade do Vale do Rio do Sinos*
fpiccin@gmail.com

The invasion of exotic species is considered one of the main causes of biodiversity depletion. The evaluation of environmental variables and the importance of surrounding land management on the structure and composition of grassland ecosystems in a region characterized by a mosaic of areaswith extensive cattle farming, agriculture, and eucalypt plantations represent an important step to identify invasibility processes in protected areas. We out a study of biotic and abiotic factors that influence invasibility in southern Brazil (Pampa Biome). Vegetation sampling was carried out in 22 farms located in the grassland formation of southern Brazil, where the main land use is eucalyptus. Plots were situated in permanent protected areas with grassland remnants. We evaluated 215 plots (distributed among the farms) of 0.25 m . 270 species were identified including exotic species. Composition of grassland communities did not correspond to what would be expected based on biotic, climatic and land use variables. In general the communities with higher species diversity demonstrated to be less invaded (p=0.06). Communities with less species diversity - with a distinct history of land use – demonstrated a close relationship with exotic species (p=0.001).

Török P.

Oral presentation
Traditional cattle and sheep grazing in short-grass steppes: is the livestock type more crucial than grazing intensity?
Session: Fire and grazing in non-forest vegetation

Péter Török[1], Orsolya Valkó[1], Balázs Deák[1], András Kelemen[1], Edina Tóth[2] & Béla Tóthmérész[1,2]

[1]*MTA Biodiversity and Ecosystem Services Research Group, H-4032 Debrecen, Egyetem sqr. 1, Hungary and* [2]*University of Debrecen, Department of Ecology, H-4032 Debrecen, Egyetem sqr. 1, Hungary*
molinia@gmail.com

In agriculture-driven landscapes, grasslands have an outstanding importance in maintaining species richness. Restoration and conservation of grassland biodiversity, therefore, became a top priority both in research and practice. In many regions sheep or cattle grazing are vital options for biodiversity conservation. In our study we compared the effects of cattle and sheep grazing on short-grass steppe vegetation under various grazing intensities. We tested the following hypotheses: A) Sheep grazing maintains a lower taxonomic and functional diversity, lower amount of forbs compared to cattle grazing. B) The effects of grazing are highly intensity-dependent and differences between cattle and sheep grazing are more pronounced at low grazing intensities than at high ones, because the selectivity of grazing decreases at higher intensities. We found lower taxonomic- and functional diversity, and lower cover of forbs in sheep grazed steppes compared to cattle grazed ones. Grazing intensity had a significant effect only on species richness. The livestock type had a significant effect on Shannon diversity and evenness. While most single trait indices were affected by the livestock type, significant effect of intensity was detected only in a few cases. Our findings clearly indicated that most of the vegetation characteristics were significantly affected by livestock type, while fewer intensity-dependent effects were confirmed. These findings suggest that the selection of the livestock type is more crucial in biodiversity conservation and management than the adjustment of grazing intensity. Our results also suggest that cattle grazing creates a more species- and trait-rich vegetation with higher cover of forbs compared to sheep grazing. However, sheep grazing is a much better choice to suppress forbs, including weedy ones, than cattle grazing. For optimal ecosystem functioning and for highest variability of traits proper grazing intensity should be also carefully set and fine-tuned in respect of the habitat type and the grazing animal.

Tóthmérész B.

Oral presentation
Successful recovery of species rich grasslands on croplands - case studies from Central Europe
Session: Classification, structure and dynamics of plant communities

Béla Tóthmérész[2], Balázs Deák[2], Péter Török[2], András Kelemen[2], Tamás Miglécz[2], Katalin Tóth[1] & Orsolya Valkó[2]

[1]*University of Debrecen, Department of Ecology, Debrecen, Egyetem sqr. 1, H-4032 Hungary and* [2]*MTA-DE Biodiversity and Ecosystem Services Research Group, Debrecen, Egyetem sqr. 1, H-4032, Hungary*
tothmerb@gmail.com

Grasslands are vital landscape elements, and sustaining their biodiversity is crucial for biodiversity conservation, especially in agricultural landscapes. In Central Europe the large-scale abandonment of croplands resulted in landscape-scale changes in biodiversity, ecosystem services and agricultural production. Grassland restoration on former croplands offers a vital opportunity to mitigate the loss of grassland biodiversity. We studied vegetation changes in 24 former croplands sown by low-diversity seed mixtures in East-Hungary. Our first aim was to evaluate the usefulness of sowing low-diversity seed mixtures, which is a frequently used restoration technique because of its high predictability and fast results. Our second aim was to test a novel approach by the establishment of colonisation windows for increasing the diversity of species-poor sown grasslands, restored by the use of low-diversity seed mixtures. We compiled a high-diversity seed mixture containing 35 species. We established altogether 32 colonisation windows (1×1-m, 2×2-m and 4×4-m size) in eight 8-year-old grasslands restored by low-diversity seed sowing. Our third aim was to compare the success and cost-effectiveness of spontaneous grassland recovery with an active grassland restoration by seed sowing in terms of the restoration of ecosystem services, like weed control, biomass production, and recovery of biodiversity. Our results showed that using low diversity seed mixtures grassland restoration on croplands offer a viable solution for restoring biodiversity and ecosystem services. By establishing colonisation windows we overcome the microsite- and propagule limitation and we can successfully introduce target species to the species-poor recovered grasslands. All sown species established in the colonisation windows and many of them maintained or even increased their first-year cover to the second year. Larger colonisation windows were characterised by higher cover of sown species and more homogeneous species composition compared to the smaller ones. Thus, in restoration practice larger colonisation windows are recommended. Seed sowing ensures higher weed control and biomass production, but lower biodiversity compared to spontaneous recovery. We found that both spontaneous grassland recovery and seed sowing can be cost-effective methods, and can be successful even in a relatively short period of a nature conservation project.

Vélez-Martin E.

Oral presentation
Species richness and ecosystem stability in south Brazilian grasslands during El Niño and La Niña episodes
Session: Concepts in ecological stability

Eduardo Vélez-Martin[1], Tatiana M. Kuplich[2], Andreise Moreira[1], Gerhard E. Overbeck[1], Ilsi I. Boldrini[1] & Valério D. Pillar[1]

[1]*Federal University of Rio Grande do Sul (UFRGS) and* [2]*National Institute for Space Research (INPE)*
velezedu@portoweb.com.br

Identifying the relationships between diversity and stability is relevant for the adaptation to climate change, but evidence shows that there is no universal pattern. In this work we evaluated how grassland species richness of south Brazilian grasslands (Campos) affected primary productivity during periods of climatic anomalies produced by the ENSO cycle (El Niño/Southern Oscillation). In this region, precipitation and productivity are increased during El Niño and decreased during La Niña compared to neutral years (our baseline for normal conditions). We hypothesized a positive effect of plant species richness on stability measured by resistance during these climatic anomalies. Plant species richness data were obtained from 93 locations distributed throughout our study region of 185,067 km^2. For each location we built a 12-year time series of NDVI (Normalized Difference Vegetation Index), as a proxy for plant productivity, using MODIS data (250 m spatial resolution and 23 acquisitions/year). We assigned the NDVI data to El Niño, La Niña (four episodes each) or to neutral climatic conditions, based on the Oceanic Niño Index with a threshold of +/- 0.5°C. The baseline was constructed for each location as the mean monthly NDVI observed during normal climatic conditions. We quantified resistance as the absolute change in proportion to the baseline NDVI values. Species richness and resistance data were log-transformed. Resistance during ENSO anomalies was significantly lower than in normal climatic periods. No relationship of resistance with species richness was observed for La Niña episodes, but a positive relation was found for El Niño. We observed mixed patterns in the direction and intensity of NDVI changes within El Niño and La Niña episodes. We also analysed each episode individually. A marginal positive effect of species diversity on resistance was found for two El Niño episodes. In both cases, increased productivity was observed. During one La Niña episode, we found a positive effect of richness. However, NDVI values also increased, opposing the expected drought pattern during La Niña. Our results suggest that a better understanding of stability patterns requires additional analyses considering observed climatic data and the sign of the changes in productivity.

Villén-Pérez S.

Oral presentation
Forecasting global warming effects on understory species of boreal forests
Session: Climate change and plant communities

Sara Villén-Pérez[1,2], Maija Salemaa[1], Juha Heikkinen[1] & Raisa Mäkipää[1]

[1]*Natural Resources Institute Finland (Luke) and* [2]*Universidade Federal de Goiás (UFG)*
sara.villen@gmail.com

The distribution and abundance of boreal vegetation are changing as a response to current global warming, and are expected to keep this path during the following decades. In order to take advantage of the best management possibilities for conservation, the effects of warming on vegetation may be first forecasted and then monitored. With this aim, we modelled the influence of temperature sum on the abundance of 89 understory plant species along 1869 nation-wide plots in Finland. We use 99%-additive quantile regression models to focus on the limiting effect that temperature exerts on the maximum potential abundance of species, which we defend is an interesting strategy to discuss future global warming effects. We test the hypothesis that temperature sum has a significant effect on species' abundance, both in models including only this predictor variable and in models also considering other environmental factors such as soil type, soil fertility, tree species and tree maturity. Only for species showing a significant positive response to temperature sum in both types of models, we derive spatial predictions of species maximum potential abundance across Finland for period 2041-2070 under A1b climate change scenario. We predicted major changes in maximum potential abundance and northward shifts of geographical range of distribution for these understory plant species. These are potential indicator species that could be used by the national forest inventory or by citizen science for monitoring the effects of global warming.

Wilde M.

Poster presentation
Microwave soil heating for controlling invasive plant species germination
Session: Plant community invasion

Mélissa de Wilde[1], François Mesléard[2,1] & Elise Buisson[1]

[1]*IMBE - Université d'Avignon, CNRS, IRD, Aix Marseille Université, France and* [2]*Tour du Valat, Arles, France*
elise.buisson@univ-avignon.fr

Several methods of invasive plant eradication are available (manual and mechanical control like plant uprooting, shredding, burning and mowing; chemical control like herbicide use; or biological and ecological controls) but examples of successful long-term eradications are rare. This can be partly explained by the fact that the eradication methods target only the adult stage and does not take into account the development capacities from a very important propagule bank. New methods thus have to be implemented. Microwave radiation causes dielectric heating of moist material and enables reaching rapidly temperature needed for loss of seed viability (60-80°C range). We tested the effect of different combination of powers (2, 4, 6kW) and durations (2, 4, 8 min) on 3 target invasive plant species (Fallopia japonica, Datura stramonium, Solidago gigantea). We also evaluated the effect of soil humidity (10, 20, 30%) and seed depth (2 cm, 12 cm) on the efficacy of the microwave treatment on germination capacity. The most efficient treatments were: 2kW8min, 4kW4min, 6kW2min and 6kW4min (4kW8min and 6kW8min were not tested for technical reasons), but did not allow to eradicate all seeds. Their efficiency decreased with increasing soil humidity. In some cases, efficiency also decreased with depth. Solidago gigantea was the most sensitive species, probably due to the small size of its seeds. These first results are encouraging and experiments are on-going to determine the characteristics of the microwave that will be used in the field.

Wildi O.

Poster presentation
Data transformation affects clustering
Session: Data analysis methods in vegetation ecology

Otto Wildi

WSL Swiss Federal Institute
otto.wildi@wsl.ch

The role of clustering and allocation methods is a widely debated issue in the assessment of classification systems. But what is the effect of data transformation? Specifically, *how does transformation affect the predicting power of classification?* I vary transformation of cover-abundance scales from quantitative (cover %) to qualitative (presence-absence) and subject this to the most common clustering methods. Resemblance functions are varied where feasible. Silhouette plots visualize the quality of resulting classifications and predictive power is measured as explained variance, that is, within-group variance as a proportion of total variance. A small real world plot sample (n=63, "sveg", Wildi 2017), systematic sampling used. Clustering methods are extremely sensitive to transformation of abundance scores. This is not the case when using some distance measures transforming scores intrinsically, Bray-Curtis and Canberra distance, for example. But these distances mimic presence-absence scores for which they are frequently considered "robust". Various results confirm transformation being a key factor in classification. Average linkage clustering and Ward's method perform best. Good results are also obtained from divisive clustering (DIANA). Correlation as distance is the most successive distance measure irrespective of clustering method chosen. The results of clustering are strongly dependent on the transformation of the cover-abundance scale. This probably holds for any type of vegetation classification, including expert-based classification systems. Variance explained by the classification is an intrinsic quality criterion. An extrinsic (environmental predictive power, for instance) should be considered as well.

Wildi O.

Poster presentation
The flexibility of ordination methods
Session: Data analysis methods in vegetation ecology

Otto Wildi

WSL Swiss Federal Research Institute
otto.wildi@wsl.ch

The choice of methods used for the analysis of vegetation data is known to be crucial as it may hamper the success of investigations. In this poster I concentrate on the role of the transformation of species or traits scores and its outcome in different ordination methods. Specifically, *how do ordination methods respond to variation in cover-abundance scale?* As ordination is the adequate approach to visualize similarity patterns, I vary transformation of cover-abundance scales from quantitative (cover %) to qualitative (presence-absence) and subject this to the most common ordination methods. Resemblance functions are varied where feasible. An array of 132 ordinations of one and the same data set reveals the outstanding role of transformation in spanning a similarity space of observations. Some popular methods (CA, DCA, for example) and widely used distance functions (Bray-Curtis, Canberra, for example) intrinsically transform cover-abundance scales close to presence-absence. The resulting ordinations reflect the "qualitative" aspect of the data only. "Old fashion" methods (PCA, PCOA, for instance) yield similar results if the cover-abundance scale is properly chosen. Their strength is responsiveness to transformation, not achieved by Bray-Curtis or Canberra distance, or CA and DCA as ordination methods, for example. The most flexible choices are PCA based on covariance, PCOA and NMDS using Euclidean distance. Transformation of cover-abundance scale can be more influential than an ordination method chosen. PCA and PCOA may eventually experience a revival since they offer an undistorted projection of the input data.

Wildi O.

Poster presentation
Unsupervised clustering excels expert-based classification in predicting environmental factors
Session: Data analysis methods in vegetation ecology

Otto Wildi, Klaus Ecker, Elizabeth Feldmeyer-Christe

WSL Swiss Federal Research Institute, 8903 Birmensdorf, Switzerland
otto.wildi@wsl.ch

Measuring the success of revising vegetation classifications is commonly either species-based or community-based (see Roberts 2015 for an overview). In our case study of wetland data (n=1496, Wildi 2013) we probe the use of external evaluators for the purpose, that is, the power of classifications in predicting independent site factors. (1) Do expert-based classifications (associations) perform better after numerical revision (k-means reallocation)? (2) How does unsupervised clustering compares in predicting environmental factors? (3) Do diagnostic species sets exist that are valid in all alternative classifications? Analysis of variance with environmental measurements as independent and classifications as dependent factors. An internal evaluator (percentage explained variance) is also computed for comparison. (1) The predicting power of expert-based classification is much improved by numerical reallocation (Figure 1). (2) Clustering by Ward's method by far excels expert-based classifications including their revisions (Figure 1). (3) Universally valid diagnostic species do not exist in the realm of the predicting power of classifications (Table 1). In model-context, the predictive power of expert-based classification is considerably improved by k-means reallocation. But the best clustering methods outperform these. An internal evaluator (% explained variance) does not reflect the findings obtained from independent site factors.

Winkler M.

Oral presentation
Two decades of biodiversity monitoring: transformation of plant species composition at the limits of plant life in the European Alps
Session: Climate change and plant communities

Manuela Winkler, Philipp Semenchuk, Andrea Lamprecht, Klaus Steinbauer, Manfred Bardy-Durchhalter & Harald Pauli

GLORIA, Austrian Academy of Sciences & University of Natural Resources and Life Sciences Vienna (BOKU)
manuela.winkler@boku.ac.at

Biota living in high mountain environments are governed by low-temperature conditions and, thus, are used as indicators for warming-induced impacts on natural or semi-natural ecosystems. Moreover, high mountain organisms may be highly vulnerable to climate change, if suitable habitats progressively disappear, as projected by recent modelling studies. At the GLORIA (Global Observation Research Initiative in Alpine Environments, www.gloria.ac.at) and LTSER site Schrankogel (Tyrol, Austria) we aim to assess climate-warming induced changes in plant species composition across the ecotone from alpine grassland to the nival zone. The presence and cover of vascular plant species in 664 1 m -plots established in 1994 was resurveyed in 2014. Each species was assigned a literature-derived altitudinal rank, and an ecological indicator value for moisture and humus (Landolt indicator values). Altitudinal ranks and indicator values were weighed with species cover. Changes in species richness, altitudinal ranks and indicator values were analysed by means of generalised linear mixed effect models. On average, 3.6 species were newly found, while 0.9 species disappeared from each plot between 1994 and 2014. Thus, mean species numbers per plot increased from 9.9 in 1994 to 12.6 in 2014. Colonizing species were typically alpine species with smaller Landolt indicator values for moisture and larger ones for humus than disappearing species, who tended to be subnival to nival species. Consequently, climate change has been leading to a significant transformation of the vegetation towards more thermophilous species and species indicating drier and more humus-rich conditions.

Yang Y.

Poster presentation
Size-dependent shift from competition to facilitation in an alpine cushion plant
Session: Functional and phylogenetic patterns in plant communities

Yang Yang[1], Jian-Guo Chen[1], Zhi-Min Li[2] & Hang Sun[1]

[1]Key Laboratory for Plant Diversity and Biogeography of East Asia, Kunming Institute of Botany, Chinese Academy of Sciences, Kunming, 650201 Yunnan, China and [2]School of Life Sciences, Yunnan Normal, University, Kunming, 650500 Yunnan, China
yangyang@mail.kib.ac.cn

Plant size or stage is an indicator of a wide range of ecological and evolutionary processes including responses to neighbours. Plants experience distinct differences in tolerance to extrinsic factors at different stages and therefore has evolved different physiological status. This, then manifests itself as variations in morphological traits of plant, which in turn mediates plant-plant interactions by altering microhabitat conditions for other species. Within alpine habitat, species that have cushion morphology often act as a 'nurse' and provide facilitation to other non-cushion species. However, little is known about the mechanism link of size-dependent morphological and physiological variabilities of cushion species and the variation in balance between competition and facilitation so far. In this study, we assessed a series of functional traits in different size (i.e. 10 cm, 15 cm, 20 cm and 30 cm in diameter) of *Arenaria polytrichoides* (Caryophyllaceae), a common cushion plant occurs at high elevations of Himalayan Hengduan Mountains, SW China. Furthermore, we analysed how these size-dependent functional traits related to soil properties beneath cushions and the number of associated species and individuals compared with open areas. Large cushions showed good physiological data; they were compact, had higher soil nutrient contents (N and P) compared with open areas and showed pronounced facilitation. By contrast, physiological data indicated stressful abiotic conditions for small size cushions of *A. polytrichoides* in the study site. These cushions showed less improved soil conditions and had reduced facilitative to competitive effects on other non-cushion species as compared with those larger ones. Our data, thus, offer a clear demonstration of a size-dependent shift of interactions occur among cushion species and other plant species, because the distinctive variations in morphology and vigour of this nurse plant at different sizes. This variability may affect the small-scale environmental created by cushion plant and finally have a relevant effect on its interactions with other species.

Zanini K.J.

Poster presentation
What short-term demographic changes and patterns of stem size distribution can tell us about species dynamics?
Session: Climate change and plant communities

Katia J. Zanini[1], Cristiane F. Jurinitz[2] & Sandra C. Müller[1]

[1]*Universidade Federal do Rio Grande do Sul and* [2]*Pontifícia Universidade Católica do Rio Grande do Sul*
katyjz2009@gmail.com

The response of trees to the environment is mediated by functional traits, that are morphological-physiological-phenological attributes that influence the ability of a plant to grow, survive and reproduce, shaping individual fitness, and leading to a differential demographic performance. Global and local environmental changes are likely to influence both, fitness and demography. Long-lived organisms as trees lack adequate demographic data and stem size distribution is assumed to predicted population changes. Here we searched for shifts in stem size distributions at secondary and old-growth forests, and evaluated the predictive power of the coefficient of skewness (g1) and functional traits on short-term demographic changes of 20 subtropical species, considering two ontogenetic stages. The g1 is a coefficient that summarizes the symmetry of size distribution of each population, where negative values indicate distributions with a long tail of rare saplings and abundant adults. Traits used for the analyses were distinct leaf traits, height at maturity, wood density and seed mass, and the response variables were the changes in abundance and in basal area within five years of monitoring. We found a general pattern of reduced g1 values at old-growth forest and significant shifts (P=0.04) in size distribution of some species. Short-term demographic changes were better captured by leaf traits and the coefficient of skewness revealing that (i) abundant secondary species with high g1 values are predicted to have greater basal area gain due to growth and recruitment of new individuals at juvenile and adult stages, (ii) species at characterized by acquisitive leaf traits are predicted to lose juvenile individuals, and (iii) species with conservative leaf traits (old-growth species) are predicted to lose adult individuals as well. Therefore, we suggest that secondary species are being maintained in the forest, while the juveniles of fast-growing species are losing individuals and big trees of old-growth species are retreating their performance. Additionally, species at secondary forest tended to present a greater proportion of saplings if compared to those of old-growth forests, indicating distinct life-history strategies. The g1 and leaf traits have shown to be useful tools for the understanding of species dynamics, even in a short-term demographic study.

Zanzarini V.

Poster presentation
Do we need intervention after pine tree removal to restore the Cerrado?
Session: Restoration of subtropical and tropical grasslands and savannas

Vagner Zanzarini[1], Denise Zanchetta[2] & Alessandra Fidelis[1]

[1]*Universidade Estadual Paulista and* [2]*Instituto Florestal*
vagnerzanzarini@hotmail.com

Pinus plantations were implemented in the late 60's in Brazil, replacing Cerrado vegetation in several areas. These areas are, nowadays, the subject of restoration. However, little is known about the regeneration of vegetation after the removal of pine trees. Therefore, this study aims to evaluate and monitor the application of management techniques in areas of former pine plantations (*Pinus caribaea* var.*hondurensis*) after their removal in Southeastern Brazil. We established 10 plots/treatment (10x10m) three years after the removal of pine trees to evaluate woody species regeneration. The following treatments were used: Fire (F), Removal of Needles (RN) and Control (C, no intervention). For the herbaceous layer sampling, we randomly established five subplots (1x1m) within each experimental plot and sampled the cover of: bare soil, dead biomass, graminoid, forbs and shrubs (< 1m). For the woody vegetation, we measured height and perimeter at the soil surface (PSS) of individuals $\geq$1m. Vegetation sampling was conducted in the dry and rainy season for two years. Burned plots had an increase in bare soil (77$\pm$21.26%) and forbs cover (0.7$\pm$3.20%) compared to Control plots (33.13$\pm$34.61% and 0.44$\pm$2.08%, P$\leq$0.05). RN plots also showed a great decrease in dead biomass (12.10$\pm$21.19% C: 67.36$\pm$34.29%, P=0.0001). Woody species height and perimeter varied little after treatment application (P>0.05). However, independently of treatment, an increase in the total number of woody plants was found (before experiments: 90, two years: 205 individuals). Therefore, the removal of pine trees alone was sufficient to enhance the number of woody species abundance and treatments did not affect their height or perimeter. However, if the herbaceous layers should be restored, fire or the removal of needles should be used in order to enhance forb cover and the increase of gaps, which can be used as safe sites for the colonization of new species. Therefore, to restore areas of former pine plantations, interventions (e.g. fire) should be used in order to restore the Cerrado vegetation.

Zirondi H.L.

Poster presentation
Fire-related germination cues for Cerrado species: the study of permeable and impermeable seeds
Session: Fire and grazing in non-forest vegetation

Heloiza L. Zirondi, Talita Zupo, Luiz Felipe Daibes & Alessandra Fidelis

Universidade Estadual Paulista – Departamento de Botânica, Instituto de Biociências, Rio Claro, Brazil
helo_kiza_rr@hotmail.com

Fire is one of the most important factors affecting plant communities in the Cerrado, but less is understood about the regeneration strategies and fire-related germination cues. Thus, this study aims to evaluate the effects of fire on germination and dormancy on impermeable (Fabaceae) and permeable seeds (Melastomataceae). We hypothesize that seeds of Fabaceae species (*Mimosa pteridifolia, Mimosa leiocephala, Harpalyce brasiliana* and *Bauhinia dumosa*) will have their dormancy broken after the exposure to high temperatures, while the seeds of Melastomataceae species (*Cambessedesia hilariana, Tibouchina cardinalis, Tibouchina melastomoides, Tibouchina stenocarpa* and *Tibouchina* sp.) will have their germination enhanced after the smoke treatments. We exposed seeds (5 replicates/20 seeds/species) to different treatments: heat shock (60°, 100° and 200°C) for 1 minute; and smoke treatments (solutions 1:1 concentration for 24 hs). We also performed the combination of both treatments (100ºC + 1:1 smoke solution). Treatments affected seeds of the study species in different ways. Heat shock broke the dormancy of *Harpalyce brasiliana* at 60° (G=33%) and 100°C (G=32, Control=12%) and *Mimosa leiocephala* at 200°C (G=19%, Control=4%), but did not affected the other species (P>0.05). *Cambessedesia hilariana* had the germination increased by the smoke solution. For the combined treatment, all the hard-coated seeds had their germination increased comparing to control (P≤0.05): *Mimosa leiocephala* (G=35%, Control=7%), *Mimosa pteridifolia* (G=28%, Control=6%) and *Harpalyce brasiliana* (G=50%, C=7%),while, *Tibouchina cardinalis* decreased (G=16%, Control=47%).Thus, two hard-coated species had their dormancy broken by exposure to higher temperatures and three also had their germination enhanced after the 100ºC+1:1 treatment. One of the permeable species had its germination increased by the smoke solution. Finally, all species showed to be fire-resistant and responses of species to the treatments showed to be species-specific and further studies with other species are needed.

Zlinszky A.

Oral presentation
Mapping of Natura2000 habitat conservation status by airborne laser scanning
Session: Applied mapping for conservation and management

András Zlinszky[1], Balázs Deák[2], Adam Kania[3], Anke Schroiff[4], László Bekő[5], Norbert Pfeifer[6] & Hermann Heilmeier[7]

[1]Balaton Limnological Institute, Centre for Ecological Research, Hungarian Academy of Sciences, Tihany, HU;[2]MTA-DE Biodiversity and Ecosystem Services Research Group, Debrecen, HU;[3]ATMOTERM S.A., Opole, PL;[4]YGGDRASILDiemer, Berlin, DE;[5]Research Institute of Remote Sensing and Rural Development, Károly Róbert College, Gyöngyös, HU;[6]Research Groups Photogrammetry and Remote Sensing, Department of Geodesy and Geoinformation, Vienna University of Technology, Vienna, AT and [7]Biology/Ecology Unit, Interdisciplinary Ecological Centre, TU Bergakademie Freiberg, Freiberg, DE
heilmei@ioez.tu-freiberg.de

Natura2000 mapping and habitat quality assessment is compulsory for EU member states under the Habitats Directive. The current state-of-the-art is field mapping, which is quite reliable; however, it raises questions of repeatability and is unfeasible over large or inaccessible areas. Until now, vegetation maps and habitat quality parameters have been successfully derived from various remote sensing (RS) data. In contrast, conservation status (CS) defined by the Habitats Directive is a complex parameter, composed from many different variables. Therefore, it was so far not possible to automatically derive it from RS data. Thus, we aimed to establish an automatic mapping of all CS variables for an area of 24 km^2 in Pannonic alkali grasslands as required by Hungarian national Natura2000 monitoring guidelines. High-resolution airborne laser scanning (ALS) data were collected at a density of 10 points/m^2 during leaf-off and leaf-on period in Hortobágy National Park (East-Hungary). A wide range of field references including 20 full CS assessments was used to calibrate the models relating ALS point cloud derivatives to habitat parameters and finally to CS. A classification software based on random forest machine learning and fuzzy class theory was developed to create maps of vegetation categories and parameters relevant for CS at a spatial resolution of 0.5 m × 0.5 m. Following the Hungarian assessment scheme, proxies of these parameters were selected, and their weighted sum was calculated in GIS for generating categories of final CS. As a result, the class probabilities predicted by fuzzy classification for various habitat types correlated well with naturalness and species composition. The difference between leaf-on and leaf-off reflectance was a good proxy for over- or undergrazing. Encroachment of shrubs and weeds, and tracks and roads were well identified. The correct identification of validation plots (80%) was comparable to field assessments. While adaptation to other sites still has to be tested, we conclude that ALS is a suitable data source for Natura2000 assessments in grasslands. The Hungarian national grassland assessment scheme can successfully be used with ALS data in a GIS processing model for CS, yielding an output that is directly comparable with traditional field-based assessments.

Znamenskiy S.

Poster presentation
From mountains to plains: ecological structure of South Ural (Russia) fen vegetation
Session: Classification, structure and dynamics of plant communities

Sergey Znamenskiy[1] & Tatiana Ivchenko[2]

[1]Biology Institute, Karelian Research Center of Russian Academy of Sciences and [2]Komarov Botanical Institute RAS
seznam@krc.karelia.ru

The work was conducted on Eastern part of South Ural region within administrative boarders of Chelyabinsk oblast. Geographically it can be divided into three parts: Ural low mountain area, paeneplain area (i.e. destroyed ancient mountains) and West Siberian Plain part. Fen vegetation is mainly developed in spring areas in the mountain part but generally it distributed very sparsely. The object of study was to compare the vegetation diversity and environmental drivers of fen vegetation of the area. 121 sample plots ($100m^2$) from mountain part and 55 plots from plain part were collected totally. Clusterization with Flexible Beta algorithm using varying beta value (β=-0.24, -0.4, -0.6, -0.8) was implemented. NMS ordination was performed for finding main ecological trends. To explain the gradient meaning we used environmental values by H. Ellenberg (1990), E. Landolt (2010). L. Ramensky (1956) and D. Tsyganov (1983). Multidimensional analyses were performed with using PC-ORD 6.18 software (McCune, Mefford, 2011). Seven types of fen vegetation (mainly along the gradient of Ph and mineral richness of soil and water) were designated by clusterization, six of them occur in mountain part, only three are from plains. Plainland fens have peripheral position on ordination diagram yet do not form separate cluster. Paeneplain fen vegetation is almost identical to one of mountain fen flood-coast fen types. Fens of West Siberian plain form separate type close to one described in West Siberia by (Lapshina, 2010). Plainland fen vegetation is less diverse, mineral rich fens and spring fen communities are not found here. Both mountain and plainland fen vegetation are driven by the factors of substrate chemistry (pH and mineral richness), substrate humidity, annual temperature and altitude. Plainland fen vegetation is also influenced by factor of geographical latitude (however no relation of geographical coordinate and climate factors was found here) and probably influence of flood alluvium.

Zupo T.

Oral presentation
Post-fire regeneration traits of plants in Cerrado
Session: Plant strategies and disturbance

Talita Zupo, Luis Felipe Daibes, Mariana N. Rissi & Alessandra Fidelis

Universidade Estadual Paulista, Departamento de Botanica
talita.zupo@gmail.com

Fire is a natural disturbance present in many ecosystems worldwide where plant species can persist by resprouting and/or recruiting from seeds. In order for a species to recruit from seeds, propagules must be able to persist after a fire event. Thus, the aim of our study was to determine the main regeneration traits: ability to resprout (R+) and propagule persistence (P+) of a Cerrado campo sujo (open savanna). We selected 38 species of different functional groups (graminoids, forbs and shrubs), belonging to the most common families found in the community (e.g. Fabaceae, Asteraceae, Lamiaceae, Velloziaceae, Cyperaceae and Poaceae). Ability to resprout of species was assessed after experimental fires in the area. Seeds of all species were collected and submitted to four different treatments: heat shocks of $100^{o}C$ 1 minute, $100^{o}C$ 3 minutes, $200^{o}C$ 1 minute and control (not exposed to high temperatures). Seeds were then put to germinate for 30 days after which seed viability was determined. One-way analysis of variance applied to randomization tests were carried out to evaluate differences in germination and viability percentage between treatments for each species. All species were able to resprout after fire. None of the species had seed germination stimulated by heat shocks, however propagules of all species persisted after being exposed to $100^{o}C$ for 1 and 3 minutes. Species could thus be considered facultative resprouters (R+P+, able to resprout and propagules persist). Nonetheless, when considering temperatures of $200^{o}C$, only 55% of the species could be considered facultative resprouters (R+P+) and 45% are obligate resprouters (R+P-, able to resprout but propagules do not persist). Since fire temperatures below soil surface typically reach <100ºC, if seeds are buried in the soil they can survive fire events. However, on soil surface, fire temperatures frequently reach $200^{o}C$ and could be fatal to propagules of at least half of the community. Resprouting is the dominant regeneration trait in Cerrado campo sujo, but most species can maintain their population after fire as propagules (facultative resprouters), which has an important implication for such communities as it promotes genetic variability.