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ABSTRACTS BOOK

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PLENARIES

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FRONTIER LANDSCAPE ECOLOGY AND THE CONQUEST OF TERRA AUSTRALIS

Abstract
European settlement of the great southern island continent, Terra Australis, triggered an ecological upheaval that has little parallel on any other continent. In two centuries there has been near complete destruction of some habitats, introduction of numerous animals and plants species, extinctions and range contractions of many vertebrates, particularly mammals in the arid zone, ecological collapse of river systems and the poisoning of the large areas of soil with dry-land salinity. The reasons for this dramatic environmental impact relate to the unusual evolutionary theatre presented by an isolated, ancient and tectonically stable chunk of Gondwana that had drifted into the arid mid-latitudes. This gave rise to a unique biota that Darwin aptly described as a 'second creation'. Throughout Australia, fossils and anomalous biogeographic patterns provide clues to the extraordinary evolutionary journey from Gondwanan rainforests to Australian flame forests and arid lands.

Tragically, the impacts of European settlement were magnified by the clash of two profoundly different cultures: Aboriginal hunter-gatherers who were steeped in sustainable ecological 'localism', and Europeans colonists at the leading edge of modern mercantile globalism. This cultural clash is well illustrated by the continuing incapacity of most settler Australians to appreciate the fundamental role of landscape burning in traditional Aborigines economies, a failure which has begot Australia's deadly serious fire management problems. While there can be no doubt the first people who colonised Australia in the late Pleistocene also caused significant ecological changes, it is nonsense to compare these impacts to the changes that have occurred since 1788.

Landscape ecologists have a vital role to play in a 'frontier' like Terra Australis because they can identify specific places where resource conflict is likely to occur. They provide a view of the 'pre-settlement' ecology of now-degraded areas that is vital to their ecological restoration and rehabilitation. Unlike other ecological sciences that can become befuddled by abstractions, landscape ecology is literally grounded by the gold standard of land. More fundamentally, the discipline provides an invaluable perspective to comprehend the relationship between humans and land, and help in the refinement of this story of evolutionary origins and ecological destiny. Such a narrative is of particular importance in moulding of a national identity of a people whose cultural roots typically lie elsewhere, and inspires new and sustainable ways of belonging to land. Should Australia fail to embrace the lessons and warnings from the discipline of landscape ecology and seriously apply it's tools to solve real problems, then the Terra Australis may come to be remember as Terra Horribilis. The failures of the south will be repeated in the north but given modern technologies they will be occur at a greater rate and magnitude and will be exaggerated by the extreme seasonal climate, extraordinary flammability, and fragility of a vast nutrient-poor landscape and vulnerable scattered resource rich patches

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BUILDING BRIDGES BETWEEN CULTURES, DISCIPLINES, AND APPROACHES: DEMYSTIFYING INTEGRATIVE LANDSCAPE RESEARCH

Abstract

Integrative approaches (= interdisciplinary and transdisciplinary) have gained increasing importance for landscape research. There exist many opinions and myths but few data on integrative processes and products. To counter this, we undertook a literature review, a web survey and qualitative interviews with project participants and funding agencies. We also contacted journals that publish landscape research for their perspectives on the subject. Results were often counterintuitive, contradicting commonly held views. Projects struggle with organisational problems and have difficulties achieving integration of knowledge cultures. Few projects reach an operational definition of interdisciplinarity. The majority of journals welcome papers from integrative research, but researchers perceive a difficulty in getting papers published. PhD students are often responsible for integration in projects as well as working on a disciplinary thesis. Most researchers had a positive attitude towards integrative research and would do it again. Integrative research increases contact between disciplines and insights into other knowledge cultures. We suggest thinking more clearly about what integration is, what is expected from it, and when it is more effective at solving landscape management problems.

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SPATIAL PLANNING WITH ECOLOGICAL NETWORKS: FROM SCIENCE TO SUSTAINABLE LANDSCAPES

Abstract
Landscape scientists aiming to promote sustainable landscapes should be able to tell landscape planners and stakeholders under what circumstance landscape patterns and land use are in balance with ecological processes. In this talk I first argue that, for developing multifunctional landscapes towards sustainability, the ecological network should be the backbone of the landscape structure. Then I show what kind of knowledge is needed for network planning, and discuss application in interactive planning. Finally, I argue that network planning for nature quality should be integrated with other functions that need large-scale landscape networks.

Ecological networks for sustainable development

Ecological networks are sets of similar ecotopes, scattered in the landscape matrix, which are linked by ecological processes and by that generate a better nature quality (e.g. the level of biodiversity). Such networks may also support other functions, for example recreation. The point is that the spatial characteristics of the network, on which biodiversity depends, are determined on a much larger spatial scale than many economically-driven decisions are: farming, housing development. Therefore, planning for landscape sustainability needs to start with regional structures like ecological networks. These structures may also be used for other functions.

Scientific knowledge for planning ecological network

A prime responsibility of scientists in planning and design processes is to offer a knowledge basis on which decisions leading to sustainable landscapes can be based. I observe a large gap between landscape ecological theory and the falsification of hypotheses on the one hand and applicable concepts and guidelines on the other hand. This is particularly so for the planning and design of multifunctional landscapes in which many stakeholders are involved. The main solution is that we transfer ecological knowledge into a form that fits the needs for planning and design. So, we must be able to tell how an ecological network should be shaped if it is meant to serve a specific function for nature. In other words, we must (1) integrate knowledge about ecological processes to a landscape level, (2) develop simple, but ecologically meaningful indicators for the spatial complexity of the network, and (3) define minimal threshold levels for those indicators.

For application in the complex multifunctional planning process, we must transfer all this knowledge into a flexible system that makes decisions explicit. It is not the ecologist who decides about the future landscape, and often nature conservation is not the dominant land use function, so the challenge is to support stakeholders to find, for the defined nature quality, the best network layout in a multifunctional context. The key to flexibility is a set of alternative design options that lead to the same goal, leaving space for stakeholders to decide the most preferable one.

From ecological to multifunctional networks

My final point is that landscape planning should evolve towards designing multifunctional networks. For functions with overlapping spatial requirements, a blue-green landscape network may be a powerful concept for landscape planning, since it unifies societal forces and all sorts of funds for the same spatial structure. Greenblue veining in the multifunctional farmland may be a carrier for nature, recreation, historic landscape values, and natural pest control. The challenge here is to develop and design guidelines for compatible combinations of functions, e.g. recreation and nature. For balancing conflicting interests, we also need indicators for network sustainability based on economic, societal and ecological sustainability.

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THE EVOLVING SCIENCE AND APPLICATION OF LANDSCAPE PATTERN ANALYSIS

Abstract
Landscapes contain complex spatial patterns that vary over time; quantifying these patterns and their dynamics is the purview of landscape pattern analysis. The science and application of landscape pattern analysis has undergone several significant transitions: (1) from metric development to metric understanding and synthesis; (2) from single- to multi-scale models of landscape patterns; (3) from anthropocentric to ecocentric representations of landscape patterns; (4) from static to dynamic models of landscape patterns; (5) from 'structural' to 'functional' measures of landscape patterns; (6) from categorical patch mosaics to continuous gradients of local landscape structure; and (7) from the 'science' of landscape pattern analysis to its application in conservation planning. While these seven transitions will continue to define the evolution of landscape pattern analysis over the next decade, there are two largely unexplored frontiers that I believe will define future developments: (1) relating the structure of continuous surface patterns to landscape ecological processes, and (2) quantifying the landscape structure of 3-dimensional environments (e.g., aquatic systems), where patches occupy volume instead of area. In summary, landscape pattern analysis continues to evolve to meet the challenges of an evolving discipline and offers exciting challenges and opportunities for the next generation of landscape ecologists.

ORAL PRESENTATIONS

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SPATIOTEMPORAL PATTERNS IN FORAGE PRODUCTION AND UTILIZATION ALONG DISTANCE FROM WATER GRADIENTS

Abstract
Large herbivores can impose spatial patterns on otherwise homogeneous vegetation, but how these patterns change through time is poorly understood. Domestic livestock pastures provide model systems for studying the evolution of coupled grazing and vegetation patterns. We sampled forage production and utilization by cattle along distance to water gradients to provide a "snapshot" of grazing and vegetation patterns, then tested the ability of simple simulation models to qualitatively reproduce these patterns. In the field, forage production increased with distance from water, as expected, but grazing intensity (utilization) peaked at intermediate distances from water. Simulations based on different foraging behaviors and different landscape configurations produced three mains results: 1) All simulations produced steep gradients in forage production and, after sufficient time, peaks in grazing intensity at intermediate distances. Distance from water gradients thus represent historical, but not necessarily contemporary, gradients in grazing intensity. 2) In simulated pastures with a point water source, different foraging behaviors produced similar patterns, while in pastures with a linear water source each behavior produced distinct patterns, demonstrating the potentially overwhelming influence of landscape configuration. 3) The simulations produced unrealistically abrupt thresholds in grazing and forage distribution, suggesting that factors besides resource distribution influence herbivore distributions.

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A COMPARISON OF TWO PERIODS OF EXCEPTIONAL FIRES IN CENTRAL AUSTRALIA: 1974-1977 AND 1999-2002

Abstract
This paper will compare the rainfall and fire patterns across the southern half of the NT during two periods of exceptional rainfall, 1974 to 1977 and 1999 to 2002; in contrast to the intervening 22 years. The periods of above-average rainfall contribute to a build-up of biomass and widespread fires. After the start of fire research in central Australia in the early 1980s, fire ecologists have been anticipating the inevitable return of a period of exceptional fires. Our knowledge of the fire regime over the past 3 years is the first spatially explicit fire record of such an event. Past fire history databases failed to adequately record the mid1970s fires due to the limited availability of satellite images. More than 500,000 km², or 70% of the arid region of Australia's Northern Territory was burnt between 1999 and 2002, including 13% that was burnt twice. Large areas of the arid regions of South Australia and Western Australia were also burnt. Awareness of the magnitude of this event by global fire community is very limited. Assessment of the significance of these fires to issues of biomass burning and carbon credits deserves attention.

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'CAN'T SEE FOR LOOKING': ROBUST AND SUSTAINABLE INDIGENOUS ECONOMIC FUTURES ON COUNTRY

Abstract
This paper begins with a case study of Indigenous landscape and natural resource management in western Arnhem Land by Kuninjku people. It reflects back on research undertaken with modern harvesters in relatively undegraded landscapes since 1979. Eastern Kuninjku people are committed to maintain a robust and sustainable customary economy, despite negligible state recognition and support and challenges from external threats, most recently the poisonous cane toad. The analysis provides some comparative data on harvesting activity in 1979–80 and 2002–03. It also alludes to these people's engagement with the market as the region's most prolific artists over the same time frame. An argument is made that there are powerful links between contemporary Kuninjku economic activity and landscape maintenance.

Moving from the particular to the regional, the paper analyses three historical issues:

1. changes in sustainability discourse over the last two decades, particularly in relation to harvesters in the tropical savanna;
2. changes in institutional settings, particularly in regional and wider Indigenous organisations and their articulations with harvesters; and
3. wider policy considerations, especially an inability of politicians and policy makers to comprehend ('can't see for looking') the significance of the customary sector of the economy.

The paper ends by considering options for facilitation of enhanced Indigenous economic futures on country predicated on wider public recognition of cultural difference, of economic choices and of biodiversity contributions—and the local, regional and national benefits of such enhancement.

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FACTORS INFLUENCING HOME-RANGE SIZE IN ELK (CERVUS ELAPHUS) IN NORTH AMERICAN LANDSCAPES

Abstract
The home-ranging behavior of individual animals underlies the spatial distribution of a population. We examine how population density (elk/km2), and the quantity and spatial heterogeneity of forage biomass and forest cover influence the seasonal home-range sizes of elk (Cervus elaphus) in four study landscapes: Yellowstone National Park, Wyoming, USA; eastern slope of the Canadian Rockies; Northern Wisconsin, USA; and Bancroft, Ontario, Canada. Environmental variables were analyzed at radii of 1000, 2000, 3000, and 4000m from the center of the home range of each animal. Results suggest that elk adjust their ranging behavior according to the availability of forage. For example, analysis of summer ranging in Northern Wisconsin indicates that at the 1000 and 2000m scales, home-range size was inversely related to forage biomass and mean patch size of productive patches. Forage biomass was a significant factor at all scales, but its influence was strongest at the 2000m scale. Home-range size was also inversely related to population density, and directly related to percent cover of forest. These findings suggest that elk ranging patterns are sensitive to factors that influence their ability to meet energy requirements (forage biomass), reduce intra-specific competition

(population density), and reduce predation risk (forest cover).

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'ECOPOLIS' NOW. A CASCADIAN CITISTATE… WITHIN THIS DECADE? FRESH IDEAS FOR AMERICA'S PACIFIC NORTHWEST

Abstact

Seattle and Vancouver are neighbors in the confined Puget Sound / Fraser Valley lowlands corridor of North America's Pacific Northwest. The region is growing and changing rapidly – so much that it's prized quality of life is threatened by urban sprawl that consumes farmland, open space and rural communities. Present response mechanisms, geared to preserving the status quo are reactive, fragmented and have limited success. A coalition led by major universities is exploring a dynamic solution that meets the challenge head-on. The Cascadia Pacific Delta3 project will investigate rational land-use strategy and the phased development of a unique, international metropolis. The project ultimately envisions Vancouver and Seattle anchoring a bi-polar, cross-border 'Citistate' region that is centered on a 'GreenHeart' of preferential space for productive farms and forests, nature, recreation and healthy rural communities. It reflects new realities already transforming the whole context for regional landscape planning. Implementation is well within the capacity of communities and institutions, given effective leadership and citizens inspired to embrace cultural alternatives; to think beyond horizons - act across boundaries. We describe progress; plans to overcome inertia, engage popular support and make the best of available science to fashion the future – a model for North America.

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CAUSES, PROCESSES AND CONSEQUENCES OF LAND USE AND LAND COVER CHANGE

Abstract
Land use and land cover are primary features of the landscape for any observer. Numerous actors influence the current changes; most of them are no scientists interested in the processes and causes. An internet search was used obtain an overview of the general context the concepts land use/cover occur. Although this is a crude approach, using only English terms and without any evaluation of quality and scientific significance, the preliminary results indicate some interesting associations and trends. The term "land use" occurs 13 times more than "land cover". Both are mainly associated with "development", "agriculture", "nature" and "population". However, "land use" refers also to "economy", while "land cover" more to "climate". Changes in land use/land cover are equally associated with "development", "climate" and "agriculture". "Land use" is almost exclusively used in domains dealing with the "rural" and "countryside". Both concepts frequently occur in landscape typology, evaluation and monitoring, and less in planning and landscaping. In landscape ecology and applications as land evaluation, "land cover" is relatively more frequent than in other disciplines and "land use/cover" are used more in combination. Relations between concepts differ a lot and indicate the need for better integration of theoretical frames in landscape science.

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SUSTAINABLE LANDSCAPES: CONTRADICTION, FICTION OR UTOPIA?

Abstract
Landscapes are the perceivable result of the interaction between natural processes and human actions. They are complex dynamical systems that evolve continuously and offer both a spatial frame and decorum for all living activities. Sustainable development implies a controlled (economic) growth, which includes landscape changes adapted to societal needs and seems contradictory to landscape constancy and conservation. Natural capital refers to the earth's natural resources that provide vital life-support services. It is too narrow to encompass all aspects of the landscape. Achieving sustainable landscapes is different when dealing with cultural or natural landscapes. This was experienced in three integrated landscape studies in Flanders were historical geographers, archaeologists and landscape ecologists were involved and confronted with different views of land use planners, nature conservationists, urban planners and cultural sociologists. In all cases the lack of consistent implementation of the aesthetical and heritage values in the actual applications using concepts of sustainability and natural capital as principles is stressed. Very often aesthetical landscape aspects are associated with wilderness, the sublime, the Arcadian countryside and the link to natural capital focuses upon ecosystems and productive rural areas. Here the utopian view of a sustainable landscape meets the ecological one.

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SPATIAL ANALYSIS AND LANDSCAPE ECOLOGY: A REVIEW

Abstract
Recently, GIS and other spatial analysis techniques have become increasingly important in landscape ecology. Many spatial analysis methods and landscape indices are now integrated into GIS and these have become almost basic tools applied by landscape ecologists worldwide. This paper will review both the theoretical basis for different spatial analysis and landscape indices in landscape ecology and provide a taxonomy of spatial analysis methods based on both data type (points, lines, polygons, rasters) and functions. This provides a framework within which to evaluate current methods and to identify opportunities for development and application of spatial analysis techniques in landscape ecological studies in the future.

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ASSESSMENT OF LANDSCAPE AESTHETICS BY QUANTIFYING PREFERENCE PREDICTORS AS A BASIS FOR LANDSCAPE PLANNING

Abstract
In densely populated, industrialised countries sustainable landscape development cannot be achieved without spatial planning. As an applied science, landscape ecology supports this overall objective by providing landscape ecological knowledge to landscape planning and management authorities. Activities to implement environmentally-sustainable strategies are often perceived as restrictions to private freedom and to be in conflict with economic growth. A promising approach to bring people and the environment closer together for the benefit of both, and to find broader acceptance for ecological measures,

is to link them with human aesthetic preferences. Environmental psychology provides the knowledge as to how spatial composition and configuration of landscape affect human landscape preferences. A combination of four informational factors has shown their significance to explain characteristics of preferred environments. To integrate these preference predictors as indicators for scenic quality into landscape assessment procedures, established landscape metrics and especially developed parameters are used for their quantification. This paper presents a regional-scale methodology to assess landscape aesthetics based on parameterised preference predictors using GIS and land cover data. The results enable the formulation of sound and spatial differentiated concepts to protect and enhance the scenic quality of the assessed region and thus the integration of ecological and aesthetic concerns.

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CARABID DIVERSITY IN AGRICULTURAL LANDSCAPES: EFFECTS OF SPATIAL HETEROGENEITY AND FARMING INTENSITY

Abstract
Agricultural intensification has led to a major loss of biodiversity. Semi-natural habitats have been removed, the arable mosaic has been homogenized and intensive farming practices have modified habitat quality. Few studies considered landscape and farming parameters to explain the response of biodiversity to agricultural intensification at the landscape scale. This study, which is part of the European project "Greenveins", aims at investigating respective impacts of spatial heterogeneity and farming intensity on carabid beetles at the landscape scale. The study is conducted in western France, in three 25 km² hedgerow network landscapes demonstrating a decreasing structural complexity and increasing agricultural intensity. Carabid beetles were sampled in various semi-natural habitats. Landscape structure was characterized by habitat diversity and matrix heterogeneity. Farming intensity was evaluated by interviews of farmers to characterize their farming systems. Our results show that the decrease in habitat diversity and the homogenisation of the agricultural mosaic induce a shift from forest to field species. Increasing use of pesticides associated to cereal cropping induces a drop in carabid beetle abundance independently of landscape structure. Both the design of suitable habitat at landscape scale and farming practices should be considered in Agri-environmental policies for the conservation of biodiversity in agricultural landscapes.

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GRADIENTS OF AGRICULTURAL LANDSCAPE PATTERNS ACROSS TEMPERATE EUROPE

Abstract
During the 20th century, agricultural intensification and the associated loss of semi-natural habitats – Greenveins - had a dramatic effect on biodiversity. To assess the impact of landscape structure and land-use intensity on biodiversity the European Union has commissioned the Greenveins project. We present analyses of the woodland and grassland Greenveins across sites in Western France, Belgium, The Netherlands, Switzerland, Germany, the Czech Republic and Estonia. Our aim is to explain species richness variability in relation to structural differences across agricultural landscapes of the European temperate climate zone. A range of landscape metrics (% greenveining,

fragmentation etc.) display large differences among study sites (25 sites of 4X4 km). For instance, the % of greenvening of these agricultural landscapes varies from 2 to 39%. Simulation of the potential utilisation of the different landscapes by species with different dispersal abilities and habitat size requirements further permit the characterisation of the sites. It gives heterogeneity a functional meaning and indicates threshold values for landscape metrics in terms of suitable habitat. The range of variability may be used for the future characterisation of other study sites to place them within this continental gradient and to define landscapes that are to be analysed for biodiversity.

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MAXIMISING THE NON MARKET BENEFITS OF CAP REFORM: A SPATIALLY TARGETED APPROACH USING GIS.

Abstract
The majority of England's most valued habitats have evolved from centuries of agricultural management of the natural environment. However, with the establishment of the Common Agricultural Policy (CAP), this relationship has undergone a dramatic transformation. The UK Government now acknowledges that our stock of 'natural capital' is being managed unsustainably and is considering CAP reforms to provide a more sustainable form of agriculture. Such reforms will be based on the recognition that there is an economic rationale for continued payments for the provision of Non-Market Benefits (NMBs) such as biodiversity, carbon sequestration, landscape and recreational benefits. A basic lower tier payment is proposed for general environmental practices, with higher tiers of payments being available for 'NMB generating' habitat maintenance and creation. In order to maximise the benefits of such habitat creation, some form of spatial targeting is required. This paper uses a suite of spatial criteria within a GIS to measure how the potential NMBs of woodland creation vary across an agricultural landscape. Such an approach enables the targeting of woodland creation to optimal areas in return for higher payments.

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CHANGING INTENSITY OF FARMLAND MANAGEMENT IN A CANDIDATE EU COUNTRY AND ITS EFFECTS ON BIODIVERSITY

Abstract
Agriculture is the main land use form in Hungary, more than half of the country is arable land. The political and economic changes of the last decade had, and the forthcoming joining to the EU will have drastic effects on agriculture. Both land abandonment and intensification threaten wildlife. As a pilot study of a European scale project on the effects of agri-environmental schemes, we compared bird communities of abandoned, extensively used and intensively used sites in two very distinct landscapes: vineyards and grasslands. In both landscapes the community structure parameters indicated impoverished bird communities in the intensively managed sites both with respect to diversity and density. Abandonment had small effects in vineyards. At the grassland sites the natural succession of vegetation resulted in an increase in species richness and density, but a decrease in grassland birds like the skylark. These results indicate that the introduction of the EU's agricultural policy to Hungary must be tailored very carefully for the benefit of wildlife.

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FOCAL SPECIES RESPONSE TO ENVIRONMENTAL COMPOSITION, LANDSCAPE CONNECTIVITY AND HABITAT STRUCTURE

Abstract
Effective wildlife conservation increasingly relies on focal species spatially explicit models to predict the effects of current management and to provide alternative scenarios. The aim of this study is to assess the effects of environmental and landscape patterns affecting forest focal species abundance in Northern Italy. Available spatial information are: (a) CORINE Land Cover data, and (b) our bird survey with more than 5000 point counts evenly distributed over about 25.000 square kilometers. As focal species we chose three interior bird species strictly linked to broadleaved forest and we related their abundance with: (1) the environmental mosaic composition evaluated using multi-scale spatially explicit models (variables measured in 500, 1000, 2500 and 5000 m radius plots centered in each point count); (2) the landscape connectivity; (3) the forest habitat structure. The model results outline the importance of environmental mosaic for the first three inner plots. Models also quantify the resistance met by focal species in colonizing suitable areas from source ones. Finally, structural habitat analysis specifies management guidelines for the canopy layer stratification, and the number and size of trees that should be maintained per hectare.

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THE INFLUENCE LANDSCAPE STRUCTURE AND HIGHWAY DESIGN ON WILDLIFE HIGHWAY CROSSING LOCATIONS

Abstract
Because of their extensive nature, highways effect and are in turn affected by entire landscapes. Therefore, to minimize their ecological impacts, they must be considered from a landscape, not simply a roadside perspective. I examined locations where wild animals cross highways to determine if they are correlated to identifiable characteristics of the surrounding landscape and/or the roadway itself. I recorded locations of roadside animal tracks with a GPS devise over a two-year period to determine where wild mammals were most likely to cross the highway at two Southern Rocky Mountain (USA) locations. I measured characteristics of crossing zones and random roadside locations for comparison, using digital data layers created from field measurements or remote photography. My results indicate that crossing zones are related to variables from both the landscape and highway itself. Important components of landscape structure were cover type composition, slope, and slope complexity. At the local scale, the most important features were location of and distance to roadside barriers, location of drainages, design of highway features that spanned drainages, and distance from the roadway to cover. My results provide an important point of reference for both wildlife and highway professionals who want to reduce wildlife/highway conflicts.

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LANDSCAPE AESTHETICS: AN EMERGENT COMPONENT IN MANAGING NATURAL CAPITAL

Abstract
Ecosystem and landscape management typically focus on physical factors (e.g., soil chemistry, rainfall, and landscape topography) and biological processes (e.g., biotic diversity [genetics, species, and habitat], primary productivity, stages of ecosystem development, and nutrient restoration). We argue that landscape aesthetics is of equal importance regarding the management of natural capital. Recently G. W. Barrett (Ecosystem Health, 2001, Volume 7:79-84) discussed the need for a unified and transdisciplinary science - termed integrative science - to address challenges and promote plans toward a sustainable future. Likewise, cultural factors, such as philosophy (e.g., perspectives of nature), need to be encompassed within this management process. Although members of each society uniquely recognize and engage "the beauty within nature," few appreciate how the field of aesthetics impacts resource management, determines policy, and provides protection regarding natural capital. We will outline aesthetics as an emergent component in bridging disciplines and in problem-solving approaches concerning sustainable ecosystems and landscapes.

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LANDSCAPE CHANGE ON THE TROPICAL FLOODPLAINS OF THE TRANS-FLY BIOREGION, SOUTHERN NEW GUINEA.

Abstract
Wasur National Park (Taman Nasional Wasur) and Tonda Wildlife Management Area (TWMA) are situated in the biologically rich Trans-Fly Bioregion of southern New Guinea. Of particular interest from a biodiversity perspective are extensive tracts of grassland, which are not represented elsewhere in Indonesia or Papua New Guinea.

The unique and extensive grasslands of Wasur and Tonda are at the centre of an alarmingly rapid landscape change. Woody vegetation encroachment is clearly evident when examining historical aerial photography from the 1940s in comparison with recent satellite imagery. The dominant woody species invading the grasslands is Melaleuca sp. A significant reduction in the swamp reed Phragmites karka has also been observed. The primary disturbance agent in the wetlands is believed to be the introduced Rusa Deer (Cervus timorensis).

A combination of feral animal impacts and fire in conjunction with the drying out of swamp habitats is leading to a demise in the area of grassland, which will ultimately result in a reduction in the region's biodiversity. This paper presents a conceptual model that illustrates a combination of disturbance agents that may be contributing to the conversion of the grasslands into forests.

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LANDSCAPE DIAGNOSIS IN DIFFERENT SPACE AND TIME SCALES - A LANDSCAPE PLANNING CHALLENGE

Abstract
Landscape diagnosis includes several steps of landscape analysis and evaluation, and it is the key to bridge scientific knowledge and socio-economic issues to be up to the

demands of landscape planning. To cope with this so-called transformation problem, the assessment of landscape functions at different space and time scales has turned out to be a useful tool. Landscape functions can be assessed in different space and time scales. As reference units, various landscape classification systems can be applied, e.g. grids, lowest common geometries, geochores, biochores, landscape units. From the huge amount of approaches developed to assess landscape functions, examples both from Saxony (Germany) and the Czech Republic are presented and discussed, focussing on several landscape functions like groundwater regulation, regulation of water retention and nitrate leaching, agricultural yield function, but also on landscape aesthetic values and landscape character. Regarding the time aspect, both structural (e.g. land use, vegetation cover) and functional aspects (landscape functions) have to be studied. The results obtained from assessing landscape functions can be adapted to the each tasks and levels of landscape planning (e.g. for land consolidation, designing ecological networks, E.I.A.).

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HEDGEROWS AT A CROSSROAD - CONTEMPORARY PATTERNS AND CHALLENGES FOR FUTURE FUNCTIONS

Abstract
Hedgerows have played a significant role in the landscapes of Brittany, France and Jutland, Denmark for more than a century. The history of hedges in the two regions is briefly outlined. The policy objectives and practical planting policy have been very different in the two regions leading to different types of landscapes. Some of the functions of hedges are in common for the two regions (e.g. land demarcation, wildlife habitats) whereas other functions are very different (firewood, windbreaks). Hedges are a truly multifunctional element of the landscapes. However, the hedges of both regions are facing a shift in social expectations and roles in farms in the contemporary agricultural landscapes challenging both the planning policies and the practical planting and maintenance of hedges. We discuss these new challenges, such as production versus stewardship/conservation, uniformity versus diversity and the ecological effects of integration of hedges in field management and vice versa. The hedge function should be interpreted at different scales - collective plantings ensure efficient windbreaks at the landscape scale, whereas individual plantings have the potential to ensure larger structural and biological diversity of the hedge landscape. The intensification of the agricultural production challenges research and management of hedges in future multifunctional landscapes.

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THE USE OF GIS, GEOSTATISTICS, AND MULTILEVEL MODELLING FOR BIODIVERSITY ACTION PLANNING

Abstract
With limited resources available to protect threatened ecosystems, a spatially-explicit targeting approach to determine the most suitable sites is desirable. This research developed a multi-species targeting approach for threatened bird species associated with rare grasslands. Areas were identified for inclusion in habitat management

prescriptions under the Upper Thames Tributaries Environmentally Sensitive Area scheme (27,000 hectares), Oxfordshire, UK. Suitable habitat areas for each bird species were identified through the development of two predictive models: an environmental model developed using multilevel regression, and a geostatistical model developed using indicator kriging. The two models were combined using Bayesian decision rules to produce a refined map of habitat suitability within a Geographical Information System. Probability threshold values, symptomatic of sites of highest habitat suitability, were chosen in relation to national habitat creation targets. An area (1.56 ha) was identified shared by all eight target species, and as such should have the highest priority for future conservation initiatives. Further species assemblages were also investigated, and the approach effectively identified land parcels that potentially met the species requirements of these assemblages. If applied to other agri-environment schemes this targeting approach could make conservation effort more effective and reliable at both the regional and national scale.

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PREDICTING MAGPIE GOOSE *Anseranas semipalmata* NEST DISTRIBUTION FROM BROAD SCALE WETLAND FEATURES

Abstract
The unique Magpie Goose Anseranas semipalmata is abundant in tropical floodplain environments of the Northern Territory, despite having been displaced from much of its historical range in temperate Australia. For effective conservation of this species, which depends on habitats that are increasingly used for intensive grazing, improved understanding of factors influencing selection of nesting sites is critical. We combined several measures of wetland features thought likely to influence quality of nest sites, including vegetation type and hydrology, to frame a deductive model for predicting nesting habitat suitability at large spatial scales. Using Geographical Information System techniques, we applied the model to produce maps of variation in putative habitat quality. Predictions were reasonably congruent with observations of spatial variation in nest density, but returned substantial numbers of false positives (nesting absent from apparently high quality sites). We discuss the reasons for this result, implications for conservation management, and propose enhancements of the model to increase its utility for management.

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POLICY, POLICY EVERYWHERE BUT NOT A DROP OF SCIENCE? NATIVE VEGETATION PLANNING IN NEW SOUTH WALES

Abstract
In New South Wales, regional groups (Regional Vegetation Committees, Catchment Management Boards) have been given the task of reconciling objectives for agricultural production, social and economic outcomes, and biodiversity conservation. A plethora of policy proposals are being debated to help guide this process including target based schemes, offsetting (mitigation) schemes and market-based approaches. Despite being intended to address sustainability and conservation these proposals typically have little or no scientific content beyond reference to broad generalisations (e.g. possible critical thresholds of habitat loss). In this paper, we investigate one such policy proposal, an offsets scheme in which vegetation clearing must be offset by the setting aside or

revegetation of other sites. We use a spatially explicit model to simulate the operation of such a scheme in a large band of the New South Wales sheep-wheat belt. The consequences of alternative ways in which the scheme might be applied, and problems such as non-compliance, revegetation failure etc. are quantified using a multi-species conservation index.

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MAJOR RIVERS AS PATHWAYS FOR FAUNAL DISTRIBUTION: THE MURRAY RIVER AND ITS AVIFAUNA IN SOUTHEAST AUSTRALIA

Abstract
In regional land mosaics, riparian vegetation along major river systems potentially functions as a pathway for faunal distribution. We studied the role of the Murray River, south-eastern Australia, in facilitating the expansion of temperate forest-adapted birds into semi-arid environments. The avifauna was censused over two years at six locations along the Murray River, on a 480 km gradient from temperate to semi-arid environments. At each location, a site in riparian River Red Gum forest and in non-riparian vegetation was sampled seasonally. The riparian avifauna differed significantly from that in adjacent vegetation and supported a distinctive suite of species. The similarity in the avifauna between locations along the gradient decreased with increasing separation, but this change was less for sites in the riparian corridor than in adjacent vegetation. There was a progressive reduction in the occurrence of forest-adapted birds along the gradient, but the distribution of at least 21% of these species (10 of 48) extended further into dry environments along the riparian zone than in adjacent vegetation. The Murray River greatly enhances regional biodiversity and facilitates species' expansion into drier environments, but increasingly it is vulnerable to anthropogenic pressures, and the loss of habitat quality and continuity.

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BEYOND PATTERNS: TOOLS TO BALANCE PRODUCTION AND ENVIRONMENTAL GOALS ON PRIVATE LANDS

Abstract
Creating functional agroecosystems requires balancing and integrating production goals with environmental protection. To achieve these multiple goals, the National Agroforestry Center (NAC) has developed an ecological planning and design process that integrates regional, landscape, and site-scale concerns through a question-driven framework that relies on GIS assessments as a foundation. NAC has also developed several design tools to support the planning process including an economic analysis tool, visual simulations, a plant selection database, and the Conservation Planning Guide, which synthesizes agroecosystem research into illustrated design principles. To ensure scientific validity and user utility, our applications are subjected to an extensive review process and are evaluated through stakeholder use in several case study sites. The result is a process and set of tools that balance issues of scientific certainty with the need to make efficient decisions. The Nebraska City watershed, a 10,600 ha catchment facing issues from water quality and, biodiversity to economic development demonstrates use of our process and tools. Riparian connectivity, agroforestry, and other assessments illustrate how these rural and urban concerns are addressed simultaneously. Through implementation and evaluation, this process allows agroecosystem schemes to serve as real world experiments for landscape ecology, encouraging refinement of future

strategies.

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GOAL ORIENTED SET ASIDE OF ARABLE LAND FOR PROVIDING PRIORITY SPOTS OF NATURE CONSERVATION

Abstract
The present agricultural policy of the European Community forces farmers to set aside at least 10% of their arable land. Parts of this land can be used for providing specific areas for satisfying habitat demands. Areas of fields that are more or less extreme from the point of abiotic site parameters (sandy, steep, wet) as well as stripes along non-agricultural biotopes (ponds, woods) are selected. Combined with specific nature goal oriented management schemes these areas can be developed to priority spots for nature conservation. Results of investigations of more than 115 nature conservations spots in north-east Germany, which had been conducted from 1999-2002, show their high efficiency for protecting biodiversity. More than 450 species of wild flowers, including highly endangered herbs were investigated. Wood edges with stripes of set aside are habitat for a typical association of bird species (e.g. Lanius collurio and Emberizia citrinella), which need a close contact of nest stands and feeding areas. Lepus europaeus and Perdix perdix breed, rest and feed there regularly. Amphibians as Hyla arborea use the stripes for feeding and sunbathing. Set aside stripes along water bodies provide habitat areas for amphibians (e.g. Bombina bombina, which are typical species for pond rich agricultural landscapes. An obligation for establishing of "nature conservation set aside" is recommended to the agro-environmental policy.

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RESEARCH INITIATIVES FOR THE DEVELOPMENT OF SPATIAL INDICATORS FOR NATURE PROTECTION IN EUROPE

Abstract
In order to protect its biodiversity, the European Union is currently establishing the Natura-2000 network, composed of protected sites selected to cover the habitat and species diversity of the Un-ion. In order to prepare management and reporting tools, different research initiatives have been initiated. Among these, the project EON2000+ (Earth Observation for Natura-2000 plus), co-funded by the European Commission, aims at developing harmonized databases and spatial indicators using Earth observation and geographic information data. We will illustrate the outcomes of such project on one of the EON2000+ test-sites, the National Park of Mercantour, a French Alpine park close to the Mediterranean. The first activity specifies the needs of the Park managers to report on the state, the dynamics and pressures on the Park and on this basis define relevant databases and indicators. The second activity concerns the mapping of the vegetation and more particularly the grasslands of the park at 1/25 000 scale. The method combines information on vegetation physiognomy derived from Earth observation data to map broad grassland types, that are further refined using ecological rules and GIS data. The third activity concentrates on change detection of land cover changes using multitemporal EO data to provide insight into regional landscape dynamics.

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SUSTAINABLE LANDSCAPES, NATURAL CAPITAL AND GEOINFORMATION: SPATIAL CONFIGURATION MATTERS!

Abstract
The paradigm of natural capital suggested by Haines-Young implies the integration of economic, environmental and social-cultural qualities in a physical setting. It is somehow revolutionary in landscape ecology since it challenges the widely accepted patch-matrix concept. An important question is: can spatial arrangement of land use types add specific qualities beyond statistical measures of their existence? For instance, can a landscape be sustainable, as long as 20 percent of the land use is extensive, 10 percent is protection area etc., no matter WHERE the respective patches are, which typical size and shape they have, how connected patches are and how often land use types are adjacent? The matrix of land use types provides the key to understanding land use systems and land use changes. I will demonstrate several examples that structural indicators can play a significant role to analyze the status of a land use pattern and their dynamics. Many problems with landscape metrics and various biases still remain. Only recently, sound methodologies are developed to utilize metrics in spatial indicators. I will demonstrate that statistical figures of land use types do not provide a comprehensive description of the status quo and the change of a landscape and I will encompass shape, context, connectivity, connectedness, adjacency or isolation of patches.

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HIERARCHICAL LANDSCAPE CLASSIFICATION: THE VEGETATION MAP OF ITALY

Abstract
The Italian Ministry of the Environment requested the development of a 1:250,000 map of the actual and potential natural vegetation of Italy. A hierarchical land classification of the whole country was therefore developed as a tool to locate and delimit potential vegetation units. Land classification, through the integration of litho-morphological and phytoclimatical GIS layers, generated a 1:250,000 map of land units. Potential and actual vegetation types (referred to phytosociological series) were then assigned to land units. Therefore, the Vegetation Map of Italy is the result of the integration of two processes: land units are obtained through a hierarchical land classification, whereas their vegetation series are assigned through the expert knowledge of the relationships between actual vegetation types, environmental factors and vegetation dynamics. The Vegetation Map, with more than 150 vegetation series, reflects the high landscape heterogeneity of Italy. The application of the proposed model proved very effective for identifying and mapping vegetation series. The knowledge of potential vegetation and vegetation dynamics is essential for landscape planning at different scales, e.g. it could help identify areas to be surveyed under implementation of the EU Habitat Directive.

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NATURAL RESOURCE MANAGEMENT SCHEMES IN EAST-AFRICA: A HUMAN-ECOLOGICAL CASE STUDY

Abstract
Farmers are managers of agro-ecosystem biodiversity and active creators of cultural

landscapes. A successful (= sustainable) management of natural resources is a prerequisite for poverty reduction, food security and natural heritage conservation - all of which are pressing targets which need to be pursued by global society in the 21st century.

What kind of successful schemes are available? What are the causes of variations (which 'success indicators' can be identified)? And what impact do successful schemes have on the natural, socio-cultural and economic environment? These research questions have been investigated by looking at 18 successful smallholder farms located in three project areas through applying a multi-method approach with a main focus on participant observation.

The study has revealed that agri-environmental schemes vary as to the degree of sustainability due to the involvement of a wide range of different interconnected factors. Furthermore, various positive trickle-down effects resulting from the farmer's activities have been assessed.

One way to come closer to the aim of a sustainable management of landscapes and their resources is to incorporate innovative female and male farmers into projects through e.g. gender training, workshops, seminars, etc., thus enabling them to act as environmental agents and knowledge disseminators.

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SPATIAL PROCESSES IN LANDSCAPE TRANSFORMATION: DEFINITION, CLASSIFICATION, AND DETECTION

Abstract
The conversion of landscapes by human activities results in widespread changes in landscape spatial structure. Regardless of the type of land conversion, there appears to be a limited number of common spatial configurations that result from such land transformation processes. Some of these configurations are considered optimal or more desirable than others. Based on pattern geometry, we define nine processes responsible for pattern change: `attrition', `creation', `deformation', `dissection', `enlargement', `fragmentation', `perforation', `shift', and `shrinkage'. A novelty is the inclusion of transformation processes causing expansion of the land cover of interest. A decision tree algorithm that enables detection of these processes is proposed, based on three parameters that have to be determined before and after the transformation of the landscape: land cover area, perimeter length, and number of patches. As an example, the decision tree algorithm is applied to determine the transformation processes of three divergent land cover change scenarios: deciduous woodland degradation in Cadiz Township (Wisconsin, USA) 1831-1950, canopy gap formation in a terra firme rain forest at the Tiputini Biodiversity Station (Amazonian Ecuador) 1997-1998, and forest regrowth in Petersham Township (Massachusetts, USA) 1830-1985. The examples signal the importance of the temporal resolution of the data, since long-term pattern conversions can be subdivided in stadia in which particular pattern components are altered by specific transformation processes.

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SELF-ORGANIZATION AND COMPLEXITY IN HISTORICAL LANDSCAPE PATTERNS

Abstract
Self-organization describes the development of complex structures emerging spontaneously from internal variations of a system. Self-organization to the critical state is manifested by scale-free behavior across orders of magnitude. Spatial scale-free behavior implies fractal properties and is quantified by fractal dimensions. Temporal scale-free behavior is evident in power spectra of fluctuations obeying power laws. Self-organized criticality is a general phenomenon that likely produces some of the fractals and power laws observed in nature.
A two-dimensional cellular automaton model with one adjustable parameter was applied to investigate the historical landscape of southern Wisconsin (60,000 km2), USA, for self-organization and complexity. The data was derived from the US General Land Office Surveys, conducted during the 19th century prior to Euro-American settlement. The landscape was patterned into prairies, savannas, and forests.
Model evolution replaces a cell that dies at random times by a cell chosen randomly within a circular radius 1<r>10. Cluster probability measures the degree of organization. The model landscape self-organizes with neighborhoods of intermediate size (r=3). Comparisons between simulated and observed landscape using fractal dimension (spatial), cluster probability (temporal), algorithmic complexity (GIF-file size), and patch statistics (landscape metrics) show good agreement and are robust towards perturbations. The simple model thus suffices to replicate the landscape patterns resulting from complex spatial and temporal interactions.

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FACING THE CHALLENGE OF SUSTAINABLE SYSTEMS PLANNING. A CASE APPLICATION IN A MEDITERRANEAN CULTURAL LANDSCAPE.

Abstract
Effective tools are required to implement sustainable principles into land planning. However we recognize that there is a significant gap between science, planning, decision-making, and the public's role in general in the planning process. Additionally, it is crucial to acknowledge the multiple dimensions of sustainability: ecological, social, economical, etc. We argue for the integration of natural and social sciences with humanities under transdisciplinary studies. We adopted landscape ecology as the theoretical "pivot" to develop a planning toolbox, under a unified framework for sustainable land planning (SLP). A selected set of core landscape metrics provide quantitative tools that are fundamental to the transdisciplinary integration. The PROBIO project, Natural Park of Sintra-Cascais, in Portugal provides a case application. Public participation through SWOT analysis and collaborative design were important to understand the cultural dimension and its interface with natural processes, and to promote social sustainability of the planning process. Landscape history and landscape temporal dynamics were useful to identify key ecological and socio-economic processes as the driving forces of landscape change, i.e. contemporary urbanization from the capital Lisbon, and to learn with the past to envision the future. Alternative scenarios were generated through public participation and compared and tested with landscape metrics.

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FIRE REGIMES AND FIRE MANAGEMENT: TOWARD A CONCEPTUAL UNDERSTANDING OF LANDSCAPE-LEVEL RESPONSES

Abstract
Sustainable fire management seeks to protect humans and their assets and conserve

biodiversity. In each case, this involves the evaluation and quantification of risk posed by adverse fire regimes. Ideally, an informed choice between different management options should be based on an understanding of effects on these risks. Such insights are dependent on a fulsome understanding of the sensitivity of landscape-level fire regimes to an array of anthropogenic, biotic and abiotic influences. Current debate in much of temperate Australia concerning appropriate landscape fire management is highly polarised and contentious, reflecting a lack of coherent concepts concerning landscape-level properties of fire regimes. An overview of landscape fire regime properties is presented using Australian examples to illustrate the predominant influence of weather in structuring fire regimes. Evidence from spatial modelling is then used to demonstrate that multiple pathways of change in fire regimes occur in response to changes in ignition rate/weather interactions (i.e. management inputs). The primary management trade-off involves a reduction in area burned under the influence extreme weather conditions at the expense of a reduction in the average inter-fire interval experienced in the landscape. Such a conclusion provides a generic basis for risk assessment in relation to land management objectives.

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INVESTIGATING THE ECOLOGICAL STRUCTURE OF URBAN LANDSCAPES - METHODS AND RESULTS OF GERMAN URBAN ECOLOGICAL RESEARCH.

Abstract
The author will evaluate the theory of urban landscapes and present own results in structuring the urban landscape on examples of German cities in different scales and compare this with other European examples.
Urban ecology in Europe could contribute already in the 1970th to solve the question of spatial distribution of investigated ecological phenomena. It could be showed that there were connections and regularities between single species, plant communities, urban soil conditions, urban climate et cetera and the urban form and inner structure. It was recognized that human impact as land use and land cover are the most important factors influencing the conditions of urban habitats. This lead to the hypothesis of determination of the urban ecological conditions by land use influences and to the theory of urban ecological units and to modelling the urban ecosystem and allows the comparison of different cities in the same "cultural and natural sphere".
This model has been used in an excellent procedure of urban biotope mapping for more than hundred German cities and towns. Urban ecological units in different scales of investigation can be a useful tool not only to describe the existing ecological condition of an area but also to connect the scientific results to planning, environmental quality targets and to modern technical methods in analysing the ecological conditions of a whole city or urban landscape.
The development of methods for investigating and to describe the urban ecological structure will be explained. The used methods will be showed and explained on concrete examples of German cities and it will be explained how modern technical methods as remote sensing and Geographical Information Systems can be linked with the analysis.

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ASSESSING CONNECTIVITY USING GENETIC MARKERS IN THE AMERICAN MARTEN

Abstract
The connectivity of resources patches is critical to population dynamics. At the landscape scale, the connectivity is defined as the interaction between the structure of a landscape and the movement of individuals. Empirical studies have been conducted to estimate landscape connectivity, but they are limited by the difficulty of directly measuring animal movement at the landscape scale. Here we used an estimate of gene flow occurring in a given landscape as an indirect measure of animal movement. This study was conducted on the American marten (Martes americana) in a harvested boreal forest in Ontario (Canada). Our goal was to establish the effect of habitat structure on functional connectivity. In that aim, ten microsatellite loci were used to study the genetic structure of marten populations in a managed forest, and several indices of habitat connectivity were computed using a GIS data base. The connectivity of this landscape for M. americana was then represented by the relationship between structural indices and the level of gene flow observed. The use of genetic parameters allows to exclude non-successful movement of individuals from analyses and to compute a measure of connectivity at a large time-scale.

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LAND-SCOPING A FUTURE: LANDSCAPE ECOLOGY IN POLICY AND INSTITUTIONAL TRANSITIONS

Abstract
We know there is connectivity in nature as well as flexibility that might provide resilience over various temporal scales. This is also true of social systems (taken here to include politics, economics and other formal and informal institutions), yet they are difficult to change. Society and the environment are complex inter-twined systems. Both are now faltering. This paper will draw on some research examples in discussing three critical factors. These are: 1) policy history; 2) property rights, ecosystem context and cross-boundary NRM; and 3) nested scaling of combined social and ecological functions of landscapes. With the maturing of the discipline of landscape ecology comes a timely shift towards more seam-less research into linked social-ecological landscape mosaics. There is a need for greater understanding of these complex systems in local, national and international assessments. Practical applications might then be derived to facilitate political and other institutional transitions, from local to global levels, and to examine pathways towards more sustainable futures.

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SPATIAL OPTIMISATION FOR INTEGRATED LANDSCAPE RESTORATION

Abstract
Practical restoration efforts in fragmented agricultural landscapes have varying and often multiple goals. Integrated landscape restoration aims to set geographic priorities for the restoration of more natural communities in the landscape with multiple goals in mind – conservation, erosion, salinity etc. In this paper I build a preliminary mathematical integer programming (MIP) model of integrated landscape restoration of the Mt. Lofty Ranges of South Australia. The model selects the spatial arrangement of sites for revegetation that maximises the value of a given restoration effort in terms of the ecological benefit, and the effect on salinity and erosion mitigation. Certain constraints are also placed on the model such that a minimum area and/or proportion of each environment type must be

restored, and salinity and erosion criteria are met. By combining Geographic Information Systems (GIS) with MIP, spatially explicit priorities may be set for the type and location of habitat to be restored for the benefit of the natural biodiversity within a physical environmental, economic and social context.

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VULNERABILITY OF BIODIVERSITY IN THE AGRICULTURAL LANDSCAPES OF WESTERN EUROPE: THE EU PROJECT "GREENVEINS"

Abstract
More than 50% of the surface area of the temperate zone of Western Europe consists of agricultural landscapes. These landscapes consequently have a large impact on biodiversity. To facilitate the incorporation of biodiversity preservation in agricultural policies, an assessment method for the effects of changes affecting it is needed. In the GREENVEINS (EU, 5th framework) project, research institutes from Belgium, Germany, Switzerland, Estonia, France, the Czech republic and the Netherlands therefore co-operate in investigating the relationship between Land Use Intensity, amount and structure of "Green Veining" and biodiversity in the agricultural landscape. The main aim of the project is to identify a possible vulnerability zone, where a small deterioration of conditions would cause a large collapse of biodiversity.
Results of the project will be most useful if they are translated into practical tools or guidelines for protection, conservation or reconstruction of biodiversity. Stakeholders will therefore be involved in interpretation of results, to ensure their general applicability and use. The project has started in 2001 and fieldwork is about completed. First results will be shown. The presentation will focus on the integration of results from different assessment levels and sources and possible application on different scale levels.

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ASSESSMENT OF LAND COVER CHANGES AND HYDROLOGIC RESPONSE IN TAMNE RIVER BASIN IN GHANA, WEST AFRICA

Abstract
The Tamne river basin is located in northeastern Ghana where adverse climatic conditions, e.g., long dry season and land degradation had caused farmers to extend their agricultural activities into marginal lands, particularly the flood plains. This presentation discusses the flooding scenarios and efforts to assess the nature of land degradation in the Tamne river basin through integration of the remote sensing and geographic information systems (GIS). Inter-annual variations in rainfall and stream flow were assessed with statistical hypothesis testing. The Gumble Extreme Value distribution was used to estimate the peak flood flow for selected return periods, while field interviews provided first hand information on farming systems in the river basin. The results suggest that there were no significant changes in the inter-annual variation in rainfall and hydrologic response in the river basin. Although less than one percent of the land cover area of the basin changed during the study period, the distribution of land cover changes were found to confirm the assertion that farming systems were the primary causes of land degradation in northeastern Ghana. This study also highlights the problems associated with incomplete and often outdated environmental information and their impacts on integrating remote sensing, GIS, and hydrological analyses.

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HABITAT QUALITY AND CONNECTIVITY IN AGRICULTURAL LANDSCAPES: THE ROLE OF LAND USE SYSTEMS AT VARIOUS SCALES IN SPACE AND

Abstract
Agricultural landscapes are characterized by a mosaic of crops that change from year to year. This rapid dynamics of the "matrix" is rarely taken into account by models of habitat quality or connectivity that mostly focus on long lasting landscape elements. Nevertheless, the shifting crop mosaic plays a major role both in terms of interactions with "perennial elements", that affect their quality (pesticide drift etc.) and as temporary suitable elements to traverse landscapes. This key issue is barely addressed, even when "matrix matters" though it has important potential both in understanding landscape scale mechanisms and providing information for land managers.
Specifically, a model of landscape structure as being time dependent can be constructed. It would permit a multiple scale approach to 1) study connectivity with differences in rate of behavior between landscape and species, and 2) better understand the interactions between ecological and land use systems.

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METROPOLITAN DELTA LANDSCAPES: COMPLEXITY AND CONTRADICTION THAT DEMAND TRANSDISCIPLINARITY

Abstract
Metropolitan delta landscapes are complex landscapes shaped by natural and anthropogenic forces and processes. They are located at the meeting points of land and sea, of fresh and saline water, marine and terrestrial ecosystems as well as human and natural systems. These landscapes are also influenced by upstream and overseas activities and cultures. They are the first sites for intended and unintended migration of humans and organisms. Local, regional, national and global policies and processes regarding economy, planning, culture and the environment, impact them. Established mechanisms to deal with urban areas are hardly capable of dealing with natural resources. Existing mechanisms to manage natural resources have difficulties to mange them on their on, and are not capable to deal with them when combined with urban and human aspects. Therefore, the complexity in resources and processes that characterized metropolitan delta landscapes demands the establishment of a network of bridges among forces and authorities that are not usually mashed together. The understanding of the complex interconnections and impacts becomes a major task in the management of these landscapes that existing mechanisms are hardly capable of. The need to establish new transdisciplinary mechanisms and authorities that can deal with the complexity of metropolitan delta landscapes as well as some of the expected and needed characteristics of these mechanisms will be discussed.

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SUSTAINABLE WINE PRODUCTION THROUGH ECOLOGICAL

MODERNISATION AND LANDSCAPE MANAGEMENT

Abstract
Arguably, the economic prosperity of the Australian wine industry depends on the clean-and-green image of the Australian landscape. In 1995 the Yalumba Wine Company instigated an action research programme to determine whether its corporate beliefs, values and attitudes have the propensity to be translated into a land ethic that respects and understands the integrity of the landscape on which its wine brands depend. Socio-anthropological techniques were used to analyse and describe the salient features of Yalumba's organisational ethos. A mensurative experiment was also established to assess the suitability of a suite of environmental parameters as indicators of the impact that corporate culture and behaviour was having on the landscape. The research demonstrated that Yalumba had reached a stage of corporate maturity that allowed it to develop a land stewardship ethic based on environmental quality as well as social equity and economic prosperity. Individually, all the monitoring techniques were found to be deficient in some aspect. Collectively they complemented each other and contributed to the interpretation of biodiversity and soil health indices collected from the monitoring quadrats. The action research set Yalumba on the strategic path of ecological modernisation. This ecosystem approach to winemaking and grape growing is contributing to the eco-redesign of a comprehensive brand image that reflects Yalumba's commitment to a sustainable production landscape.

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THE MULTI-DISCIPLINARY EVALUATION OF AGRI-ENVIRONMENT SCHEMES: THE ECOLOGISTS' PERSPECTIVE

Abstract
There is no doubt that agri-environment schemes should be evaluated against their objectives. When a scheme has multiple objectives covering different disciplines careful consideration is required to provide a balanced evaluation. A multi-disciplinary team identified five main criteria (agreement negotiation; appropriateness; environmental effectiveness; compliance by farmer; and side effects) that could be assessed to determine whether agreements with individual farmers met the objectives of two English schemes to maintain or enhance: wildlife; landscape; landscape history; and public access. Performance of agreements against the five criteria was assessed by answering a set of 24 questions. This required a panel of experts (ecologist, landscape architect, landscape historian, socio-economist specialising in rural issues and a Chair) to assimilate information from ecological, landscape, and historical surveys, farmer interviews and a desk study of the contents of agreement files held by government regional offices. The panel discussed their answers to the questions and each agreement was then given a score for each of the five criteria. The overall additionality provided by each agreement was then determined. The appraisal of 650 agreements showed that overall the schemes are providing additionality but preventing the few bad agreements would improve the schemes greatly. This multi-discipliary method was successful.

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ECOSYSTEMS AS INTANGIBLE SYSTEMS AND LANDSCAPES AS TANGIBLE SYSTEMS: LAND MANAGEMENT IMPLICATIONS

Abstract

Two central concepts in ecology, the concept of ecosystem and the concept of landscape, are presented as distinct paradigms that affect ones view of the world. Ecosystems are intangible systems with vaguely defined borders. Landscapes are the three-dimensional functional and spatial matrix for all organisms, including humans. As such, they fit better to serve as the conceptual basis upon land planning and management is built. They should be studied, managed, planned and evaluated with a transdisciplinary and biperspectivable systems view, treating them simultaneously as material, natural entities and as mental, cognitive entities. Landscapes become thereby the tangible bridge between mind and nature. Examples from ecological research and conservation practices in Israel show the advantage of such a holistic landscape-ecological approach, linking between the natural and social sciences, the humanities and arts.

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NITROGEN DEPOSITION AND MINERALIZATION IN FORESTS ALONG URBAN-RURAL GRADIENTS IN TWO CITIES

Abstract
Making inter-city comparisons of the direction and magnitude of variation in anthropogenic factors that control ecosystem processes can help determine which trends most cities share. Establishing such trends will help predict how remnant natural communities may respond to urban development. An urban-rural gradient approach was used to establish that greater atmospheric nitrogen (N) deposition and greater soil N production occurred in urban oak forests in New York City (population 8 million) compared to rural counterparts. Another urban-rural gradient of oak forests was established in Louisville, Kentucky USA (population 700,000) to determine whether these patterns existed in a smaller city. Similar to trends in New York, net throughfall flux of inorganic N to oak canopies was five times greater in urban than in rural forests from May-October 2002 (7.0 vs. 1.4 mmol N m-2). However, unlike New York, soil N mineralization rates were not highest in the urban forests over a similar period (14% less than rural). This unexpected result suggests that some factors controlling N-mineralization may counteract the expected stimulatory effects on this process of urban heat islands and of greater ammonium deposition. Urban forests may therefore receive proportionately more N from exogenous anthropogenic sources than do nearby rural forests.

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COMPARISON OF SENSITIVITY OF LANDSCAPE-FIRE-SUCCESSION MODELS TO TERRAIN, FUEL PATTERN AND CLIMATE

Abstract
The sensitivity of the number and size of modelled fires to variation in terrain (flat, rolling and mountainous), fuel pattern (finely and coarsely clumped) and climate (observed, warmer/wetter and warmer/drier) was determined for four existing landscape-fire-succession models (EMBYR, FIRESCAPE, LANDSUM, SEM-LAND) and a new model implemented in LAMOS using climate from three locations (LAMOS(DS)). Sensitivity was measured as the variance in the results explained by each of the three treatments, and all of the possible interactions amongst them, in a standard generalised linear modelling analysis. Models were most sensitive to climate, with the number of fires in two cases, and total area burnt in four cases, demonstrating considerable sensitivity.

For these, the number of fires, or area burnt, increased from observed climate to the warmer/wetter climate and then increased again for the warmer/drier climate. In one case, total area burnt was sensitive to terrain, and in another, total area burnt was sensitive to fuel pattern. These results demonstrate that these models are generally more sensitive to variation in climate compared with terrain complexity and fuel pattern, although the sensitivity to these latter drivers in a small number of models demonstrates the importance of representing key processes.

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URBAN DESERTS, GARDENS AND BUSHLOTS: SPATIAL THRESHOLDS AND BIRD ASSEMBLAGES

Abstract
Maintaining terrestrial wildlife assemblages in urbanising regions depends on retaining or recreating suitable habitat. Avifaunal changes with urbanisation in the Brisbane region (eastern Australia) are reviewed using data from 15 site-types within four broad categories of urban vegetation cover (bare suburbs, vegetated suburbs, small remnant patches, large remnant tracts), spanning five years' of observation. Cleared and urbanised areas show a dramatic reduction in the number of small-bodied species, and a small increase in introduced species. Suburban developments that incorporated more trees supported more large-bodied native species. Individual species show three patterns: "Aussi icons' (e.g. kookaburra, magpie) are large-bodied birds, often ground-feeders, that characterise well-vegetated suburbs and 1-2 ha forest remnants. "New arrivals" (e.g. house sparrow, magpie-lark) are a group of mixed habits that characterise poorly-vegetated suburban areas. "Neglected foliphiles" (e.g. pardalotes, whistlers) are small-bodied, foliage-feeding species that prefer large forest remnants. Interspecific aggression by a single large-bodied edge-favouring species, the noisy miner is a key process. A hierarchy of scales is needed for planning vegetation cover in urban areas, if avian diversity is to be sustained, and local "bird attracting" garden plantings may have unintended outcomes.

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LANDSCAPE ECOLOGY STRUCTURE AND HUMAN WELL-BEING

Abstract
This study explores the relationship between people's natural perception towards the environment and the landscape ecology structure indexes. There are two major steps in the research design. The first step, the relationship between landscape ecology structures and the species diversity were examined. The second step, the relationships between species diversity and the respondent's perception by viewing the landscape were tested. The boundary of the Yangmingshan National Park in Taiwan was used as the testing site. For each kind of land use, the indexes of the landscape structures like the patch density, patch shape, size of patches, the arrangement of the corridors, edge effects, and the networks were defined as the independent variables. The dependent variables were defined generally as residences natural perception and their satisfaction toward the selected environment. The species diversity was the mediating variable by the local representative birds in order to depict the relationships between landscape ecology structure and respondent's perception. The result shows that the landscape ecology structure indexes have significant relationships with residences natural perception. The edge and shape effect of vegetated areas were have significant

relationship with residences place image of natural and satisfaction.

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SPATIAL SIMULATION OF FOREST LANDSCAPE LONG-TERM RESPONSES TO FIRE SUPPRESSION IN NORTHEASTERN CHINA

Abstract
Hu Zhong region, located in Daxinganling, northeastern China, was frequently disturbed by forest fire. Active fire suppression measures were often taken to control forest fire. It provides a good site to explore the influence of fire suppression on boreal forest ecosystem, evolvement and recover over large spatial and temporal scales. Up to now, no reports on the similar studies have been found in this region. However, such studies are increasingly needed to design reasonable forest management and restoration plans for this region. We design three simulation scenarios a) no fire, b) no fire suppression, c) fire suppression, use LANDIS to simulate long-term (500 years) successional trajectories of dominant tree species and examine the landscape pattern change using aggregation index. Our simulated results suggest that the trajectories of major dominant tree species basically represent the ideal states of forest succession without fire disturbance. The trajectories fluctuate more frequently due to fire disturbance with no fire suppression. Fire suppression has the trajectories approach the ideal states gradually, increases fire frequency and decreases fire size and damaged area. Our results also show that LANDIS can reasonably simulate fire disturbance in this region, and aggregation index is an good indicator of forest succession process.

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REVIEW OF ENVIRONMENTAL EFFECTS OF URBANIZATION WHEN VIEWED FROM LAND OR WATER

Abstract
Urbanization has many effects on natural environments. These include fragmentation of habitats into remnants, provision of new and artificial habitats, introduction of feral species, increased pollution of land, air and water and ongoing physical disturbances of large numbers of people interacting with their surroundings. Effects of urbanization have been considered far more widely in terrestrial than in marine habitats, even though many large cities are on the coast or in estuaries and therefore impact adjacent waters. In addition, the relative importance that ecologists place on different "classes" of impacts appears to reflect their background in terrestrial or aquatic ecology. Much research of urbanization in terrestrial habitats has considered isolation and connectedness of habitat fragments, addition of new built structures and introduced species. In adjacent marine waters, most research considers problems of water quality or pollution. This division of interest and emphasis, with little overlap, interaction or quantitative comparison between the two approaches, decreases our understanding of the overall ecological effects of urbanization. Here, I review selected publications in urban ecology in marine and terrestrial habitats to quantify differences in interest, methodology and analyses, to attempt to develop a more holistic approach to the ecology of urbanization

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EFFECTS OF RURAL COMMUNITY FORESTS ON LOCAL STREAMS AS LANDSCAPE ECOLOGICAL RESOURCES IN KOREA

Abstract
Rural community forests (RCF), established about 400 years ago, are historical assets of rural communities of more than 40,000 and they have provided an identity through the cultural heritage. The RCF is a part of unique cultural landscape in rural areas in Korea. Many of the RCF's are located close to stream corridors. The objective of this study was to understand the function of the RCF on the stream water quality and evaluate its landscape ecological values. The water quality of the streams that have RCF's and maintained with local culture was compared to the water quality of the streams where RCF is absent. Eight study sites were selected. Water samples were collected at three different locations at each study site. Water samples were analyzed for pH, total P, totl N, dissolved oxygen, etc. Aquatic invertebrates were used as water quality indicator species. Initial analysis results showed that there was no difference in water chemistry between with and without RCF. However, the biological indicator showed that the water quality at RCF sites was better than that of no RCF sites. The role of RCF's was evident in maintaining the quality of stream water as well as in conservation of local landscape and culture in Korea.

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LANDSCAPE COMPLEMENTATION AND LARGE HERBIVORES: HABITAT COMPOSITION AND WILD PIG POPULATION DYNAMICS

Abstract
The effect that proximity of habitats containing essential resources has on animal population dynamics is called landscape complementation. We tested the effect that the proximity of habitat-related thermal refugia had on interaction between wild pigs and their limiting food resources. We found that although food availability was similar across the range of our study population, rates of increase generated by pigs were lower in areas where access thermal refugia was limited, and that this effect was more pronounced under conditions of food shortage. These results suggest that the need to access thermal refugia compromises the foraging efficiency of pigs to an extent that their population dynamics are affected. We used the results of this study to modify a long-standing model of interaction between large herbivores and their food resources to reflect the effect that landscape complementation can have on foraging and demographic efficiency. This model is used to demonstrate how landscape complementation limits the spatial extent of wild pig populations through its effect on source-sink dynamics at the edge of their range.

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PERCEPTIONS OF LANDSCAPES AND THEIR MANAGEMENT BY INDIGENOUS PEOPLE

Abstract
Aboriginal people comprise a significant sector of the Northern Territory population and hold title to approximately 85% of the extensive Northern Territory coast. The seas and waters are a vital part of their cultural, spiritual and economic lives. Indigenous

knowledge about the marine environment is extensive and intrinsic to their existence. For coastal ("saltwater") peoples, the seabed, reefs, and other marine habitats are an extension of the land. They have ongoing spiritual responsibilities for the many sacred sites and ceremonies that extend into the areas of land covered by the sea, relate to many sea animals, and include the water itself. Indigenous people have customary hunting and gathering rights over sea country, which they continue to assert. Aboriginal land managers living on coastal communities continue to depend on the marine resources of sea country for economic as well as social and cultural reasons. To this end a network of Aboriginal sea rangers is evolving across the Top end of the Northern Territory to manage their sea country, and maintain it as a sustainable shared resource. They are doing this in the face of increasing pressure by the fishing industry both legal and illegal, to harvest the unique and valuable marine resources within their marine estates.
GURIG GUNAK BARLU is a National Park consisting of land and the seas surrounding that land. However, the management of the two are controlled and managed by different authorities. The Aboriginal members of Board of Management wish to have control of the seas the same as the land, which is how indigenous people see their estate.

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VEGETATION DYNAMICS OF URBAN BIOTOPES SUBJECTED TO DIFFERENT MANAGEMENT STRATEGIES IN POTCHEFSTROOM

Abstract
Urban vegetation studies are useful for management and conservation purposes. Floristic and phytosociological studies were carried out in some South African cities to develop biotope maps and make vegetation information more accessible to planners and managers. Urban open spaces are, however, still over-managed due to a lack of studies focusing on the long-term monitoring of changes to plant communities in reaction to anthropogenic influences. To address this issue, the dynamics of species composition and abundance has been investigated in different anthropogenically disturbed biotopes such as pavements, managed grasslands and specific urban agricultural areas (ecocircles) in which certain management practices were changed. Quantitative studies were conducted in fixed plots over a three year period. Through multivariate data analysis techniques significant trends in vegetation dynamics were identified. These trends include changes in the abundance of certain species due to differences in chemical and physical soil characteristics and management practices such as mowing and irrigation. The results will give managers the opportunity to develop strategies to manipulate species abundances with regard to invasive exotics versus natives. To enhance the understanding of the complex disturbances in urban biotopes this research should be complimented by urbanization gradient studies linked to specific biotopes based on certain land-uses.

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MODELLING APPROACHES FOR PREDICTING THE OUTCOMES OF FIRE MANAGEMENT AT LANDSCAPE SCALES IN NORTHERN AUSTRALIA

Simulation modelling allows us to extrapolate observations and data collected over short time spans to the medium and long term. The ability of a model to do this reliably rest of course on the assumptions behind it. By making and explicitly stating those assumptions, modelling focuses attention on the processes for which we have insufficient understanding and thus guides future research. The Flames computer simulation model incorporates much of the understanding of vegetation and fire ecology that has been gained over the past decade in north Australia into a tool to allow the interactions of fire frequency, fire timing and rainfall patterns to be investigated at landscape scales. Outputs include issues of relevance to a diversity of land managers including carbon fluxes and gaseous

emissions,vegetation structure and species composition and pasture productivity. The great challenge in creating a model is to ensure sufficient complexity is incorporated to allow reasonable faith in its outputs at the same time as keeping it simple enough to understand the interactions of the driving processes. This paper presents several outputs that exemplify this issue and highlight the implications of our current knowledge for the effects of fire management on vegetation over decadal timespans.

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'ECO-CIVIC' OPTIMISATION PROVIDES A NESTED FRAMEWORK FOR PLANNING AND MANAGING LANDSCAPES

Abstract
The ecological sustainability of future landscapes and their capacity to support human communities and resource uses depends on a range of institutions. An essential institution for regional resource management is civic engagement in local affairs including resource management issues. Local civic engagement has traditionally been structured around local government and recently to catchment based committees. With few exceptions, these have generally failed. If citizens are to participate in regional resource management in ways that are meaningful to them, it is important that both the landscape units being discussed, and the jurisdictional boundaries also be meaningful. We have developed a method to explore how boundaries for resource management regions might be identified. The choice of management region maximises the areal proportion of an ecologically similar region that is also considered to be part of their 'community' by the inhabitants. This should lead to greater commitment to civic engagement in resource management. By bringing together, mapped social-civic characteristics and relatively homogeneous ecological landscapes within a multi-scaled or 'nested' framework, such regions and local sub-regions can be identified. Application of this technique in delineating a series of nested 'ecocivic' resource management regions for part of New South Wales, Australia, will be discussed.

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RESOLVING THE APPROPRIATE SCALE IN NATIONAL LEVEL ASSESSMENTS

Abstract
National and international scale ecological assessments are an important instrument to examine sustainable forest management and to direct strategic planning initiatives. Most of these assessments use a criterion and indicator framework. Worldwide, there are nine separate international criterion and indicator processes and many are similar at the criterion level. There are two general analytical approaches used in national scale assessments. One is to aggregate available information from detailed local investigations. This small-scale approach leaves gaps in the assessment because local investigations do not occur everywhere. Another is to use national level databases to examine the area as a whole. This landscape approach allows for data and analytical consistency but does not allow one to address indicators with the same detail as local investigations. The key to successful application of a landscape approach is balancing the resolution of data and analyses with the resolution of the indicators. National scale assessments often lack a landscape perspective and would benefit from landscape approaches.

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SECONDARY SALINITY IN AUSTRALIA: LINKING BROADSCALE HYDROLOGICAL RISK WITH LOCAL ECOLOGICAL OUTCOMES

Abstract
Broad-scale clearing of native vegetation in Australia and its replacement with shallow-rooted annual crops has led to the development of shallow water tables and land surface salinization. Secondary salinity is currently amongst the greatest threats to natural ecosystems in Australia, with more than 2 M ha of remnant vegetation predicted to be at high risk from shallow water tables by 2050. Hydrological models have provided important information on the spatial extent of shallow water tables at a catchment scale, and of the risk to native vegetation, based on an assumption of a critical water table depth for plant/ecosystem health. However, at the scale of individual remnants, factors such as local hydrology, fine-scale elevation and species/community tolerance of soil salinity and waterlogging interact to produce local ecological outcomes that may differ from the predictions from catchment-scale modelling. We present data from hydrogeomorphic (HARSD) modelling at the catchment scale and at the remnant scale, and compare this with field data on the spatial extent of salinity and its impact on tree health and understorey species composition. We conclude that effective decision-making requires consideration of the risk to native vegetation at all relevant scales.

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CHANGING AUSTRALIAN AGRICULTURAL LAND USE: AN ECOLOGICAL CHALLENGE

Abstract
Australian agricultural landscapes need to be re-vegetated with trees, shrubs and perennial crops and pastures, to address pressing environmental issues. Dryland salinity for example, is severely damaging river systems, wetlands and agricultural land. Competition for water between industry and the environment is increasing and land use changes for reducing groundwater recharge may further compromise stream flows. A focus catchment approach has been adopted for long-term ecological research in south-eastern Australia. The aim is to work with local communities to plan, implement, monitor and adaptively manage catchment scale agricultural land use change. The ability to integrate knowledge of diverse physical and ecological processes, and model their response to land use change in a spatial land-use planning framework, is central to the methodology. Environmental classification has established a framework for assessing current biodiversity status. The classification of groundwater flow systems has proven helpful in assessing likely effectiveness of land use change for salinity mitigation. Such approaches will help extend process knowledge to similar catchments in the region. The challenge is to ensure that land use changes to Australian agricultural landscapes are ecologically sound, occur within an integrated catchment management framework and meet multiple objectives including specific environmental goals.

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BISON GRAZING RESPONSE TO LANDSCAPE HETEROGENEITY CREATED BY FIRE

Abstract
To determine whether fire spatial and temporal scales affect foraging behaviour and grazing intensity by bison (Bison bison), we burned three different spatial scales of fire (225 m2, 900 m2, and 3600 m2) across an otherwise homogeneous landscape and monitored grazing intensity for the succeeding fourteen months. During the first five months after the burn (August to January), grazing intensity was inversely related to plot size. During the next five months (January to June), grazing intensity was highest in the 900 m2 plots and lowest in the 3600 m2 plots. The final four months (June to October), the bison grazing intensity was higher in the control plots compared to the burn plots except in the 3600 m2 plots. The pattern displayed within the first five months after the burn is congruent with the expectations of optimal foraging theory with overmatching in the smallest plot size of 225 m2. The next two sampling periods displayed a matching aggregate response to plot size relative to biomass availability. The temporal shift that we found in bison response to burn patch size is, to our knowledge, the first such examination of both spatial and temporal responses by bison to landscape heterogeneity.

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THE RIVERSIDE AND BERWYN EXPERIENCE: CONTRASTS IN LANDSCAPE STRUCTURE, PERCEPTIONS OF THE URBAN LANDSCAPE, AND THEIR

Abstract
Urban landscapes provide an ideal place to study the interaction between people and their environment. The Chicago suburbs of Riverside and Berwyn offer contrasting yet complementary paradigms of an urban landscape. Designed in the 1800's by Frederick Law Olmsted, Riverside, Illinois, incorporates several unique design elements (curvilinear streets, ample setbacks, parkways of variable width with naturalistic groupings of trees) that affect the structure and composition of the landscape. The urban forest was the keystone of Olmsted's desire to create a harmonious community characterized by a refined sylvan beauty. In contrast, the adjacent community of Berwyn has a right-angled street grid that accommodates narrow setbacks for houses that occupy a large portion of the land area. Public parks constitute a smaller percentage of Berwyn compared to Riverside. The composition and structure of the urban forest differ between the two communities in diversity, size, and number of species. Within this contrasting setting, we addressed these questions: How do residents' perceptions of the urban forest differ within and between communities? Do residents exhibit positive psychological benefits from their interaction with a forested urban ecosystem including some of the benefit of mental revitalization predicted by attention restoration theory?

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GRADIENT-BASED APPROACHES TO ANALYSING CONTINUOUS AND MULTI-SCALED LANDSCAPE PATTERNS.

Abstract
Understanding pattern-process relationships depends on characterizing heterogeneity in ways that are relevant to the organism or process under consideration. In this regard, landscape ecologists have generally adopted a single paradigm–the patch mosaic model of landscape structure–in which a landscape is represented as a collection of discrete patches. While this paradigm has provided an essential operating framework for landscape ecologists, it also imposes some severe limitations. A variety of gradient-based approaches to analyzing landscape structure exist enable researchers to describe patterns in more sophisticated ways, and more directly link patterns and processes. Gradient approaches may allow more realistic representation of landscape heterogeneity by not presupposing discrete structures, and can facilitate multivariate representations of heterogeneity compatible with advanced statistical and modeling techniques, as well as provide a flexible framework for organism- and process-centered analyses. In this paper we present simple examples applying a number of methods, including wavelet analysis, fractal scaling, moving-window analysis and surface metrology, to analysis of continuous patterns of landscape structure, and discuss the strengths and weaknesses of each approach. The paper concludes with an attempt to look forward into the future of gradient-based spatial analysis in ecology.

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MULTI-SCALE GRADIENT MODELING OF SPECIES-ENVIRONMENT RELATIONSHIPS, IMPLICATIONS FOR VIABILITY ANALYSIS

Abstract:
Landscape-level analysis of population viability often involves modeling organism habitat through space and then inferring population viability from the amount, distribution and connectivity of modeled habitat. This approach assumes that habitat quality is accurately modeled and that population size is strongly related to the extent and pattern of quality habitat. In this talk we present the results of a multi-scale analysis of forest bird habitat relationships and discuss the implications of these results for population viability analysis. We decomposed the species-environment relationships of 69 species of forest birds across these three spatial scales to test four hypotheses about the importance of environmental control of community structure across spatial scales. We found that plot-level factors were better predictors of community structure than either patch- or landscape-level factors. In addition, while landscape-level variables contributed substantial independent explanatory power, there was little evidence that patch-level environmental variability provides substantial additional explanation of community structure beyond that provided by plot- and landscape-level factors. There were major differences among life-history groups in terms of the relative importance of factors at the three spatial scales. Our results have a number of implications for population viability analysis. In particular, landscape-level inferences about population viability usually rest on spatial representation of habitat quality for the species of concern. Our results show that habitat inferences that do not take explicitly multi-scaled approaches and address specific attributes of organism life history may produce habitat quality inferences that are incorrect or are artifacts. However, the coupling of hierarchical, multi-scale habitat modeling with spatially explicit surface analysis provides a flexible and powerful approach to inferring population viability of organisms with a wide range of spatial, behavioral and life-history attributes.

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CHANGES IN LANDSCAPE PATTERNS AND LAND USE PRACTICES OVER THE PAST 150 YEARS IN CENTRAL GEORGIA, USA

Abstract

Landscape indicators were examined for their ability to signal ecological change in intensely and lightly used lands at Fort Benning, Georgia. Landscape characterization for five time periods was performed using witness tree data from 1827 and remotely sensed data from 1974, 1983, 1991, and 1999. The data from 1827, although coarse, are

useful in characterizing the historical range of variability in ecological conditions for the area. The steps for the analysis involved the creation of a land-cover database, computation of landscape metrics, and evaluation of changes in those metrics over time. An examination of land-cover class and landscape metrics, computed from the time series of land cover maps, indicated that a suite of metrics adequately describe the changing landscape at Fort Benning. The most useful metrics were total edge (m), landscape composition, number of patches, descriptors of patch area, nearest neighbor distance, and clumpiness. Identification of ecological indicators is an important component of building an effective environmental monitoring system. The indicators suggest that altered management practices in the 1990s have resulted in changes to the landscape at Fort Benning including in an increase in pine populations and a decrease in

hardwood invasion.

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PLOT-TO-PATCH BIO-HYDROLOGIC PROCESSES

Abstract
At the plot scale, semi-arid landscapes comprise patches of perennial vegetation separated by interpatches with annual or no rooted vegetative cover. As the source of primary productivity, the patches maintain high biological activity and macropore development. Where disturbance is low, the interpatches are typically covered with leaf litter and other plant debris and also can have high levels of biological activity and relatively high water infiltration rates. Increasing disturbance through grazing or fires reduces the quality of the interpatch zones first and then expands the interpatch area as perennial patches decline in quality and die. These changes are associated with declines in the diversity and activity of macroinvertebrates, particularly earthworms. Termites appear to be one of the most resilient groups, capable of maintaining activity in degrading landscapes. We will discuss the implications of these relationships of macroinvertebrate activity and patch to interpatch dynamics for maintaining and enhancing landscape processes.

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CULTURAL LANDSCAPES, A CHALLENGE FOR THE FUTURE

Abstract
Major parts of Europe consist of cultural landscapes. Quite often, they have existed for centuries and even millennia. By examples from the Scandinavian, Atlantic and Mediterranean regions, we will deduce the major characteristics of these cultural landscapes and evaluate the role of their components in maintaining high levels of specific biodiversity and landscape integrity. Today, preservation of these landscapes becomes an important objective of Europe's rural policy. In that sense, there is a need to develop methods to assess sustainability of old cultural landscapes. Landscape typologies are often used as a starting point in this respect. We analyse mapping methods and indicators for their sensitivity to clarify disruptions of landscape patterns, loss of biodiversity, changes in biogeochemical cycles. Do these typologies elucidate the degree of sustainability of cultural landscapes, do they discriminate for the elements that hinder or reinforce sustainability? It is concluded that only an integrated approach, that combines the different components of the landscape, that works on different scale levels

within the same landscape and thus relates spatial structure and spatial functioning, yield appropriate results.

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A FRAMEWORK FOR ECOLOGICAL, ECONOMIC AND SPATIAL ANALYSIS OF LANDSCAPE FUNCTIONS AND VALUES

Abstract
To reconcile landscape conservation with changing demands on land use and natural resources, the economic, socio-cultural and ecological values of the involved landscape units and "Natural Capital" should be fully taken into account in planning and decision making.
This paper will present a comprehensive ecological-economic valuation framework and spatial model for integrated assessment of ecological services and socio-economic benefits of natural and semi-natural ecosystems and landscapes.
The Framework can be applied at different scale levels to different ecosystems or landscape-units and basically consists of three steps: (1) Function Analysis: translates ecological complexity into a limited number of ecosystem (or landscape) functions, goods and services. (2) Function Valuation: includes ecological, socio-cultural and economic valuation methods. (3) Spatial Analysis: to facilitate the application of function analysis and valuation at different scale levels, spatial and biophysical models and assessment techniques should be integrated with economic valuation techniques.
The proposed framework and spatial model would not only indicate the total value of the goods and services provided by a specific area, but also in (digital) maps which parts of the area are most important for the maintenance of ecosystem (or landscape) functions, and which values can be assigned to the different landscape units.

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SPATIAL ANALYSIS TO DISTINGUISH MANAGEMENT FROM PHYSIOGRAPHIC EFFECTS ON FARMLAND BIODIVERSITY: INSIGHTS AND

Abstract
The sensitivity of wildlife diversity to land covers and management was investigated in the River Earn catchment, Scotland. The objective was to devise a spatial analysis of empirical data to distinguish physiographic from management effects on species diversity.

Data were collected on:
a. wildlife of representative land covers.
b. land cover, soils, altitude and line features.
c. linear and small habitat features.
d. crop rotations, stocking rates and inputs.

Regression analysis was used to identify the factors affecting species diversity, supplemented by interpolation to map the patterns of species diversity across the landscape. Simulations used values for model variables derived from agricultural statistics 1980-1998 and extrapolating these trends to 2010 and 2020.

This method had several limitations.
a. The coarse resolution of the model did not resolve within-field patterns but expressed the general distribution of species diversity. The physical effort of collecting and sorting

samples of the biota limited the possibilities for finer resolution models.
b. A different model was necessary for each taxon.
c. Uncertainty translating agricultural statistics into precise values for model variables, hence for simulation outputs.

The model identified physiographic and management factors affecting species diversity. The simulated changes in species diversity were of the magnitude evident from long-term monitoring.

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PLANT SPECIES COEXISTENCE AT MULTIPLE SPATIAL SCALES IN GRAZED GRASSLANDS

Abstract
The interactive effect of grazing and resources on plant species richness is predicted to vary across spatial scales. At small scales grazing should increase richness but only when resource supply is high. At large scales richness is predicted to decline due to loss of grazing intolerant plant species. We examined these hypotheses in grazed grasslands in southern Australia. Patterns of plant species richness were found to vary across scales. This was due to a positive correlation between exotic plant richness and grazing pressure, but only at small scales and high resource supply. At larger scales, variation in exotic plant richness was not explained by grazing or resource supply. Native plant richness declined due to increasing grazing pressure at all scales. Grazing reduces survival and seed production of native species, driving large-scale variation in species richness. Although grazing favours invasion by exotic species at small scales, the number of exotic species that successfully invade a region limits their response at larger scales. The processes and the scales at which they operate differ between those species that have recently invaded a region and those that are indigenous.

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ECOLOGISTS IN THE LANDSCAPE OF POLICY.

Abstract
This paper examines the role of landscape ecology in contemporary policy debates around sustainability. Attributes of sustainability problems - complexity, cross-problem connectivity, uncertainty, broadened and deepened spatial and temporal scales - demand increased attention to interconnections within natural systems, between natural and human systems, and between isolated disciplines and policy communities. Landscape ecologists seek more integrated understandings of mixed natural-human systems, to inform their sustainable management. This recent shift of focus has occurred elsewhere, such as in integrated catchment management, ecosystem approaches in fisheries, and cross-sectoral policy assessment. Ecologists find themselves in closer relationship with other natural sciences, social scientists, local communities, and policy makers and managers. While the theoretical and applied skills of ecologists are necessary for purchase on sustainability problems, they may not assist with understanding policy systems or other disciplines. This paper discusses the state of these relationships, the demands they place on ecologists, misuses of ecology in policy debates and other disciplines, avenues for better connection with other disciplines, and linkages between ecologists and policy makers and managers. Perspectives are drawn from the 'interdisciplines' of environmental history and ecological economics, and from

experiences in community-based environmental management and science-policy linkages.

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THE COST-BENEFIT APPROACH TO MEASURING CONNECTIVITY

Abstract
This paper presents the cost-benefit approach to measuring habitat connectivity that forms the basis for techniques that have been successfully integrated into a number of regional conservation assessments in New South Wales, Australia. The approach extends the applicability of some rigorous, but not universally applicable, analytical techniques from metapopulation ecology by applying them to fine-grain (raster) habitat data. The approach forms the basis for a suite of techniques for evaluating linkage value, neighbourhood effect and landscape connectivity, and for prioritising conservation action across the landscape. Using a raster approach permits the adoption of an improved method for estimating inter-site distances based on variable permeabilities along a least-cost path. The computational efficiency of the approach has been highly optimised within a customised computer program by bounding the searching algorithm to a functional neighbourhood based on a dispersal parameter and by introducing a 'petal' sampling technique which allows for coarser sampling with increasing distance from the site of interest. The approach is illustrated through its application to artificial and real landscapes.

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OASIS LANDSCAPE CHANGE DOMINATED BY HUMAN AND ASSESSMENT OF ECO-SECURITY

Abstract
Oasis is a special landscape dominated by human in arid region, and has existed in the famous “silk road” in China for more than two thousand years. This paper analyzed the landscape changes of modern oasis in the inland drainage basin in Gansu province. In order to study the relationship between landscape pattern and process on the oasis according to the characteristics of different oasis types, an index system was established for oasis eco-security: the degree of integrate development of the oasis, ecological carrying capacity, the degree of the water resource ensure, the amount of water resource per capita, the degree of land use, the biological output ,forest and grass coverage, and the condition of the oasis edge. As far as the fragile landscape in the arid inland drainage basin is concerned eco-security should focus on the health status of ecosystem, the threshold of ecological pressure, the rate of landscape change, ecological risk and alarm, and countermeasures for eco-security.

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ARTIFICIAL NIGHT LIGHTING AND INSECTS WITH REMARKS TO INCREASING LIGHT POLLUTION IN GERMANY

Abstract
Artificial night lighting replacing the natural dark sky is developing more and more to a serious impact factor to nature and ecosystems. The illuminated area is fast growing from urban areas into landscapes and along coasts. A field study about the attraction of insects to standard street lamp types is presented. Insects are very sensitive to lighting at all showing a special flight-to-light behavior. Based on empirical catch rates and observations about the fate of insects at lamps insect mortality near street luminaries is estimated: a) for a medium-sized town and b) for the state area of Germany. In an industrial nation like Germany light pollution is increasing due to different factors: urbanization of rural landscapes, more luminaries and lamps of higher efficiency. Extreme examples of light pollution are the skybeamers, searchlights used mainly for commercial advertising. Their negative effects on insects and birds have been documented in some examples and their distribution in Germany has been analyzed. In response to the increasing light pollution it is necessary to monitor insect numbers permanently to detect long term changes on abundance and diversity of the fauna. It is proposed that artificial night lighting should become part of the Agenda 21.

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EU POLICY FRAMEWORK ON NATURE PROTECTION (NATURA 2000) AND THE PROTECTION OF EUROPEAN FORESTS (FOREST FOCUS) AND THE

Abstract
The main mission of the Joint Research Centre of the European Commission is to provide technical and scientific support to the preparation, definition and implementation of EU policies and legislation. This paper is focusing on two JRC activities related to the protection of the environment, to support (1) the implementation of the NATURA-2000 network of protected areas to be established in 2005 under the EU "Habitat" Directive and (2) the implementation of the forthcoming new Framework Regulation referred as Forest Focus, dealing with the Protection of European Forests against atmospheric pollution, against fires and including new issues on carbon, soils, climate change and biodiversity.

Within the Natura 2000 activity, this paper presents the technical JRC contribution on the design of the Geo-Database platform to receive Member State's input on the N2000 sites, their habitat and species harmonized all over the EU and enabling queries with multiple criteria. The scientific contribution is a critical review of environmental indicators for reporting on nature protection and both the relevance of CORINE Land cover and of an Earth Observation and GIS approach for reporting on protected sites.
Within the Forest Focus activity, this paper introduces the foreseen contribution of JRC to the set-up and maintenance of a common data platform for the data received from the Member States and also illustrates the JRC exploratory and applied research for the development of methods and products in the field of forest condition assessment, forest biodiversity and forest fires.

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LANDSCAPE CHANGE (1940-2000) OF CONTRASTING COLOMBIAN ECOSYSTEMS: PATTERNS AND RATES

Abstract
Colombia is one of the biologically mega-diverse regions in the world. However, it is heavily impacted by human activities, with 40% of the land currently cleared of natural vegetation. This presentation outlines the spatial and temporal patterns of change for different Colombian ecosystems. Multi-temporal aerial photographs, satellite imagery and

thematic data at 1:50 000 scale are used, and statistical and stochastic models applied to analyse probabilities and significant factors of change. For the 1940-2000 period, ecosystems such as rainforests, dry forests, mountain forests and savannas show distinct rates of loss and fragmentation of the original cover. Savannas tend to be completely replaced in the landscape, while rain and dry forests tend to stabilize between 5 and 20% of the original cover. The proportion of remnant natural vegetation and patch size in forested ecosystems is significantly correlated with topographic constraints, soil fertility and distance to roads. Cattle grazing is the most extensive and impacting land use in recent Colombian history, with introduced pastures the major land cover type, and having the lowest transition probability to other covers. Conservation implications of patterns and rates of change of the major ecosystem types are discussed.

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LANDSCAPE-SCALE EFFECTS OF HABITAT CONFIGURATION

Abstract

Theoretical predictions of the relative effects of habitat amount vs. habitat configuration vary widely, due to differences in model structures. The vast majority of empirical studies on habitat configuration measure configuration in ways that are confounded with habitat amount, which means that the relative effects of habitat amount and configuration cannot be determined. One of the main problems leading to this confounding is the inappropriate extrapolation of patch-scale studies to landscape-scale inferences. To date there are 17 empirical studies (of which I am aware) in which the landscape-scale effects of habitat configuration, independent of habitat amount, have been estimated. Empirical studies to date suggest that habitat loss has large, consistently negative effects on species abundance and distribution. Habitat fragmentation per se (controlling for habitat amount) has much weaker effects, which are at least as likely to be positive as negative. Therefore, to correctly interpret the influence of habitat fragmentation it must be measured independently of habitat loss. More studies of the independent effects of habitat amount and configuration are needed to determine the factors that lead to positive vs. negative effects of habitat fragmentation.

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MINIMUM TARGETS TO SELECT CONSERVATION AREAS: THE USE OF UMBRELLA AND PATTERN-UNRELATED SPECIES

Abstract

Conservation areas must be large enough to maintain viable populations of all species there present. Minimum targets therefore should be an essential part of any selection method. The use of umbrella and landscape pattern-unrelated species is part of the method presented. It comprises complementary and supplementary criteria to answer three basic questions: (1) what to conserve, (2) how much to conserve, and (3) where to locate conservation areas. Obviously, minimum targets are linked to the second question. The distinction between umbrella and pattern-unrelated species emerges from different conservation types needed to prevent extinction. Umbrella species are used to calculate minimum values of topologic and chorologic representativeness for the first type of conservation areas; while pattern-unrelated species are used to calculate the

minimum habitat needed by those animals whose distribution does not coincide with the organisation of species in communities or of communities in mosaics. The values are obtained on the bases of estimations of minimum viable populations, the carrying capacity of the ecosystems and on the differentiation of chorologic types.

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ASSESSING LANDSCAPE CHANGES: THE ECO-FIELD HYPOTHESIS REVISITED

Abstract
Forest reduction, urban sprawling, river meandering, oscillation of geographical range of species are some of changes that commonly occur in natural and modified environment. Changes can be considered as the modification of an expected resource or pattern and the temporary or permanent impossibility for species, populations and communities to adapt to the new conditions. Every type of changes is scaled differently and the processes involved as well. The processes responsible can operate at individual scale by the eco-field or by the emergent properties at scale of the system.

According to the eco-field hypothesis every species or process perceives a species/process-specific surrounding (landscape) and any modification of this context produces reactions buffered or enhanced by positive or negative feedbacks. When a species encounter by chance a new condition two type of responses can occur: adaptation or extinction and this occur also at the scale of systems. The perceived changes are the result of several modifications of the landscape components and these changes can be considered an emergent property common to every complex system in which modifications occurring into a part influence all the other connected parts.

The life span of landscape patterns as perceived by human calibre is considered an important metric to evaluate the rate of changes occurring in the spatial configuration of land mosaics. We perceive the turnover of land spatial configurations because we can resume the history /memory of the land mosaics (i.e. using maps, airplane or satellite images) and then to compare the different configurations.

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VALIDITY AND UTILITY OF THEORETICAL TOOLS AND DOES THE SYSTEMATIC REVIEW PROCESS FROM CLINICAL MEDICINE HAVE A USE IN

Abstract
Many applied ecological disciplines lack fully developed theories for understanding the biophysical world in the face of human impacts or when humans intervene in order to try to alleviate those impacts. Consequently, to make decisions, researchers and practitioners often resort to more conceptual ideas or 'theoretical tools' such as environmental surrogates or the 30% cover rule from habitat threshold theory. In this paper we discuss some of the issues regarding the validity and utility of theoretical tools. We report on a review of a large component of the primary ecological literature where we found that relatively few tools were being proposed or tested. In addition, we ask if the methods for reviewing empirical evidence that have been developed for clinical medicine could be useful for assessing the tools. We found that although precisely the same method of systematically reviewing evidence is unlikely to be appropriate, there are some aspects that would be useful for increasing objectivity in reviews. In addition, adopting the main organisational model that is used in medicine to disseminate reviews could be useful to help bridge some of the gaps between the researchers and practitioners of landscape ecology.

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THE EFFECT OF ALTERED FIRE REGIME ON SOIL MICROBIAL COMMUNITY COMPOSITION AND ACTIVITY IN THE SAVANNAS OF THE KRUGER

Abstract
The long term burning experiments in the Kruger National Park provide an ideal opportunity to study the effects of altered fire regime and soil types on below ground biological processes. The composition and activity of various soil microbial communities was studied on sites burnt annually and those that have been protected from fire since 1954. These studies were performed on nutrient poor sandy soils derived from granite, and nutrient rich clay soils derived from basalt, in both the summer and winter seasons. Changes in the overall bacterial community structure were measured through community level physiological profiles using the BiOLOGä assay and the total below ground metabolic activity was inferred through the measurement of soil respiration. Population size estimates of nitrifying bacteria were obtained through most probable number counts and their activity was measured through the determination of in situ nitrogen mineralisation rates. Proportions of roots infected by mycorrhizae were determined microscopically. It was found that there was no significant difference in soil respiration rates between treatments, or sites, in winter or summer. There was no difference in N mineralisation rates between treatments, or soil types in summer due to the exceptionally hot and dry conditions experienced during the sampling period. Values ranged from –0.52 to 0.69 µgN.g-1 dry soil.day-1 in the sandy soils and from -0.31 to 1.66 µgN.g-1 dry soil.day-1 in the clay soils. However, annual burning in the sandy soils resulted in a reduction in the percentage of mycorrhizal infection in roots to 12% from 35% in the protected sites. This reduction was not noted in the clay soils. This paper will comment on fire, its management and its impacts on soil biological processes.

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APPLICATION OF SPATIAL INFORMATION TO WILDLIFE HABITAT EVALUATION IN TAIWAN

Abstract
Spatial information was used to evaluate the wildlife habitat in Taiwan. Observations of wildlife including species, abundance and spatial and temporal location were recorded in a bio-geodatabase. The habitat factors (such as climate, soil, topology, light etc.) were spatial interpolated to be 40m x 40m raster maps of different temporal scale in physical-geodatabase. To integrate the biological data and physical data with geo-coordination in same temporal scale, we could get the ecological interaction information of species. The normalized ecological amplitude of essential habitat factors into 0-1 ranges could be got. Ecological site quality index (ESQI) and habitat suitability index (HSI) were used to evaluate the suitability of tree species and avian in whole interested area. In the paper, we select two native trees species-Taiwania (Taiwania chriptomeroides), Red cypress (Chamaceparis formosines) and two endogenous avian-Swinhoe's pheasant (Lophura swinhoii), Mikado pheasant (Syrmaticus mikado) as the subjective species to do wildlife habitat evaluation in Taiwan. Some coupled data of biological observation and physical survey were used to validate the simulation results of specific wildlife habitat. The results showed that we could do a good job in the habitat evaluation with the ESQI/HSI model with spatial analysis procedures in landscape level.

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PREDICTING THE SPATIAL DISTRIBUTION AND IMPACT OF AN INVASIVE WEED IN WETLANDS OF THE WET-DRY TROPICS OF NORTHERN

Abstract
The Mary River wetlands, located in the wet-dry tropics of the Northern Territory, Australia, have national significance because of the high levels of biodiversity they support.
One of the most important threats to the wetlands structure and function is weed invasion. However, detailed studies of the factors that control invasions and the impact on flora and fauna are rare in the Northern Territory. We used landscape-scale field survey to determine the extent and type of impact an invasive grass -Urochloa mutica - has on floodplain flora and fauna. Habitat suitability modelling, using the spatial modelling capabilities of a GIS, was then used to identify the risk of invasion across a variety of habitats and these results were used to construct predictive models of invasion pathways. The predictive models identified Oryza grassland and Cyperus scariosus sedgeland communities as being at high risk of invasion by Urochloa mutica. The loss or reduction in size of these communities has important implications for biodiversity conservation in these wetlands, as many species rely on these communities for food. We conclude that improved management of Urochloa mutica is needed if further negative impacts on biodiversity are to be prevented or mitigated.

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MULTI-SCALAR LANDSCAPE ANALYSES AND RISK ASSESSMENTS OF MAJOR PRESSURES IN THE KAKADU REGION, NORTHERN AUSTRALIA

Abstract
Landscape mapping has been undertaken in the Kakadu region of northern Australia to provide a basis for spatial and temporal assessments of major pressures on wetland ecosystems and their services. The analyses have been undertaken using the formal integrated model provided by the Ramsar Wetlands Convention. Mapping was undertaken at several scales (geographic region, catchment and sub-catchment) using existing survey and spatial data and the results contained within a GIS and linked with risk assessments of major pressures on the wetland ecosystems. The risks imposed by invasive species, climate change, infrastructure development, and mining activities have also been assessed. These analyses have enabled identification of major information gaps and provided a basis for determining synergistic and cumulative effects on the wetland ecosystems and their ecosystem services. The analyses were combined to produce a model of the wetland ecosystem as a basis for further planning and management of the risk imposed by the individual and combined pressures. In particular we have provided a multi-scalar assessment of the biodiversity values of the wetlands and present a basis for further field and theoretical analyses of management options and the development of appropriate ecological models.

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CLIMATE CHANGE EFFECTS ON FIRE REGIMES

Abstract
Human activities such as the release of radiatively active gases like carbon dioxide, methane etc. are causing significant warming of the earth's surface. Climate and weather are strongly linked to fire regimes which means that the fire regime will respond rapidly to changes in climate. The fire regime has six components; frequency, size, intensity, seasonality, type and severity. These components of fire regime strongly influence the structure and function of many ecosystems and are highly dependent on climate. This presentation will demonstrate how climate change might change the future fire regime. This allows us to estimate the impact of a climate change altered fire regime on the landscape and consider options for adaptation and possibly mitigation. Past and current fire and climate change research has been conducted on the local, regional and continental scale. There is a need to address fire and climate change at the global scale and this should be done in an integrated fashion so that feedbacks, nonlinearities and interactions can be identified. Fire is an integral part of many ecosystems and human societies and directed research could identify areas that are susceptible to fire.

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HABITAT AMOUNT AND SPECIES PERSISTENCE - A SEARCH FOR THEORETICAL SYNTHESIS

Abstract
Although there is general agreement among ecologists that habitat loss is an important factor affecting species persistence, what continues to be debated is the relative importance of habitat amount in explaining observed variation in populations across different landscapes. In fact, research findings essentially span the outcome space from a minimal habitat-amount effect to habitat amount being assigned primacy. What factors account for these varied conclusions? A review of the theoretical literature and a series of simulation experiments reveal that alternative conclusions are likely related to the diversity of modeling approaches that have been used to examine populations in patchy landscapes. Model attributes that appear to account for variation in the habitat-amount effect include: basic model structure (deterministic vs. stochastic), demographic parameter choices (reproduction, mortality, and dispersal rates), choice of response variable (population size vs. occupancy rate), observation unit (patch vs. landscape), and scale (locally- vs. globally-coupled map). The diversity of modeling approaches, and their attendant variation in outcomes, makes the derivation of general conservation principles difficult. But this diversity also can serve as the basis for defining domains of applicability for the varied principles that are emerging.

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IMPACT AND VEGETATION CHANGES IN NATURAL VEGETATION PRESERVED IN URBAN AREAS

Abstract
The concept of preservation of indigenous vegetation within cities comprises utilization of the existing natural vegetation in areas where buildings and infrastructure are to be built. Since 1972 a research project concerning this topic is running in the residential area Järvafältet in Stockholm, Sweden.
Areas with natural vegetation have been found to be frequently used for recreation and play, even if they are less used than developed areas. Trampling is heavy within 100 m from the entrances, but in a distance of more than 1000 m it is very limited. Plant

communities on nutrient rich soils have been found to be tolerant, and parts of communities on poor dry soils vulnerable. However, the remaining vegetation areas have been found to be of great value for many functions, and can be utilized for purposes such as biodiversity conservation, indicating environmental change, infiltration of runoff water, shelterbelts, playing, and amenity. The planning and design process has been found to be crucial.
From the ecological point of view, the outcome of the study can be compared to studies in other winterbelt countries. Regarding planning and design as well as wear and tear it should be of great interest to compare the outcome with cities all over the world.

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ROAD ECOLOGY: TO MESH TRANSPORTATION AND NATURE

Abstract
The emergence of road-ecology science, combined with engineering and planning, promises a future where safe and efficient human mobility is meshed with natural processes and biological diversity. The extensive USA road network and massive number of rapidly growing vehicles on it are an outlier in the world. (1) Wildlife populations and biodiversity are affected by roads in several closely linked ways. (2) Diverse road-crossing mitigation structures improve wildlife movement and landscape connectivity. (3) Traffic noise/disturbance creates a wide zone avoided by sensitive birds and other species. (4) The large area in the USA devoted to roadsides contains invasive exotic plants and yet-to-be-surveyed rare species. (5) A cornucopeia of pollutants swept by wind and washed by rainwater into streams, lakes and other water bodies degrades fish and aquatic ecosystems. (6) The "road-effect zone" integrates the engineer's and ecologist's perspsectives as a basis for transportation planning. (7) The road network form in a landscape is a keystone for overall ecological conditions and for planning road removal and construction. Thus road ecology represents a major research and applications frontier, which should lead to ecological improvements around all roads and vehicles, plus large natural areas of long-term significance to society.

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CAN SMALL-SCALE MOVEMENT BIASES TO HUMAN DISTURBANCES LEAD TO THE DISTRIBUTION PATTERNS OF HERBIVORE?

Abstract
We explored how small-scale movement responses to human-induced landscape heterogeneity can be extrapolated to explain broad-scale patterns in the distribution of a large temperate ungulate. In particular, we modeled wapiti (Cervus elaphus) responses to linear disturbances, such as roads, utility corridors, and seismic exploration transects, which are prominent features in our landscape. Movement information was collected from 20 female wapiti exposed to a gradient of linear feature densities over 2 years. Each wapiti wore a GPS radio-collar that collected a location every 2 hours for up to 11 months. These data were used to parameterize a set of spatially explicit simulation models of small-scale movement. The models varied from simple random walks with no landscape effect to biased random walks where bias in movement direction and speed were functions of distance to nearest linear feature conditioned on the type of feature, forage availability, cover, and topography. We compared different models by their ability to fit the observed distribution of an independent set of wapiti locations collected over 3 years. We show how movement responses to human-driven heterogeneity yield better understanding of the distribution of wapiti in this multiple-use landscape and we

demonstrate the nature of habitat loss as human disturbances increase.

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DELINEATING CRITICAL HABITAT FOR THREATENED OR ENDANGERED SPECIES UNDER THE NEW SPECIES AT RISK ACT

Abstract

This presentation will report on a series of pilot studies to produce and promote robust, state-of-the-art methods for delineating critical habitat as required under the new Species At Risk Act (SARA) in Canada. Six endangered or threatened species for which designation and mapping of critical habitat in their breeding range have been identified as a Recovery Strategy priority (Yellow-breasted Chat, Banff Springs snail, Whooping Crane, Acadian Flycatcher, Hooded Warbler, Prothonotary Warbler) were selected to represent different taxa (birds, molluscs), habitat types (wetlands, forest, riparian scrub), terrestrial ecoregions (Lake Erie Lowland Mixed-Wood Plains, Slave River Lowland Boreal Plains, Eastern Continental Montane Cordillera, Thompson-Okanagan Plateau Montane Cordillera) and socio-political contexts. Habitat suitability mapping, spatially explicit population modeling and incorporation of socio-economic considerations were developed in consultation with Species Recovery Teams to produce critical habitat maps for the target species. Challenges of conducting this type of work will be discussed in relation to the multi-disciplinary and multi-institutional character of the project team, the variety of taxa and habitats involved, geographic scope of the species, sophistication and novelty of approaches, and the requirement for stakeholder consultation under SARA.

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CLIMATE VARIATION AND STOCKING RATE DETERMINE THE IMPACT OF SHEEP AND KANGAROO GRAZING ON LANDSCAPE PATTERNS IN A

Abstract

The impact of six densities of kangaroos only, sheep only and sheep plus kangaroos was examined over 15 years in a grazing study within an Acacia aneura (mulga) woodland in eastern Australia. These Acacia woodlands are strongly patterned with groves, grassy inter-groves and densely treed drainage lines. The distribution of grasses and forbs (herbage) is also strongly patterned with widely scattered tussock grasses on runoff slopes and dense bands of grasses just up-slope of the groves (runon zones). The primary productivity of these landscapes depends on the maintenance of this fine scale patterning. High densities of herbivores (irregardless of species) obliterate this pattern of herbage distribution, particularly during drought. Low densities of herbivores have little impact on herbage patterning. These relatively infertile, flat and dry landscapes are remarkably resilient. Prolonged El-Nino droughts substantially reduce herbivore populations by starvation or by forced removal of domestic livestock. These episodic droughts are often followed by periods of prolonged rainfall which may occur only once in 10-20 years. Fine-scale landscape patterns are rapidly rebuilt during these periods of high rainfall and low herbivore densities. These fine-scale patterns are dynamic through time and space. They are strongly influenced by herbivore density, rainfall and subtle variations in topography.

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APPLICATIONS OF THE FOCAL SPECIES APPROACH FOR DEVELOPING LANDSCAPE MANAGEMENT GUIDELINES IN EASTERN AUSTRALIA

Abstract
We have found the "focal species approach" (Lambeck 1997) to be an effective communication tool for engaging with community groups seeking scientific input into the redesign of agricultural landscapes to enhance the conservation of native wildlife. We have used the approach to communicate the value of increasing remnant patch size, improving woodland structure and reducing isolation of remnant patches. We have used woodland birds as candidate focal species to show how some birds are highly sensitive to landscape fragmentation and habitat degradation while other species are less sensitive. Our rapid landscape assessments (stratified bird surveys and GIS analysis) show that small, over-grazed and isolated remnant patches provide habitat for only common farmland birds (large granivores and insectivores). However, a few "focal" birds don't tell the whole story. One of our projects also surveyed a wide range of other taxa including plants, fungi, invertebrates and cryptogams. We found that nearly every surveyed patch had a unique combination of species. No one patch, small or large, provided habitat for all species cumulated across all of the sites combined. The focal species are useful surrogates as starting points. It allows us to talk about the landscape needs of a few species instead of talking about broad and fuzzy concepts like species richness or biodiversity.

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LANDSCAPE FIRE ECOLOGY, A NEW FIELD

Abstract
The new field of Landscape Fire Ecology involves study of the physical and biological factors that control the frequency of fire, the behavior of fire in a landscape, and the effects of fire on plants and animals. It occurs in the region of overlap between the fields of fire ecology and landscape ecology, but possesses emergent properties of its own. Some concepts of the field include landscape scale fire frequency gradients, fire compartments, fire filters, fire tension zones, fire frequency indicator species, fire frequency indicator communities, and fire-exposed versus fire-sheltered areas. Such concepts can be used to reconstruct natural fire regimes and presettlement vegetation. From recent fire history studies, much of presettlement North America can be seen to have been a fire landscape. Natural fire regimes ranged from nearly every year to more than 700 years. Certain rare plant species appear to be rare because they are obligate fire species, limited to a narrow range of fire frequency. The pattern of these fire-frequency indicator species on the landscape can be used as a key to mapping past fire regimes. Using fire frequency indicator species and communities, along with principles of landscape fire ecology, original fire frequency can be approximated for any point in a landscape. Given the climate and ignition rate within a region, natural fire frequency for any point is a function of factors such as fire compartment size, distance of the point from the nearest firebreak or fire filter, topography, prevailing wind, and vegetation. Using elements and concepts of landscape fire ecology, I constructed presettlement fire frequency maps of North American landscapes at several landscape scales.

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MANAGING SUSTAINABLE LANDSCAPES: BALANCING THE NEEDS OF NATURE AND CULTURE IN THE LANDSCAPE

Abstract
This paper explores landscape management for both nature conservation and cultural heritage interests. In many cases, there appears to be a good match between the management needs required to ensure the sustainable supply of services provided by these two important landscape interests, nevertheless, sometimes the needs of culture and nature conflict. A landscape ecological perspective is presented that can help us to understand where the links between culture and nature are positive and where they are likely to conflict. The management challenges of achieving both cultural and natural heritage goals on the same site are discussed. Case studies are used to illustrate the dilemma.

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FOREST COVER IN KALIMANTAN, INDONESIA ANALYIZED WITH MODIS SATELLITE DATA

Abstract
Deforestation in Indonesia poses a significant threat to the region's biodiversity. We mapped forest cover in Kalimantan, Indonesia in 2002 using imagery provided by the Moderate Resolution Imaging Spectrometer (MODIS). Comparison of our new forest cover map with data from 1997 on forest cover reveals that almost 3 million ha of forest have been lost in Kalimantan since the major El Niño event in 1997-98. We found that fires that occurred during late 1997 were associated with areas that had lost forest. We also found that over two-thirds of the deforestation occurred in proposed and existing protected areas, especially those that range in area from 100-250 thousand hectares. The results of our analysis have implications for designing conservation strategies that aim to preserve remaining forest habitats in Kalimantan.

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ARE PATTERN METRICS THE CADAVERS EQUIS OF LANDSCAPE ECOLOGY?

Abstract
Metrics of spatial patterns provide a succinct characterization of differences between landscapes, allowing the consequences of landscape change to be quantified. Although multitudes of metrics exist, most are based on similar information (i.e., number of land-cover types, their relative proportions, etc.), resulting in strong correlations among seemingly different metrics. Consequently, only a small subset of metrics is required to describe most differences among landscapes. Metrics are also useful for predicting potential changes in landscape processes resulting form changes in pattern. However, relationships between pattern and processes are often nonlinear making the development and selection of suitable metrics a difficult problem. This presentation reviews examples of dispersal studies (both empirical and theoretical) to demonstrate how to verify the usefulness and reliability of metrics to predict pattern-process relationships. Biases due

to data-set development procedures (e.g., choice of grain and extent, land-cover classification rules, etc.) are discussed and recommendations for population protection and restoration presented.

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LANDSCAPE BIOTECHNOLOGY - ARE WE READY FOR THIS?

Abstract
This paper briefly reviews new applications of biotechnology to landscape-scale phenomena (e.g. pest control), and explores some of the implications of those proposals. From genetically modified viruses to humane target specific poisons, biotechnology opens new possibilities in landscape intervention. Whilst parts of the scientific community are aware of these developments, for many others in society this is radically new. Recent interviews in Tasmania and Western Australia on GM viruses for fox control offer some insights: effectiveness, safety, control and consultation were persistent themes, but it was evident a GM virus was a fresh and unproven concept. There are also potential problems raised by technically informed people. For instance, while Australia works to control rabbits with a GM virus, Spain is working to conserve theirs with similar technologies. We are just beginning to think of truly landscape-scale biotechnologies, and their implications. There are other questions here yet to be asked, a complex set of ecological, ethical, and social issues that need to be identified, debated and addressed. This paper: 1. Presents a primer of landscape biotechnologies under development, 2. Looks at the possible reception of some of these prospects, and 3. Outlines some broader questions arising from the work.

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ADAPTING GAP MODELS TO FLUVIAL LANDSCAPES BY ACCOUNTING FOR GEOMORPHOLOGICAL AND HYDRAULIC PROCESSES

Abstract
Predictive tools are needed in order to evaluate the new approaches of river restoration that aim at improving the ecological qualities of fluvial systems. Available models of forest succession were mainly designed for application in upland areas and do not adequately account for hydraulic and geomorphological processes that are extremely important for high energy streams. Although significant knowledge gaps subsist, especially concerning the interaction between geomorphology and vegetation dynamics, we argue that modelling using available approaches may yield useful results, especially if accompanied by careful uncertainty/ sensitivity analyses. In our contribution we identify a set of relevant processes and present an attempt of a coupled modelling approach. The latter has a modular structure that allows for its evolution and is based on TreeMig, an existing GAP model. We emphasize on ecological processes such as growth response to submersion, groundwater fluctuations and on mechanical stress resistance, such as uprooting, stem breakage or erosion. Relatively simple modules are adopted for hydraulic and geomorphological processes. We illustrate model's operation by applying it on hypothetical cases. In order to account for stochastic variability of environmental factors and for uncertainties in processes and parameter values we perform Monte-Carlo simulations.

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MATRIX STRUCTURE AND INVERTEBRATE MOVEMENT AMONG FRAGMENTED HABITATS: EVIDENCE FROM THE SUBTIDAL ZONE

Abstract
Species diversity is maintained by movement among habitats, a process threatened by the loss of habitat and associated increases in distance between habitats. Yet habitat availability may be related to the structure of the area surrounding suitable habitats, the matrix, rather than distance between habitats. Tests of hypotheses about animal movement across landscapes with different types of matrix remain rare, especially for small, cryptic organisms such as invertebrates. The subtidal kelp, Ecklonia radiata, forms extensive forests across temperate Australia. The base of each plant, the holdfast, forms a discrete patch habitat for a diverse group of invertebrates. When these forests are fragmented, different species of algae can establish between remnant E. radiata plants, changing the nature of the matrix. I have documented that assemblages in E. radiata holdfasts differ between monospecific stands of E. radiata and stands of mixed algae across Australia. But what is driving this pattern? I tested whether movement between E. radiata habitats differed when the matrix contained other species of macroalgae (mixed stands) than in forests with relatively bare matrix areas (monospecific stands).

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GRAZING IMPACTS OF LARGE HERBIVORES AT VEGETATION

Abstract
Boundaries between vegetation patches are focal points for the interactions between plant communities. We show that key resources attract herbivores, and the surrounding vegetation receives a higher impact than if it is associated with less preferred vegetation. We studied the influences of grass availability and proximity to grass patch on heather (Calluna vulgaris) utilization by sheep (Ovis aries) and red deer (Cervus elaphus) at a range of spatial scales in the Cairngorm Mountains of Scotland. There was a sharp decline in heather utilization with increasing distance from the edge of a grass patch. The proportion of grass in the landscape had a significant positive effect on heather utilization both at the grass/heather boundary and beyond 5 m from grass. There was a significant effect of the dominant grass type on the utilization of heather within 50 cm of the grass patch edge which reflects the known different preferences for these vegetation communities by red deer. The greatest contribution to variance in heather utilization was at the smallest scale, and variance components decreased as spatial scale increased. These finding suggest that vegetation/herbivore interactions are localized within the landscape with vegetation dynamics being driven by vegetation boundaries associated with key resources.

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LIVING LANDSCAPES

Abstract
The challenge for Australian agriculture is to move from a position where nature conservation is an add-on to where nature conservation is managed as a part of landscape systems in which decisions are underpinned by the principles of Ecologically Sustainable Development (ESD). While many agriculturally based catchment groups in Australia have developed and are implementing more sustainable farm and catchment-scale management plans, their primary focus is on protecting agricultural capacity. However, there is increasing recognition that the planning context must be extended to consider broader landscape issues such as nature conservation and ecological health.
Living Landscapes is underpinned by a planning process for integrating conservation and production outcomes. The project is focused on people working together to rehabilitate their local landscape so that the ecological needs of the landscape can be maximised within the constraints of the agricultural production system. The long-term challenge is to realign our planning and management processes to a stage where we can meet our social and economic demands within the context of the ecological needs.
Living Landscapes links science and community through a simple framework for learning, planning, doing and reviewing. It provides opportunities for land managers to learn about their local ecology, through their own experience and through the eyes of others, and then to apply new knowledge at the local level whilst contributing to landscape-scale outcomes.

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INTERACTIONS MATTER - COMPLEXITY IN LANDSCAPES AND ECOSYSTEMS

Abstract
To understand the distributions of plants and animals in a landscape, we need to understand how they interact with each other, and with their environment. The resulting networks of interactions are highly complex. Recent research on complexity and artificial life provides many new insights about the effects of these networks on ecological patterns and processes in landscapes. Simulations provide useful testing beds for virtual experiments to test hypotheses about ecosystem processes. For example, cellular automata models have reveal useful insights about the influence spatial processes and of landscape connectivity on genetic variation, competition, invasion and persistence and the maintenance of diversity. Likewise, models of multi agent networks have revealed the roles that feedback and interaction patterns play in self-organisation of plant and animal communities, the appearance of keystone species and on the origins of stability in complex ecosystems.
Successful management of the world's ecosystems will need to combine information about biodiversity, environmental, geographic and socioeconomic information with models of landscape and ecosystem complexity. This need raises many practical issues, such as the need for integrated modelling and information systems, and the need for appropriate standards.

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LANDSCAPE LEVEL HABITAT MAPPING AND MONITORING: IMAGE DATA AND INFORMATION

Abstract
The potential of image (ie. remote sensing) data in landscape ecology has been extensively developed, investigated and demonstrated through recent decades, with, in general positive results. So much so, that, without neglecting the more technical aspects, it is now increasingly meaningful to focus upon image data in terms of the characteristics of the quanta they carry into holistic informational discourses. This is particularly the case where image data and other data sources (such as field survey) share input to the informational milieu. The use of very high spatial resolution image data in landscape level habitat mapping and monitoring is a case in point: both image data and field survey map and monitor habitat. So, how are the information quanta they provide characterised and interactable? Integrated field survey and image based mapping and monitoring of European habitats for biodiversity work is being developed within the Biohab project (2002-05). This paper develops the basis for an information-orientated understanding of image data, with illustrations of its application from the methods and data being developed and used in Biohab and other European image data experiences.

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INTEGRATED ASSESSMENT OF TWO DECADES OF LAND COVER, FOREST AND SOCIOECONOMIC CHANGE IN THE MIDWESTERN UNITED STATES.

Abstract
We developed a spatial database of changes in the biophysical and socioeconomic landscape across 7 states in the Midwestern US between 1980 and 2000. We mapped change in three primary characteristics: 1) the distribution of what is on the land (land cover), 2) the distribution and characteristics of people across the region, and 3) the characteristics of the forests within the region. Land cover change was documented at a 1-km resolution using novel methods to compare maps derived from aerial photos (USGS LUDA) and satellite imagery (AVHRR). Human demographic and economic changes were mapped at the county and community/neighborhood level using US Census and Bureau of Economic Analysis data. Changes in the area, structure, condition, and ownership of forests were mapped at the county level using US Forest Service (FIA) data. Changes in other natural resources, such as songbird and deer abundance, forest insect outbreaks, and recreational opportunities were also documented to illustrate effects related to changes in the three primary characteristics. We used this database to model how ecologic factors contribute to the pattern of population and housing density change within the region.

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WHEN SINKS BECOME SOURCES - SUSTAINABLE LANDSCAPES AND THEIR REGULATION CAPACITY

Abstract
Current approaches of integrated landscape analysis are mainly focused on the assessment of the impact of land use changes on landscape functions like the regulation

functions especially the retention capability. The capability of different landscape types to regulate water fluxes and filter, buffer and transform inputs like acids, heavy metals and nutrients is a significant natural capital and plays an important role for the assessment of the environmental sensitivity and suitability of different landscape types for land use systems. This is the base for the derivation of such land use and landscape pattern variants leading to a reduction of material discharges and a decrease of the resulted surface and groundwater loading. Investigations regarding the sink-source-relation are carried out as a contribution to sustainable spatial planning and watershed management. However, temporal aspects of the landscape's regulation and retention capability are mostly unregarded at these assessments. Thus, an exhaustion of the regulation, buffer and retention capacity by chemical saturation of soils changes their function from a matter sink to a matter source initiated by mobilization and migration processes and a missing supply of neutralization material. The presentation introduces an integrated approach that considers the temporal aspects of the regulation capability on the example of critical loads and levels for acid inputs of inorganic compounds on different scales to develop concepts for sustainable land use.

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COUNTRYSIDE QUALITY: SCIENTIFIC REALITY OR POLITICAL MYTH?

Abstract
If we accept that countryside contributes to the quality of people's life - is it possible to develop indicators of countryside quality to track the changing condition of rural areas in ways that are both resonant with people and scientifically credible? This paper will examine the extent to which landscape ecologists have been able to help solve this question in the context of an on-going project initiated by Central Government to develop indicators of change in countryside quality and countryside character for England.

Although social and political pressures have stimulated the development of the indicators of quality and character, it is essential that they are underpinned by a robust, scientific methodology so that planning decisions are sound and defendable. The paper describe how, by linking the idea of landscape, natural capital and ecosystem function one can develop indicators that capture aspects of the integrity of the countryside. It is argued that the indicators should help us to identify the 'environmental choice space' within which decisions about sustainability at the landscape scale are made. They should also help us identify the trade-offs that may be necessary if particular types of ecosystem or landscape function are to be sustained over time, and take account of spatial heterogeneity and scale.

The paper critically reviews the success of the current initiative in England, and considers what role landscape ecological concepts have played in the development of different approaches to the problem of defining countryside quality.

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ASIAN DELTAS: FLOODING AND POVERTY CONTRAST BOOMING ECONOMIES

Abstract

The fertile river deltas have been the most favourable regions for human life also in Asia. In this region characteristics of delta areas are high population densities, going along with land uses as agriculture, industry, tourism and nature conservation (wetlands, riverine systems and coastlands). However, there are big differences between the Asian delta regions: sever problems in water management (flooding) and poverty contrast booming economic expansion elsewhere. Past management of delta regions often prioritised investments in technical infrastructure at the expense of environmental concerns. Newly emerging integrated concepts are needed in order to develop strategies for sustainable development in water management and spatial planning in combination with poverty alleviation. An exchange in knowledge and experiences in a network of scientists, policy makers and stakeholders can contribute to solve the problems.

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DEVELOPING CONCEPTUAL SPATIAL HABITAT MODELS OF RELEVANCE TO FROGS

Abstract
Conceptual spatial models have been developed to characterise and define landscapes for ecological interpretation. These models are often used as a foundation for examining how landscape modification has affected biota. This paper explores these models and their applicability to an animal group that has received little attention in modified Australian landscapes - frogs. Conventional species habitat models are often based on vegetation patterns. In this paper, habitat models were developed to reflect landscape patterns of relevance to frogs in the Southern Tablelands of NSW. While vegetation may be an important defining landscape feature for birds or mammals there are several other components (e.g. wetlands, constructed ponds and soil moisture gradients) likely to influence the spatial distribution of frogs. Habitat models that link land and water may be used to design studies that examine multiple animal groups simultaneously, such as reptiles and amphibians. While it is common knowledge that habitat is a species-specific concept, this is not reflected in the way we characterise modified landscapes for conservation. Habitat models that underpin landscape scale studies require further complexity to avoid land management and conservation strategies with inappropriate assumptions of how biota respond to landscape change.

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SIMULATING FIRE RISK DYNAMICS AT LANDSCAPE SCALES—THE LANDIS APPROACH

Abstract
Quantifying fire risk for the landscape over time is important for prioritizing fuel reduction and other management activities. We have developed a fuel module for LANDIS, a raster based, landscape disturbance and succession model. The module tracks fine, coarse, and live fuels. Fine fuels are primarily foliage liter fall and are the primary source for fire ignitions. Coarse fuels are determined by the time of fuel accumulation and decomposition, and is primarily responsible for fire intensity. Live fuels can further increase fire intensities under crown fire situations. LANDIS also tracks fire probability based upon mean return interval (a land type level variable) and time since last fire (a cell level variable). Potential fire risk is derived from the potential fire intensity and fire probability, and broken into five categorical classes (very high, high, medium, low, and very low). The fuel module simulates common fuel load reduction including prescribed burning and physical fuel removal. Fuel treatments are specified using the spatial (where), temporal (when), and reduction method (what) variables. The combinations of

these three variables provide numerous alternatives that can simulate the effects on fire risk reduction. We present an application of this approach from the Missouri Ozark area.

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EFFECTS OF LAND DEGRADATION ON LANDSCAPE FUNCTIONS AND VALUES: A CASE STUDY OF THE GUADALENTIN, SPAIN

Abstract
The Guadalentin basin is located in the Southeast of Spain and is one of the driest areas of Europe. The study involves the following steps: (i) analysis of the socio-economic value of the main landscape functions in the study area; (ii) assessment of the biophysical implications of land degradation on the performance of these functions; and (iii) estimation of the socio-economic consequences of land degradation as a result of changes in environmental function performance.
The performance of the main functions of the area (agriculture, hunting, grazing, nature conservation, and sedimentation control) will be quantified and valued using economic and/or ecological indicators. The assessment of the biophysical implications of land degradation on the performance of these functions involves two basic steps: (i) quantification of land degradation, including biological, chemical and physical aspects; and (ii) assessment of the impact of land degradation on the function performance.
For some functions, the effects of land degradation on function-performance will be determined, using an existing erosion model of the area and GIS analysis. The socio-economic impact of erosion is then assessed by combining spatially explicit information on the socio-economic value of the environmental functions with the impacts of land degradation on function performance.

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EFFECT OF LOW-INPUT HABITATS ON BIODIVERSITY IN SWISS AGRICULTURAL LANDSCAPES

Abstract
Since 1993 Swiss farmers increasingly convert land to low-input habitats. Today, the utilised agricultural area (UAA) is interspersed with these ecological compensation areas (ECA), making up 10% of the UAA (extensified grassland 100,000 ha, traditional orchards 25,000 ha, wild flower strips 3,300 ha, other elements 8,000 ha). Biodiversity indicators are monitored to assess whether government objectives are reached (halting the loss of agro-biodiversity, re-spreading of endangered species). Faunistic indicators react more rapidly to the introduction of ECA than the vegetation. On 1401 ECA meadows, 511 vascular plants were recorded, the composition of the vegetation still reflecting the former intensive management of most grasslands. Amongst 2008 nesting sites of 29 bird species, the nests of hedgerow birds and birds of humid areas were more frequent on or near ECA. Canonical correspondence analysis of spider communities showed significant differences between ECA and non-ECA grassland. 80% of carabid beetle species in an arable landscape were found exclusively or preferably on wild flower strips. Although butterfly diversity was generally low, it was significantly higher on ECA and they attracted more specialised species compared to intensively managed control plots. Grasshopper diversity and abundance increased in landscapes where source populations still occur.

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INVENTORIES, FOCAL SPECIES, AND SIMPLE PLANS: EVALUATING CONSERVATION PLANNING TOOLS

Abstract
Conservation biologists strive to balance rigorous science with the need for expediency. The essence of our question was "Can simple approaches that require few data and little time and money identify land for protection as effectively as complex approaches that require substantially more data, time, and money?" We compared the effectiveness of an inventory-based plan, a focal species plan, several "simple" plans, and random selection of forest patches that identify land to protect forest biodiversity in the Triangle Region of North Carolina, USA. We measured effectiveness as the proportion of known forest species and communities of conservation concern included in each plan. The inventory-based plan was the most effective. The random and simple plans were generally as effective as the focal species plan This suggests to us that inventory data are necessary, if only a small amount of land can be protected. Very simple, and even random, approaches might suffice when a relatively large amount of land can be protected in a region. We speculate that a threshold exists, in terms of total area or the proportion of a region's land to be protected, above which simple plans are as effective as more complex approaches.

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PREDICTING HABITAT QUALITY FOR WOODLAND BIRDS USING AIRBORNE LASER SCANNING TECHNIQUES

Abstract
Habitat quality is a fundamental concept in ecology, but quantifying it objectively is difficult. The problem is exacerbated for woodland birds by the three-dimensional complexity of their habitat and the birds' mobility within its structure. Thus, habitat quality is often inferred retrospectively from bird performance and survival, patterns of territory occupancy and stability, or measurements of resource availability. Remote sensing offers the potential to quantify habitat characteristics at a landscape scale. Airborne Laser Scanning (ALS) is an 'active' remote sensing technique operating on a principle of Light Detection And Ranging (LiDAR), that can supply three-dimensional information on vegetation structure at a landscape-scale. We show how ALS was used to derive a thematic map of woodland structure based on 'top-canopy' height and vertical density. This digital map was validated against field-based estimates of canopy density and used to extrapolate relationships between canopy structure and reproductive performance in Great Tits (Parus major) and Blue Tits (Parus caeruleus) from territory-based samples to an entire woodland. This demonstration of the potential to quantify habitat quality remotely has positive implications for assessing avian biodiversity in a changing environment.

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INVERTEBRATE BIODIVERSITY IN URBAN LANDSCAPES: ASSESSING REMNANT HABITAT AND ITS RESTORATION

Abstract

Remnant vegetation in urban landscapes is often highly fragmented and subject to substantial anthropogenic disturbance. Despite this, the original and unique vegetation remaining in cities may be of high conservation value and remnants are often subjected to intensive management and active restoration efforts. We investigated the ecology of urban fragmentation of woodland habitats in the Sydney Basin bioregion of eastern Australia, focusing on arthropod assemblages and the dominant flora. We used surveys and manipulative experiments to assess how changes in invertebrate assemblages may affect levels of herbivory and seed dispersal in urban fragments. We found that disruptions to fundamental ecological processes associated with the loss of species from higher trophic levels contributed to declines in the quality of vegetation in small remnants, limiting the extent to which pre-disturbance states could be restored. Species loss, and subsequent disruptions to ecological processes, may therefore be indicative of the biotic state and health of these remnants. Our work also suggests that terrestrial invertebrates may be effective indicators of the success of restoration of ecological processes in restored bushland remnants. These findings reflect the need to consider invertebrates and their ecological roles when developing restoration and management strategies for remnant bushland in urban landscapes.

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DELINEATION OF AN ECOLOGICAL NETWORK TO FACILITATE CONSERVATION PLANNING IN THE SOUTHEASTERN U.S.A.

Abstract
A research team at the University of Florida and Region 4 of the U.S. Environmental Protection Agency (EPA) has conducted an analysis of ecological infrastructure in the southeastern United States called the Southeastern Ecological Framework (SEF). Urban sprawl is a major problem in the region and current land use trends show high losses of many unique ecosystems and important natural resources. The goal of this project was to identify an ecological network connecting and buffering larger existing conservation lands and other primary areas of ecological significance using major riparian ecosystems and other suitable landscape features to protect key ecosystem services and biodiversity. The SEF was identified using a variety of region-wide and state GIS data layers in an Arc-Info GRID model, and prioritization of regional conservation opportunities has also recently been completed. Based on this analysis, large areas of the region are still capable of supporting critical biodiversity elements including wide-ranging species such as the Florida panther (Puma concolor coryi) and black bear (Ursus americanus). The Southeastern Ecological Framework is being used as a planning framework for prioritizing and coordinating conservation programs and initiatives between the EPA and other federal agencies, state agencies, NGOs, and community groups.

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THE SIGNIFICANCE OF SPATIAL STRUCTURING TO THE ASSESSMENT OF WILDLIFE CORRIDOR EFFECTIVENESS

Abstract
Wildlife corridors are commonly described as “linear strips of vegetation connecting habitat patches”. By virtue of this description, connected patches and the populations of organisms within them are usually treated as spatially homogenous entities within a heterogeneous landscape. This assumption formed the basis of the current project that investigates the scale of spatial structuring present in small rodent populations. Samples

were taken from within a) a corridor/patch/matrix system within a rainforest/agricultural landscape and b) from within continuous forest. Population structuring was investigated using mitochondrial DNA (mt DNA). Results indicate structuring of rodent populations, within both connected patches and unfragmented control sites, occurring over spatial scales shorter than the length of the corridor within the system. These results suggest that: a) wildlife corridors may potentially link only sub-sets of the population within the connected patches rather than the patch as a whole and; b) any genetic differentiation between populations at either end of a corridor may be indicative of natural partitioning rather than a lack of corridor function. Such spatial structuring has implications for the design and interpretation of research assessing the effectiveness of wildlife corridors using both ecological and genetic techniques.

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PROBLEMS OF IMPLEMENTING LANDSCAPE ECOLOGICAL KNOWLEDGE INTO THE UK PLANNING SYSTEM

Abstract
Whilst it is widely accepted that the application of landscape ecological knowledge has a fundamental role to play in local and regional planning, putting ideas into practice is not so straightforward. In the United Kingdom the current hierarchy of regional, county and local plans is complex and confusing. Too often plans are produced to different time-scales and contain inconsistent policies. This multi-level structure has become a major barrier to responsive and effective planning. Not surprisingly, the implementation of landscape ecological knowledge has been slow compared to progress in other European countries and despite the current review of the planning system in England, improvement on the current situation is not guaranteed. Despite 'islands of excellence' exemplified by Cheshire County Council and the European Union (EU) funded Life EcoNet Project, the situation is hindered by a degree of misunderstanding, uncertainty and lack of knowledge on the strengths of landscape ecology amongst the planning profession. Reasons for this situation are often historical but, more recently, financial as local authorities have failed to prioritise and resource nature conservation planning effectively during a period of economic constraint.

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UNIFICATION OF PLANT COMMUNITIES IN COLONIAL CITIES: ECOLOGICAL AND CULTURAL PHENOMENA

Abstract
Original English landscapes played a vital role in shaping urban landscapes in new English colonies in the USA, Australia and New Zealand. Plant communities such as pasturelands, park lawns, private gardens, hedges, flowerbeds, and broadleaved woodlands were the landscape architecture vocabulary for new colonists. The lawn was the most powerful and widespread element; it was, and still is, a cultural and social symbol of traditional colonial culture. In temperate cities urban lawns consist of traditional European grasses (e.g., Poa, Lolium and Festuca), whilst in hotter and drier conditions lawns are a mixture exotic Eurasian species. Landscape styles, floristic composition, structure and maintenance practices are very similar in colonial cities because of the introduction of aesthetical cultural perceptions of 18th/19th century English society. As a result we observe the process of unification not only of urban floras in the sense of similar species but the same urban landscape configuration and more importantly the same human meaning in all types of urban landscapes. There are strategies that can be

offered by modern ecological design such as the plant signature concept, alternative lawns, wildlife and rain gardens, buffer zones and united green corridor systems that can contribute to increasing urban biodiversity and creating sustainable urban ecosystems.

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VEGETATION AND BIOTOPE CHANGES IN TERRESTRIAL SWEDISH ECOSYSTEMS - METHODOLOGICAL STUDIES OF INDICATORS IN COLOUR

Abstract
Vegetation is the long time answer of physical geographical factors of bedrock, soil, hydrology and climate, heavily influenced with human factors seen in present and past land-use and its technology. Vegetation and biotope changes are thus evidence of landscape change and also of environmental impact of importance for ecosystem function and biodiversity maintenance. Colour infrared aerial photographs give high-resolution information of vegetation, biotopes and it status, and old photographs gives information of changes fifty years or more back in time. The aim of the study was to analyse changes and identify indicators in colour infrared aerial photographs in different scales, that could be used to quick and efficient detect changes of Swedish vegetation type. The aim was also is to develop and implement methods for monitoring and environmental planning.
Colour infrared aerial photographs in stereo pair were tested in selected terrestrial ecosystems and habitats in Sweden; in, mountains, mires, forests, agricultural landscapes and in the urban/semiurban areas. Development of methods includes the identification of indicators, development of classification methods and classification systems and evaluation the accuracy. The result shows that several and different indicators can be used. In the mountain ecosystems the indicators is cover of vegetation and lichen cover, and the results shows decreased lichen cover and increased number of bare mineral soil patches; in mires and wetlands the indicators used is increased tree growth, especially of pine. In forests ecosystems the indicators used are steep north facing slopes, small rivulets and ravines, old growth trees, pine or hardwood deciduous trees with wide crowns, and dead wood. Defoliation and discoloration are also used as indicators. In the agricultural landscape the amount, distribution and shape of grasslands, especially ancient meadows and pastures are good indicators. In the urban/semiurban areas old growth hardwood deciduous trees, grasslands, wetlands and amount of vegetation cover in built up areas were good indicators of biodiversity. The findings in the mountain areas, and in the forests, as well as in the urban areas are used for applications in monitoring and planning.

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THE INFLUENCE OF RESOURCE CONSERVATION ON SOIL PROPERTIES REGULATING RUNOFF AND EROSION ACROSS SCALES

Abstract
The paper will present the results of field investigations undertaken in contrasted semi-arid and sub-humid landscapes in SE Spain, Portugal and Greece since 1991. In the studied areas It was found that the dynamics of resource conservation profoundly influenced the dynamics of the soil structure and its hydrology (regulation and conservation functions). In Spain it will be shown that on both abandoned agricultural fields, and on burnt pine forests resource accumulation around shrubby plants has a large influence on the coarser slope scale hydrology. Resource conserving systems seem to function differently according to both the state of the system and climate. This will be illustrated for research sites on Lesbos and Crete. Studies at the catchment scale,

enable the relationship of climate to different patterns of resource accumulation to be analyzed. The importance of the time-scales and thresholds associated with the processes affecting conservation at different scales will be discussed. The results will be presented within the frameworks of state and transition, hierarchy theory, and adaptive systems. The nature of both thresholds and resilience will be discussed. Recommendations for monitoring the state of the systems and on the use of indicators will be given.

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ADEQUATE DATA OF KNOWN ACCURACY ARE CRITICAL TO ADVANCING THE FIELD OF LANDSCAPE ECOLOGY

Abstract
Acquiring adequate data of known accuracy is the one "top ten" priority research topic that pervades the other nine. Lack of available, high-quality data often limits progress in other realms. Though massive strides have been made in data acquisition, technology, and management over the past two decades, we still have a long way to go. Many of today's global environmental challenges need additional reliable data with a known (and preferably high) degree of certainty to sustain the political will to implement practical solutions to the challenges. We need basic biological data on species, populations, and communities, with adequate spatial resolution. We need the data collected consistently over time, so that trends can be assessed and adaptive management can proceed. We need new, creative ways to gather and extrapolate heterogeneous information across large regions, by combining the use of field sampling, experimentation, remote sensing, and modeling. A primary research opportunity is developing and testing methods of uncertainty analysis and assessing their effects on landscape pattern analysis and modeling. Acquiring and maintaining high quality and spatially referenced raw data, metadata, and derived data products is imperative for landscape ecologists to make credible recommendations on the many landscape issues facing society today.

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ENVIRONMENTAL CLASSIFICATION IN EUROPE: CO-ORDINATING ECOLOGICAL DATA AND LINKING FIELD MONITORING

Abstract
Europe is by far the best surveyed continent in the world with countless national databases and assessments for different objectives, e.g. forestry, agriculture and nature conservation. Most of this data can only be used at national scale due to different temporal and spatial scales or bias, which makes the data unsuitable for European wide assessments. Furthermore, high quality satellite data cannot be linked to field observations because there are no consistent criteria for site selection. A second, associated problem is the increasing cost of field surveying. The Countryside Survey (http://www.cs2000.org.uk/) in Great Britain has tackled the two aforementioned problems, data integration and effective sampling, on a national scale. A statistically derived environmental classification formed the basis for the integration of ecological data from outside the countryside survey. Statistically sound relations between disparate data sources such as Landsat images, soil maps and species distribution data were found. A high-resolution stratification of Europe's environment into more or less homogeneous regions would provide a framework for integration of available spatial ecological data, and for strategic random sampling of new data. It is essential that this environmental classification has a fine resolution and is statistically derived so that the classes are clearly defined and unbiased. Using experience in creating a 0.5°x0.5°

Classification (Bunce et al., 1996) we developed a 1x1km Environmental Classification of Europe (EnC), distinguishing 84 classes, based on high-resolution climate and altitude data. The EnC will provide the framework for integration aiming to set up a European sampling scheme, similar to the UK countryside survey (see: http://www.ecoland-forum.org).

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SPATIAL SCALE ANALYSIS OF ENVIRONMENTAL BIODIVERSITY SURROGATES

Abstract
Using GAP data from several US states including Florida, Kansas, New York, and West Virginia, we analyze the effect of spatial scale on the performance of environmental biodiversity surrogates. We study scales from about 1 to 100 sq. km. At the first stage of analysis we impose a requirement of one representation of all vertebrate species in conservation area networks. Later stages will impose percentage representation requirements. (In some of our analyses we give preference to federally endangered species. When available, we also analyze data on other taxa including butterflies.) As surrogates we use all available environmental data. These include data on precipitation, temperature, soil, and vegetation classes, and, on occasion, aspect and elevation. Initial results are promising, with about 92.5 % of the biota achieving the required target at lower scales and about 93.5 % at higher scales. The results are uniform across regions. Most importantly, there is a critical scale after which there is no significantly better representation with higher areas. We argue that this is the scale at which rapid conservation planning should take place.

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PRIORITISATION PROCESS FOR CATCHMENT REMNANT VEGETATION

Abstract
A Multi-criteria Analysis (MCA) of remnant vegetation blocks was undertaken on a saline affected catchment in the wheatbelt of South-western Australia. Existing GIS themes were examined to determine their applicability to biodiversity criteria and the relevant themes transformed to represent 15 criteria associated with biodiversity assets and risks. A workshop was held with stakeholders and experts to help weight each criterion. MCA was conducted using concordance analysis and pairwise comparisons to rank alternative remnant vegetation blocks in terms of investment priority. The resulting ranks were then categorised into high, medium and low priority remnants and the data transformed to create an additional theme to spatially represent investment priority. The Lake Chinocup catchment was ideally suited to a GIS-based MCA, as many themes representing biodiversity assets were available and there was a high level of interest in biodiversity conservation among farmers. The process is highly suitable to prioritisation of remnants at a catchment scale and is a useful tool for decision-making and natural resource management.

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STRATEGIC STUDY FOR RESTORING GRASSLAND IN RURAL JAPAN

Abstract
Grassland is one of the landscapes being extinguished due to economic and social reduction in rural regions of Japan. It used to be managed by local people in the strict social manners, to harvest grasses as organic fertilizer and roof material. Almost grassland is no longer managed and it has been changing to woodland due to rapid invasion of tree species. Decrease of grassland area has caused several problems ecologically and socially; many grassland-species have been endangered, scenery value for tourists is reduced, social system including knowledge and techniques which are necessary to maintain grassland has been vanishing from the region and thus the grass-roof houses even in which have been designated as cultural monument cannot be maintained. In order to solving the problems, grassland restoration is necessary, and it can be done by cooperative work with local people. The purpose of our project is to seek the possibility of grassland restoration cooperating with local people at Higashi-Iyayama Village in Shikoku mountain region. We are clarifying ecological process and function of grassland in the region to provide people the target image for restoration. Then actual plans will be made through workshop among researchers, local people, teachers and officers.

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BIODIVERSITY VALUES OF REFORESTATION IN RAINFOREST LANDSCAPES OF TROPICAL AND SUBTROPICAL AUSTRALIA

Abstract
Rainforests in north-eastern Australia have been extensively cleared over the past two centuries, with reforestation efforts increasing in recent decades. However, styles of reforestation vary considerably in cost and economic potential; and the extent to which they restore structure, composition and ecological function to cleared land is poorly understood. In this paper, we develop an approach to quantifying the biodiversity values of the main reforestation styles practiced in tropical and subtropical Australia, including unassisted regrowth, timber plantations and diverse 'restoration' plantings. We use data from a network of 104 sites in rainforest landscapes of the tropics and subtropics to outline ways in which transect-level survey data (e.g., of plants, vertebrates and invertebrates) might be integrated to attribute 'biodiversity values' to reforestation projects. There was considerable congruence between different biodiversity surrogates. We used the biodiversity values of different reforestation styles to compare their relative costs and likely economic values, and discuss the implications of the results for strategies to reforest cleared rainforest lands. This enables comparison between the cost-effectiveness of purchasing remnants with that of replanting. We conclude that area, style and context must all be considered when seeking biodiversity outcomes from reforestation across a landscape.

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MANAGEMENT OF SHELTERBELTS IN AGRICULTURAL LANDSCAPES FOR

LIVING RESOURCES PROTECTION

Abstract
The importance of shelterbelts for vegetation and fauna occurring in an agricultural landscape was assessed. Shelterbelts and small forest have been found to contain more than 260 plant species, which makes 32 per cent of total vascular plants in agricultural landscape. The higher species diversity is found in well-developed mixed forests and small mid-field water reservoirs. Native plants contribute to 88 per cent of shelterbelts flora. Newcomer species easily settle in shelterbelts. The differentiated structure of agricultural landscape creates the conditions favourable for the survival and development of numerous animal species, first of all for the important functional group of predators and parasites. This is reflected in the increase of biodiversity, density and biomass of invertebrates - mainly insects - on the fields located in a diversified landscape. A well-developed mosaic pattern of shelterbelts provides refuge sites where animals can overwinter and find shelter from harmful agricultural measures. The biomass of hibernating insects in the newly planted shelterbelts in the studied landscape is almost 15 times higher than that in a cultivated field. After 3 to 5 years the biomass of hibernating insect approach the level characteristic for old shelterbelts. The range of field penetration by various insects is differentiated, and therefore much higher densities of predatory forms are observed close to the refuge than in the middle of a field.

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LOGGING AND SITE INTERACTIONS INFLUENCE FLORISTIC PATTERNS IN SUBTROPICAL RAINFOREST

Abstract
Patterns of floristic assemblages and site characteristics following different levels of logging intensity were investigated in 23 quadrats of subtropical rainforest in north-eastern New South Wales, Australia. Floristic assemblages were significantly different between low (200-400), medium (400-700) and high altitudes (over 700 m asl). Levels of shade tolerance of different species were correlated with habitat characteristics at a finer scale. The abundance of some tree species was positively correlated with both disturbance intensity and topography (mid slope through lower slope to creek/gully), but negatively correlated with aspect (NE - NW). An increase in disturbance was associated with an increase in the abundance of juvenile trees of some shade- intolerant and tolerant species. A similar effect was found for mature shade-intolerant trees ³ 10 cm dbh. Conversely, the number of individuals of shade-tolerant trees decreased with disturbance intensity, especially beyond 50 cm dbh. These suggest that the sites are yet to recover from the logging disturbance. Information of floristic and site characteristics would assist the design of silvicultural regimes in subtropical rainforest. Such information would also assist forest establishment, rehabilitation and restoration work by ensuring that the use of local species was well targeted and ecologically appropriate.

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LANDSCAPE DYNAMICS AND WOODLAND CONSERVATION STRATEGIES: SEARCHING SUSTAINABLE TRAJECTORIES

Abstract

This paper presents a case study from an oak woodland site in southwestern Finland, where information of the past landscape and woodland dynamics was used to bring out sustainable management strategies for protected oak woodland habitats. Landscape dynamics was analysed at land cover and woodland land use levels respectively and the focus was 1) to form and test a spatio-temporal GIS data model in determining landscape changes and 2) to study the implications of landscape dynamics, primarily nature–human interactions, on the oak woodlands. The data sets used in the GIS analysis were old land use maps and aerial photographs between 1690-1998. The GIS-based landscape change model concerned 'time' as the framework in which changes in geographic entities were observed. Sequential maps were compared and visualised using different techniques to determine the location and nature of changes. Results show that the knowledge of the landscapes as continuously changing, dynamic systems causes reconsideration of the philosophy of how to preserve and manage cultural woodland environments, such as the oak woodlands. Spatio-temporal evidence of landscape dynamics can be used to suggest alternative habitat management strategies for Ruissalo. These will promote both ecological and amenity values of the oak biotopes.

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A CLASSIFICATION OF LANDSCAPE FIRE SUCCESSION MODELS

Abstract
A classification of spatial simulation models of fire and vegetation dynamics (Landscape Fire Succession Models-LFSMs, was developed to help identify the appropriate fire and vegetation processes and their simulation to include in Dynamic Global Vegetation Models and to construct a key for research and management applications. The classification can also be used to interpret differences between LSFMs as well as provide a stratification of comparing models. The classification is based on the four primary processes that influence fire and vegetation dynamics: fire ignition, fire spread, fire effects, and vegetation succession. Forty two LFSMs were rated on a scale from 0-10 for their inherent degree of stochasticity, complexity, and mechanism for each of the four processes. These ratings were used to group LSFMs into similar classes using various ordination and clustering techniques. Another database was created to describe each LSFM using keywords for over 20 explanatory categories. This database and ordination and clustering results were then used to create the final LSFM classification containing 12 classes and a corresponding key. The database and analysis results were used to construct another classification key so managers can select the most appropriate model for their application based on computer resources, expertise, and management objective.

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POPULATION VIABILITY AT LANDSCAPE SCALE: MODELLING MANAGEMENT OPTIONS FOR A PLANT EXPOSED TO FIRES AND DISEASE

Abstract
Effects of fires and disease on the viability of an endangered shrub from Tasmania, Australia, were examined using a stochastic matrix population model. The model structure included 12 life stages and 17 spatially explicit populations. The size and structure of populations were parameterised using field survey data. Transition probabilities and environmental stochasticity were estimated using demographic census data gathered over 4 years. Density-dependence was modelled using a function that reduced growth

and survival rates whenever population size exceeded carrying capacity. Simple abstractions were used to model the spread of fires and disease across the landscape. Fires temporarily reduced survival and seed production, and triggered germination from the otherwise dormant soil seed bank. Disease reduced growth and survival of standing plants, which was modelled indirectly by reducing carrying capacity with time since infection. Simulations over 50 years predicted certain decline of >90% and several local extinctions, although global extinction was unlikely. Of several management scenarios examined, on-site treatment that reduced disease-related mortality by 90% was the only action that reduced the risk of decline appreciably. This result provides valuable guidance for management priorities constrained by resource availability. With minor adaptation, the model is applicable to many other species and landscapes with similar characteristics.

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LONG TERM INFLUENCES OF CLIMATE, VEGETATION AND PEOPLE ON FIRE IN THE AUSTRALIAN TROPICS

Abstract

A variety of factors, including the current high rates of climate change and landscape transformation and the often experimental nature of biomass burning, inhibit understanding and prediction of the role of landscape fires in global change from historical records and monitoring studies. We present evidence of charcoal and pollen preserved in lake and marine sediments over the last 100-500 thousand years across northern Australia to provide a firmer basis for assessment of fire activity in relation to climate and vegetation both before and within the period of human occupation. Global climate forcing, reflected in this region by glacial-interglacial changes in precipitation levels and vegetation distributions, has exercised the major control over temporal fire patterns. Superimposed on this cyclical pattern is a trend towards increased burning, best explained by intensification of the regional monsoon and El Niño-Southern Oscillation systems. This trend has generally accelerated since the arrival of people although it has been reversed in drier areas, possibly the result of reduced fuel availability due to human impact on the vegetation. In those areas supporting a sufficient biomass, fire activity has increased recently but it is uncertain whether it is now regionally higher than at any previous time.

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A PROPOSED METHODOLOGY FOR APPROACHING THE MANAGEMENT OF LANDSCAPE DISTURBANCE

Abstract

The disturbance of the natural movement of water in the landscape can create many environmental problems that affect land productivity. Using GIS methodologies, the relationships between landscape ecology, soil science and the hydrological cycle, especially the movement of water within the landscape structure, are the emphasis of this research.

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SELF-DEVELOPMENT OF SPATIAL PATTERN IN BOREAL FOREST LANDSCAPE IN RUSSIA

Abstract
The hypothesis tested assumes that evolution of landscape pattern is a result of two phenomena. Normally soils and plant cover respond to contrasts of abiotic environment and gradually adapt to it. At the same time new patterns can emerge being independent on abiotic conditions. This is treated as self-organization induced by occasional impulses. The objective is to evaluate contributions of abiotic determinism and self-development and to identify driving forces of self-development. Field data are collected in boreal forest region in northeastern European Russia. We use classification of landforms based on DEM, GIS technologies and remote sensing data to characterize landscape diversity. The key point of the study is estimation of uncertainty measure in relations between landscape geocomponents: landforms, deposits, soils, and plant cover. Uncertainty calculated with discriminant analysis is believed to be in compliance with non-equilibrium of landscape organization. Low uncertainty indicates perfect adaptation and determinism in relations of geocomponents. High uncertainty reveals areas with greater potential of self-development. Modelling relations between diversity in moving window and landscape properties in sample plot shows much promise for interpretation of uncertainty and forecast of trends in evolution of spatial pattern. Changing size of moving window we determine scale level of interaction between geocomponents.

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MOVEMENTS OF ROCKY MOUNTAIN ELK (CERVUS ELAPHUS): EFFECTS OF LANDSCAPE STRUCTURE

Abstract
We examined movements of Rocky Mountain elk (Cervus elaphus) in northeastern Oregon, USA. Movement vectors at 449 locations over a 7,762 ha study area were calculated based on 35,798 sequential observations of 128 individual elk during spring 1993-1996. We calculated movement vectors prior to morning and evening feeding bouts (0500, 1900 hrs) and during periods of least activity (0100, 1500 hrs). We then measured landscape variables representing spatial heterogeneity (structural contrast between neighboring patches, number of different patch types, patch shape, and spatial arrangement of patches) at 3 spatial scales (250 m, 500 m, and 1,000 m around each point). During all 4 time periods, mixed models at the largest (1,000-m) spatial scale (adjusted for spatial correlation with semivariance analysis and evaluated with AIC scores) best represented vector lengths (speed of elk movements). In general, elk moved more quickly through landscapes that contained multiple patch types (high patch richness density), and where patches were not clumped (low contagion). Patterns differed, however, among time periods. These results are consistent with previous knowledge concerning elk movements and foraging behavior across large landscapes. Elk movements also were examined with respect to topography and habitat-patch boundary characteristics such as curvilinearity and porosity.

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THE IMPLICATIONS OF CHANGES IN IGNITION REGIMES FOR THE VEGETATION OF SOUTH WEST TASMANIA

Abstract
Historical fire regimes dictate the current mosaics of vegetation within landscapes. Contributions by both natural and anthropogenic ignitions determine such fire regimes. Simulation models can provide an insight into how historical fire regimes produced present day landscape vegetation mosaics, and as such they can be used to devise appropriate fire management strategies. Such models incorporate a sound understanding of fire and vegetation interactions into a simulation model capable of depicting fire regimes over heterogeneous landscapes and large temporal and spatial scales.
FIRESCAPE-SWTAS is a process-based landscape simulation model devised for simulating natural and anthropogenic burning patterns within the World Heritage Area in the south west of Tasmania. The frequencies and locations of lightning, arson and management ignitions can be varied to identify key long-term principles in fire regimes responsible for creating and maintaining current vegetation distributions.
FIRESCAPE-SWTAS demonstrates that the current mosaic of vegetation is unlikely to have resulted solely from lightning fires, suggesting long-term anthropogenic manipulation of the landscape with fire. Within multiple century investigations, changing the anthropogenic ignition regime has a direct impact on the resultant mosaic of vegetation and overall fire regime dynamics. Such findings have implications for current fire management strategies.

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SPATIAL CONSIDERATIONS FOR LINKING WATERSHED LANDCOVER TO ECOLOGICAL INDICATORS IN STREAMS

Abstract
Watershed landcover is widely used as a predictor of stream ecosystem condition. However, numerous confounding factors limit our ability to identify causal linkages between landcover and stream indicators. Here we consider potential solutions to the analytical problems of spatial autocorrelation among stream samples, correlations among explanatory variables, and spatial arrangement of landcover classes within watersheds. To illustrate, we used landcover, abiotic (water quality, instream habitat) and biotic (macroinvertebrate) indicators from 325 watersheds in the Maryland coastal plain, USA. Using a multivariate approach, we showed that spatial autocorrelation between catchment-scale landcover and stream indicators often resulted in spurious correlations; however, several significant linkages were evident even after this spatial component of variation was removed. Correlations among abiotic indicators further complicated the task of relating landcover to biological condition, yet we identified several independent abiotic pathways between landcover and biota by factoring out the combined effects of other abiotic variables. Subsequent analyses revealed that spatial arrangement of landcover also had an important influence, as the predictive ability of different distance-weighting schemes varied with landcover class and indicator. Thus, influential scales and patterns of watershed landcover on stream ecosystems likely depend on an array of interacting spatial factors.

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A GRAPH-THEORETIC PERSPECTIVE ON PLAGUES WITHIN A CONNECTED PATCH SYSTEM.

Abstract

The rapid rise in abundance of an organism at a patch scale will only have regional implications if dispersal processes enable the exploitation of new resources. The outbreak of plagues throughout a highly connected system of discrete patches is difficult to model using regular data types. Points, lines, polygons and pixels describe features in the landscape with minimal attention to their extended connectivity. Graph structures with nodes and edges can provide a data model that offers useful insights into ecological flow across a large network. This study examines the growth and dispersal of Crown-Of-Thorns-Starfish (COTS) (Acanthaster planci) within the Great Barrier Reef, Australia. COTS consume coral polyps and during severe outbreaks can reduce coral cover to less than 1% for an entire reef. Long term monitoring studies describe the abundance of COTS populations, the percentage coral cover and the coral community composition. These measures provide the predator-prey states for the nodes depicting the reefs. The linkage strength and direction between reefs was created using hydrodynamic models. Analysis of the source/sink status of reefs is examined using edge thresholds and node removal for coral-cover-weighted minimum spanning trees. Identification of reefs with high traversability offers insight into the mechanism of dispersal rates and colonisation extent.

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THE IMPACT OF HABITAT QUALITY, SIZE AND CONFIGURATION ON POPULATION VIABILITY. WHEN TO IMPROVE WHAT?

Abstract
Populations of many species are endangered as a result of changes in their habitat such as a decrease in the amount and quality and a change in spatial structure. The latter can cause high levels of fragmentation. To protect species insight is needed in the relative impacts of deterioration and fragmentation of habitat on species survival such that conservation measures and strategies can be ecologically effective. Compared to quality and size, spatial configuration of habitat has received an overwhelming attention in both theoretical and applied literature during the last decades. However, configuration only seems important for population survival when the amount of habitat in a landscape is below certain threshold values. Seemingly the importance of habitat configuration is over emphasized and more attention should be given to the role of quality and size in population survival. Obviously, the three habitat aspects are related. Changes in one of these aspects results in changes in one or both others. To compare the results of studies on the importance of one of these aspects for population viability, authors should clarify their definitions of the habitat aspect and population viability, and the time and spatial scales they consider. Moreover, insight is needed in how the definition of the habitat aspect is related or redundant to the other aspects and how relevant the results are for other spatial scales. This presentation aims to give a review of current literature on the importance of the three habitat aspects, points out some pitfalls and gives some general rules.

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THE INTERACTION OF SCIENCE AND POLICY: A CASE STUDY OF THE DUTCH ROBUST ECOLOGICAL CORRIDORS

Abstract
At the Alterra department of Landscape Ecology, the research group Environmental Policy Assessment supports policy and policy making, and facilitates the public debate on nature conservation, environmental issues and spatial planning, by applying and implementing landscape ecological knowledge and tools. To succeed in this mission we co-operate with other teams within the Department of Landscape Ecology, other departments at Alterra and other groups of the Dutch scientific community. Members of the Environmental Policy Assessment-team have to be able to cross the gap between science on one hand, and policy and public interests on the other. Even more, we have to be able to create a bridge between those. Because of our role we have ample experience with the implementation of landscape ecology in policy and planning at different scale levels, from the local level up to the national and European level. In my paper I will present a number of cases of the co-operation between Science and Policy. Doing this I will focus on the way both areas influence each other. This will lead to the conclusion that policy makers need scientists, but that scientists need to be able to speak the policy maker's language and understand their problems.

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GROUND BEETLE (CARABIDAE) ASSEMBLAGES ACROSS URBAN-RURAL GRADIENTS: AN INTERNATIONAL COMPARISON

Abstract
Although complex to quantify, urban-rural gradients are intuitively obvious – most people know what is meant by urban, suburban and rural. These gradients have proved useful for comparative studies of the ecological effects in increasing land-use intensity in urban areas. We studied communities of carabid beetles in residual forest patches along urban-suburban-rural gradients in four cities (Helsinki, Finland; Edmonton, Canada; Sofia, Bulgaria and Hiroshima, Japan) to examine their responses to urbanisation. Cluster analyses revealed distinct separation of the carabid communities along the gradient in both Helsinki and Hiroshima, but not in Edmonton and Sofia. Furthermore, our results provide some support for the predictions that species richness will decrease, that opportunistic species will gain dominance, and that small-sized species will become more numerous under disturbance such as that provided by urbanisation. Given these broad generalisations, individual cities did display city-specific carabid beetle community characteristics. For example, Edmonton was characterised by large numbers of exotic carabid species, and Hiroshima by a highly significant change in number of individuals and species across the gradient and by very distinct carabid communities in urban, suburban and rural sites. These city-specific differences are explored with reference to differences in the historical makeup of the cities and in terms of the intensity of the urbanisation gradient.

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CATCHMENTS, STREAMS AND SAND SLUGS - A STUDY IN SCAPE ECOLOGY

Abstract
Scape ecology seeks to apply the approaches of "landscape" ecology to both terrestrial and aquatic systems. This case study is concerned with creeks that flow from the Strathbogie Ranges in central Victoria onto the Goulburn River floodplain. European settlement of the Ranges, accompanied by clearing, grazing, and drainage works, led to severe erosion and stream incision with consequential export of massive amounts of

sand. Downstream persistent sand slugs developed that transformed the heterogeneous habitat patchiness of the original wood-rich 'chain of ponds" into elongated and shallow sections of sand. In the latter, the likelihood of summer drying of surface water has increased, especially in drought.
In comparison with unsanded reference streams and creek sections, there are differences in both invertebrates and fish. The sand slug invertebrate fauna is similar to that of sandbed streams elsewhere, except it lacks an abundant hyporheos. It is marked by high variability between sites and between creeks. With the fish, abundance in the sand slugs is low with only three native species being present, compared with a higher diversity of both native and introduced fish downstream. Stream rehabilitation is difficult as the sand slugs are now static necessitating habitat heterogeneity to be created within the slugs.

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FOCAL SPECIES IN CONTEXT: IS SPECIES-BASED CONSERVATION SUFFICIENT?

Abstract
Conservation biology and landscape ecology are of limited assistance to managers seeking to maintain or restore biological diversity. In the absence of generic answers regarding the type, amount and placement of actions required to prevent further loss of species, we require robust processes to derive answers appropriate for particular areas of interest. The focal species approach to conservation planning provides such a process. However, the approach has received criticism on theoretical, empirical and practical grounds. I review the strengths and weaknesses of the focal-species approach. I conclude that, while the requirements of species need to be considered if they are to be conserved, the parameters for landscape design and management may be set by factors other than species requirements. Nonetheless, the formal threat-assessment framework that underpins the approach provides a logical pathway for determining the factors that should be used to determine the type and magnitude of actions that should be implemented. I acknowledge the empirical limitations of the approach and argue that application of the precautionary principle would suggest that the approach is of value in landscapes that require restoration, but may have inherent risks when used in clearing scenarios. I also argue that the answers generated by the process should be treated as initial hypotheses and procedures applied to test biotic responses against those predicted.

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IMPACT OF REMOTE SENSING CLASSIFICATION ERRORS ON LANDSCAPE METRICS

Abstract
Remote sensing images are routinely classified into different land cover types and then used as base maps for the calculation of landscape pattern metrics. These classifications are never completely accurate and the errors are generally specified in terms of the number of misclassified pixels, with no specification of the spatial distribution of the errors. Some research has concluded that bias in landscape metrics is not amplified by land-cover misclassification. We determined whether it is it possible for different maps with the same overall classification error to have significantly different errors in the derived landscape metrics. We address this question using sets of replicated synthetic neutral landscapes with varying proportions of two land cover types and different types of classification errors. Even relatively minor classification error rates

can cause significant changes in the values of several commonly used landscape metrics. We also show that the common practice of reducing classification errors by use of a minimum mapping unit size can increase the errors in several landscape metrics. We conclude that classification error is not always a good predictor of errors in landscape metrics. We also suggest which landscape metrics are most and least sensitive to different types of classification errors.

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ABORIGINAL LAND MANAGEMENT IN ARID AUSTRALIA

Abstract
I consider that the Australian landscape has been considerably changed during the time since Aborigines first occupied the continent, producing the present day highly flammable vegetation. To cope with this situation past Aboriginal land management generally entailed burning the country whenever fuel loads were sufficient, thereby producing a mosaic of burnt areas at different stages of fire recovery, as well as reducing wildspread damaging fires. Hunting methods also used fire but probably produced minimal long term change, especially as certain areas, often of high biological value, were considered of such important 'spiritual' significance that they became sanctuaries where plants and animals live untouched. The last 100 years has seen considerable changes, both in regard to Aboriginal lifestyle and the biota. Just what is now the best way forward to manage the vast areas of changed lands is a problematic issue.

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USING THE PRECISION OF LANDSAT IMAGERY TO MAP HABITAT, AND THE IMPLICATIONS FOR LANDSCAPE PATTERNS

Abstract
Many studies of wildlife distribution patterns are based on landcover maps created from satellite images. While this body of research has been instrumental in the development of landscape ecological theory, the mismatch in grain between habitat descriptions (e.g.,10-102 m2) and landcover training datasets (e.g., 102-103 m2) likely adds substantial error into statistical analyses. Further, landcover classes may not accurately or precisely explain the levels of ecological organization to which species respond. To address these potential problems we developed a landscape sampling protocol that specifies a common grain, based on the resolution of Landsat 7 ETM+ imagery, for creating datasets describing forest bird occurrence and landcover. This approach allowed us to match sampling locations with individual pixels to exploit the spectral and spatial precision of Landsat imagery. We then used a cross-validation approach to identify growing-region parameter values that maximized the accuracy of maps predicting forest bird species occurrence based solely on the spectral information contained within pixels. These parameter values were then used in combination with the landcover training dataset to create maps that help bridge the gap between how humans characterize the landscape and how wildlife respond to landscape heterogeneity.

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ELUCIDATING THE MECHANISMS BEHIND SUCCESSFUL INDICATORS OF BIODIVERSITY

Abstract
Groups of species have been proposed as indicators of biodiversity for use in conservation planning. Different tests of indicator groups have produced divergent results varying with taxonomy, methodology, scale, and location. At large scales, successful indicator groups should be composed of species with small non-overlapping ranges occupying different environments. We investigated these predictions with a database of occurrences of 920 species over an area of 317,000-km2 in the eastern United States. First, we randomly selected sets of species and tested their ability to act as indicators of biodiversity for selecting reserves to protect all species. We then compared indicator group composition with performance. Second, we used a stochastic optimization technique to identify sets of species that performed particularly well as indicator groups. Performance was associated with the area and compaction of species' ranges ($r^2 = 0.40$). Optimally selected indicator groups were composed of rare species from several different taxa. Sites selected to protect these species covered a more diverse set of environments than those selected to protect the randomly chosen indicators. We conclude that indicator performance can be linked to simple aspects of species distributions, and that carefully chosen environmental surrogates may be a useful alternative to indicator species.

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ASSESSING THE REGIONAL ECOSYSTEM APPROACH TO BIODIVERSITY CONSERVATION IN SOUTHEAST QUEENSLAND

Abstract
The bioregional ecosystem approach is a widely used landscape-level conservation planning methodology in Queensland. We use quadrat-based floristic data to assess the utility of bioregional ecosystems as a surrogate for biodiversity in southeast Queensland. Numerically-based cluster analysis and ordination techniques are used to derive species assemblages, which in turn provide a basis for comparative analysis with bioregional ecosystem mapping. This information is compared within a GIS to elucidate spatial influences. Initial results show varying levels of similarity between the bioregional mapping and the results of the numerical approach. Landscapes exhibiting high heterogeneity show greater differences between the two approaches than do more homogeneous landscapes, a factor that is largely the result of the impact of bioregional mapping scale. Databases incorporating other taxa will also be investigated as possible scalars to these floristic patterns.

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BEYOND THE LANDSCAPE: SIMULATING THE BROADER-SCALE IMPACT OF FIRE ON THE GLOBAL CARBON CYCLE

Abstract
Despite the large impact of fire on the global carbon cycle, fire processes are represented in only a few dynamic global vegetation models (DGVMs) simulating broad-scale impacts of climate change. The MC1 fire disturbance module simulates fire severity and area, key components for estimating fire impacts on the carbon cycle. Fire

severity (i.e., carbon consumption and mortality) is simulated using fire behavior/effects functions from landscape-scale fire models that are scaled-up in MC1 by assuming homogeneity of climate and fuel characteristics within relatively coarse-scale grid cells. The landscape-scale approach to simulating fire area (i.e., explicit estimation of fire spread) is precluded in MC1 where grid cell size exceeds most observed burn areas, and where finer-scale variation in constraints on fire spread is not represented. Fire area in MC1 is a function of the current fire rotation period (a dynamic function of vegetation type and current climatic conditions) and time since fire. MC1 successfully simulates the observed timing of relatively large and small fire years in the United States over the period of record. Simulated annual fire area is within the expected range for pre-suppression conditions, and a new fire suppression function should increase the accuracy relative to the suppression era record.

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FROM DATA TO DECISIONS. STEPS TO AN APPLICATION-ORIENTED LANDSCAPE RESEARCH

Abstract
On the basis of six examples from different projects and landscapes, steps as well as needs for bridging human and natural sciences by an application oriented landscape research will be elucidated. Besides the specific results of clarifying uncertainty, improving data modeling (ad i), and delineating potentials and elaborating scenarios (ad ii), the use of process oriented and participative planning methods - as conceptual tools to cope with the problems - is demonstrated (ad iii), and finally the development of integrative frameworks, like the Environmental Impact Assessment Multi-level Approach ("EIAMA", or good planning practice approach; Lenz et al. 2000, 2001) is suggested (ad iv).

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LAND USE & LAND MANAGEMENT PRACTICES INFORMATION FOR CATCHMENT SOLUTIONS IN AUSTRALIAN LANDSCAPES

Abstract
Land use and land management practices have a major impact on landscape processes that underpin Australian soil, water and biodiversity assets. For example, crop selection and other farm management practices can play a key role in processes affecting catchment salinity and water quality, and rates of soil erosion, acidification, nutrient decline and carbon losses. Key natural resource processes generally operate at regional or catchment scale. Land use information at catchment scale is therefore required to develop effective responses to natural resource problems (such as salinity, water quality and soil loss) and plan for the sustainable use of Australia's landscapes. Land use information is also contributing to the assessment of agricultural productivity and opportunities for agricultural diversification, land value determination, local and regional planning, pest and disease control and emergency response planning. The Bureau of Rural Sciences is working in partnership with Commonwealth, State agencies and local government towards developing nationally consistent land use datasets for Australia. Catchment scale land use mapping will extend to about 70 percent of the continent by 2003/04.

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SPATIOTEMPORAL COMPLEXITY AND SCALING IN ECOLOGY

Abstract
Many complex spatial and temporal phenomena in ecology can be described by different, but very simple, scaling laws. A log-log plot of ecological data has the great property of displaying, more often than not, a straight line over a certain range of parameters. There is a widely spread tendency to look for simple, ideal explanation in studying ecological complexity; one often interprets a straight line as a scaling law (or scale invariance) reflecting some important information. My talk will address how deeply misleading this quest for simple interpretation can be. I will show that many mechanisms can produce a power-law distribution. In many cases, there is no single ecological mechanism behind the scale invariance. I argue that the departures from the power-law should not necessarily be explained by the finite size of the system, but could result from a deeper departure from the power-law hypothesis. Ecologically, spatiotemporal scales can give us access to additional information and clues about the underlying processes and the existence of a hierarchy of preferred scales. Studying scale covariance and dynamics should be emphasized in today's landscape ecology.

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EFFECTS OF LANDSCAPE TOPOGRAPHY AND FUEL CONDITION ON LONG-TERM FIRE DYNAMICS

Abstract
Forest fire is one of the major natural disturbances that influence the dynamics of Canadian boreal forests. Understanding on both short- and long-term fire dynamics is needed in order to assist the management of fire and forest resources. Short-term fire dynamics are the portions of fire dynamics over long periods of time. The long-term fire dynamics for a given geographical region are considered as the result from the interactions among different ecosystem components, including landscape condition, over space and time. Fire behavior studies have revealed that landscape topography can influence the speed of fire front movement, and the results from landscape ecology indicated that landscape structure such as fuel continuity could influence the spread process of a fire event significantly. This study is to investigate the possible effect of landscape topography on long-term fire dynamics under a single homogeneous fuel type without fuel breaks. Results from a model experiment suggested that the relative importance of landscape topography could vary according to the general susceptibility of a landscape to fire. No significant effect of landscape terrain could be found when the landscape is highly prone to fire (e.g., lodgepole pine). However, when the susceptibility of landscape to fire reduced (e.g., aspen), the terrain condition could alter the course of fire spread process, thus result in different long-term fire dynamics.

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EVALUATING THE EFFECTIVENESS OF NEUTRAL LANDSCAPE MODELS TO REPRESENT A REAL LANDSCAPE

Abstract
Neutral landscape models (NLM) are often employed to represent real landscapes as null hypothesis. They usually have similar statistical characteristics with real ones. But the spatial characters of the real and generated maps are seldom compared. In this study, the neutral landscape models Rule and SimMap are tested against a real forest landscape in north eastern China. A set of landscape metrics are used for comparing the resulting landscapes. Measurements of some metrics (total number of patches, total perimeter, and aggregation index) suggest that some level of consistency between the NLM generated maps and the real landscape do exist at landscape and class levels. But there are also metrics that do not show any agreement between the generated maps and the real landscape. Neutral models tend to over-aggregate small classes at higher aggregation levels. Each NLM model has its own strength in representing the real landscape, though neither is perfect. Some metrics, for example, corrected average patch perimeter/area ratio, are found having limited capabilities in representing landscape structures.

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TREEMIG: A DYNAMIC SPATIALLY LINKED LANDSCAPE MODEL INCLUDING LOCAL HETEROGENEITY

Abstract
Since detailed spatio-temporal models require many input data and computing resources, landscape models are often kept simple. At the other hand, local fix and dynamic heterogeneity, due to environmental factors, species composition, and horizontal and vertical stand structure affects local and spatial dynamics. As a compromise, the model TREEMIG describes environment driven population dynamics and seed dispersal of up to 30 tree species, whereas stand structure is simplified to height classes and horizontal density distributions. Simulations run over regions up continents on a 1km grid. The model is general enough to be applied for different landscape ecological questions: a) Holocene tree species migration in Central Europe have been simulated and compared to pollen sequences. b) First simulations of tree species colonization at the boreal timberline under climate change reveal a substantial lag of aforestation due to species migration.

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GIANT PANDAS ACROSS HUMAN-INFLUENCED HETEROGENEOUS LANDSCAPES

Abstract
Giant pandas are a world-famous endangered species endemic in China. They depend on forests as cover and understorey bamboo as food. Both forests and bamboo are embedded in human-modified heterogeneous landscapes. Even in many nature reserves specifically established for panda conservation, panda habitat is still lost and fragmented because of extensive human activities (e.g., timber harvest and fuel wood collection). Thus, understanding panda-landscape interactions is crucial for effective panda conservation and for minimizing human impacts on giant pandas. In this paper, we report some results from our study in Wolong Nature Reserve, which is located in Sichuan Province, Southwestern China. It is one of the largest reserves (200,000 ha in size) and contains approximately 10% of the total number of wild pandas and more than 4,000 local residents. Its topography is very complex, with elevation ranging from 1200 m to over

6000 m above sea level. Combining remote sensing data and field sampling data, the entire reserve has been classified into different categories of panda habitat. Pandas show varying responses to patches with different attributes (e.g., years since forest harvest, size of harvested areas, topography). These results have significant implications for landscape restoration and for balancing economic development and wildlife conservation.

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THE FOREST LANDSCAPE PATTERN AND THE GIANT PANDA HABITAT IN THE QINGLING MOUNTAIN, CHINA

Abstract
The endangered Giant Panda is the forest-habited mammal species. Therefore, the forest landscape spatial pattern has an inevitable influence on the giant pandas' habitat. However, the relevant research is few up to now. This paper aims to analyse the forest landscape spatial patterns and the related panda habitat in three different but adjacent regions located on the southern slopes of the Qinling Mountains, which are (1) early-constructed and well-protected Foping Nature Reserve, (2) Changqing Nature Reserve late-converted from forest production in 1977, and (3) Longcaoping Forest Bureau recently-stopped cutting. Helped with remote sensing and geographical information system, the forest landscape types were mapped for these three regions. The landscape pattern as well as the degree of landscape fragmentation were studied through comparing several indices among three regions, while the survey data of panda habitat were also analysed. It is found that the forest landscape patterns and fragmentation degrees of these three regions with various management levels change regularly, namely that the spatial pattern of landscape in the early-constructed and well-protected Foping Nature Reserve is better than the Changqing Nature Reserve late-converted from forest production in 1977, and both are better than the Longcaoping Forest Bureau recently-stopped cutting. The total quality of panda habitats as well as the panda populations among these three regions appear the similar regulations as the landscape patterns do.

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SPACIO-TEMPORAL ECOLOGICAL DYNAMICS, DEGRADATION PROCESSES AND DEVELOPMENT OF NORTHERN LANDSCAPES

Abstract
Altitudinal changes of ecosystem functioning in the high mountains of Norway are investigated within a long-term project and serve as a basis for comparative research in Greenland and the Urals. Accumulation of snow during winter, snow melting, freeze-thaw-action, percolation, and soil moisture variations prove to be the most decisive processes resulting from large-scaled relief differentiations. Local ecosystem interactions are quantified and entered into a GIS for spatial synthesis. Chorological process-oriented mapping of an entire mountain massif based upon measurements and remote sensing methodologically succeeds by using dynamic attributes emerging on a higher level of abstraction. The differences and gradients among landscape functioning patterns occurring with altitudinal change are determined by pronounced temperature gradients of air, surface and soil layers. Moreover, the impact of reindeer pasturing on the mountain landscapes is demonstrated. Fine scale degradation phenomena found in Greenland result from dynamics of natural populations, while broad scale destruction of

the grazing grounds in northern Norway has led to a depression of the altitudinal zonation as to overgrazing by domesticated reindeers.

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LANDSCAPE ECOLOGICAL DYNAMICS IN ALPINE NORWAY - MODELLING SPATIO-TEMPORAL PATTERNS IN MOUNTAINS

Abstract
The paper deals with landscape ecological challenges in high mountains as an example of an arctic-alpine environment. Altitudinal changes of landscape ecological dynamics in alpine Norway are investigated in a long-term project. Accumulation of snow during winter, snow melting, freeze-thaw action, percolation, and soil moisture variation are the most decisive processes resulting from large-scaled micro-spatial relief differentiations. Local ecosystem interactions are quantified, modelled and entered into a GIS for spatial synthesis. Temporal data on ecosystem functioning and spatial information about ecosystem structures are used to establish a topological characterization of ecosystems of low- and middle-alpine catchments. As one primary outcome, digital dynamic maps are produced to illustrate fluxes of energy and water as the most decisive processes determining landscape functioning. Chorological process-oriented functional mapping of an entire mountain massif based upon measurements and remote sensing is achieved methodologically by using dynamic attributes emerging on a higher level of abstraction. The differences and gradients among landscape functioning patterns occurring with altitudinal change in continental eastern Norway are determined by pronounced temperature gradients of air, surface and soil layers. This paper presents a complex modelling approach integrating simple models.

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ESTIMATING HOW MUCH THE PUBLIC WILL PAY TO CONSERVE A U.S. MIDWEST LANDSCAPE

Abstract
Rural landscapes outside the urban fringe are especially subject to change. The work reported here uses four potential scenarios of landscape development to investigate how much owners and other public stakeholders would be willing to pay to reduce risks from landscape change. We framed this contingent valuation question in the landscape of the Big Darby Creek in Ohio, and in relation to known damage to streams from suburban land use conversion. The altered processes included nutrient flux, sediment loading, toxin inputs, and change in hydrologic flow patterns. We surveyed a large sample of stakeholders (730) covering three areas of Ohio. The analytical model focused on mitigating the risk to biological endpoints in the streams (Index of Biotic Integrity, IBI). The results indicate interactions among different kinds of value, but compared to non-residents, local residents are willing to pay twice as much ($51.44 vs $25.45) to conserve their landscape. Compared to large-lot development, the average respondent is willing to pay more than twice as much ($65.02 to $24.90) to conserve the landscape in small cluster development.

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LANDSCAPE-SCALE ANALYSES OF ASIAN WETLANDS - A PROTOCOL IN SUPPORT OF THE RAMSAR CONVENTION ON WETLANDS

Abstract
The Ramsar Convention on Wetlands is encouraging the collection of information to support the wise use of wetlands. This has seen the development of an integrated model for wetland inventory, assessment and monitoring. The model applies a hierarchical, multi-scalar approach to data collation within a GIS framework enabling data fields to 'cascade' through different scales of analysis from the river basin to the wetland habitat. The multiple-scale analyses enable the role of wetlands within the landscape to be assessed and then monitored while taking into account the appropriate scale of analysis. The Asian Wetland Inventory (AWI) project has adopted the model and the general principles provided by the Convention and developed a four-tiered inventory method with core data fields and data management guidelines. A technical manual and relational database has been produced to support the model. A case study currently underway in Hokkaido, Japan has been used to validate the model. This exercise has been particularly useful in identifying spatial data sources from the Internet that could be applied to selected hierarchical levels. It has also focused attention on the Ramsar Convention's efforts to provide through wetland inventory a description of the ecological character of wetlands of international importance.

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CONTRASTING EFFECTS OF LANDSCAPE PATTERN ON BIRDS IN AGRICULTURAL AND FOREST ENVIRONMENTS

Abstract
Landscape planners often have to choose between different potential patterns of reserved native vegetation and land to be used for economic production. Advantages and disadvantages can be evaluated in part through studies of patch size and effects of edges. Recent studies of edges and their effects on birds have been conducted on ~800 sites in the largely cleared agricultural landscape of western Victoria. Bird species that obtained food directly from farmland ranged widely over the landscape, whereas species that gained most of their resources from remnant vegetation were rarely found more than ~40-100m from such vegetation. Both positive and negative effects of edges were identified on bird abundance. These and previous studies show that effects of edges and remnant patch size were greater in the agricultural landscape than in forests used for wood production. High priority should be placed on conserving large patches of remnant vegetation in farmland, where such patches remain. However, in both situations the main focus should be on conserving available examples of whatever rare vegetation types are most in need of conservation. Small patches or strips of native vegetation can have high value if they are the only remaining examples.

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PROGRESS AND PUZZLES IN DEALING WITH SPATIAL HETEROGENEITY AND SCALE: SOLVING TODAY'S PROBLEMS

Abstract
Examples of progress on developing methods for dealing with spatial heterogeneity and scale abound in the literature. However, significant old and new challenges face us, and many puzzles remain to be solved. What are the major issues and problems in spatial heterogeneity and scale needing further methodological developments? Three problems facing the Globe, in general, and Australia, in particular, are discussed here: (1) detecting significant changes in land use cover and heterogeneity at scales useful for environmental reporting, (2) quantifying the impacts or flow-on effects caused by these landscape changes, and (3) adequately understanding the processes driving these changes and impacts so that effective management actions can be taken. Landscape monitoring in northern Australia illustrates how land use changes (cover and heterogeneity) can now be routinely detected using field-based and satellite-based time-series data. One example is the monitoring of land condition. However, landscape metrics are needed as indicators that relate spatial heterogeneity patterns to processes. These indicators are needed at the finer-scales most useful to people on the land (e.g., to know when erosion scalds are forming in paddocks), and at the coarser-scales most useful to land management agency people (e.g., to know when and where wildfires are threatening). These applications illustrate that for many of today's human-induced landscape problems, indicators need to provide near real-time, early warning information.

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LANDSCAPE, A NOTION OF MATERIAL AND IMMATERIAL NATURE

Abstract
The idea that landscape has been created by human activities on a biophysical basis allows for clear cause-effect reasoning. However, landscape planning and management practice learns that it is impossible to neglect the social perception of landscape, i.e. the ways people can think about landscape. It is the result of social research and human sciences of the last decades that a differentiation of these social perceptions of landscape can be identified in the different groups of social actors in the landscape.
To gain insight in landscape development potential, therefore, the interaction between the ways of thinking about landscape and the practical attitude of the actors in landscape should be made explicit. Although landscape is imprinted in these interactions, it cannot anymore merely be considered a biological and physical material product. It is also an immaterial conception, and it is exactly the insight in the relationships between material and immaterial aspects of landscape that should be better understood.
These lines of thought are illustrated with landscape planning and management examples from several European countries. Conclusions are drawn with regard to landscape policy and public awareness raising, with special reference to the European Landscape Convention.

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PREDICTIVE MODELLING OF BIRD SPECIES RICHNESS USING RS AND TOPOGRAPHY DATA IN BOREAL LANDSCAPES

Abstract
Using bird species richness data from a spatial grid system (105 squares of 0.25km²), we tested the usefulness of satellite-based remote sensing and topographic data in bird species richness modelling in SW Finland. We built regression models for the bird species richness, and validated the accuracy of the models with an independent test area of 50 grid squares. We evaluated separately the modelling capacity of habitat structure, habitat composition, topographical-moisture variables and all variables in the model building and model test areas. The four models explained 35-61% of the species richness variation in the model test area. The explanatory power of the all variables-model and of the topography-moisture–model decreased clearly, whereas those of the habitat composition– and habitat structure–models were more sound. Areas of high species richness were concentrated along river valleys with a high habitat diversity and steep topography. This landscape type also has the highest cover of habitats important for nature conservation: semi-natural grasslands, deciduous forests and watercourses. The models were extrapolated to the whole study landscape of 600 km². We conclude that instead of scattered study plots in which birds are counted predictive modelling requires large study areas where the whole variation of the landscape can be taken into account.

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BIODIVERSITY ASSESSMENT AND PATTERNS OF CHANGE IN BOREAL LANDSCAPES

Abstract
We face the challenge to monitor not just changes on natural systems but also the impact of these changes for the quality and persistence of the organisms that depend of these environments. In order to achieve this goal we used thematic data derived from the Multisource Finnish National Forest Inventory based on k-nearest-neighbour (k-nn) estimation of wall-to-wall forest characteristics for the study area. This multicriteria approach was used to evaluate changes in structure and composition at the landscape level at three points in time (1989, 1994, 2000). Census data from Three-toed woodpecker (Picoides tridactylus) were used as Keystone indicators of change. This approach allowed the analysis of the occurrence of species in relation to landscape structure and spatial changes. Results show a landscape dominated by a mosaic of managed forest stands with high levels of patchiness in which species composition has become more homogeneous and age distribution of stands more even. The present forest mosaic lacks old-growth forest, dying and dead trees and natural disturbances. In particular, a fragmentation process was observed in the 40 to 60 years old forest. Other spatial indicators in tandem with the process observed seems to denote that a 60 years old stand age constitutes the threshold for the distribution of woodpecker.

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REFRAMING HABITAT QUALITY AS A SPECIES RESPONSE

Abstract
Habitat quality often is treated as a location-specific characteristic. However, we regard habitat quality as a dependent, species-specific response to the attributes of a location. The ultimate assessment of quality is a location's ability to support a viable population of

the target species. Four key predictors of the quality of a patch are its size, shape, landscape context, and inherent ecological structure (e.g. vegetation) and processes (e.g. predation pressure). Effective size is determined by both internal heterogeneity and matrix variegation. We suggest three measures of realized quality (from low to high grade): (1) on-going occurrence, (2) maintenance of population density, and (3) on-going non-negative local recruitment. In the short term, inferences about 'suitable but unoccupied' habitat must be based on correlative information from other locations or from similar species. In the longer term, 'unoccupied habitat' is an hypothesis that must be tested by colonization (possibly assisted translocation) and subsequent maintenance of population viability. The predictors of size, shape, context, and structure/process are important considerations for restoration efforts. Cost/benefit analysis of potential restoration projects should evaluate the extent to which human intervention is necessary to maintain key ecological processes that affect species persistence and thus habitat quality.

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SCALE-DEPENDENCE OF FUNCTIONAL AND STRUCTURAL LANDSCAPE INDICATORS

Abstract
The DPSIR (driving forces, pressures, state, impact, response) framework was used to analyze the landscape indicators for environmental sustainability of landscapes. As the functional state indicator we used the potential excess nitrogen (PEN), which was calculated as the difference between inputs to and outputs from an inorganic N pool. A rural catchment (258 km2) in southern Estonia served as a study area to test the GIS-based attempt of the PEN analysis in main land cover categories. Aerial ortophotos, topographical map and digital soil map (both 1:10,000) were used to determine land use and soil types. Nitrogen pool was calculated by mass balance model using average values for main N fluxes per land use categories, corrected by topography corrections for denitrification, net N mineralization and N uptake. Due to decreasing agricultural intensity in 1987-97, the average PEN decreased several times. It coincides with the measured data of nitrogen losses from this catchment (25 and 5 kg ha-1 yr-1 in 1987 and 1997, respectively). Several FRAGSTATS indices were used to characterize structural landscape indicators in different scales. Edge density and patch density significantly decreased logarithmically with increasing scale (pixel size). Likewise, these indices negatively correlate with N losses and PEN values.

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AN AREA-INDEPENDENT INDICATOR TO EVALUATE PLANT DIVERSITY ON WHOLE-FARMS

Abstract
To assess the total on-farm biodiversity for evaluation of agri-environmental schemes, we aimed to develop an area-independent indicator. For this purpose, the presence of vascular plant species was determined on productive and non-productive areas at 30 conventional arable farms in the Netherlands. In three different landscapes, plant species numbers of semi-natural habitats under different management regimes, crops, and within-crop distances were compared.
Significant differences between the landscapes were found for ditch banks and crops based on the species-area relationship. However, no significant differences occurred in the number of plant species between the two ditch bank management regimes, nor the two types of sown field margins. In all crops a significantly higher number of plant

species were found in the outermost meter of the field compared to the rest of the field. Based on the differences found, the species richness was weighted by the total area per habitat or crop.
Using this approach, it is now possible to evaluate species richness for crops and semi-natural habitats on a total farm level. This indicator may even be extended to other agricultural practices or other countries for the assessment of agri-environmental schemes or benchmarking.

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LIVING IN THE AGRICULTURAL MATRIX - A MULTI-SCALE STUDY OF THE VULNERABLE SUPERB PARROT

Abstract
The objective of this presentation is to describe a multi-scale approach to research the Superb Parrot (Polytelis swainsonii); a vulnerable parrot endemic to southeast Australia. One of the greatest future challenges facing humanity will be the integration of conservation and production in the same landscape. The Superb Parrot is an ideal subject for investigating this issue because it lives almost exclusively in the privately-owned agricultural matrix. Distribution is influenced by factors over a range of spatial scales. A multi-scale approach was considered essential to research the Superb Parrot. Three scales used: Macroscale in which biogeographical factors are being investigated, with GIS databases, in relation to Superb Parrot occurrence across the whole landscape. Mesoscale local-landscape and intra-regional relationships are being investigated across a field study area of approx. 18,000 km 2 (81, 1km2 sites, randomly selected). Sites were surveyed for Superb Parrot. Microscale activity patterns and nest tree use are being investigated. Preliminary results show a distribution strongly influenced by climate at macroscale. At the mesoscale 1662 individuals observed with patchy distribution, in open not dense woodland. At the microscale large trees used for nesting, many dead or affected by dieback, with little regeneration. Results have significant implications for landscape-scale restoration.

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DOES LANDSCAPE CONTEXT MATTER FOR BIRDS USING RIPARIAN ZONES?

Abstract
Creating edge habitat through the clearing and modification of woodland/forest for commercial livestock grazing and agriculture may result in alterations to bird assemblages in the remaining vegetation. One of the important questions for landscape ecology is to determine the extent to which context, as defined by the circumstances that surround a particular habitat (e.g. adjacent land uses), influences the faunal assemblages in the remaining habitat. This study took place in a variegated landscape in southeastern Queensland, where linear strips of riparian vegetation surrounded by both extensive grazing and intensive cropping operations are a common feature. We examined whether riparian edges abutting these different landuses experience similar bird species composition, richness and abundance. Three types of riparian habitat (Ungrazed, Grazed understorey modified but canopy present, and Cleared trees/shrubs removed but native pasture present) in three different contexts (Grazed woodland, Grazed Native pasture and Crops) are compared. Results suggest that habitat context does influence the bird assemblage. The bird fauna of a riparian habitat surrounded by a crop is distinct from one surrounded by native pasture, although these two edge types are more similar to one

another than a riparian habitat surrounded by woodland in either a grazed or ungrazed state.

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LANDSCAPE INFLUENCES ON OVERLAND WATER RUNOFF IN THE SEMI-ARID SAVE CATCHMENT AREA OF ZIMBABWE.

Abstract
Water deficits and floods are a common occurrence in the semi-arid regions of Africa. Whilst climatic conditions are key exogenous factors to the observed water balance, this paper tests the hypothesis that landscape patterns, which are proxies of human and ecology interactions, are key endogenous factors in the hydrological variability observed in the semi-arid Save Catchment Area of Zimbabwe. GIS was used to delineate 40 hydrological response units in which landscape patterns and other socio-economic data were geo-referenced. The sub-models for land-use cover, geology, tenure, erosion surfaces, and topography (mean gradient) showed a significant relationship between runoff and landscape patterns, implying a greater degree of water repellency in the catchment. The sub-zones dominated by forested areas showed higher levels of runoff. Natural woodlands were associated with low rates of runoff, implying that the natural woodlands maintain good water balance. In contrast to forested areas, natural woodlands and grasslands were negatively and positively related to maximum and minimum residual runoff respectively. The mean slope (gradient) was the most important topographical parameter accounting for most of the variation observed in the hydrology-landscape model. The results point to the need for an integrated approach to land use and water resource management to achieve ecological sustainability goals.

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TESTING LANDSCAPE ECOLOGY AS A PREDICTIVE SCIENCE: A CASE STUDY OF NOOSA KOALAS

Abstract
Landscape ecology has made considerable progress in recent decades in understanding the impact of human-induced habitat loss and fragmentation on fauna populations. Empirical and modeling evidence suggests that the loss of suitable habitat (area) is the primary driver of species decline, with fragmentation effects more likely to be evident below a 30% habitat extent threshold. The challenge is to empirically test this emerging hypothesis for a suite of fauna with different life history attributes living in real-world landscapes. We develop, based on expert knowledge, four alternative a priori hypotheses for predicting presence of Koalas in Noosa Shire, Queensland (Australia). These hypotheses result from a general conceptual model of the multi-scaled influence of land use, landscape structure (including habitat area thresholds), roads and site-scale habitat variables. To test these hypotheses, Koala pellets were sampled at sites (n =100) across the habitat mosaic, taking into account the probability of false absences occurring in different habitat types. Interactive logistic regression models were then applied to test the landscape hypotheses. The results highlight the need to develop, test and refine alternative a priori models of species ecology if landscape ecology is to make the transition to a predictive science.

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COMPARATIVE ANALYSIS OF THE ECOLOGY OF CITIES AND TOWNS: OPPORTUNITIES AND LIMITATIONS

Abstract
Comparative research has been an important source of enlightenment and understanding contributing to the development of ecological theory. There has been little attempt to compare the ecology of cities and towns from around the world. We explore the requirements of cross system comparisons and the potential advantages and limitations of conducting comparative analyses on urban environments. The development of comparative studies requires an understanding of the components of the systems, their geographical distribution and the critical processes connecting them in space and time. The wealth of information on the human components and processes of urban environments presents many opportunities for comparative studies. Unfortunately, there is relatively little information on the non-human components of urban environments (i.e. indigenous plant and animal communities). To overcome the lack of detailed knowledge of the plants and animal communities, researchers can utilise the concept of functional classifications of component organisms. Successful cross system comparisons are based on good questions supported by appropriate methodologies. Comparative studies of cities and towns will provide a variety of benefits including new insights into the structure and dynamics of urban ecosystems, the identification of general principles, and opportunities to address questions at the scale of entire cities.

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ARTHROPODS IN URBAN ECOSYSTEMS: COMMUNITY PATTERNS AS FUNCTIONS OF ANTHROPOGENIC LAND USE

Abstract
Despite the accelerating pace of global urbanization, there is a lack of even basic data on how urbanization affects many organisms, and even less is known about how similar response patterns are across cities in different biomes. A recent surge in interest in urban ecology, however, has seen several studies on how urban development impacts the abundance and distribution of organisms like arthropods. Research that I conducted in Phoenix, Arizona (USA), on arthropod community composition and dynamics revealed patterns of deterministic species loss and replacement that have also been observed in other urban areas. Although the identities of the arthropod species may differ among cities, patterns of arthropod community simplification and homogenization via declines in richness are consistent and can be attributed primarily to similarities in land use (which translates to similarities in vegetative/habitat composition and structure) among cities regardless of biome. Such similar response patterns may facilitate urban planning for biodiversity conservation.

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FINDING THE LIMITS TO GENERALISATION: CATEGORISING LANDSCAPES IN AUSTRALIA

Abstract
A goal of landscape ecology is to find principles which are generally applicable across

different landscape types. However, landscapes encompass a huge range of complexity and involve many processes operating at different scales. Debates and misunderstandings arise when principles derived in one landscape are extended to other landscapes elsewhere and are found not to apply. Can we set limits to generalisation by recognising distinct landscape types that differ fundamentally in their biophysical and/or land-use characteristics? We developed a framework to encompass landscape variation using variables thought to most effectively describe major differences in landscape sensitivity to, and expression of, ecological dysfunction. Our framework includes climate (linked to bioregions), and vegetation structure to create a primary matrix representing biophysical variation. Vegetation clearing and modification describe the impacts of agriculture and urbanization. These four variables can be used selectively to identify a range of landscape types that might be relevant to a particular application. The framework may assist in the organization of existing and future learning about vegetation management. It can be used to identify where management can and cannot be generalised, enabling management strategies to be developed for different landscape types.

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A NEUTRAL MODEL FOR LOW-SEVERITY FIRE REGIMES

Abstract
Climate, topography, fuel loadings, and human activities all affect spatial and temporal patterns of fire occurrence. Because fire is a stochastic process, an understanding of baseline variability is necessary in order to identify constraints on surface fire regimes. With a suitable null, or neutral, model, characteristics of natural fire regimes estimated from fire history data can be compared to a "null hypothesis". I generated random landscapes of fire-scarred trees via a point process with sequential spatial inhibition. Random ignition points, fire sizes, and fire years were drawn from uniform and exponential family probability distributions. For this paper I focused on two sets of statistics commonly computed in fire history studies: (1) Composite fire intervals (CFIs) were calculated at multiple spatial scales for random subsets of each landscape, and (2) parameters of the Weibull distribution were estimated for each simulated "fire history" and tested for significance. Strong nonlinear relationships were evident between CFIs and area sampled for a range of fire sizes, as were consistent patterns of significance of Weibull "shape" parameters. These clear patterns on neutral landscapes suggest that deviations from them in empirical data represent real constraints on fire regimes (e.g., topography, fuels) rather than sampling artifacts.

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A SPATIAL ASSESSMENT OF LANDSCAPE CONNECTIVITY IN THE APENNINE MOUNTAINS, ITALY

Abstract
A method for assessing landscape connectivity and identifying critical connections within a regional-scale landscape is presented. Connectivity is regarded as being central to species population viability and its improvement has been proposed as an effective conservation measure. The approach has been applied to the Apennine Mountains, Italy. Fragmentation is apparent in this region where valley developments have isolated protected highland massifs. The aim was to assess current connectivity for selected species (brown bear, chamois, wolf) and detect locations where corridor restoration efforts should be targeted. Land cover data were analysed to define suitable habitat

patches for each species, these patches were considered connected if their separation was below an estimated maximum dispersal distance. Due to its advantages over Euclidean distance measurement, inter-patch distances were assessed using least-cost path analysis through a resistance-weighted matrix. Critical connections were identified using graph theory techniques. Results indicate that the region is well connected for the wolf, but suggest that habitat restoration at identified sites for less mobile species is required. The research identifies both the benefits of a species-centred perspective, and the requirement for improved ecological knowledge of key species. The method is robust and applicable at a range of spatial scales.

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ANALYSING KANGAROO POPULATION DYNAMICS WITH 25 YEARS OF SURVEY DATA AND AVHRR NDVI IMAGES

Abstract
To set quotas for the commercial harvesting, aerial surveys of red and grey kangaroos have been carried out in the sheep rangelands of South Australia for the last 25 years. We are using these data to develop models of kangaroo population dynamics driven by pasture surrogate variables, especially a time series of monthly AVHRR NDVI (normalized difference vegetation index) composite satellite images starting in 1981, and annual livestock data. The geostatistical properties of kangaroo data were compared to equivalent NDVI parameters to determine similarities of pattern in space and time, and the most appropriate analysis scale. Kriging was used to generate kangaroo abundance surfaces for further spatial and temporal analysis. The kangaroo abundance surfaces were then related to environmental data, monthly NDVI images, and annual livestock data. Spatially and temporally explicit predictive relationships for modelling the dynamics of kangaroo populations were identified with regression analysis, with emphasis on temporal lag relationships. Significant and spatially consistent correlation patterns over time were found, subject to biophysical stratification of the rangelands. These will support the development of spatially explicit models of kangaroo dynamics and abundance with application in kangaroo and grazing management at property scale, under consideration of total grazing pressure.

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FOREST STRUCTURAL DIVERSITY: COMPARING PLOT-BASED DATA WITH SPECTRAL ENTROPY CANOPY DIVERSITY ANALYSIS

Abstract
Heterogeneity plays a key role in habitat and ecosystem functions. To assess the effects of reintroducing fire to forest systems we need to be able to quantify heterogeneity in forest structure before and after disturbance. Several methods are available to do this, and their attributes vary. In traditional field studies, conclusions are drawn from a few intensive or many extensive plots. This approach provides locally detailed and precise information, but is limited by providing discontinuous measures of forest structure and its variability across a landscape. In contrast, optical remote sensing offers continuous information about forest canopies. We developed a remote sensing method for assessing canopy heterogeneity at fine spatial scales. Spectral entropy canopy diversity assessment (SpECDa) involves creating a high-resolution NDVI map of the forest, applying an entropy textural analysis filter, smoothing the image, and sampling local areas. This method highlights differences in vegetation species and structure and differentiates areas with high diversity from those that are more homogeneous. At a scale of 10m we correlated SpECDa values with plot-measured distributions of basal

area, height and diameter. Structural variability in basal area distributions had a correlation coefficient of 0.79 while diameter and height distributions were strongly inversely correlated (-0.67, -0.99).

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LEAKAGE ANALYSIS FOR CARBON SEQUESTRATION AND BIODIVERSITY CONSERVATION

Abstract
Recent analyses of the effectiveness of carbon sequestration projects have revealed the potentially serious problem of leakage. We present a spatially explicit methodology for detecting leakage in carbon sequestration and biodiversity conservation projects. Carbon leakage is said to occur when a carbon sequestration activity in one area inadvertently triggers an activity in another area counteracting the effects of the first activity. Similarly, biodiversity leakage could occur when the establishment of a protected area in one location reduces timber supply leading to clear-cutting in another unprotected location with a high conservation value. The goals of carbon sequestration projects and biodiversity conservation projects could also be potentially incompatible. Carbon sequestration projects could seriously undermine the goals of biodiversity conservation if they emphasize short-term carbon benefits derived from fast-growing monoculture tree plantations. LeakDetect, a dynamic spatially explicit leakage detection model, enables detection of biodiversity leakage and thereby evaluates the effectiveness of conservation projects. The model calculates net and gross leakage statistics based on seven raster input layers. Output maps identify the location of leakage resulting from biodiversity conservation projects and of development that takes place in spite of the biodiversity conservation projects.

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TREE AND VERTEBRATE DIVERSITY ACCORDING TO FOREST AREA AND CONNECTIVITY IN TROPICAL FOREST FRAGMENTS

Abstract
The diversity of trees (adults, seedlings/saplings) and vertebrates (lizards, frogs, birds, small mammals) were studied in 21 fragments of the Atlantic Rain Forest (Brazil) and related to forest area and fragment connectivity. The structural connectivity was measured with indices based on graph theory (C index), considering different distance thresholds and resistances of landscape units to biological fluxes. Fragment sizes varied from 3 to 275 ha and structural connectivity by secondary vegetation ranged from 61 to 1733 m. Results showed that trees, lizards, frogs and small mammals were particularly affected by forest area at a local scale (800 m around the fragment), while birds were affected by both forest area and connectivity. In this case, the relative importance of area and connectivity changed according to the landscape extension and the functional group of species. Forest cover was particularly important at the local scale (regression with richness, S, adjR2=0.45, p=0,002), but when considering the whole landscape (10,000 ha) the best relationship was observed for forest connectivity with a distance threshold of 50 m (S, adjR2=0.43, p= 0,003). The richness of all studied groups presented significant relationships with the forest extension and/or the degree of fragment connectivity, but at different scales.

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ENVIRONMENTAL, SOCIAL AND SPATIAL DETERMINANTS OF URBAN ARBOREAL CHARACTER, AUCKLAND, NEW ZEALAND

Abstract
Urban landscapes are highly impacted mosaics of primary habitat, parkland, gardens, and industry, linked by modified catchment processes. Paradoxically, cities provide refugia and restoration potential for significant elements of regional biodiversity. They frequently straddle biome junctions, national pests may be absent, human and economic resources are abundant, and social impact of conservation successes is high. However, the risks and resource values of urban woodland is poorly known in New Zealand. To quantify treed environments of residential Auckland, we randomly selected 100 250 x 250-m areas, stratified into 5 classes of satellite multispectral "greenness", and subsampled front yards within them. We recorded details of all trees, soil type and pH, topography, rainfall, coastal proximity, neighbourhood and section leafiness, social factors, and toxin parameters as predictors of residential vegetation character. Preliminary results suggest a high incidence of indigenous and fleshy fruit/nectar bearing species, but also biosecurity risks. Knowledge/interest in biodiversity varies according to location, socio-economic factors and suburb age. Our results will provide city biodiversity planners with spatial data to better target education and design/manage sustainable wildlife habitat patches, corridors and matrices, thereby contributing to urban ecological integrity and sense of place.

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INTERPRETATIVE AND PLANNING MODELS ACROSS SCALE AND TIME: A PARK-TERRITORY IN EASTERN MEDITERRANEAN

Abstract
Peninsular environments present interesting combinations of interpretative landscape models with different kinds of significance, that can be summarized under the headings of peninsularity and patchiness. In fact, all the observations of the phenomena we have so far analysed in a semi-arid peninsular territory in the eastern Mediterranean (Salentine Peninsula) seem to fall within this dual analytical key. These considerations are confirmed by multi-scalar and multi-temporal comparisons, which better clarify the concept of peninsularity and the range of its perceptibility in cross-scaling processes.
These cross-scale conditions are considered to refer also to the possibility of transferring the grain interpretative model (Forman, 1995) into that of planning device relevant not only to the shapes but also to the times and role any landscape plan should have, to the extent of indicating how much of the landscape should really be planned and managed. Landscapes are often approached from an improper scale, through incorrect choice of the grain of the plan, forgetting that in an environmental mosaic the alternation of natural, agricultural, and built-up aspects may simultaneously call for different planning scales.
The Territorial Coordination Plan for the Province of Lecce, that coincides with the biogeographical region of the Salentine peninsula, offers an opportunity to verify the different grains in which landscape planning can be expressed, considering that in Italian legislation the provincial scale lies at a hierarchical level between the macro-scale (regional level) and the micro-scale (council level), where the specific planning dimension is that of the landscape scale.

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BEHAVIOR AND LANDSCAPE EFFECTS ON MOVEMENT PATTERNS OF LARGE UNGULATES

Abstract
Movement behavior affects the way in which individuals redistribute themselves over space and thus may affect many ecological processes. It is usually assumed that landscape heterogeneity influences animal movements, but understanding of the effects of such influences is limited. We developed spatially explicit, individual based simulation models of large herbivore movement. With these models we explored the effects of behavior and landscape properties on the displacement of individuals. Our results suggest that behavioral rules together with landscape composition and structure interact to produce movement kernels with different shapes. Furthermore, the characteristics of these redistribution kernels are dynamical, with different shapes expected at different time scales. We also show that general model predictions are in good agreement with elk (Cervus elaphus) movement data collected in four different North American landscapes.

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FRUGIVOROUS BIRDS AND RAINFOREST SEED DISPERSAL IN A FRAGMENTED LANDSCAPE

Abstract
Frugivorous birds disperse the seeds of a large proportion of rainforest plants, hence differences in frugivorous bird abundance between fragmented and forested parts of the landscape may affect seed dispersal and forest regeneration processes. We investigated habitat use by frugivorous birds in a fragmented subtropical landscape in south-east Queensland, Australia. Bird abundance was assessed in a network of sites, with multiple replicates in each of three site types: extensive forest, remnant and regrowth patches. Five species showed decreasing patterns of abundance in remnants and regrowth patches, five increased in abundance in these sites, and thirteen appeared to be unaffected by these differences in habitat. We examine how differences between the "decreasers" and "increasers" in the sizes of seeds and fruits eaten may affect seed dispersal in rainforest remnants and regrowth patches. Our results suggest that large-seeded plants are less likely to be dispersed in fragmented and disturbed parts of the study landscape than in large tracts of forest.

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THE PELICAN SCENARIO AS A NATURE RESTORATION STRATEGY FOR THE ARAL SEA CRISIS

Abstract
The Aral Sea Crisis, caused by large-scale agricultural irrigation beginning in the Soviet Era, has become a well known environmental problem. In spite of the increasing abandonment of salinized fields, however, the Aral Sea has continued to shrink. The ecological damage is not only to the Aral Sea itself, but also to the unique wetland

ecosystems in arid Middle Asia formed by river systems and riverside oases. Ecotope monitoring of the Syr-Darya river delta, one of the two river water sources of the Aral, and the Ili river delta of Balkhas Lake proved that several landscape ecological features, which have been lacking under irrigation agriculture, proved to be important for sustainability. A shifting mosaic pattern of wetland ecotopes, formed by the flooding process of rivers, is an essential feature of an ecologically healthy wetland. This could be evaluated by examining the habitat suitability for pelicans, the top predator of the wetland ecosystems. The "Pelican Scenario", a natural dynamism oriented nature restoration plan for the Aral Sea Crisis, should be considered not only for achieving sustainable land use, but also for the conservation of Pelecanus crispus, a vulnerable species.

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CARING FOR COUNTRY: HEALTHY PEOPLE AND HEALTHY COUNTRY

Abstract
In recent times there has been a lack of acknowledgement by 'western' scientists and governance structures in Australia of the existence of indigenous knowledge relating to ecological systems. It is important for non-indigenous people to grasp the realisation that indigenous knowledge is not a stand alone 'bundle' of knowledge, but part of a holistic 'package'. And that examination of this system does not stop non-indigenous people understanding that this is part of a larger 'story' of people, country, governance and religion. Across the Top End of the Northern Territory, and indeed north Australia, indigenous people remain largely connected to their country. This connection to country may therefore imply that there are some aspects of indigenous knowledge still in use. In fact, holistic indigenous knowledge is alive and in heavy use across the tropical savannas, but this system of managing terrestrial and marine environments and people is under increasing pressure from changed socio-economic circumstances and increased biophysical threats. This paper will discuss the concept of healthy country and healthy people with particular experience coming from southeast Arnhem Land.

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HOLISTIC INDICATORS OF ECOSYSTEM AND LANDSCAPE STATE

Abstract
On the base of ecosystem theoretical principles, an indicator set has been developed which describes the ecological state of ecosystems and ecosystem complexes in a holistic attitude. Structural and functional elements are integrated to represent the capacity of self-organisation in ecological systems. The indicator set has been developed and applied at different scales, reaching from ecosystems to landscapes and concepts for national ecological state reports.
In the paper the normative fundamentals of the functionality indication will be presented and the basic theoretical considerations of the derivation process will be shown. Case studies will be reported and the concept of integrating this indicator set into a representation of sustainable development will be demonstrated.

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ABORIGINAL LANDSCAPE MANAGEMENT TODAY

Abstract
I will discuss the issue of Indigenous Protected Areas, how Yulngu (Aboriginal People) look after the country and environment. As Yulngu, we are trying to present our knowledge of how we are managing biodiversity to the nation and internationally. An Indigenous Protected Area is like a National Park run by Yulngu in partnership with the Commonwealth Government, the Northern Territory Government and the Land Councils in conjunction with the Dhimurru Aboriginal Land Management Corporation. What I believe as a traditional Yulngu who has worked on this land, I've seen Dhimurru become a model for all Yulngu right across the Northern Territory on how to manage country and develop links nationally and internationally.

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THE ROLE OF TSETSE CONTROL IN LAND-USE CHANGE IN THE LAMBWE VALLEY, A SOUTH-WESTERN KENYA RANGELAND

Abstract
For a long time, trypanosomosis, spread by the tsetse fly Glossina, constrained human settlement in the Lambwe Valley, a southwestern Kenya rangeland. In recent years however, following enormous efforts to control tsetse, the valley is experiencing an extra-ordinary human population growth rate, and rapid changes in land use and cover are taking place.
Using time-series aerial photograph interpretation for a 50 year period, population studies, and social survey methods, we identified significant land-use changes including crop cultivation in the settled areas of the valley, with a consequent decrease in woody vegetation and grasslands. In the Ruma National Park, the only park in East and Central Africa home to the rare Roan antelope (Hippotagrus equinus), and occupying a third of the valley floor, shrublands and thickets have expanded.
The control of tsetse is seen as having ameliorated an important constraint to human settlement and hastened land use change in the settled areas. The restriction of access to the park, reduction in fire and a stagnated browser population are seen as encouraging bush encroachment in the park, a trend seen as favourable for tsetse re-invasion, given the dwindling budgets allocated for their control. The competition to use land for different uses in the valley, mainly wildlife conservation, livestock and crop agriculture and the multiethnic combination of the valley inhabitants could provide an ideal situation for competition and conflicts in land-use, and a resurgence of tsetse could worsen the situation. This study suggests continued tsetse surveillance, agricultural intensification and goodwill activities that the community can attribute to the preservation of the park in their midst.The unique valley landscape is otherwise under threat.

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PREDICTING THE DISTRIBUTION AND ABUNDANCE OF THE COMMON WOMBAT - THE IMPACT OF LANDSCAPE

Abstract
Predicting the distribution and abundance of a species, cannot be undertaken in isolation of landscape factors. The common wombat (Vombatus ursinus) is a medium sized (upto 40kg) burrowing terrestrial marsupial that is endemic to the temperate regions of S.E. Australia. The results of a stratified survey across its distribution formed the basis of an abundance prediction system, which included analysis of the climate, environment and other factors. Additional climatic variables were added to the climatic profile of the species to reflect the physiological requirements of the species. Environmental analysis techniques utilised in this study, included a case-based reasoning system, developed specifically for this purpose, and a unique application of the Relativized Electivity Index to evaluating the habitat requirements of a species at a landscape scale. A rule-based system was implements for those areas where an expert felt confident to formulate rules to describe limitations to the species distribution and abundance. With only a limited sample size available, the system correctly predicted the relative abundance of wombats with an accuracy of more than 69 percent. A number of factors that impact upon the common wombat's distribution and abundance operate at a landscape scale and need to be incorporated into predictive models.

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AN INTEGRATED LAND-USE DECISION MAKING MODEL FOR RAPIDLY URBANIZING FLOODPLAINS IN PHOENIX, ARIZONA

Abstract
This project focuses on the floodplain as a complex socio-environmental system that is central to the function and structure of the Phoenix metropolitan area as an urban ecosystem and landscape. The goal of the project is to develop an integrated land-use decision making model based on systems theory and adaptive management that can be used in floodplain planning, policy, and management processes. The study will have two objectives: (1) the evaluation of the existing floodplain planning, management, and policy processes in the Phoenix metropolitan area and (2) the integration of data from the first objective into a spatially explicit system simulation and GIS model. The study will test hypotheses about a specific type of land transformation, the land-use decision-making that is associated with alternative land development policies, and its past and future effects on the spatial patterns of the floodplain landscape in the Agua Fria and Gila River watersheds. The emphasis is on how the decision-making of landowners, communities, and governmental agencies can influence the selection of preservation, conservation, and restoration targets as a mosaic sequences of spatial patterns in a floodplain landscape along an urban-rural transect. The hypotheses will focus on the identification and analysis of changes and thresholds in the mosaic sequences of land use, land cover, and habitat patterns in the floodplains and watersheds from alternative landscape development policies. The findings of this study will have important implications for theory in urban landscape ecological planning and ecosystem management.

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LANDSCAPE PLANNING FOR RECREATIONAL USE OF LAKESIDE FORESTS AT YACHIYO LAKE IN HIROSHIMA, JAPAN

Abstract

Recently, people (especially who lives in the urban area) are seeking for an area to have a close relationship with natural environment. Yachiyo Lake in Hiroshima prefecture Japan, where many kinds of birds and several rare plant species could be observed and which has a beautiful mountainous view, has a great potential for providing such kind of recreational opportunities. In fact a questionnaire survey revealed that a lot of people expected the Yachiyo Lake to be prepared as a recreational park. This study aims to understand the landscape structure of the lakeside forests and their relationship with the distribution patterns of birds and rare plant species in order to provide basic information for designing the recreational zones. Areas need to be reserved or rehabilitated, and sites that might be suitable for walking pathways and parking spaces, were also detected.

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ECOLOGICAL POTENTIAL OF CITY PARKS IN HIROSHIMA

Abstract

In Japan big cities, the most abundant open space in number is city park, especially children park. Urbanization from the city-center to suburbs left the ecological potential of biodiversity and ecotope for city parks in urban landsapes, Under the Master Plan of Greenery in Hiroshima City (2001), the ecological survey was done in order to evaluate conservation and rehabilitation priority at city parks in the delta urban area of Hiroshima City. Total 134 city parks were investigated on vegetation structure and woody species composition. It could be concluded park area was a significant limit of species diversity even the plantation. These Parks were classified three categories, ecologically rich (group A), ordinal (group B), and poor (group C) by ecological analysis. Structural differences were due to coverages of tree and subtree layer amoung three groups. The city parks of group C must be re-arange for improve of biodiversity and vegetation structure. This result suggests many city parks are still lower ecological status in Japan and probably in the other countries in Asia.

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SPATIAL PATTERN AND PROCESS IN URBAN ANIMAL COMMUNITIES

Abstract

Urban gradient provide a useful laboratory for landscape ecology. Along the gradient, not only decrease habitats for animals, but their arrangement changes. We compared the response of various taxonomic groups in a big city of Japan in order to examine relationships between the abundance and arrangement of the habitats, and life history trait of the species. We will present species specific responses to habitat fragmentation. We developed multiple logistic regression models for a suite of species of birds, butterflies and ants. We also built Principal Component Regression Models to predict the species richness. Species richness decreased more rapidly in birds than ants along the urban gradient, and butterflies were intermediate. Birds were influenced by the habitat area and matrix quality. On the other hand, ants were less influenced by the habitat area, but were susceptible to the history and isolation of the habitat. Effects of habitat loss

and fragmentation are different characteristics of landscape function for species existence. Simultaneously, variation of the life history influences the distribution of species. For example, Parus major can breed in urban area by using scattered trees in urban matrix: Their home range enlarges in the urban area to secure enough food.

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HUMANS AND LANDSCAPES - A TRANSDISCIPLINARY PARADIGM AND ITS APPLICATION IN LANDSCAPE RESEARCH

Abstract
Landscape ecologists have to be morally committed to the solution of the deep ecological crisis endangering the future of our Total Human Ecosystem. Their research should foster the creation of a postindustrial symbiosis between humans and nature, ensuring the functional integration of natural and seminatural biosphere landscapes with the rural, urban and industrial technosphere landscapes into a coherent, sustainable, healthy and attractive Total Human Landscape. Humans and their activities cannot be reduced into "socio-economic disturbance factors". They must be treated holistically with transdisciplinary research methods as integrative parts of the landscapes in which they live, share with other organisms, shape, use, and enjoy. In the evaluation of mutually supportive, reciprocal natural and cultural landscape functions with human society, their material as well as their intellectual and spiritual needs and aspirations should be studied simultaneously as cognitive mind events and natural physical events. Special attention should be devoted to the psychotherapeutic and restorative landscape functions. Highest research priorities deserve the most valuable natural and seminatural solar-energy powered biosphere landscape "keystone" systems, vital for the evolution of organic life, and the integrated assessment and management of their biodiversity, cultural diversity and ecological heterogeneity as "Total Landscape Ecodiversity".

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'HABITAT HECTARES' – A GENERAL METHOD OF ASSESSING HABITAT QUALITY

Abstract
The awareness of the need for retention and enhancement of native vegetation is a national focus in Australia. The fragmentation and loss of native vegetation has severely depleted the habitat available for native flora and fauna. While the area of vegetation remnants can be easily quantified, determining the quality of habitat is inherently more problematic. The 'habitat hectares' approach contrasts a total of seven site-based condition measures against pre-determined benchmarks of natural condition in each vegetation type. Where possible benchmarks are formulated from existing native vegetation that is relatively undisturbed. Three landscape context measures are also incorporated into the final score that represents a combined quantity-quality assessment of native vegetation. The 'habitat hectares' approach is designed to give a global rather than a 'species-specific' view of quality. It is not intended to identify the conservation significance of a site or the suitability of the habitat for individual species, but aims to provide an objective and integrated view of habitat for all indigenous species that may be present. It also: a) enables between-habitat comparisons, b) provides a tool for determining improvement in site condition following habitat restoration, and c) provides prospects of monitoring/reporting on habitat quality at catchment and landscape scales.

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EFFECT OF FOREST FRAGMENTATION ON THE WOODY FLORA OF THE HIGHLANDS OF CHIAPAS, MEXICO.

Abstract
The study was conducted in the central region of the Highlands of Chiapas, Mexico, in a tropical mountain region where traditional agricultural practices prevail. Multiple regression analyses were applied to examine the effects of size, matrix, isolation and shape of the forest fragments on woody, shrub, understorey tree species, and canopy tree species. Total species richness and total number of shrubs and understorey trees in fragments were related to isolation; moreover, additive effects of fragment size and matrix were observed for number of understorey tree species, and of fragment shape for the shrubs and total woody species. The number of canopy species was not related to any fragment variable or their interaction. The traditional land management have led to the development of a landscape consisting of a mosaic of forest fragments embedded in a matrix of secondary vegetation in different successional status and crop fields, which seems to attenuate the effect of forest fragmentation. Otherwise, although simple distance has been used to estimate fragment isolation, this latter concept is more complex in regions characterized by a complex topography and landforms, which include variations of both slope angle and aspect as in the studied area. The fact that fragmentation characteristics show differential effects on the various synusiae must be taken into consideration in developing plans for management and biodiversity conservation.

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EFFECTS OF LAND-COVER DYNAMICS ON THE FORAGING ECOLOGY OF AMBOSELI YELLOW BABOONS (PAPIO CYNOCEPHALUS L. 1766)

Abstract
The status of land-cover is of prime concern to spatial ecologists and wildlife conservationists. This study used Geographic Information Systems (GIS) to analyze land-cover changes that have characterised the Amboseli basin, situated in southern Kenya, over a 16-year period. The land-cover maps of 1984 and 2000 were derived from Landsat Thematic Mapper (TM) images at spatial resolution of 900 m2. Automated digital image processing and segmentation techniques were used to delineate the mapping units corresponding to twelve prior defined land-cover types. The dynamics were compared using the mean number, size, perimeter and fractal dimension of patches. The conservation significance of the maps is illustrated by evaluating the effects of the land-cover dynamics on the foraging ecology of Amboseli yellow baboons (Papio cynocephalus). The results indicate that significant transition was evident in eight land-cover types that accounted for about 68 per cent of the study area. The study groups shift their ranging area to the south-western portion of the basin. The baboons significantly changed their feeding time budget, increasing the time allocated to feeding. There was significant difference between the groups in the time spent feeding and mean daily distance travelled. The results also suggest that information sharing may be one of the prime benefits of living in larger groups for this population. The results are suitable for land-use management applications in the Amboseli basin and baboon habitat suitability modelling.

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ASSESSING CHANGES IN FOREST AND AQUATIC BIODIVERSITY FOR BROAD-SCALE ECOLOGICAL ASSESSMENTS: AN EXAMPLE FROM

Abstract
Scientifically-based ecological indicators are critical parts of regional policy assessments that address biodiversity conservation. However, no single best approach for assessing biodiversity has emerged. In a study of the Coast Range of Oregon, USA, we employed several complementary strategies that focused on species, communities, ecosystems and landscapes. Our methods rely on spatially explicit information on forest structure and composition rather than broad forest types, allowing us to incorporate effects of forest management. We assessed habitat capability for 15 focal species using models based on individual habitat components, analyzed wildlife communities associated with vegetation classes, and quantified habitat quality for salmonid fish. We assessed the distribution and pattern of fine-scale habitat elements such as snags and old-growth trees, and of coarse-scale ecosystem types, across a continuum of land ownership and management emphasis in the current landscape. We compared effects of alternative management scenarios on biological diversity in future landscapes, projected using simulation models. We measured trends in habitat abundance and pattern, indices of ecosystem diversity, and ecological integrity relative to historical range of variation. The study demonstrates the importance of fine-scale stand structural information when assessing forest biodiversity policies at broad scales. The spatially explicit analyses and mapped results provide opportunities for shared learning among researchers, landowners, and natural resource managers. Although our measures are specific to the Oregon Coast Range, the approach could be used in other forested regions.

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MODELLING BIRD HABITAT SUITABILITY BASED ON LANDSCAPE PARAMETERS AT DIFFERENT SCALES

Abstract
Habitat suitability as characterised by presence of a species and reproductions success was modelled related to different parameters of landscape diversity at different scales. Parameters characterising landscape pattern were determined for the UTM 10x10 km cells covering all Estonia and correlated to spread of over 30 forest bird species. The landscape parameters include areas of lakes, mires and built areas, length of boarders between different land cover units and length of selected line elements, share of different kinds of forest and peatlands. The bird species are grouped by correlation into three major groups (a) independent, (b) wetland-preferring (with subgroups avoiding built areas and roads, and independant from that), and (c) built area dependent (with subgroups depending on the importance of line elements). For selected predator species nesting success was related to landcape parameters on finer scale using cells of 10 km2. Land pattern was characterised by total length of line elements (streams, roads, borders, ecotones) and certain areal coverage (forest, mires, fields, build areas) within the cell. Impact of variations of food availability was linked to the relation. Possibilities for downscaling and upscaling of relations determined at different precison and areal coverage are discussed.

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UNDERSTANDING PEOPLE'S REACTIONS TO LANDSCAPE CHANGES AS A BASIS FOR INNOVATIVE MANAGEMENT

Abstract
The municipality of Mértola is located in the South-Eastern part of Portugal, in a marginal area in relation to socio-economic parameters and agricultural production. The traditional extensive land use system has in the last decades been subject to significant changes, raising questions as to future landscape quality and functionality. There is, specifically in these type of areas, a growing demand for functions such as conservation, recreation, identity support, life quality, but the actual trends and management mechanisms do not really favour the development of such functions. We consider that, for designing the appropriate instruments, there is a clear need to understand how the different local stakeholders are reacting to the changes occurring and what expectations they have for their future landscapes. In this paper, we will present the methodological approach developed for this case-study, integrating the assessment of reactions to past and on-going changes and the evaluation of future preferences, and the integration of the analysis results into proposals for a more contextual management strategy. For that we defend that different research traditions have to be combined, in a real interdisciplinary approach, which still has to be founded, and can best be developed on a case-study basis. The municipality of Mértola is located in the South-Eastern part of Portugal, in a marginal area in relation to socio-economic parameters and agricultural production. The traditional extensive land use system has in the last decades been subject to significant changes, raising questions as to future landscape quality and functionality. 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IMPORTANCE OF HERBIVORY FOR THE PLANT COMMUNITY STRUCTURE IN THE FOREST-TUNDRA ECOTONE

Abstract
Herbivores influence vegetation patterns in arctic communities. However, little is known on importance of different herbivores in different habitats. In the forest-tundra ecotone of Scandinavia, areas covered by fairly dense birth forests is found close to areas of treeless tundra heath. Even though it often is no large differences in climate or geology between areas with or without forest, the field layer vegetation often differs substantially. The objectives of the present study were, therefore, (1) to quantify the relative role of large vertebrate herbivores (reindeer and moose) and small vertebrate herbivores (voles and lemmings), (2) to evaluate the role of herbivores for the differences in ground and field layer vegetation between birth forest and tundra heath. We built exclosures excluding only large herbivores and exclosures excluding both small and large herbivores in forest and in tundra, at four different sites. After 5 years, herbivores have an effect on the plant community, both in the forest and in the tundra. Small vertebrate herbivores had larger effect on the plant community than large vertebrate herbivores at all four sites. However, there were no indication that differences in herbivory caused the large differences in plant community composition between forest and treeless tundra heath.

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FUNCTIONAL HETEROGENEITY IN RESOURCES IN LANDSCAPES: CONSEQUENCES FOR HERBIVORE POPULATION DYNAMICS

Abstract
Large mammalian herbivores are renowned for their propensity for population irruptions and crashes, yet many herbivore populations remain relatively stable. I explore the mechanisms that may underlie such differences, with special reference to resource heterogeneity within landscapes. While spatial heterogeneity is recognised as being fundamentally stabilizing, the mechanisms through which this influence may be expressed are diverse. Scale-related effects need to be distinguished from intrinsic features of the available resources set by their landscape context. I investigated these effects using a metaphysiological population model that enables resource fluxes to be integrated across levels of aggregation, from individuals to guilds, in a consistent way. This enables the basic consequences of resource heterogeneity to be distinguished from additional effects that may arise from the spatial configuration and scale of resource patches. A wide range in the nutritional quality of available resources can be functionally stabilizing by buffering seasonal and annual variability in resource supplies. How readily this resource distribution is accessed depends on the spatial scale of the quality distribution relative to movement scales of the herbivores. Findings suggest fundamental contrasts between nutrient-rich and nutrient-poor landscapes, and indicate how the consequences of compressing migratory movements could depend on the landscape context.

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THE FORGOTTEN LANDSCAPES OF CENTRAL EUROPE: HOW TO RE-ESTABLISH THE LOST HARMONY BETWEEN NATURE AND MAN

Abstract
The proposed paper will focus on the man-nature interrelationships in the Central European context. Differently from the West of Europe, Central European landscapes have undergone severe and abrupt changes in the driving forces behind the landscape change during the last 200 years. We will explore how these changes in the human systems reflect in landscape and land use patterns; how they have influenced the value systems of land users; how these fluctuations have contributed to the loss of identity and uprootedness, people's attachment to their landscape. We intend to reveal the political background of the intactness and depopulation of some peripheral landscapes, which are becoming main focus areas of the nature conservation. We will illustrate these changes through four case studies (Setumaa in EE, Roztocze in PL, Fertő-Hanság in HU, Kras in SI), showing also the differences within the region. We conclude that the discontinuity of the harmonious man-nature relationship due to the rapid political changes led to boost the alienation, evoke the lack of traditional landscape identity and thereby also environmental problems.

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RIPARIAN HABITATS IN FOREST MOSAICS: WHY ARE THEY RICH HABITATS FOR BIRDS?

Abstract
Riparian habitats are distinct elements in many forest mosaics and are widely considered to provide high quality habitats that support increased species richness and abundance. Ecological processes promoting greater wildlife use of riparian habitats, however, are poorly understood. Thirty paired study sites, constituting a riparian and adjacent non-riparian site, were used to investigate bird communities occurring in extensive forest mosaics near Melbourne, southeastern Australia. Bird surveys were conducted over two years, with 29 visits to each site. Compared with non-riparian habitats, riparian habitats featured a more substantial small tree layer, greater diversity in ground layer and low vegetation structure and greater proportion of large trees. Species richness and relative abundance of birds was significantly greater in riparian habitats. ANOSIM showed significant differences between habitats in the composition of the avifauna. To identify mechanisms likely responsible for riparian zones being rich habitats for birds, census data were used to test two hypotheses: 1) a greater number of habitat-use guilds are present in riparian habitats; 2) the mean number of species per guild is greater in riparian habitats. By providing structurally distinctive habitats supporting a rich and abundant avifauna, riparian vegetation forms a critical landscape element within forest mosaics.

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EXPLORING THE RELATIONSHIP BETWEEN ECOLOGICAL COMPLEXITY AND DISTURBANCE FREQUENCY

Abstract
Ecosystems subject to persistent and frequent levels of disturbance may exhibit a loss of resilience or of ecological integrity, the loss of which may not be immediately discernible until the state of the system has been significantly, and often irreversibly, altered. For this reason, it is important to be able to characterise the state of an ecosystem in such a way that incremental changes due to disturbance can be detected, and the magnitude of such change can be put in perspective. With this as our objective, we investigate the effectiveness of different measures of complexity at characterising the global level dynamics of modelled ecosystems. All simulations are performed with the model WIST (Weather driven, Individual based, Spatially explicit, Terrestrial ecosystem model). WIST

is a mostly deterministic, rule-based model that has been shown to exhibit persistent spatiotemporal self-organisation in simulated ecosystems. We compare several different simulations based on multi-species configurations subjected to increasing frequencies of disturbance. Based on analysis of biomass history in the modelled ecosystems, we demonstrate that information-based measures of complexity are sufficient to capture some of the important changes that occur in the dynamics of a disturbed ecosystem.

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THE EFFECT OF LANDSCAPE PATTERN ON THE LONG-TERM DYNAMICS OF FIRE-PRONE ECOSYSTEMS

Abstract
Fire can be considered a contagious disturbance process which spreads itself across the landscape. Thus, the extent and duration of such a disturbance is strongly determined by the landscape pattern (e.g., continuity, structure). Furthermore, landscape patterns are currently being modified by land-use changes. In this framework, I ask to what extent different landscape patterns might determine long-term dynamics in fire-prone ecosystems. To answer this question I built a spatially-explicit version of the FATE vegetation dynamic model (SFATE) and incorporated the main plant functional types related to fire response (resprouters, recruiters). Then, a series of landscape scenarios were generated with different landscape structure but with the same abundance of each plant type. The SFATE model was run for 200 years for each of these initial landscape scenarios. For each landscape four fire regimes were also tested: no fires and interfire intervals of 50, 25 and 10 years. Results are compared in the light of the different initial spatial patterns and the different fire regimes, using different landscape indices. Preliminary results suggest that for a given fire regime, both final plant cover and spatial pattern are different for the different initial spatial pattern, and that low spatial autocorrelation favors resprouter species.

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QUANTIFYING SPATIAL STRUCTURE IN THE "TOP END " -HOW CAN WE DEAL WITH ISSUES OF SCALE AND VARIATION

Abstract
This paper looks at the problems of trying to quantify landscape structure in northern Australian landscapes. Given the remoteness and inaccessibility to large parts of northern Australia for long periods of time during the wet season, spatial analysis and environmental modelling are vital. However, these landscapes have not experienced the same large-scale land clearance and intensive land management evident in other regions and subtle changes can be difficult to analyse. This paper presents the use of some of the available approaches for quantifying spatial structure that can be applied to remotely sensed data and field data within a GIS environment. Although, there are many measures and indices, it is still incredibly difficult to model the structure present where subtle changes have taken place and where continuous gradation of features exist across the landscape rather than abrupt changes. A further complication arises because we often try to quantify structural changes using data collected at different times of the year and sometimes even over different years, as well as at different scales, and levels of accuracy. This paper examines approaches for modelling landscape structure that do not rely on the definition of boundaries between landscape features and suggests that there may not be one single solution to dealing with problems of scale and variation.

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GEOGRAPHICALLY WEIGHTED REGRESSION ANALYSIS OF GLOBAL FIRE ACTIVITY (1997-2001)

Abstract
The relationships between global spatial patterns of night-time fire activity detected with the Along Track Scanning Radiometer (ATSR-2) during the period 1997-2001, and a series of environmental correlates are analysed at a spatial resolution of 0.5º. Spatial patterns of active fires are postulated to depend on net primary productivity, precipitation, temperature, land cover, and population density. First, we explore the dependence of the density of active fires in each 0.5º grid cell on each environmental variable individually. Next, a multiple regression model is developed using geographically weighted regression (GWR), to analyse the joint relationship between the environmental variables and the spatial pattern of fire activity. GWR permits parameter estimates to vary locally. These estimates are mapped, and the resulting geography of parameter space is analysed, identifying regions where predominance of a specific variable or set of variables is evident, and spatial gradients of parameter importance. GWR is shown to be a promising tool for analysing the macroecology of global vegetation fires. This study is the first ever global application of GWR.

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INTEGRATED ECOLOGICAL KNOWLEDGE FOR INTEGRATED PLANNING: THE RIVER BASIN MANAGEMENT CHALLENGE

Abstract
European countries are currently forced to develop integrated and landscape related planning procedures. The Water Framework Directive constitutes several ecological principles as binding guidance for water related planning. The river basin principle, combined emission and immission approach, point and non-point sources of pollution control, polluter pays principle, cost recovery principle including environmental and resource costs, and integrated concepts for the use and the protection of water resources and river basin systems are principles inherent to river basin management in terms of the WFD. Therefore, knowledge used in water management needs to be extended to landscape ecological and ecohydrological issues.

Taking the German environmental planning system as an example, the presentation highlights steps for successfully implementing landscape ecological knowledge into river basin management. Issues covered: (a) A regional scale assessment procedure for eco-hydrological landscape functions (e.g. renewal of groundwater resources, retention of water and matter fluxes in landscapes, agricultural production) is presented, to plan measures for realizing sustainable river basin systems. (b) The crucial question for implementing landscape ecological knowledge: Is river basin management capable to adopt landscape ecological knowledge and to put this knowledge into action? (c) Environmental planning in administrative boundaries and split into sectoral planning fields (nature conservation, water management, agriculture) is rather badly prepared to meet the river basin management challenge. (d) Therefore, formal and informal cooperation of planning authorities and stakeholders from different policy fields and the concerned public are described as being of key relevance for successful river basin management guided by landscape ecological knowledge.

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BRIDGING THE GAP BETWEEN POLICY MAKERS AND LAND OWNERS: TOWARDS MORE SENSITIVE AND CREATIVE LANDSCAPES

Abstract
This paper will address the relations between the decisions, at central level, concerning landscape classifications and policies affecting landscapes, originating from various sectors, and their application at local level, specially in what concerns the flexibility to adapt to local specific conditions and to motivate local involvement. The discussion will be based on experiences from three very different corners of Europe. The assessments and evaluation of these experiences are the basis for common reflections on a communication lead, action-oriented and open ended approach for more sensitive landscape management strategies, based on an understanding of authenticity in each landscape and on a development of involvement and creativity at local level. Both local people and professionals should work less as outsiders and more as insiders in the future. It would be important to develop an attitude of sharing, both within and between different groups of actors. This would improve flexibility in policies and coherence between these various levels of rural landscape management. But for making this become reality the established frameworks for landscape management would have to change, and become more based on the respect of local landscape situations and their social contexts.

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DEVELOPMENT OF PLANNING PRINCIPLES FOR SUSTAINABLE MANAGEMENT OF LANDSCAPE

Abstract
Land use planning in modern society's perception is envisaged as an important tool and requires principles that would embed general roles of landscape ecology. The forests in many countries are important source of natural resources and plays essential role for conservation of biodiversity, production vital elements for atmosphere like organic carbon, oxygen and etc. as well as providing services for ecosystems and society. Lack of forests in certain ecosystems intensifies land erosion, loss of biodiversity and degradation of environment. Estimations of forest impact on landscape of certain territory's were made. Through the research of different reports and other research data conducted over several decades we have estimated this positive effect of forest. Forest as a single land use unit is impacting surrounding environment at least up to 300-400m. Therefore within the segmented land use systems this number is very vital, for example limited survival of small insects as well as other fauna representatives of the forests or plant species. Recognized forest-impacted zone around forest is an indicator that shows a sum of different effects erased from forest. In developing of planning policies the principle of forest impacted zone should be defined and used for estimations of sustainability of the landscapes.

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SPATIAL PATTERNS IN SEED BANKS OF ARID ZONE WETLANDS

Abstract
Most spatially replicated ecological field experiments are spatially confounded, increasing the likelihood of type I errors when standard parametric statistics are used. Data that display significant spatial structure are more efficiently analysed by spatially explicit models. Spatial patterns and structure in communities can reveal patterns in responses to ecological processes. This research examines spatial patterns in seed abundance, species diversity and depth in wetlands with varying connectivity 3 – 300 km apart in arid Australia. Mantel tests were used to determine if seed banks were spatially autocorrelated and the interaction of species abundance, environmental variables and geographic distance among wetlands is determined using partial Mantel tests. Mantel correlograms and maps are used to illustrate the nature of this spatial structure. Seed abundance in all wetlands was highly variable and showed strong spatial autocorrelation. Patch size was related to wetland morphology and duration of inundation with areas of maximum depth, that retained water longest, showing elevated density and species diversity. Mean-variance relationship was used to examine sampling adequacy and precision and species-area curves to predict total species richness and determine sampling efficiency.

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DEVELOPMENT OF A LANDSCAPE SCALE SPATIAL MODEL FOR HABITAT RESTORATION IN WALES, UK

Abstract
Increasing concern about the loss of important semi-natural habitats resulting from agricultural intensification is stimulating the development of modelling techniques to identify suitable sites for habitat restoration at landscape scales. A spatial model was developed to determine the suitability of land parcels for restoration to broadleaf woodland, semi-natural grassland and lowland heath for two pilot areas in Wales with funding from the Countryside Council for Wales. The GIS model uses a set of landscape ecology spatial decision rules based upon consultation with local ecologists, to include: patch size; patch isolation; matrix characteristics and existing habitat type.
A major component of the model is to 'weight' the model output by Landscape Type in recognition of the significance of physical and cultural factors that are known to determine the suitability, or otherwise, of a land parcel for creation of the target habitat type. Thus the model combines the important concept of 'habitat potential', largely determined by the physical factors of soil type, geology and landform at the broad scale, with decision-rule modelling based on principles of landscape ecology at the field parcel scale. The results demonstrated the potential of spatial modelling techniques for identifying potential sites for habitat creation and identified the need to account for variations in landscape character as part of the targeting process.

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OPTIMAL HABITAT RECONSTRUCTION FOR WOODLAND BIRDS

Abstract
While habitat reconstruction for birds (and other wildlife) is a major investment around the world, the problem of how to optimally reconstruct habitat has not been properly formulated. We formulate the problem of optimal habitat reconstruction and show how it can be solved at two scales. In the first problem we use a detailed presence-absence metapopulation model for the critically endangered Mount Loifty Ranges southern emuwren Stipiturus malachurus

to determine the optimal schedule of patch and or corridor reconstruction. Stochastic dynamic programming is used to solve the first problem. In the second problem we scale up to consider habitat reconstruction for a suite of woodland birds that span the entire Mount Lofty Ranges. Simulated annealing is used to find efficient solutions to the problem of reconstructing habitat to maximise benefits to a range of species. These problems are examples of how decision theory can be used to make landscape-scale habitat reconstruction a more objective science.

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"QUALITY OF LIFE" IS MORE THAN THE SUM OF ECOSYSTEM FUNCTIONS

Abstract
This paper explores how the quality of environmental assessment could be improved by using the concept of natural capital. The issues are examined by reference to golf course developments in the area between Freiburg, Germany and Basel, Switzerland. The paper evaluates the decision making process leading to almost always an acceptation of the golf course project. The nature and scale of impacts however is highly dependent on subsequent management, which lies outside the regulation process. Moreover, the assessment does not take account of the consequences of the economic failure of the project, in impact on the social life of the local people and the implications this may have for the long-term sustainable development of the area. In order to find ways to remedy these deficiencies this paper considers how the concept of natural capital might be used to develop a more strategic focus when assessing proposals. The paper explores a particular formulation of the natural capital concept, namely the UKs Quality of Life Capital approach, and concludes by considering these ideas in relation to the 'Leitbild' concept, which is now being widely debated in the German-speaking literature. It is argued that theses concepts taken together offer the basis for a more integrated and strategic assessment of development proposals.

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BASE LEVELS: USUALLY OVERLOOKED GEOMORPHIC DRIVERS OF LANDSCAPE AND CATCHMENT FUNCTION

Abstract
Progress has occurred widely in the area of landscape function of relatively natural landscapes such as the rangelands. The focus for this work has been on patch dynamics. Emphasis has been placed upon how patch quality, size and distribution affect the capacity of a landscape to conserve critical resources such as water, topsoil and nutrients. Of particular interest has been how disruption to patch dynamics by disturbances such as overgrazing lead to "leaky landscapes". From work in southern Africa and Outback Australia we contend that there is much to be learnt about ecosystem function beyond the patch dynamics of hillslopes and sheetflood plains. In particular, we present a case for inclusion of usually overlooked geomorphic drivers of change that may operate at broader scales, and in which patch dynamics of landscape elements are nested. Base levels are critical to geomorphic processes and change drainage and erosion/deposition patterns as well as local soil moisture balances. Base levels range from sea levels to subtle sills maintaining small ephemeral wetlands. Without this broader, hierarchical and geomorphic view of ecosystems influenced by inter-level interactions, we lack critical context and our understanding and capacity to manage

ecosystems is significantly constrained.

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SCALE-DEPENDENT IMPORTANCE OF LANDSCAPE CONTEXT

Abstract
Whenever ecological pattern and processes are analysed on a landscape scale, ecologists are confronted with complexes of parameters resulting from both (local) site and (regional) landscape context. Here, we tested the relative importance of local and regional parameters in agroecosystems on different spatial scales. We analysed 38 wheat fields and their surrounding landscapes located in two regions in Germany, each characterized by gradients ranging from monotonous landscapes (mainly agriculture) to structurally rich landscapes (>50% noncrop-area). We compared to which degree landscape pattern was coined by variation in local and regional parameters, respectively, on scales varying from 0.5 to 3km². On large scales, relative variation of regional parameters such as the proportions of habitat-types was distinctly higher than that of local parameters (e.g. local soil properties), while the opposite was true on small scales. We detected region-specific threshold scales, where parameter groups shifted in importance, amounted to 1.5km² and 2.0km², respectively. This could be related to the specific arrangement of habitat-types in the two regions. We use data on epigeic arthropod diversity to demonstrate that regression analyses relating landscape factors to ecological data can lead to very different conclusions about the drivers of ecological processes, depending on the considered scale.

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TREE-RATS AND TRANSMITTERS: EFFECTS OF FRAGMENTATION ON VERTEBRATE FAUNA IN TROPICAL SAVANNA FORESTS

Abstract
Unlike southern Australia there has been limited land clearing in the Northern Territory following European settlement. However, the area of land used for agriculture is now expanding rapidly. Although there is a substantial body of information on the effects of clearing and habitat fragmentation on fauna in other areas of Australia, no data is available regarding how these activities may be affecting the wildlife of this region. To address this issue, fauna surveys were undertaken in remnants of eucalypt woodland of variable size and isolation, cleared areas and undisturbed continuous bush in the vicinity if Darwin. Based on the results of these surveys a target species, the Black-footed Tree-rat (Mesembriomys gouldii), was selected to investigate animal movement within a fragmented landscape. The black-footed tree-rat is a large native arboreal rodent that is confined to northern Australia. In this paper I will provide an overview of the initial study and present some results of the movement study, before discussing the implications for future landscape planning of agricultural systems in the Northern Territory.

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TEMPORAL AND SPATIAL DIVERSITY OF SAHELIAN LANDSCAPES – HUMAN AND BIOPHYSICAL ROOT CAUSES OF LAND USE DYNAMICS IN SENEGAL

Abstract
The basic assertion of the paper is that we need better understand the extent, causes and effects of the ongoing expansion of cultivation into adjacent savannah grasslands or forest in order to revisit prevailing but often too simplistic perceptions of man-environment relationships. Whereas overall land use figures in the Sahelian region points towards a gradual saturation of arable land, landscape specific land use change analyses reveal more complex dimensions of the change process.
Based on satellite images and aerial photos from 1950's until 2000, land use changes are monitored in two different agroecological zones in Senegal. Looking at landscape specific changes disclose important traits that are otherwise disregarded. Such changes may not primarily be a result of increased pressure on land or degraded soil productivity; it may e.g. be driven by socio?economic or cultural factors or be the result of adaptation to climatic changes that impact water availability.
Trajectories of change are interesting in a local, national and regional context, e.g. because of a) the effects on the quality of productive natural resources, b) the impact on carbon storage, c) the impact on biodiversity at the landscape level, and d) the potential impact of climate change on resource management options.

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EVALUATION OF REVITALISATION MEASURES ALONG RIVERS IN SWITZERLAND: POTENTIALS AND LIMITS TO RE-ESTABLISH FLUVIAL

Abstract
Due to a new philosophy in river management an increasing number of revitalisation projects were initiated in the last years. One measure is to create so-called "river-widenings" that allow unconstrained flowing within a limited area. However, little scientific work has been performed to assess positive or negative impacts of these revitalisation measures on riparian habitats.

Thus, this project investigates the landscape changes due to river widenings at three different scales, namely the:
· Landscape scale (habitats);
· Scale of functional groups; and,
· Scale of individual species.

A major focus of the study is the comparison of pre- and post restoration stages (composition and configuration), i.e. the comparison of terrestrial habitats and corresponding vegetation species. In order to have a reference state the restored sites were compared with near natural reaches. To describe the various states we employ landscape metrics calculation and multivariate analyses of plant assemblages.

Results show that mainly pioneer stages will establish in such river widenings but in a more complex mosaic than in the natural reference, resulting in higher edge density and smaller patches.

One can conclude that it is possible to re-establish some aspects of fluvial ecosystems. But river widenings cannot replace (near) natural ecosystems.

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TESTING THE GRASS-FIRE CYCLE: ALIEN GRASS INVASION IN THE TROPICAL SAVANNAS OF NORTHERN AUSTRALIA

Abstract
Andropogon gayanus Kunth. (Gamba grass), a tall perennial grass from Africa, is invading ecosystems in the Top End of northern Australia. This invasion could have dramatic, irreversible ecological consequences for the savannas of northern Australia. This study compared the fuel loads and fire characteristics of invaded sites with those of native grass savannas to determine if A. gayanus invasion alters savanna fire regimes. Experimental fires were lit early in the dry season in savannas dominated by A. gayanus. Fuel load was substantially higher at sites in which A. gayanus dominated the understorey. This higher fuel load supported fires up to 8 times more intense than that in native grass savannas at the same time of year (means 15700 ± 6200 and 2100 ± 290 kWm -1). These are the highest fire intensities ever recorded in the Northern Territory. These results suggest that A. gayanus is a serious threat to the savannas of northern Australia, with the potential to affect savanna tree mortality and recruitment and initiate a grass-fire cycle in the Northern Territory. This cycle could cause a decrease in savanna tree cover and the conversion of a diverse savanna ecosystem into a tall perennial grassland.

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LANDSCAPE ECOLOGY AND ENVIRONMENTAL PLANNING AND ASSESSMENT ON A LOCAL AND REGIONAL LEVEL

Abstract
Since the mid eighties the European Union has established a system of environmental planning and assessment methods. Furthermore there are different national planning instruments. These planning instruments are either supposed to actively develop new possibilities for the use and protection of landscapes or to control the effects of plans and projects on the landscape. In order to be able to use landscape ecology for these planning processes it needs to be put into such a form that it can be easily adapted by planners and users for their specific requirements.
The presentation outlines the aims of these planning instruments and the required landscape ecological knowledge on a regional and local level. Examples from Brandenburg illustrate the required input from landscape ecology for Strategic Environmental Assessment (SEA) and Management Plans based on the EU Water Framework Directive. They show that even within a single planning instrument the requirements for knowledge from landscape ecology differ considerably on different scales and for different tasks. Planning aspects cannot simply be added to the results of landscape ecological research but must be actively integrated into the research design at the outset, if this research is to be used for planning purposes.

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ASSESSING LANDSCAPE RUNOFF AND SEDIMENT LEAKINESS ACROSS A RANGE OF SCALES

Abstract
A framework relating landscape health to hydrological response is proposed for savanna woodlands of north-eastern Queensland. Before European settlement, soil function was intact and the landscape in equilibrium. After the introduction of cattle, soil hydrological function became degraded through a decline of soil surface condition, leading to

increased runoff and erosion. We postulate that this has changed discharge characteristics, with a shift towards a higher proportion of quickflow at the expense of baseflow. Consequently, we hypothesise that grazing-induced changes to soil surface condition are one of the key determinants of hydrological responses in tropical savannas. We present results obtained with a variety of methods suited to different scales, including rainfall simulation, Landscape Function Analysis, hillslope runoff monitoring, and stream gauging. The results obtained to date indicate that this hypothesis holds across a range of scales, from the point or small patch (~1m2) possibly to the small catchment scale (~15km2). We also show that the degradation process is reversible and that soil health can be expected to recover in most cases following the exclusion of cattle. Implications for the development of further improvements to methodologies linking across different scales of observation and directions for future work are discussed.

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A CONTINENTAL ASSESSMENT OF AUSTRALIAN CONTEMPORARY FIRE REGIMES—1997-2002

Abstract
The paper reports the application of monthly continental-scale fire mapping data derived from NOAA-AVHRR imagery for describing the distribution and extent of landscape fire in Australia with respect to ancillary climate and other landscape surfaces, for the six year period 1997-2002. The reliability and limitations of assembled data are considered with reference to studies undertaken as part of a nationally commissioned project. Results indicate that: (a) by far the greatest extent of landscape fire occurs each year in the tropical savannas; and (b) in the last few years substantial areas of central Australia also have been burnt in association with decadally atypical high rainfall conditions. The paper discusses the implications of these data for national biodiversity and international greenhouse agendas. Finally, the paper considers the future role of remote sensing, especially the recent application of MODIS imagery, for monitoring and mapping national fire regimes over the next ten or so years.

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INFLUENCE OF AGRICULTURAL LANDSCAPE STRUCTURE ON WATER FLUXES AND CONTROL OF DIFFUSE POLLUTION

Abstract
Because of structural simplification in agroecosystems brought about by the obvious need to increase yields, the cultivated fields are characterized by a lower tie-up in internal cycles of chemicals that can result in increased leaching or blowing out of substances from agroecosystems. Farmers can moderate the intensity of various material-dispersing process through properly applied tillage technologies, but they are unable to eliminate them entirely regardless of whether they use integrated or organic farming systems. Combining on-farm environmentally friendly technologies with the structuring of landscapes with various stretches of permanent vegetation can provide a more successful elimination of environmental threats.
The development of new methods for estimation of heat and water balances under field conditions enabled estimations of plant cover structure influence on water cycling in agricultural landscapes.
It was shown that shelterbelts use nearly 3 times less energy for air heating than cultivated fields. Thus cultivated field can be called the landscapes "ovens". At the same time shelterbelts or forests used about 50 per cent more energy for evapotranspiration

than cultivated fields. Grasslands show intermediate values. So trees function as “water pumps” in respect to water cycling in the landscape. According to estimations obtained for agricultural landscape during the plant growth season (20 March till 31 October) evaporated water from coniferous forest patch was more than 200 litter per 1 m2 higher than in wheat field. For mid-field shelterbelt this difference was almost 180 litters per 1 m2.
Long-term studies carried out in the Research Centre for Agricultural and Forest Environment in Poznan, Poland indicated that shelterbelts (mid-field rows or patches of trees), stretches of meadows and small mid-field water reservoirs located in upland parts of watersheds impact on the chemistry of water passing.
It was observed that nitrate concentrations were decreasing substantially when ground water carrying them from under fields passed under biogeochemical barriers. Both shelterbelts or small mid-field forests could decrease concentrations of incoming N-NO3 from fields in range of 63% to 98%. In meadows the detected decrease of nitrate concentrations was similar and ranged from 79% to 98% of the input.
The decrease of phosphate concentration under the biological barriers is also clearly evident although not in cases when plant residues underwent rapid decomposition and release phosphorus compounds.

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RIVERINE LANDSCAPE: DEFINITION, STATE AND MEANING

Abstract
The authors define the spatial, temporal and functional structures of the riverine landscape, with man as a complete actor within this ecosystem. Riverine landscapes belong to the largest and most important of landscape types. Here, we describe the general conditions and the role of the riverine landscape of the Morava River basin (4 067 km length) and we have reconstructed the changes since the neolithic. All functions depend on the ecological state. At present, only one third is in an acceptable ecological state, almost 27% are in an ecological disaster. Settled areas have nibbled away over 20% of its length and 10% of its surface area. The river's flood protection capacity has been studied in detail. Excessive destruction of the landscape is responsible for both a decrease in flood protection and a decline in biotop and species diversity. Both these functions can only be preserved in an active floodplain. The optimization of the Morava River landscape, an area of 63,565 hectare that can accumulate as much as 430 million m3 of floodwater has been elaborated. Our ecological method has been chosen as the main flood protection strategy and is already being implemented at five locations.

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THE UTILITY OF SURROGATES FOR BIODIVERSITY CONSERVATION PLANNING: ISSUES OF TYPE AND SCALE

Abstract
The use of both biological and environmental surrogates for biodiversity conservation planning, especially for the design of conservation area networks is becoming commonplace. This is inevitable when planning must be based of rapid biodiversity assessments rather than detailed surveys. It is known that some traditional methods such as the use of flagship, focal, keystone, and umbrella species performs little better than random site selection. It is shown here that some environmental and habitat-based

surrogates do perform better provided that the goal is place prioritization for conservation action rather than species' distribution prediction. Such surrogates can be easily and accurately assessed often through remotely sensed data and reliable interpolation through models making them useful for planning. These surrogates include aspect, precipitation, soil type, temperature, and vegetation class. Some easily accessible biological distributional data (for instance, on birds and butterflies) are less useful than environmental surrogates. However, the accuracy of surrogates depends critically on spatial scale, apparently increasing logarithmically with cell size. The data sets analyzed are all from North America: Québec, New York, Texas, and West Virginia. The future will show whether generalizations made from this region of the world continues to hold for data from other regions.

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THE DEVELOPMENT OF MANAGEMENT PLANS FOR MULTIFUNCTIONAL LANDSCAPES AS A TOOL TO BRIDGE DISCIPLINES

Abstract
Traditional landscapes have multifunctional roles through the use of natural resources and as arenas for myths, symbolism and meaning. During the more recent industrialised period, however, rural landscapes have been reduced to single functions, such as forestry or agriculture, while areas of specific interests have been designated for conservation. In Sweden, management plans established by County Administrations are the principal documents that determine content and composition of nature- and culture reserves, and identify landscapes for environmental subsidies. Although natural and cultural heritage values are generally agreed to be interdependent, they have often been dealt with as conflicting interests. More recently, integrated landscape management approaches and movement from an object-oriented to larger scale management can be detected in research and landscape policy. This study reviews management plans and interview advisors from culture/nature backgrounds in order to detect the relationships between conservation perspectives and policies, and the intentions and outcome of management. Formulated goals and intentions are analysed in order to evaluate their contribution to a multifunctional approach and a wider scale consideration. Many current management plans are found too condensed, and not able to fulfill integrated targets. A stronger focus on multi-purpose management plans can strongly contribute toward the integration of disciplines.

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ACTIVATING "INDIGENOUS KNOWLEDGE" TO STRENGTHEN NATURE CONSERVATION MEASUREMENTS IN EUROPE

Abstract
Scientific knowledge of landscape ecological correlations is almost useless if it is not applicable to the landscapes because of the strong resistance or ignorance of the local, regional or national communities. For example, the lack of acceptance of nature conservation measurements or strategies, such as the European Council's habitats directive, is widely known in Europe. More than financial or technical motives it seem to be the troubled relations between nature conservation authorities on the one hand and landowners, tenants and their stakeholders on the other, that cause conflicts and rejection. Often the authorities unintentional slight their target group not esteeming their traditions concerning the use of the landscape, their (religious) attitude towards nature and creatures, their social values and their knowledge about the landscape. This is part

of the results of an ongoing study with more than 50 conducted qualitative interviews with all groups touched by the habitats directive in Germany on regional level. The study shows, that recent principles of foreign aid projects have to be considered in Europe as well. Such is the use of participative and cooperative planning methods in combination with staff trained in cross cultural awareness to benefit from the indigenous knowledge still existing.

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FRAGMENTATION INDICES ESTIMATED FROM SATELLITE IMAGES WITH DIFFERENT SENSOR SPATIAL RESOLUTIONS: IS COMPARISON ACROSS

Abstract
Analysing the effect of scale on landscape indices is currently one of the key research topics in quantitative landscape ecology. We describe the effect of sensor spatial resolution on six commonly used fragmentation indices (selected for characterising forest fragmentation within the Third Spanish National Forest Inventory) and present several novel results to this respect. We analyse simultaneously gathered Landsat-TM and IRS-WiFS satellite images, as well as TM patterns aggregated to coarser resolutions through majority rules. We show that majority rules tend to produce more fragmented patterns than actual sensor ones, and we suggest that sensor point spread function should be specifically considered to improve comparability among satellite images of varying pixel sizes. It is shown that power scaling-laws allow predicting the variations of some of the indices with spatial resolution: mean prediction errors are found to be under 10% for number of patches and under 5% for edge length. We show that an arbitrarily large value for the patch cohesion index can be obtained by resampling the pattern to smaller pixel sizes; an explanation and simple solution for correcting this undesired behaviour is provided. Landscape division and related indices are found to be the least sensitive to spatial resolution effects.

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DISTURBANCE, BIOMASS, AND PHYSIOLOGICAL INTERACTIONS: LINKING SCALES USING COMPLEX AND SIMPLE MODELS.

Abstract
Predicting the long-term dynamics of forest ecosystems is dependent on understanding multiple processes that often operate at vastly different scales. Disturbance and dispersal are landscape scale phenomena and are spatially interactive across the landscape. Physiological processes (e.g., growth and respiration) operate at much smaller scales and are generally characterized at a finer resolution (< 1 ha). To link these disparately scaled processes, we used biomass (living and dead) as an integrating variable that provides feedbacks between forest disturbances and physiological processes. Specifically, we linked a complex model of forest disturbance and succession with a simple model of growth and respiration. We used LANDIS, a spatially explicit, stochastic landscape simulation model, and PnET-II, a generalized ecosystem process model. The combined model has enabled us to quantify how fire and windthrow alter forest succession, living and dead biomass, and productivity across a landscape. In addition, we quantified the effect of harvesting on the intensity and severity of natural disturbances. Finally, the model provided valuable insights into the feedbacks between the processes operating at different scales. The model also shows promise for answering questions about carbon cycling and climate change on forested landscapes.

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THE RESPONSE OF BOREAL SONGBIRDS TO HABITAT AMOUNT AND CONFIGURATION AT MULTIPLE SPATIAL SCALES

Abstract
The relative contribution of habitat loss and fragmentation to species decline is an important topic in landscape ecology. In dynamic, heterogeneous landscapes where forest harvesting is the dominant land use, quantification of habitat loss and fragmentation requires explicit identification of the habitats of concern. We use empirically-based, multi-scaled abundance models of bird species associated with older forests to address these questions in the Canadian boreal forest. A landscape dynamics model projects population persistence over time under various scenarios. In harvested landscapes, the total amount of forest remains relatively constant, while the amount and configuration of older forests changes dramatically relative to landscapes experiencing a natural disturbance regime. Both factors influence the observed local abundance of some species. At a landscape level, the effect of habitat amount and configuration was strongly influenced by how habitat was quantified; as our definition was refined (from all forest to older forest to older deciduous forest), the effect of configuration increased. We are now evaluating data from a 2-year field study of 90 - 100 km2 landscapes, designed specifically to assess response to both local and landscape characteristics of habitat amount and configuration and to test for threshold effects for sensitive bird species.

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ASSESSMENT OF EXTINCTION RISK FOR MIGRATORY SONGBIRDS IN DYNAMIC LANDSCAPES

Abstract
We evaluated extinction risk for five types of migratory songbirds, which differed in edge and area sensitivity, within theoretical landscapes subjected to chronic habitat loss and fragmentation. Habitat was destroyed at various rates (0.5%, 1%, or 5%/yr) and degrees of fragmentation. The vulnerability threshold was identified as the point where the population growth rate (?) declined by ?1%/yr, based on the most-conservative IUCN criteria for assessing extinction risk. Species with intermediate edge sensitivities were the most sensitive to fragmentation effects, but surprisingly, appeared to persist longer, across a greater range of habitat destruction, when habitat was lost rapidly (5%/year) than at slower rates of disturbance (0.5%/yr). This paradoxical result occurs because of a lagged population response to landscape change; the landscape is changing more rapidly than the demographic potential of the species in this scenario. Such species actually cross the viability threshold in less than 20 years (time to total denudation) under this scenario of rapid habitat loss (5%/yr), but persisted up to three times longer in landscapes subjected to lower rates of disturbance (0.5%/yr). Thus, landscape metrics (amount and fragmentation of habitat) are not sufficient for assessing population viability in the absence of information on the landscape's disturbance history.

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IMPLEMENTATION OF AGRI-ENVIRORMENTAL MEASURES IN ESTONIA: EXPECTATIONS AND OUTCOMES

Abstract
The implementation of agri-environmental measures in Estonia is expected to have a significant influence on the protection and enhancement of the rural environment. Development of the AEP for Estonia began at the end of 1997. The proposed programme consists of four connected schemes: Environmentally-friendly Management Scheme, Supplementary Measures Scheme, Abandoned Land Scheme, Training and Demonstration Scheme. In 2001 Estonia started to test most of the proposed agri-environmental measures and the administration system in pilot areas. The overall aim of the Pilot Project was to test the proposed agri-environmental measures and administration system, before the full set of measures proposed will be implemented nationally. Management of agri-environmental measures should be based on a scientific, well-designed and properly functioning landscape and environmental monitoring system providing the information necessary for good management decisions. To evaluate the real outcome of agri-environmental policies we need a good set of environmental indicators. Therefore the evaluation and monitoring methodologies were worked out and tested and analysed at the pilot areas. Also interviews with farmers on agri-environmental measures and expectations were contacted and analysed.

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UNIVERSITY-LED PARTICIPATORY WATERSHED PLANNING AT THE MOUTH OF THE MISSISSIPPI, NEW ORLEANS, USA

Abstract
The past decade in the USA has seen an increase of public attention and environmental restoration money focused on the water quality and wetland habitat destruction problems of southern Louisiana. The metropolitan area of New Orleans is wedged between the two, with the polluted Lake Pontchartrain estuary to the north, and the Mississippi River and delta wetlands to the South. The physical and economical feasibility of restoration in the area is being hampered by a combination of physical infrastructures for shipping and oil and gas exploration; culturally sensitive agricultural, fishing and trapping leases; and urban sprawl caused by crime and other social problems. Regardless, politics and publicity has helped to inflate the funding sources to this intractable problem, and in some cases academia and non-government organisations have been given management of these funds. This talk will discuss, along with the challenges of management and analysis in a decentralised society such as the USA, the process of attempting stakeholder-based inquiry and management where the impetus is in the form of money, rather than mandate. The management of the US Congress' Pontchartrain Restoration Act, signed in 2000, will be discussed in detail and contrasted with several other initiatives and approaches.

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FUNCTIONAL RESTORATION OF DISUSED SEMI-NATURAL GRASSLAND BY CATTLE INTRODUCTION IN S.W. JAPAN

Abstract
Landscape fragmentation of semi-natural grasslands increases extinction risk of the species dependent on open habitats. In the Aso region, southwestern Japan, controlled fire managements have been continued traditionally for grassland maintenance.

However, farmers aging makes it difficult to continue firing in resent years. To maintain grassland vegetation and prevent from invasion of tree or shrub species, laborsaving alternative ways are required. A cattle introduction test has been conducted on a disused semi-natural grassland in the region, where the annual precipitation exceeds 3,000 mm and the annual mean temperature is approximately 11 °C. Although vegetation of the disused grassland after 8 years without any management had been dominated with tall-type grass and shrub species, the cattle introduction shifted the vegetation to short-type species dominant. Species richness of vascular plants per unit area has been increased with year after the introduction in 2000. However, aboveground biomass has been decreased drastically. The cattle introduction has modified soil and water environments of the grassland. Six months (2 months per year) grazing has increased hardiness and has decreased water permeability and aeration of the surface soil. Ecological functions of disused semi-natural grassland might be restored thorough cattle introduction.

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ROLE OF TRADITIONAL AGRICULTURAL LANDSCAPES IN CONSERVATION OF BIOLOGICAL AND CULTURAL DIVERSITY

Abstract
Traditional agricultural landscapes often play a vital role in preserving biological and cultural diversity. This is especially the case in many regions of Japan, where intensive rice paddy agriculture has been practiced continuously for more than two thousand years. On the other hand, traditional landscapes are rapidly disappearing in many areas. This research uses GIS data and field studies to analyze recent changes in the traditional rice paddy landscape of the southern Kanto Region, surrounding the great city of Tokyo. This landscape consists of a mosaic of forest, open field and wetland habitats, and supports a rich biodiversity. The results of this study, however, demonstrate that various socio-economic forces are conspiring to eliminate or degrade the traditional landscape. One of these is pressure for residential development. Another is abandonment of smaller paddies, which are biologically rich but inefficient to work. Traditional coppice forests were also found to be in the process of being abandoned or replaced by conifer plantations. These changes in the landscape were found to effect distribution of key species. Practical countermeasures for preserving the remaining habitats are identified and presented to prefectural and local municipalities for use in formulating long term zoning and landscape planning.

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THE CVCA MODEL LOOSE COUPLING OF LANDSCAPE ECOLOGICAL STRATEGIES WITH THE CA - SLEUTH MODEL

Abstract
The main purpose of this paper is to develop an environmental model based on landscape ecological strategies (CVCA) loose coupled with an existent Urban Cellular Automata Model (SLEUTH), with the goal of integrate landscape ecological strategies with urban growth modeling.
The Countervailance Cellular Automata (CVCA) assesses landscape metrics and proposes a set of landscape strategies that will interact with the urban cells proposed by SLEUTH (Slope, Land Use, Excluded, Urban, Transportation, Hillshade). The objective is to direct urban growth to favorable areas that do not increase the damage of environmental elements such as corridors, large patches of forest or agriculture, or small

patches of parks, forest or agriculture. The main goal is to increase connectivity and avoid have urban growth causing irreversible barriers to nature. The objective of this research is not only the combination of the urban and the ecological landscape component, but also to bring in a third component, through the inclusion of different landscape planning strategies.

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MODELING FIRE AND BIODIVERSITY TO GUIDE ECOLOGICAL RESTORATION OF PINE FORESTS IN ARID NORTH AMERICA

Abstract
Stand-replacing crown fires have increased in size and destructiveness in the American Southwest over the past five decades. Suppression of frequent, low-intensity ground fires has resulted in dense stands of fire-prone forest over large areas. Efforts to restore structural characteristics that would allow a return to historical fire regimes are hindered by the inability of managers and the public to compare the effects of alternative forest management practices on fire threat and biodiversity. Currently, forest management issues are mired in controversy, endangering ecosystem function, biodiversity, public safety, and municipal watersheds. Our research program, motivated by the need to examine the cumulative effects of many independent management decisions over large planning areas, focuses on the development of spatial data and modeling tools to guide landscape-scale planning. Data layers describing forest composition and structure allow modeling of fire threat and wildlife habitat over areas of several hundred thousand hectares. Modeling alternative forest management treatments and their effects allows managers to prioritize treatment areas and allocate limited resources to minimize negative impacts on biodiversity while maximizing restoration objectives, namely the return of frequent, low-intensity fire that sustains native forest structure and the biological diversity dependent upon it.

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LAND-COVER-HISTORY PROFILES. MEANS TO DEAL WITH HUMAN IMPACT ON BIOTOPE RESILIENCE AND BIODIVERSITY

Abstract
To understand the effects of landscape change on the wider countryside we must know the trajectories of change and turnover of key landscape elements. By using key diagnostic characteristics and spatio-temporal analysis in satellite imagery combined with historical landscape data, we may make inferences regarding habitat loss as well as quality change governed by land cover history. For multiple reasons land cover classifications based on satellite imagery frequently pay little attention to fragmented and complex landscape components, such as grasslands. However, grasslands, including spontaneous woodland successions, are generally associated with high biodiversity as well as other values in the rural landscape and must be integrated in any future satellite based environmental monitoring process. The key research question of this study was to determine if the grassland component could be directly assessed in SPOT satellite imagery. Due to the complexity and dynamic nature of the grasslands, major spectral confusion between grasslands and other land-cover types was encountered. This problem was assessed through a multi-step hybrid classification approach of satellite imagery and supplementary landscape data. It is suggested that this method, after further refinement, could be a useful component in a future monitoring system addressing potential biodiversity status of the wider countryside.

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THE LANDSCAPE DIALOGUE: A TRANSDISCIPLINARY APPROACH FOR PLANNING OF METROPOLITAN DELTA AREAS

Abstract
Throughout history, the fertile river deltas have been the most favourable regions for human life. Common characteristics of delta areas today are high population densities, going along with a high degree of urbanisation, which transformed formerly separated rural and urban systems into large metropolises with dense infrastructure networks and highly intense agricultural production. This means that problems, which are known from other areas of the world are culminating in the delta regions. New integrated approaches are demanded to identify existing interests and lifestyles and bring the relevant stakeholders together to commonly develop a strategy for a sustainable spatial development of their delta region. The Landscape Dialogue is such an approach. It aims at developing an integrated and innovative vision for a region by means of participatory planning. It has the underlying idea of developing system innovations by transcending disciplines and cooperating with stakeholders. The paper will present case studies where such a Landscape Dialogue was introduced.

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THE GEO-ECOLOGY OF PROSOPIS-INVADED LANDSCAPES IN NAMIBIA

Abstract
Introduced as multi-purpose plants that can cope with the demanding conditions of arid savannah landscapes, four species of the genus Prosopis multiplied rapidly during the last three decades in Namibia. These plants mainly occur along drainage lines where they outnumber indigenous species shortly after their appearance. Intermitted flooding disperses great proportions of Prosopis seeds, causing continuously new invasions downstream. Herbivores, which are often confined to drainage lines, spread the seeds in addition. In contrast to its negative ecological impacts are Prosopis frequently perceived as valuable plants because of their high degree of tolerance to adverse geo-ecological conditions and ability to produce high yields of nutritious fodder and fuel wood, on top of providing shelter and combating soil erosion. This research analysed geo-ecologically the landscapes where the plants occur in Namibia to identify distinguishable climatic, hydrological and litho-pedological indicators: Prosopis prefers landscapes where the annual precipitation is marginal, daily and seasonal temperatures range widely, sub-surface discharge is confined and where soils are immature, shallow and infertile. This scenario corresponds to a large part of Namibia, which implies urgent landscape management measures. Some of these measures are evaluated against their socio-cultural and politico-economic costs and benefits.

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INTEGRATED MULTI-SCALE ECOLOGICAL ASSESSMENT IN THE UK

Abstract
This presentation addresses the design and utilisation of multi-scale ecological information from the perspective of national and European policy on the environment. CEH, in the UK and the EU, is addressing the issues of ecological data collection at a range of different scales creating a structure to integrate detailed field-based measurements with information from remote sensing. CEH undertakes 'Countryside Surveys' which comprise sample-based field surveys and land cover maps from satellite images. Integration and inter-calibration of the data for the field surveys and remotely sensed maps is creating a unified product that exploits the strengths of each. In Europe, land cover maps, produced as part of the CORINE programme have a coarser spatial resolution, thus the UK contributions to CORINE are generalisations of the national products. The UK therefore has integrated ecological assessment data from field to European scales. The European Global Monitoring for Environment and Security (GMES) programme aims to improve ecological assessment through the development of standard products and operational delivery services at continental scales. GMES must build on programmes such as Countryside Survey and CORINE to deliver data and information for truly multi-scale landscape ecological applications across Europe.

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ESTIMATING NATURAL BACKGROUND CONCENTRATIONS OF NUTRIENTS IN STREAMS AND RIVERS OF THE CONTERMINOUS

Abstract
Knowledge of natural background concentrations of nutrients is of great value in water quality assessments, but their determination in the developed world has been hampered by lack of pristine monitored watersheds covering a range of ecosystems and basin sizes. We used data from a national network of minimally-impacted reference basins to develop modified SPARROW (SPAtially-Referenced Regression On Watershed attributes) models of background total nitrogen (TN) and total phosphorus (TP) yields and concentrations as functions of runoff, vegetation and other landscape characteristics. These models can be used to extrapolate background concentration measurements from small reference basins to larger streams and rivers of the conterminous United States. Based on these models, TN concentrations in US streams and rivers currently exceed natural background levels by a much larger factor than do TP concentrations. Due to local variation in runoff and other factors, the range of background nutrient concentrations is very large in some ecoregions. It is likely that background nutrient concentrations in some streams in these regions exceed proposed nutrient criteria.

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HOW PERI-URBAN AREAS ACT AS SOURCE FOR NATURE QUALITY IN CITIES

Abstract
Cities often lack sufficient space for high quality of urban nature, while peri-urban areas do have more opportunities to support that kind of nature. However, the perception of citizens is mainly based on nature-experiences within their direct environment. Therefore

a combination in which the peri-urban area would support the nature quality within cities would be perfect. The spatial relation between the city and its environment was studied by using GIS and Correlated Random Walk (CDW) simulation models. CRW-models simulate movements of individuals by using parameters like velocity within different biotopes and transition-probabilities between biotopes. For this study butterflies are selected as species-group to act as indicators for both ecological and nature-experience values. Several scenarios are used to describe the effect of landscape changes for species. 'Release-locations' within those scenarios are representing alternative sites for nature development and resulting sources of dispersers. The simulations provide insight into the role of structural elements in the urban landscape, determining the flow of individuals through the city and the potential exchange of individuals between the city and the peri-urban area. The results of the simulation show that peri-urban areas could indeed play a remarkable important role as sources for urban nature.

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SALINITY MANAGEMENT IN AUSTRALIA: THE GROUNDWATER FLOW SYSTEM FRAMEWORK

Abstract
Australia is a vast continent facing an unprecedented environmental challenge: land and water salinisation. Process understanding has been the focus of the research efforts in the last decades and needs now to be translated into viable management options, both from a biophysical and socio-economic point of view. The search for answers is constrained by the fact that there will never be enough data everywhere to drive data intensive models, and therefore new top down approaches relying on existing data and looking at emergent properties of catchments needed to be developed. The Groundwater Flow System (GFS) approach provides a spatially explicit framework based on landscapes hydrogeomorphologic characteristics for such methods, and a significant body of research has been involved in recent advances in that area. From a management perspective, there is a need to know what can be done and where, including both the spatial and temporal (time lags between action and reaction) impacts. Building on the GFS, a modeling approach called Biophysical Capacity to Change (BC2C) provides a simple multiscale impact assessment of management option on river salinities, salt loads and water yields that is already applied within the Australian Government's National Action Plan for Salinity and Water Quality (NAPSWQ).

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A NATIONAL LANDSCAPE FRAMEWORK FOR RIVER AND STREAM CONSERVATION

Abstract
The rehabilitation of severely degraded rivers receives considerable attention. Yet the importance of protecting remaining streams with high ecological value is only now widely acknowledged. A landscape framework to support the systematic identification of priority streams for conservation across Australia is being developed. This framework incorporates a spatially nested, hierarchical environmental classification and indices of anthropogenic disturbance as indicators of naturalness. The classification groups streams on the basis of the shared similarities of key abiotic attributes that drive hydrological, geomorphological and ecological processes and hence are responsible for

observed patterns in stream characteristics at landscape scales. The influence of human activities is summarised in the form of disturbance indices that rank individual stream sections and their catchments along a continuum from near-pristine to severely disturbed. They are derived by coupling geographical data, recording the extent and intensity of human activities known to impact on river condition, with a drainage analysis of a continent-wide DEM. Over 3 million km of stream will be assessed providing a consistent and comprehensive characterisation to support a wide range of conservation assessment tasks including evaluation of ecological value criteria (representativeness; uniqueness; naturalness); design of biological surveys and use as a biodiversity surrogate where no data exist.

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MODELLING MULTI-SCALE EFFECTS OF WATER CARRIED MATTER FLUXES UNDER "DIFFERENTIATED LAND USE"

Abstract
The theory of `differentiated land use´ developed in 1972 by W. Haber signifying a split-up of landscapes into protection and production areas is regarded as a solution for sustainable land use perspectives of the central European cultural landscapes. Seizing and applying this suggestion to existing agricultural landscapes of Germany, the effects on runoff components and water quality are quantified based upon the actual state of two investigation areas of 8 km² (micro scale) and 300 km² (meso scale). Different scenarios of land use management and landscape changes are created using the physically based watershed scale model SWAT (Soil and Water Assessment Tool). Effects of these changes on runoff process as a whole as well as on different runoff components and the water quality unambiguously prove the environmental relevance of this theory. Attention has also been directed to general methodological problems in landscape ecology dealing with landscape subsets of different scales. Proposals are submitted to find scale specific data with respect to different spatial, temporal, and thematic resolutions. Finally, recommendations for land use changes are given contributing to a sustainable land use development even in densely populated areas, where production of food and protection of nature have to be realised at the same time within the same area.

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LANDSCAPE ECOLOGY OF URBAN FOREST AND DESIGNING FOR ECO-CITY IN KOREA: A DEAL AND COOPERATION WITH GO & NGO

Abstract
Recent change of the urban forest landscape is significantly related to decrease the area of forested land. Industrialization and urbanization have created man-made barriers such as roads and railroads, which separate ecosystems, thereby threatening habitat richness and biodiversity in the forest patch. According to quantitative landscape analyses of urban landscape change, Seoul during 1983-1996, we clarified that the developed area was extended to inner boundary of forest patches. Land transformation process usually produce source-sink patches according to several land use patters and the various bio-geoecological ways. Including some naturalized plants that had been support to artificial landscape restoration, many alien plant species have been invaded to original habitat or ecosystem for native plant. Moreover, fragmented forest patch and extending developed area was source patch or corridor to transfer invaded plant species. Urban forest has multifunctional ecosystems including air, water and human health, therefore, urban forest should be major landscape element in urban landscape. In

recent, many joint projects with GO and NGO to increase green-space in the urban landscape according to biotope creation and urban forest management. Especially, useful guidelines for ecological forest creation planning provided the joint projects are applied to landscape planning in many cities in Korea.

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GLOBAL DRIVING FORCES AND LOCAL LANDSCAPES-DEVELOPMENT PATTERNS, ANALYTICAL CONCEPTS AND POLICY IMPLICATIONS

Abstract
For much of the 20th century, landscape quality has been conceptualised and analysed in terms of the spatial integration of nature and culture. Connectivity, proximity, contiguity and coherence are valued and expressed in landscape character assessment and policy. However, the rise of the global network society is creating a new spatial logic for human activities. Information, goods and people increasingly move through networks that link with remote locations rather than locally bounded places. This new 'space of flows' is challenging traditional 'place focused' landscape research as well as policy. Using cultural landscapes within the metropolitan regions of Copenhagen, Denmark and Christchurch, New Zealand as examples, concepts and principles for landscape research and implications for policy are critically reviewed in terms of the way they address these contrasting spatial logics. There are two conclusions. First, policy orientated landscape classifications and analyses need to be sensitive to a dynamic hierarchy of scales of social activity in space and time, from global to local, as well as more conventional biophysical pattern and process. Second, the translation of landscape evaluation principles into landscape policy requires a focus upon concepts, structures and processes that 'bridge' between these different spatial logics.

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THE ROLE OF ECOLOGY AND SOCIAL SCIENCE IN MEETING NATIONAL ASPIRATIONS FOR LANDSCAPE MANAGEMENT

Abstract
It would be great if landscape ecologists could tell a nation what was worth preserving and why. Relying on ecologists Australia could have a knowledge based policy that would ensure healthy environments for future generations. Unfortunately democracies don't work like that. Decisions are made on trade-offs between current human values. For this reason it is important that ecologists and social scientists review their role in decision making. To begin with it has been demonstrated in Australia that a partnership is required between scientists and the community in making decisions. The community wishes to have input into the criteria for the outcome of decisions and require "experts" to provide the "evidence" about what can be achieved. Theoretically through negotiation the community and the scientist can then move towards a desired future. But there are many provisos on the acceptance of scientific evidence. These include the perceived justice in the decision making process, trust in the agency, perceptions of uncertainty in science, the role of emotion in decision making and the differences in the evidence required for national and local decision making. These issues are elaborated. Suggestions are made about improving the effectiveness of both social scientists and landscape ecologists.

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MODELING LONG-TERM EFFECTS OF ALTERED FIRE REGIMES AND URBANIZATION ON VEGETATION SUCCESSION

Abstract
Periodic wildfire is a necessary agent of change in southern California Mediterranean-type ecosystems, shaping the composition and structure of most plant communities in these regions. Humans have altered the fire regime beyond the natural range of variability as a result of fire suppression and human-caused ignition, and the magnitude and direction of this change varies across the landscape. Suppression has lowered fire frequency in higher-elevation conifer forests, but population growth and urban development has increased ignitions and fire frequency in low-elevation shrublands. We used a spatially explicit simulation model of landscape disturbance and succession (LANDIS) to predict the long-term effects of altered fire regimes on vegetation patterns in two study areas. Simulations in the foothills and mountains of San Diego County indicated that shade tolerant tree species and shrubs dependent on fire-cued seed germination were most sensitive to altered fire regimes; responding negatively to the shortest fire return intervals. Also, ecotone species shifted distributional patterns under varying fire frequencies. Because human settlement is the primary driver of increased ignitions in the low-elevation shrublands, an urban growth model is being integrated with LANDIS to evaluate high fire frequency and habitat fragmentation in the mountains adjacent to Los Angeles.

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MONITORING AUSTRALIA'S VEGETATION FOR IMPROVED NATURAL RESOURCE OUTCOMES

Abstract
All levels of governments, and non-government, community and industry groups increasingly require up-to-date and reliable information on the type, extent, distribution and condition of vegetation. Information on these parameters are needed at a range of scales for developing policy, planning resource development and for monitoring the outcomes of management actions for sustainable production and biodiversity conservation. To consistently describe and monitor vegetation parameters across the States and Territories, two complementary nationally frameworks have been developed through a partnership of key agencies responsible for vegetation research, management and/or information management. The National Vegetation Information System framework is used to compile a structural and floristic mapped baseline across the whole landscape. The Continental Monitoring Framework is being implemented in forested areas to measure changes relative to selected baseline parameters; changes in the type, extent and distribution of vegetation. Through coordinated implementation of these two frameworks at national, State and regional levels, consistent and cost-effective information will be collected, compiled and reported on the status and condition of Australia’s native vegetation. Information from the two frameworks is presented for a pilot study area in Victoria. Applications of the two frameworks are discussed for monitoring and evaluating the outcomes of management actions.

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BIOCONTROL OF CEREAL APHIDS, ORGANIC FARMING, AND THE LANDSCAPE CONTEXT

Abstract
Biological control of plant pests due to natural enemies classically relied on local enhancement of populations of natural enemies, but landscape structure may be of overriding importance. This is shown here with experiments at different spatial scales using cereal aphids (Homoptera, Aphididae), which are important pests on wheat (Triticum aestivum). Our studies focused at the field scale on effects of large fallows (set-asides) adjacent to wheat fields, and at the farm scale on effects of farming practices (organic vs. conventional). By compairing farms with similar landscape features but different farming systems, we were able to quantify the relative impact of local and regional effects. Mortality of cereal aphids caused by natural enemies, in particular parasitoids (Hymenoptera parasitica), did not differ between farming systems. Irrespective of farming system, aphid mortality was higher in structurally complex landscapes than in structurally simple landscapes with a high percentage of annual crop fields. Our results indicate that agri-environmental schemes should consider both the local and the regional spatial scale to efficiently support functioning of ecological processes such as biological control.

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IMPACT OF LAND USE CHANGE IN BANGKOK METROPOLITAN AND SUBURBAN AREAS

Abstract
Rapid expansion of Bangkok Metropolitan (which situates in Chao Phraya delta) during the past twenty years has led to transforming of agricultural land and water basin into urban area including factories. It induced serious problems such as insufficiency of land utilization, inadequate urban facilities and infrastructure, traffic congestion, pollution, reduction in water quality and other environmental problems. To solve the problem, The Bangkok Metropolitan Administration establised a core team to look after its implementation of the pilot project. Its objectives are public hearing and participation in order to identify problems and causes to define sustainable solutions for the problems. Rattanakosin Island was an example.

For a proper planning for land uses which overcome any ecological imbalance information on land resources and the responsible degradation factors is needed.

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NATURE CONSERVATION: THE PLANNER'S PRINCIPAL "TOOL BOX"

Abstract
Population pressures and their associated land uses are turning natural landscape into

semi-isolated "habitat islands" in a sea of man-dominated or man-altered landscape. The current destruction rate is alarming and calls for constant examination of conservation strategies and approaches.
This paper provides a brief guide to five regulatory approaches that dominate the theory and practice of nature conservation: ex-situ conservation, protected areas, biosphere reserves, regional networks of protected sites and ecological planning of environmentally sensitive areas. The issue here is pertinent to the characteristics of these approaches, their shortcomings and their relevance in the Israeli context. The investigation is based upon both international and Israeli experience.
The paper shows that many technical, administrative and political problems in the implementation of biosphere reserves, regional networks of protected sites, and ecological planning have remained unsolved. It also shows that the Israeli experts in nature conservation do not regard these approaches as relevant courses of action, particularly in small and densely populated countries like Israel. Together with this it was found that, despite the skepticism of the experts, there is an ongoing process of incorporating generally recognized principles of ecological planning into national development policy and planning.

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THE TRADITIONAL LAND TENURE OF THE ABORIGINAL PEOPLE OF NORTH-EAST ARNHEM LAND (THE YOLNGU)

Abstract
The traditional land tenure of the aboriginal people of north-east Arnhem Land (the Yolngu people) is best understood by looking at some of traditional terms to illustrate its nature. Madayin is the law and covers commerce, moral, social, judicial and land tenure. The Madayin includes laws for the conservation and farming of, fauna, flora and aquatic life. Bapurru is like clan, the paternal land-owning and trading group. The estate owned by each Bapurru is the Yirralka. By the authority given to them through their Madayin law the Bapurru has rights to all the resources of their estate. They have full rights to; expel foreigners, seek restitution for violation of that estate and to alienate areas of the estate.

Each Bäpurru clan divides their Yirralka estate into a number of different areas according to the resources available within and the different farming activity that occurs there. This includes, the Marrandil the area of sea that is owned by the Bäpurru, the Gärul yam garden and the Mewiyal, an area where eggs are harvested. This division of the estate allows for various laws and restrictions, which help in managing and propagating the resources in these areas.

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SPATIAL HETEROGENEITY AND ECOSYSTEM PROCESSES

Abstract
Enhancing knowledge of the patterns and causes of spatial heterogeneity in ecosystem function remains at the frontier of ecosystem and landscape ecology. Landscape ecology has contributed to tremendous progress in quantifying spatial heterogeneity and understanding how organisms and disturbances interact with spatial heterogeneity at varying scales. However, the spatial patterns, causes, and effects of ecosystem function across landscapes have received less emphasis. Integration of ecosystem and landscape ecology is needed and offers opportunities to generate new insights about how landscapes function. Key research questions are presented for understanding the

causes and consequences of spatial heterogeneity in ecosystem process rates; the influence of land-use legacies on current ecosystem condition; horizontal flows of matter and energy in landscape mosaics; and the linkage between species and ecosystems. Examples to illustrate these research directions are drawn from the effects of fire on vegetation and ecosystem processes, exchanges of nutrients between terrestrial and aquatic ecosystems, and effects of historical land use in forested landscapes. A more synthetic understanding in spatial heterogeneity in ecosystem processes is a key research topic that should include both theoretical development and empirical study.

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DOES POSITIVE FEEDBACK COLOR THE WORLD?

Abstract

The question why the world is green has been a central topic in food web theory for over four decades. It centers on the issue why herbivores, in most terrestrial systems, are unable to fully utilize and exert control over the available vegetation. Competing explanations focused on either predation or on food quality, explaining the effects of herbivores on vegetation. Essential in the latter argument is herbivore-created spatial heterogeneity within landscapes, which allows herbivores to survive by maintaining grazed swards, despite of the overall low quality of forage. We investigate this hypothesis by analyzing a simple spatial explicit model that addresses the consequences of spatial aggregation of herbivores for the potential of control on vegetation by herbivores. Our analysis confirms the traditional view that in a non-fluctuating environment with constant herbivore numbers, spatial aggregation allows for top-down in at least a part of the vegetation. High primary productivity is likely to invoke a partial release of the vegetation from herbivore control. This allows the herbivores to maintain an high intake in the remaining short swards. Most terrestrial environments, however, experience strong seasonal fluctuations in primary productivity. Such conditions leads to a continuing cycle of release of vegetation from herbivore control, followed by a decrease in herbivore numbers, until the vegetation finally develops a dense sward unsuitable for herbivore grazing. Hence, seasonal fluctuations in productivity, typical of many systems in both tropical and temporal environments, trigger a positive feedback between reduced cover of intensively grazed swards and reduced herbivore numbers that explains why vegetation predominates in most of the terrestrial world.

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SPATIALLY EXPLICIT RISK ANALYSIS: A NEW SOLUTION TO CONTAMINATION PROBLEMS IN THE METROPOLITAN DELTA

Abstract

The Metropolitan Delta area in Europe can be characterised as densely populated, with high claims on land use by different functions. These claims urge for a multifunctional and sustainable land use. Due to changes in demography, economic prosperity and time expenditure of people, there is an increased demand for areas for nature conservation/development and for recreational use. Such areas should optimally be located nearby the urbanised centres. However, it is not always feasible to allocate areas to nature development which are optimal suitable. More often, nature development and enhancement of recreational functions will be achieved in conjunction with other functions, or in areas with low-quality functional land use, which may be upgraded. Current methods used in dealing with risks of contamination are based on scientific

ecotoxicological arguments and ignore standpoints of other actors in the process. In the presentation an alternative process of dealing with ecotoxicological risks will be presented, which incorporates spatial structure of the habitat into the risk-assessments. This results in an iterative process between risk assessment and spatial planning, in which all major stakeholders can play a role. Such a process will increase the involvement of non-scientific stakeholders in defining solutions to a complex spatial planning problem.

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TOOLS TO ASSESS THE IMPACT OF SPATIAL DEVELOPMENTS ON THE SURVIVAL OF ANIMAL POPULATIONS

Abstract
Ever expanding urban areas, and the continuous construction of new infrastructure in between, reduces both the quantity and quality of wildlife habitat. Therefore, the need is increasing to predict the environmental impact of such spatial developments. Especially the effects of anthropogenic activities on animal population viability or even the survival of a species. We developed different tools to study the potential effects of such spatial developments on the viability of animal populations. With dynamic (meta)population models impacts of spatial developments can be accurately quantified. However, these models are often species specific and require detailed field research to validate the parameters used. If a multi-species analyses is needed the use of such models is often impractical and expensive. In that case an expert system, in which analyses of different species can be aggregated, may be a better tool to assess impacts. Pros and cons of both type of tools will be illustrated with (1) the analyses of badger (Meles meles) population viability in central Limburg (The Netherlands) after the (proposed) construction of highway A73, and (2) the multi-species analyses of high priority locations to restore habitat connectivity across main roads in The Netherlands.\

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THRESHOLDS IN LANDSCAPE CONNECTIVITY: THE USE OF ISOLATED WOODLAND PATCHES BY ARBOREAL MAMMALS

Abstract
Single trees and small patches of trees are conspicuous components of agricultural landscapes around the world, but their value for biodiversity conservation is unclear. In this study, arboreal mammals were censused with hair-sampling tubes in small patches of woodland (< 1.0 ha in size) in cleared farmland adjacent to a linear network of woodland known to support populations of arboreal mammals. Ninety-one small isolates were stratified by size (single trees or small patches) and distance from the linear network to test the capacity of animals to cross habitat 'gaps'. The genus Petaurus (small gliding marsupials), the most commonly detected taxon, was recorded in 31% of hair-tubes (98 of 316). It occurred in 21% of sites in isolated trees and patches, and in all linear strips. A statistical model demonstrated that Petaurus sp. was most likely to occur in isolates in close proximity to linear strips and other patches of woodland. A distance threshold of 75 m from the nearest linear strip was evident in which 95% of detections occurred, corresponding with the maximum glide distance. The size of isolates did not influence utilisation rates. This study provides quantitative data to assist landscape design and habitat restoration in rural environments.

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NATURE CONSERVATION & SPATIAL PLANNING OF METROPOLITAN AREAS; NEW DEMANDS FOR ECOLOGICAL KNOWLEDGE

Abstract
Spatial planning in metropolitan areas is characterised by complex decision-making processes involving a diversity of actors, goals and policy domains. Collaborative planning approaches are gaining importance. Various stakeholders are actively approached in order to generate knowledge and to accommodate the various requirements, wishes and objectives as far as possible. In these planning processes nature conservation is only one of many objectives. This should be taken into account in nature conservation policy. Issues of nature development and protection have to be linked with objectives of other actors and policy domains. Nature conservation interests need to be communicated with a diversity of disciplines, public authorities, and societal actors. This requires another view on the use of ecological knowledge and a different role for experts. Two cases will illustrate this. One case will deal with the implementation of ecological networks in The Netherlands (nature development). Another case will deal with the implementation of the European Habitats Directive in decision-making processes (nature protection).

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LANDSCAPE INDICATORS AND THEIR IMPLEMENTATION IN FLANDERS (BELGIUM)

Abstract
In Flanders, as an autonomous region of the federal state Belgium, the need for indicators increased when environmental reporting became a regular policy. The aims for applying indicators differ according to the policy and planning levels. At the national scale, quantitative, generalized and synthetic indicators giving a complete coverage of the territory are preferred. Regular square (kilometre) grids, administrative units or geographical surfaces are used for presenting their spatial distribution. At the local level, simple and transparent, but detailed indicators specific for the communal scale are more useful. The high landscape heterogeneity due to extreme urbanization and severe fragmentation by infrastructure networks, adds to the problem of finding significant and reliable indicators. Using the Landscape Atlas of Flanders and the non-geometrical map of Ferraris (1770) as historical baseline, indicators were defined for these different levels related to landscape condition and stability. Results are interesting for applications in planning, environmental impact assessment and monitoring. However, several problems remain, such as a multifunctional transformation of information from historical maps into a GIS. Also, many practical constraints exist as well for implementing landscape indicators, such as transferring indicators to an international scale, demanding integration of the regional (Flemish) indicators at the federal level.

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SELECTING PRIORITIES FOR BIOLOGICAL CONSERVATION IN COLOMBIA

Abstract
The selection of areas to conserve all animal and plant species must be done in the correct way in order to prevent extinction. For a successful selection, three elements are needed: (1) valid criteria, (2) proper techniques to apply them correctly, systematically and efficiently, and (3) good ecological and biological information comparable for the whole territory considered. The prioritisation of conservation areas for Colombia was carried-out based on these three elements: a set of selection criteria, including quantitative targets, were implemented in the program FOCALISE, that was run using as input the present and original-potential distribution of the terrestrial ecosystems. Three scenarios were constructed by applying different redundancy values. In all of them, the number of areas selected is far higher than the present number Colombian national parks.

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DESIGNATION OF GROUNDWATER PROTECTION ZONES AND ECOLOGICAL CORRIDORS -LANDSCAPE ECOLOGY IN REGIONAL PLANNING

Abstract
Land areas are designated for specific purposes as tools for countryside planning. Many designations are ecologically reasoned, but employment of contemporary landscape ecological knowledge in the delineation of designated areas is often not clear. We analyzed the employment of landscape ecological data and theories in the designations of groundwater protection zones and ecological corridors in the plans of the Danish regional authorities. We made a general characterization of the corridors and groundwater protection zones (soil, land use, land cover etc.) and interviewed responsible planners in the regions. The designation of groundwater protection (delineation, extent) areas was based on future demand of drinking water, ground water recharge, location of polluted land areas, location of vulnerable nature areas, present land use and location of high quality aquifers. Political interests determined the extent of groundwater protection zones too, however. We expect the groundwater protection zones to be strong tools in the future countryside planning. Principles determining delineation of ecological corridors varied strongly among the regions. The reason was lack of understanding of the function of the corridors, the proper scale, and confusion as to the practical validity of the landscape ecological theories behind (bio-geographical models, island theories etc.). The future use of the designated corridors in countryside planning is uncertain.

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LANDSCAPE CHARACTER MAPPING IN SARDINIA: A FRAMEWORK FOR CORK OAK HABITATS MAPPING

Abstract

The combined impact of development, land-use change and fire have resulted in the degradation of cork oak (Quercus suber) habitats in the island of Sardinia, Italy. Despite the cultural and biodiversity value of these habitats at a European level, as well as their importance for the local economy, little is known about the interaction of physical and

cultural factors that have influenced their distribution. The paper reports on the development of a landscape typology framework as a means for mapping the distribution of cork oak habitats in a pilot study area on the island. Field survey and local expert knowledge demonstrated that these habitats in Sardinia reflect differences in physical (e.g. geology) and cultural (e.g. land-use) factors. Layers of data on the physical and cultural attributes of the landscape were integrated within a GIS database followed by the successive sub-division of the mapped attributes in order to produce homogeneous landscape units. These units were classified into landscape types using multivariate analysis (TWINSPAN) and the results were mapped into a GIS to produce a landscape character map. This map is the first step towards identifying potential sites for creation and restoration of cork oak habitats in Sardinia especially in protected areas.

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LANDSCAPE CONSERVATION AND SUSTAINABILITY

Abstract
Landscape ecology has great potential in bridging the gap between research and application. Which factors determine the success of a close linkage between science application and conservation policy? Scientists should take additional steps to translate research results into general concepts that can be applied in landscape planning. Close contact with nature policy makers is necessary to determine the main problems and to find spatial concepts to solve these problems. This asks for a balance between on the one hand knowledge development on the functioning of species and the development of spatial concepts for conservation. On the other hand close communication with policy makers and appealing presentation of design rules are needed.
The process is illustrated with the implementation of a recent landscape ecological concept into conservation policy: robust ecological corridors. The following steps are presented:
1. Problem definition and solution: advise robust multi species ecological corridors are needed to improve the connectivity of natural areas.
2. Development of spatially explicit design rules for multi species robust corridors
3. Development of a handbook and interactive cd-rom to facilitate the process of implementation of robust ecological corridors.

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WHAT CAN LANDSCAPE ECOLOGY GAIN FROM INTEGRATING GRADIENT ANALYSIS WITH MULTIVARIATE GEOSTATISTICS?

Abstract
Gradient analysis uses ordination methods to study the structure of biotic communities caused by biotic processes operating in a heterogeneous environment. This structure has two spatial components: spatial processes within the community create autocorrelation, and the spatial structure of environmental factors creates spatial dependence. Ordination methods, however, do not make use of spatial information. I show how ordination methods (PCA, RDA, CA, and CCA) can be partitioned by distance (indirect and direct multiscale ordination) and integrated with geostatistics. Regionalized analysis can then be used for simultaneous modelling of spatial dependence and spatial autocorrelation across different levels of organisation from species and functional groups to species composition and diversity. This will be useful for answering questions

about the organism-specific scale of response to the environment, the optimal spacing of sampling units, or the scale-dependent effect of environmental factors, as well as for understanding the spatial structure of complex variables that result from a combination of different organism responses to a spatially structured environment. Multi-scale ordination provides a diagnostic tool to assess the need for regionalized analysis and to determine characteristic scales and an appropriate aggregation level of the variables.

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LIVING IN THE LANDSCAPE: THE PEOPLE'S PERSPECTIVE

Abstract

Landscapes are imbued with meaning, history and community. The relationships people have with landscapes form distinguishing attributes for communities of people. Contemporary issues in landscape management echo past environmental concerns with increasing urgency and the dimension most critical to these issues is the people themselves. Implementing viable solutions to environmental issues at the landscape level is in essence an activity that must engage people and operate within the frame of their relationships with landscapes. This research uses three dimensions of people's relationships with landscapes to relate social structures to landscape use and management. Relationships between a sense of place, social capital and the norms that frame decisions in landscape management are identified across a range of community scales. The diverse relationships people have with landscapes are sustained by specific forms of social capital that are framed and limited by norms of environmental discourse. These norms facilitate some solutions and preclude others. By integrating social dimensions in landscape management, an understanding of social structures and decision frameworks in a landscape context can be correlated with biophysical approaches. Solutions to landscape issues must engage people and operate within the frame of their relationships with the landscapes in question.

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INTEGRATING PLANTS, ECOLOGY AND PEOPLE FOR MANAGEMENT PLANNING: LOCKHART RIVER DOGIT, CAPE YORK

Abstract

We integrate floristic assemblage data with data on human ecological, economic and cultural uses, to assess landscapes for management planning in the Lockhart River DOGIT, Cape York. Floristic data from 80 quadrats in the immediate environs of five outstations were combined with recorded local Aboriginal peoples uses of the plant species. Integrating the analysis of floristic pattern with plant uses reveals congruency between vegetation types, and economic and cultural landscapes. All plant communities defined are valued for various economic and cultural purposes by local people. However, some receive greater use, and are accorded different levels of importance for particular cultural and economic practises than others. For example, coastal ecotone communities demonstrate highest historic Aboriginal population densities, greatest use by people and highest numbers of plant species used for a wide array of purposes. These are also the environments where vegetation structure and species composition are most readily manipulated using fire to achieve different economic and cultural outcomes. This work has application in the identification, mapping and prioritisation of cultural landscapes for management actions, but does not imply that particular cultural landscapes are any more constant than the plant communities with which they are associated.

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EUROPEAN LANDSCAPE ASSESSMENT: FROM CHARACTERISATION TO EVALUATION

Abstract
An analysis of the existing monitoring programmes at the national level shows that "Landscape Character Assessments" have become an important tool for the conceptual and spatial integration of a wide range of factors relevant for the state and trends of land systems.
The large diversity of landscapes characteristics - especially at the European level - must be considered as a key methodological challenge when assessing the vulnerability and resilience of terrestrial land systems with regard to pressures from land use and land cover changes. Landscape characteristics such as topography, soil type, vegetation, structural elements (hedges, trees), cultivation patterns and history provide a variety of both natural and cultural values. The objective of a harmonised landscape character assessment is to develop reliable indicators and a geographic reference base that allows assessing the role and function of landscape-management for the protection/conservation of important natural and semi-natural landscapes.
By comparing national and international approaches from European and non-European countries, the paper is meant to identify the commonalities and differences between Landscape Character Assessments as actual as well as potential tools for policy development in different regions of the world.

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A COMBINED APPROACH OF MODELING AND PARTICIPATION FOR EFFECTIVE PLANNING

Abstract
It is argued to combine in integrated assessment of regional multifunctional landscapes a modeling approach with a participatory approach. The question is when and how in the policy process modeling and participation can contribute logic and meaningful. In this contribution we analyze a dozen of regional integrated assessment studies, in which we participated. These studies were directed at European landscapes where nature, recreation, agriculture, transport and water resource functions had to be combined. We focus on the role of science, models and communication among actors in the various stages of the process. We conclude that (1) the function of participation is often not recognized; (2) science and policy are often not explicitly separated; (3) local actors as well as scientists should be involved from the start; (4) up-scaling of physical and ecological patterns and/or downscaling of societal processes is necessary; (5) an argumentative approach is preferred when the number is low of feasible alternatives on which actors could agree; (6) when the number of alternatives is large optimization techniques are helpful in selecting the most effective ones; (7) spatially explicit models are helpful in determining spatially differentiated alternatives; (8) subjectivity is unavoidable and should be given explicit place in the process.

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AN ALTERNATIVE WAY TO STUDY FRAGMENTATION: A RESOURCE REMOVAL EXPERIMENT AT THE LANDSCAPE SCALE

Abstract
Most studies investigating the short to medium term consequences of habitat fragmentation compare species richness of selected organisms to various fragment attributes. Results from these studies vary greatly: studies of similar organisms in different systems and different organisms in the same system often display highly divergent patterns. In woodlands of eastern Australia, numerous studies have documented deleterious effects of fragmentation on birds, richness decreasing with patch size and quality. Conversely, native mistletoes - a keystone resource in this system - respond positively to increased light, decreased herbivory and higher disperser occurrence associated with habitat edges. Hence mistletoe may play a compensatory role, masking the true effects of fragmentation on bird distribution. Here, I report on a landscape-scale removal experiment focused on mistletoe that aims to uncouple these positive and negative effects and yield a more complete understanding of determinants of diversity in habitat fragments. Forty woodland fragments of known age in southern New South Wales, Australia have been selected for study and once base-line surveys are completed, all mistletoe plants will be removed from 20 fragments, with diversity monitored in subsequent multi-taxon inventories. Preliminary data indicates a strong negative effect of mistletoe removal on bird distribution and possible impacts to nutrient cycling and long-term vegetation dynamics. In addition to generating a resource-based understanding of the consequences of habitat fragmentation, this long-term study will allow a detailed appraisal of the basis and influence of edge-effects.

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LANDSCAPE ECOLOGICAL ASSESSMENT OF THE CHESAPEAKE BAY WATERSHED

Abstract

The Chesapeake Bay watershed, located in the mid-Atlantic region of the United States, is experiencing rapid habitat loss and fragmentation from sprawling low-density development. The bay itself is heavily stressed by excess sediment and nutrient runoff. Three states, the District of Columbia, and the federal government signed an agreement in 2000 to address these problems. The commitments included an assessment of the watershed's resource lands, and targeted the most valuable lands for protection. As part of this task, the Resource Lands Assessment identified an ecological network comprised of large contiguous blocks (hubs) of forests, wetlands, and streams interconnected by corridors to allow animal and plant propagule dispersal and migration. Hubs were prioritized by ecoregion, by analyzing a variety of ecological parameters including: rare species presence, rarity and population viability; vegetation and vertebrate richness, habitat area, condition, and diversity; intactness and remoteness; connectivity potential; and the nature of the surrounding landscape. We found that much of the watershed was still fairly intact, although this varied by ecoregion. Current protection also varied, and an ongoing assessment of vulnerability will help focus protection efforts among the most valuable hubs and corridors.

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INDIGENOUS LANDSCAPES – WHICH ECONOMY WILL SHAPE THEM?

Abstract
Human economies shape landscapes and are in turn themselves reshaped through complex feedbacks. The Indigenous economy in northern Australia can be characterised as hybrid: a mix of customary, market, and state sectors. Contemporary management of Indigenous lands is compromised by a weakened customary economy that has reduced

the human presence and allowed adverse processes to go unchecked. Customary activity in remote areas has not been effectively replaced by state or market sectors. In remote locations, the arts and crafts industry draws on Indigenous knowledge and skills and engages large numbers of Indigenous people with the market. However, incomes from arts and crafts alone are insufficient to support resumption of land management activity over whole landscapes. Other commercial harvests of native plants and animals are compromised by outdated regulatory regimes that privilege some patterns of use and entirely deny others. In the short term, expansion of the mainstream market economy into Indigenous lands is likely to be dominated by various forms of more intensive resource extraction (mining, and pastoralism through agistment) which generate limited local employment and work against customary management. In addition to sometimes-intractable local and regional biophysical impacts, exclusive focus on such uses may further weaken customary activity and so extend impacts much further. The state has a critical role to invigorate all sectors of the hybrid economy. Options for Indigenous people to improve their socio-economic status must be diverse if they are to maintain a corresponding diversity of landscapes and human interactions with them.

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USING A LANDSCAPE APPROACH TO GUIDE CONSERVATION, RESTORATION AND ACQUISITION

Abstract
An interdisciplinary team at the University of Florida was charged with developing a management plan for the Marjorie Harris Carr Cross Florida Greenway in Central Florida. Strategies are needed that help to protect and restore natural levels of spatial and temporal heterogeneity that are necessary for maintaining intact ecosystems and biodiversity while minimizing the effects of fragmentation (Harris et al. 1996). Spatial analysis of conservation lands using GRID, the cellular-based module of ESRI's Arc/Info GIS software, proved to be an effective tool for systematic landscape analysis of ecological significance and the prioritize areas that facilitate critical landscape linkages. Landscape linkages facilitate spatial and temporal relations between heterogeneous landscape patches and can serve as faunal habitat, alter landscape fluxes, and enhance the aesthetic appeal of a landscape (Hobbs 1995). The identification of linked ecological networks of lands key to conserving natural resources is a critical strategy for applying ecological principles in planning efforts to thwart and minimize the threats to ecological integrity caused by habitat fragmentation (Carr et al. 2002). The ultimate goal is to provide a foundation in which protection of the important ecological processes can be optimized for multiple benefits at a variety of scales (Carr et. al 2002, Noss 1996). Results of the modelling results proved effective to develop strategies for management, restoration and acquisition endeavours within the Greenway.

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INTEGRATING LANDSCAPE PRINCIPLES INTO CONSERVATION PRACTICE IN THE NATURE CONSERVANCY

Abstract
In recent years, The Nature Conservancy has expanded its focus from “pretty places” (e.g. preserves) to “functional landscapes.” While the emphasis on landscapes is both practical and welcome, we must ask what has been done to move beyond words, to actual conservation practice. To address this issue, I consider five core principles of landscape ecology: (1) landscape elements differ in quality; (2) patch boundaries influence within- and among-patch dynamics; (3) patch context is important; (4)

connectivity is a key feature of landscape structure; and (5) spatial patterns and processes are scale-dependent. For each, I ask how (or whether) the principle has been applied in the work of The Nature Conservancy, and assess the apparent impediments to putting the principles into practice. As landscape ecologists we have claimed great relevance for our discipline, but the acid test is whether we, and the discipline, can deliver. Judging from the work of The Nature Conservancy, the answer is mixed.

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ECOHYDROLOGY OF SEMIARID WOODLANDS: SCALE AND DISTURBANCE

Abstract
In this paper summarize results from long-term and multiple-spatial-scale observations of runoff and erosion in both a stable and degraded piñon-juniper woodlands. We found strong scaling relationships for both runoff and erosion and that these relationships were fundamentally different in the stable and disturbed landscapes. On the stable landscape, the redistribution of water and sediment within the hillslope was substantial and that there was a strong and nonlinear reduction in unit-area runoff and erosion with scale. For the disturbed landscape, there was less storage of water and in particular sediment on the hillslope. In addition we found that for low-slope-gradient sites disturbance leads to accelerated runoff and erosion, and these conditions may persist for a decade or longer. On the basis of our findings we suggest further that disturbance alters the effects of scale on runoff and erosion in a predictable way—scale relationships in degraded areas will be fundamentally different from those in non-degraded areas because more runoff will escape off site and erosion rates will be much higher.

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A TONNE PER HECTARE PER YEAR PERHAPS: FIRE AND CARBON SEQUESTRATION IN MESIC AUSTRALIAN SAVANNAS

Abstract
Tropical savannas cover a quarter of Australia. Much of the savanna biome in north-western Australia is relatively intact structurally, hence it represents a potential carbon sink. However, these savannas are subject to frequent, extensive fire, especially the wetter savannas. Fire regime is likely to affect the productivity and sequestration potential of savannas, via effects on both biomass and emissions. Savanna sequestration potential is estimated by quantifying carbon storage in biomass and soil pools, plus the net fluxes to these pools, plus carbon losses via disturbance, namely fire. We present data describing the magnitude and distribution of these carbon pools for mesic and semi-arid savannas of the NT. Previous work in mesic savanna demonstrated a substantial carbon sink, although impacts of fire were not well accounted for. These estimates of sink strength are combined with remotely-sensed estimates of area burnt and associated emissions, to quantify the impact of fire on the long-term savanna sequestration potential, the Net Biome Productivity (NBP). Preliminary data indicate that these savannas are a net carbon sink (about 1 t/ha/yr) even when burnt, but reducing fire frequency is likely to increase the sink size. Uncertainties surrounding these estimates, and implications for land management, are discussed.

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SPATIAL RELATIONSHIPS OF TREE GROWTH AND ENVIRONMENT - WHICH SCALE IS MOST USEFUL FOR PARK PLANNERS?

Abstract
Global warming especially affects high latitude ecosystems. The boreal forest as part of these systems stores tremendous amounts of carbon and influences the global climate through feedback loops (CO2 sink or source). Advancement or retreat of treelines changes the energy balance over these areas. In this paper we present a multi-scale study of tree-growth-environment relationships of the treeline species white spruce (Picea glauca) in two National Parks in Alaska. National Parks have the dual role of providing educational experiences to visitors and protecting natural heritage. Our results indicate that small scale and watershed scale differences in environmental factors have great impact on the distribution of white spruce, but not on the general growth response, e.g. negative or positive with warming. Weak relationships were found between exposure, elevation and growth response, namely that treeline areas in general respond positively to warming, and south facing forests respond negatively. In Denali National Park bus tours provide the main visitor experience with wildlife viewing. Changes in the position of forest versus tundra will have great effect by changing the relevance of certain areas for these experiences. Our results provide maps of possible forest expansion and should be seen as a tool for park planning.

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LINKING LANDSCAPE STRUCTURE WITH SUSTAINABILITY - AN AUSTRIAN APPROACH TO ASSESS LAND USE INTENSITY ON A NATIONAL SCALE

Abstract
Ecological indicators reduce complexity and can help to communicate ecological issues to the public. If landscape pattern is seen and interpreted as “flows and process”, it should reversely be possible to use landscape structure information for describing the ecological sustainability of landscapes, especially if they are under agricultural pressure. We developed the so called SINUS approach for assessing the sustainability of land use systems in Austrian agricultural landscapes in a nation-wide survey by linking earth observation data with information derived by field mapping. In a first step a complete coverage land cover data set was derived by semi-automatic segmentation and classification of satellite images. As standardised set of indices of landscape structure was then calculated. In second step we documented the landscape structure and the naturalness or so called hemerobiotic state of 200 stratified random selected sample landscapes of 1 x 1 km size. A calculation of landscape indices was then performed with all samples. Finally, we combined the national and the local scale in two different ways. The so-called REGSUST approach is a statistical procedure, in which we extrapolated the hemerobiotic state with a ordinal regression model. The deviance of the mean hemerobiotic value for a given landscape type was then identified as sustainability indicator and visualised as a map for the whole Austrian territory. The second approach was using fuzzy logic by describing the relation of landscape structure to sustainability with linguistic variables. These variables were used in a rule-based expert system to determine the membership function of a given landscape to a certain sustainability class. Those approaches are compared and the results will be discussed in the light of experiences, which we gained when we confronted the Austrian authorities with maps and other outcomes of our research.

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SPATIAL SCALING: PLURALISM VS. UNIVERSALITY

Abstract
Spatial scaling is the translation of information across two or more scales in space, and provides an indispensable basis for understanding how landscapes are structured, function, and change over time. Scaling is also crucial for successful interdisciplinary research and environmental problem-solving. Yet, a general understanding of the diversity of methods and their proper use is lacking. Spatial heterogeneity, non-linearity, feedbacks and hierarchical linkages that are pervasive in diverse landscapes are the primary reasons why scaling is imperative and challenging. In this paper, I review several theories that pertain to scaling, including space-time correspondence principle, hierarchy theory, self-organization, self-organized criticality, similitude principle, and self-similarity. Scaling approaches are classified into two general types: dynamic model-based and similarity-based scaling approaches, which include a variety of statistical and modeling methods. The applications of these methods in ecology and related disciplines are evaluated, and the pros and cons of the methods are analyzed. There is no universal scaling law for complex landscapes. Thus, it is critical to find an appropriate scaling method or a proper combination of scaling methods for different kinds of ecological problems. Finally, I argue that the seemingly conflicting scaling theories can be reconciled in a comprehensive and coherent conceptual framework.

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A REMORE SENSING APPROACH TO STUDY THE EFFECT OF VEGETATION IN REDUCING URBAN HEAT ISLAND IN BEIJING

Abstract
Urban heat island existing in almost every city. The problems it caused include more energy consumption for cooling, air pollution, and health problem for human in region with a warm climate. Tree planting and other vegetation construction program have been proposed as effective ways to alleviate heat island. However, past studies, which are mainly based on extrapolation from small-scale measurements or model simulation, failed to provide enough information on how the construction of green space inside city can help to attenuate heat island. In this article, TM Landsat satellite images were used to analysis the change of distribution and intensity of heat island in urban Beijing in past twenty years. At the same time, changes of urban vegetation characteristics include spatial pattern, structure, species and other features were studied by analyzing satellite images as well as historical records. A strong relationship was found between the distribution of heat island and vegetation. Size, shape and structure of vegetation also have important influence on the extent and intensity of heat island. A guideline was developed for future planting program to reduce urban heat island in Beijing.

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EVOLUTION OF THE LANDSCAPE, (DREAMTIME STORIES) AND THE IMPORTANCE OF SACRED SITES.

Abstract
Otto is a Rembaranga man for central Arnhem Land. His dreaming is fire. His clans use fire as a tool to manage wildlife and country. Otto has worked as a Djelk Ranger for the past 8 years and now specializes in fire management and is involved in research and monitoring of burning practices. His special talent lies in being able to understand and interpret both the traditional and modern concepts and ideas regarding fire. Otto will attempt to present concepts and ideas about traditional land management practices and how they relate to the ecology and the landscape. He then will attempt to explain how the landscape is related to his culture.

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FUNCTIONAL ZOODIVERSITY IN BIOMES OF SOUTHERN AFRICA AND THEIR CHANGES BY LAND-USE AND ENVIRONMENT

Abstract
In an ongoing study, our team examines the diversity, population dynamics, reproduction and trophic relations of small mammals (Gerbillinae, Murinae, Soricidae, Macroscelidea) and arthropods on selected biodiversity observatories (1 km 2) within the multidisciplinary BIOTA (biodiversity transect analysis in Africa)-Project. These observatories follow a transect from northern Namibia to western South Africa, thus including a variety of biomes, climatic conditions and different forms of land use. An increase in the number of small mammal species and of arthropod orders was found towards the north along with an increase in the structural diversity and annual precipitation. The comparison of two adjacent observatories with striking differences in land use in Southern Namibia (Nama Karoo) revealed that the highly overgrazed site (Nabaos) consistently had a lower diversity in conjunction with a low overall abundance of small mammals compared to the less used site (GellapOst). For the future, it is planned to emphasize the aspect of the influences of human use by including more pairs of observatories with differences in land use and by restauration experiments, which exclude livestock from parts of the study site. Another important aspect planned to be addressed in the future is the role of microhabitats in relation to the animals investigated.

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SPATIAL ANALYSIS OF FIRE-INDUCED LANDSCAPES IN THE TROPICAL SAVANNAS USING REMOTE SENSING DATA

Abstract
This paper investigates the variation of patch configuration in fire-induced tropical savanna landscapes in northern Australia. Fire patches were mapped during the seven-month dry season (c. April- October) over a twelve-year period using a Landsat Thematic Mapper (TM) data set that included 27 images. A fire-induced landscape patch Geographical Information System was produced using a grid data model. This comprised of fire patch and vegetation patch layers that were derived from TM images. Landscape patterns were analysed using a number of patch indices, including total landscape area, number of patches, mean patch size, patch size standard deviation, total edge, mean shape index and area weighted mean shape index. Patch indices in the fire-induced landscape show conspicuous seasonal variations and have a middle season high. Percentages of burned patches in the early dry season that were also burned in the previous late season were derived from the digital fire maps, and all the patch indices, as discussed above, were also produced for those patches that were burned in sequent

years. The results reflect a dynamic fragmented process in the landscapes, which may significantly enrich the understanding and lead more implications on the ecological process in the habitats of savanna landscapes.

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VEGETATION PATTERNS OF UPLAND AND RIPARIAN FOREST PATCHES ALONG URBAN-RURAL GRADIENTS

Abstract
To summarize vegetation patterns of upland and riparian forest patches along urban-rural gradients, I used published data from Milwaukee, Wisconsin (remnant-upland) and New York, New York (remnant-upland) and unpublished data from Baltimore, Maryland (remnant-upland and riparian) and Syracuse, New York (remnant and reforested-upland). Structurally, tree-stem densities increased with urbanization with opportunistic tree-species accounted for the increase in density. For upland forest patches, the largest diameter trees were found in the urban landscape. For riparian landscapes, they occurred in the rural landscape. Non-native species richness and non-native tree, seedling and herbaceous stem densities increased with urbanization. Non-native shrub density in riparian patches decreased from rural to urban. Riparian and reforested patches also showed compositional shifts. In riparian forest patches, species shifted from a wetland to an upland composition with urbanization. In rural reforested patches, native species dominated the canopy, whereas in urban reforested patches, non-native species dominated. Structural and compositional shifts were attributed to patch size, disturbance regime, altered moisture regime, and site legacy. Shifts indicate that urban forest patches are undergoing major structurally changes.

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RISK ASSESSMENT OF BIOLOGICAL INTEGRITY AT THE LANDSCAPE LEVEL

Abstract
To protect landscape mosaics at the broader scale is often necessary identifying gaps in the existing reserve network to establish new reserves and protected areas. Conservation management and reserve design fundamentally aim not just at the preservation of maximum species diversity per se, but the preservation of the diversity of species “typical” (or rare) of natural habitats. That refers to biological integrity, defined as the capability of supporting and maintaining a balanced, integrated, adaptive community of organisms comparable to that of natural habitats. Prioritization of candidate areas can be based on risk assessment, associated with ecotypes or ecotype mosaics, of native species most threatened with extinction and reduction. We present results of baseline risk assessments starting from threatened vertebrate distributions, by simple conceptual models for fragility incorporating metrics of human and natural induced stresses. Since the stronger the species confinement to particular favorable habitats, the more it is likely that species will be affected by habitat loss, procedures expanded, through endemic flora-area accumulation curves, also to (ex-post) risk assessments and extinction rates of floristic species. Current and displayed fragilities of biological integrity were shown to be related to baseline and ex-post risk assessments respectively.
