

BOOK OF ABSTRACTS

IUFRO 8.01.02 Landscape Ecology Conference 2017 The Green-Blue Nexus: Forests, Landscapes and Services

24 - 29 September 2017
Halle (Saale), Germany



MARTIN-LUTHER-UNIVERSITÄT
HALLE-WITTENBERG



Bundesministerium
für Bildung
und Forschung



IUFRO 8.01.02 Landscape Ecology Conference 2017

**The Green-Blue Nexus:
Forests, Landscapes and Services**

**24 - 29 September 2017
Halle (Saale), Germany**

Book of abstracts

Edited by:

Alina Schürmann, Prof. Dr. Christine Fürst, Dr. Marcin Spyra

Scientific board:

Christine Fürst (lead), João Azevedo, Marc Deconchat, Ljuska Ola Eriksson, Peilei Fan, Davide Geneletti, Louis Iverson, Peter Akong Minang, Felix Müller, Guillermo Martínez Pastur, Giovanni Sanesi, Yusuf Serengil, Pinar Pamukcu, Robert Scheller, Tanja Suni, Wei Ning Xian.

IUFRO Division 8.01.02: Sandra Luque (Coordinator)

Organizing committee:

Christine Fürst, Prof. Dr.; João Azevedo, PhD; Urmaz Peterson; Martin Volk, Prof. Dr.; Marcin Spyra, Dr.; Martin Schultze; Patrick Halka; Ignacio J. Diaz-Maroto, PhD.

Photography at the front cover: Landscape between Lednice and Valtice, South Moravia, Czech Republic. Author: Marcin Spyra

Acknowledgement

Special thanks to our Sponsors



INTEgrated Landscape
Assessment for Sustainable
Resource Management



Bundesministerium
für Bildung
und Forschung

Federal Ministry of
Education and Research



Social-ecological research and
technological innovations
for improved integration of
cultural ecosystem services
in participatory planning
processes



Land - Open Access Journal -
sponsorship PhD Award



Climate - Open Access Climate
Science Journal

Special Issue Supporters

Change and Adaptation in Socio-Ecological Systems

Climate Change, Social Changes, Technological Development -
Open Access Journal

Ecological Processes

Open Access Journal

Organizers & host:



IUFRO 8.01.02 Landscape
Ecology Working group



International Association for
Landscape Ecology



Martin-Luther-University
Halle-Wittenberg

Supporters:



European Land-use Institute
GLP nodal office on integrated
land management, planning
and policy



An interdisciplinary community of
science and practice fostering the
study of land systems and the co-
design of solutions for global
sustainability



Worldwide network to enhance
the science, policy and practice
of ecosystem services for
conservation and sustainable
development

Programm

Sunday, the 24th September	
Hörsaalzentrum (Lecturing Center, Theodor-Lieser Str. 9), entrance area	
From 12:00	Registration
House 4 (Geography, von Seckendorff-Platz 4) PC 3.34 (3rd floor)	
11:00 - 14:00	Christine Fürst (Frank Pietsch, HongMi Koo) GISCAME Training (presentation + live)
House 4 (Geography, von Seckendorff-Platz 4) PC 3.34 (3rd floor)	
14:00 - 17:00	Ola Eriksson ForSYS (Heureka) Training
House 4 (Geography, von Seckendorff-Platz 4) H4 3.32 (3rd floor)	
10:00 - 18:00	Peter Vogt Guido's Toolbox Training
18:00 - 21:00	Icebreaker and welcome note

Monday, the 25th September							
Hörsaalzentrum (Lecturing Center, Theodor-Lieser Str. 9), G.Vollhard-HS							
08:00 - 08:30	Registration						
08:30 - 08:45	Plenary Welcome note of the conference chair, organizational information, overhanding of the LAND award to Chiara Cortinovis, University of Trento						
08:45 - 09:00	Plenary Keynote IUFRO LE coordinator, Sandra Luque						
09:00 - 09:30	Plenary Greeting Chancellor of MLU, Marcus Leber						
09:30 - 10:00	Plenary Keynote - Pushpam Kumar Sustainable Development Goals: Looking through the Lens of Natural Capital						
10:00 - 10:30	Plenary Keynote - Giovanni Sanesi How green are our cities?						
10:30 - 11:00	Coffee Break						
Parallel sessions							
11:00 - 13:30	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="background-color: #004a7c; color: white; text-align: center; vertical-align: middle;"> Fabio Salbitano, Marcin Spyra Urban planning and new technologies in participation </td> <td style="background-color: #4a7c99; color: white; text-align: center; vertical-align: middle;"> Ignacio Diaz-Maroto Integrated forest landscape management: biodiversity conservation and ecosystem services </td> <td style="background-color: #004a7c; color: white; text-align: center; vertical-align: middle;"> Jose Alberto Gobbi, Sandra Luque Ecosystem Services in Changing Forested Land-scapes: tradeoffs and land use options at different scales </td> </tr> <tr> <td style="text-align: center;">Von Seckendorff-Platz 1, SR 1.02</td> <td style="text-align: center;">Von Seckendorff-Platz 1, SR 1.03</td> <td style="text-align: center;">Von Seckendorff-Platz 1, SR 1.30</td> </tr> </table>	Fabio Salbitano, Marcin Spyra Urban planning and new technologies in participation	Ignacio Diaz-Maroto Integrated forest landscape management: biodiversity conservation and ecosystem services	Jose Alberto Gobbi, Sandra Luque Ecosystem Services in Changing Forested Land-scapes: tradeoffs and land use options at different scales	Von Seckendorff-Platz 1, SR 1.02	Von Seckendorff-Platz 1, SR 1.03	Von Seckendorff-Platz 1, SR 1.30
Fabio Salbitano, Marcin Spyra Urban planning and new technologies in participation	Ignacio Diaz-Maroto Integrated forest landscape management: biodiversity conservation and ecosystem services	Jose Alberto Gobbi, Sandra Luque Ecosystem Services in Changing Forested Land-scapes: tradeoffs and land use options at different scales					
Von Seckendorff-Platz 1, SR 1.02	Von Seckendorff-Platz 1, SR 1.03	Von Seckendorff-Platz 1, SR 1.30					
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">Fan, P.</td> <td style="width: 25%;">Nature-based solutions for urban landscapes under post-industrialization and globalization: Barcelona versus Shanghai</td> <td style="width: 25%;">Paletto, A.</td> <td style="width: 25%;">Aesthetic value of peri-urban forest landscapes: the visitors' viewpoint in Monte Morello forest (Italy)</td> <td style="width: 25%;">Luque, S.</td> <td style="width: 25%;">Forest related ecosystem services and trade-offs in multifunctional systems</td> </tr> </table>	Fan, P.	Nature-based solutions for urban landscapes under post-industrialization and globalization: Barcelona versus Shanghai	Paletto, A.	Aesthetic value of peri-urban forest landscapes: the visitors' viewpoint in Monte Morello forest (Italy)	Luque, S.	Forest related ecosystem services and trade-offs in multifunctional systems
Fan, P.	Nature-based solutions for urban landscapes under post-industrialization and globalization: Barcelona versus Shanghai	Paletto, A.	Aesthetic value of peri-urban forest landscapes: the visitors' viewpoint in Monte Morello forest (Italy)	Luque, S.	Forest related ecosystem services and trade-offs in multifunctional systems		

	Goncalves, A.	Impact of Urban and Peri-urban Landscape on Local Climate Conditions - The Case Study of the City of Braganca (Portugal) - 2012-2016	Isaacs, P.	Restoration priorities in Colombia using a landscape analyst. The roam protocol in a posconflict scenario	Repo, A.	Quantifying climate benefits and biodiversity loss of harvesting forest residues for bioenergy - an integrated assessment
	Salbitano, F.	AGUACRUZ: Water, Landscape, and Cities. Hydrological and landscape ecology modelling for the green and blue future of Santa Cruz de la Sierra (Bolivia)	Khanina, L.	Integrated landscape management: vegetation patterns and biodiversity conservation on forest and abandoned agricultural lands in the Central European Russia	Lecina-Diaz, J.	The positive relationship between forest carbon stocks and biodiversity: spatial distribution, concurrence and drivers across five climates in Spain and Quebec
	Halka, P.	Approaches for understanding and analyzing urban agglomerations – experiences from European and German spatial planning	Pamukcu-Albers, P.	How to integrate water related ecosystem services into forest management plans? - A case study in Mediterranean forests of Turkey	De Meo, I.	Relationships between forest management practices and ecosystem services: an analysis in black pine (<i>Pinus nigra</i> J.F.Arnold) forests in Central Italy
	Nguyen, L.	Managing the urban colour: similarities and differences between European and Asian strategies	Diaz-Maroto, I.	Biodiversity conservation and ecosystem services in highland landscapes: case study of Galician eastern mountain	Romero-Oliva, C. S.	Saprophytic Litter Fungi and associated Coleoptera as bioindicators of land use change in fragmented landscapes from the Lachua Eco-region, Alta Verapaz, Guatemala
	Spyra, M.	Ecosystem services deficit areas in urban cross-boundary landscape context: Insights into environmental governance	Schulz, J.	Identifying suitable multi-functional Forest Landscape Restoration areas in Central Chile providing an efficient nexus between habitat connectivity, carbon sequestration and erosion prevention	Gobbi, J.	Paying for ecosystem services to improve forest conservation in Northern Argentina

	Reyes-Paecke, S.	Challenges for riversides management across administrative borders: The Cautin River reclamation in Temuco and Padre Las Casas municipalities (Chile, South America)	Diaz-Maroto, I.	Socio-economic and practical factors for the adaptation of natural hardwood forests of temperate areas in a context of global change	Torano Caicoya, A.	GreenFuture Forest: Landscape-scale forestry projections for biodiversity conservation
	Sulkarnaeva, L.	The current state of knowledge of urban ecosystem services in Russia	Goginashvili, N.	Study of the structure of populations of <i>Ostrya carpinifolia</i> Scop. in Colchic forests of Adjara region in Georgia, South Caucasus (Poster)	Locher Krause, K.	Reconnecting landscapes: how corridors areas impact ecosystem services supply and its beneficiaries in Southern Chile
	Laforteza, R.	Assessing the benefits of green spaces in urban areas by fusing remote sensing and social data	Wang, W.	Forests Resource Use and Landscape Formation Based on the Succession of Washi Paper Industry in Gokayama Heritage Village (Poster)	Jerabkova L.	Using Co\$ting Nature to forecast forest ecosystem services in the UK and other European countries (Poster)
13:30 - 14:30	Lunch break					
14:30 - 16:30	Hannes J. König, Christine Fürst Human Wildlife Conflicts in cultural landscapes: who pays the bill?			Pinar Pamukcu, Ola Eriksson, Carsten Lorz Biodiversity, Ecosystem Services and Natural Capital from multiple land uses		
	Von Seckendorff-Platz 1, SR 1.27			Von Seckendorff-Platz 1, SR 1.29		
	König, H.	Human-Wildlife-Conflicts in Agricultural Landscapes: an integrated assessment approach	Wei, W.	Coupling role of terracing and reforestation in blue vs. green water conversion and erosion control		
	Bastidas Urrutia, A. M.	Impact of oil palm cultivation on deforestation rate over the last three decades in the southwest of Colombia	Lorz, C.	Non-wood-products-Ecosystem Services of Managed Forests		
	Hemminger, K.	Cranes in agricultural landscapes: a review of scientific literature addressing human-wildlife interactions	Iverson, L.	Potential impacts of increasing drought and temperature on trees of the eastern United States		
	Spyra, M.	Peri-urban landscapes as the arena of human - wildlife interactions: environmental governance recommendations	Pamukcu-Albers, P.	Impacts of Landscape Pattern on Water Flow Regulation Service of Forest Ecosystems		

	Wenz, E.	Reconciling people and predators? A review of current research related to wolf management in Europe	Dietze, V.	Soil ecosystem services in agriculture farming systems. A case study from Saxony, Germany
	Reinke, H.	Wild boar (<i>Sus scrofa</i> L.) population monitoring methods and management practices: a review		
	Fürst, C.	Human Wildlife Interactions - how to model future conflict hot-spots		
16:45 - 17:15	Coffee Break			
17:15 - 18:45	João Azevedo Applications of the ecosystem services concept in forest decision making: Landscape Forestry revisited		Pinar Pamukcu, Ola Eriksson, Carsten Lorz Biodiversity, Ecosystem Services and Natural Capital from multiple land uses	
	Von Seckendorff-Platz 1, SR 1.30		Von Seckendorff-Platz 1, SR 1.02	
	Bozkurt, S.G.	A Biotope Mapping Study conducted in Gürün (Sivas) County and its potential to contribute to Conservation of Biodiversity	Thamsakon, S.	Adopting Ecosystem service to inform alternative rehabilitation of limestone quarries in Thailand
	Sugimura, K.	Forest management options to sustain forestry, tourism and rare species conservation in the Amami Oshima Island, Japan	Altamirano, A.	Differentiated forest loss in global biodiversity hotspots
	Tiemann, A.	Challenges of aligning forest function mapping and the ecosystem services concept in Germany	Ramírez, W.	Restoration Opportunities Assessment Methodology-ROAM, an opportunity for the postconflict conservation and restoration in Colombia. Prioritizing remaining areas in Antioquia for a sustainable use of the land
	Azevedo, J.	Solving multi-objective problems for multi-functional management in maritime pine forest landscapes	Stepniewska M.	The impact of public investment on ecosystem services provided by blue-green infrastructure: The case of Szachty in Poznań, Poland
	Perez-Rodriguez, F.	Multi-objective forest landscape management based on expert opinion in Northeastern Portugal	Esquivel, J.	Spatio temporal evaluation of the link between functional diversity and the provision of hydrological regulation ecosystem service (Poster)
	Iverson, L.	Restoring oak-hickory forests and their ecosystem services via targeted silviculture through landscape modeling		

Tuesday, the 26th September						
Hörsaalzentrum (Lecturing Center, Theodor-Lieser Str. 9), G.Vollhard-HS						
09:00 - 09:30	Plenary Keynote - Örjan Bodin People, species and habitats: social-ecological network approaches to study human - nature interactions					
09:30 - 10:00	Plenary Keynote - Shona Myers Ecology and Ecosystem Services – the nexus, some conclusions and an outlook					
Parallel sessions						
10:15 - 11:15	Martin Schultze Modelling Social-ecological Systems Towards a Sustainable Management of Ecosystem Services: Frameworks, Approaches & Models		Chiara Cortinovis, Giovanni Sanesi Nature based solutions for urban green planning		Sandra Luque, Sylvie Durrieu Remote Sensing contribution towards the understanding of ecosystem functioning and ecosystem accounting. Part I	
	Von Seckendorff-Platz 1, SR 1.02		Von Seckendorff-Platz 1, SR 1.03		Von Seckendorff-Platz 1, SR 1.27	
	Merekalova, K.	Landscapes general resilience and potentials: an assessment approach based on landscape components analysis	Cortinovis, C.	Ecosystem services in urban planning: state, challenges, and ways forward, with a focus on urban regulating services	Baibar, A.	Monitoring forest productivity by means of remote sensing, dendro-chronology and eddy covariance measurements
	Inkoom, J. N.	Utilising landscape metrics and analytical hierarchy process to assess ecosystem services in West Africa	Wang, J.	Enhancing Green Infrastructure Concept Through its Multifunctionality as Nature-based Solutions	Duflot, R.	Predicting ecosystem services in agricultural woodlands from airborne hyperspectral images
	Rozas-Vasquez, D.	Participatory Identification and prioritization of ecosystem services for regional planning in Chile	Haase, D.	Back to nature! Or not? Urban dwellers and their forest in Berlin	Guo, A.	A network-based approach to estimate habitat structural connectivity using airborne LiDAR remote sensing
	Montoya-Tangarife, C.	Ecosystem services, peri-urbanization and protected natural areas in an urban region in Chile	Lemoine, R.	Six decades of sprawling in a neotropical city: A case study of Xalapa, Veracruz, México	Bazewew, M. N.	Integrating Airborne LiDAR and Terrestrial Laser Scanner derived forest parameters for accurate estimation of above-ground biomass/ carbon in Ayer Hitam tropical forest reserve, Malaysia
11:15 - 11:45	Coffee break					

11:45 - 13:15	Martin Schultze Modelling Social-ecological Systems Towards a Sustainable Management of Ecosystem Services: Frameworks, Approaches & Models		Chiara Cortinovis / Giovanni Sanesi Nature based solutions for urban green planning	
	Von Seckendorff-Platz 1, SR 1.02		Von Seckendorff-Platz 1, SR 1.03	
	Lenfers, U.A.	From individuals to landscapes - large-scale modelling with a generic tree model blueprint	Inostroza, L.	How healthy makes us the urban green? Spatial assessment of illness related frequency and green areas at neighborhood scale in Bochum and Essen, Germany
	Schultze, M.	A Review of Social-Ecological System Frameworks to Support Decision-Making in Managing Ecosystem Services	Cortinovis, C.	Assessing the recreation potential of green infrastructures in Trento (Italy): a city-scale application of the ESTIMAP model
	Matsuura, T.	Changes in the gathering pattern of edible wild plants/mushrooms after the Fukushima Dai-ichi Nuclear Power Plant accident (Poster)	La Rosa, D.	A planning framework to address the preferences from different social groups for accessibility to urban greenspaces
	Numbisi, F. N.	Understanding spatial synergies in tree integration within cocoa agroforestry communities: a case in the forest transitional landscape in Central Cameroon (Poster)	van Vliet, J.	Alternative urbanization trajectories in Europe and their landscape ecological consequences
	Marinskikh, D.	Ecosystem Services and Landscape Ecology – congruent concepts or contradiction?	Merekalova, K.	Urban geosystems morphological pattern as a basement for landscape functions assessment
13:15 - 14:30	Lunch Break			
14:30 - 16:30	Marcin Spyra, Christine Fürst, Janina Kleman, Ibone Ametzaga, Daniele LaRosa Ecosystem services concept in participatory planning processes through new technologies		Marc Deconchat, Emilie Andrieu, Lalis Duguma, Peter Minang The nexus – interfaces between land-uses and ecosystem services	
	Von Seckendorff-Platz 1, SR 1.16		Von Seckendorff-Platz 1, SR 1.30	
	Spyra, M.	Ecosystem services - a new Esperanto to facilitate participatory planning processes?	Deconchat, M.	Forests for agriculture: new perspectives in European landscapes
	Ametzaga, I.	Ecosystem Services Assessment of the Basque Country contribution to the Basque Regional Planning Guideline	Betancur Corredor, B.	Lessons from farmers performing agroforestry for restoration of gold mine spoils in Colombia
	Picchi, P.	Ecosystem services for participatory planning and design of sustainable energy landscapes: a case study from Zeeland, The Netherlands	Grimaldi, J.	Can intercropped trees mitigate heat and drought effects on grapevines? A study of microclimate patterns in agroforestry vineyards, Southern France
	Koo, H.	Impact assessment of land use changes and land use strategies on the provision of ecosystem services in sub-Saharan Africa	Amartuvshin, A.	Raw cashmere price supply function, goat number and its impact on grazing

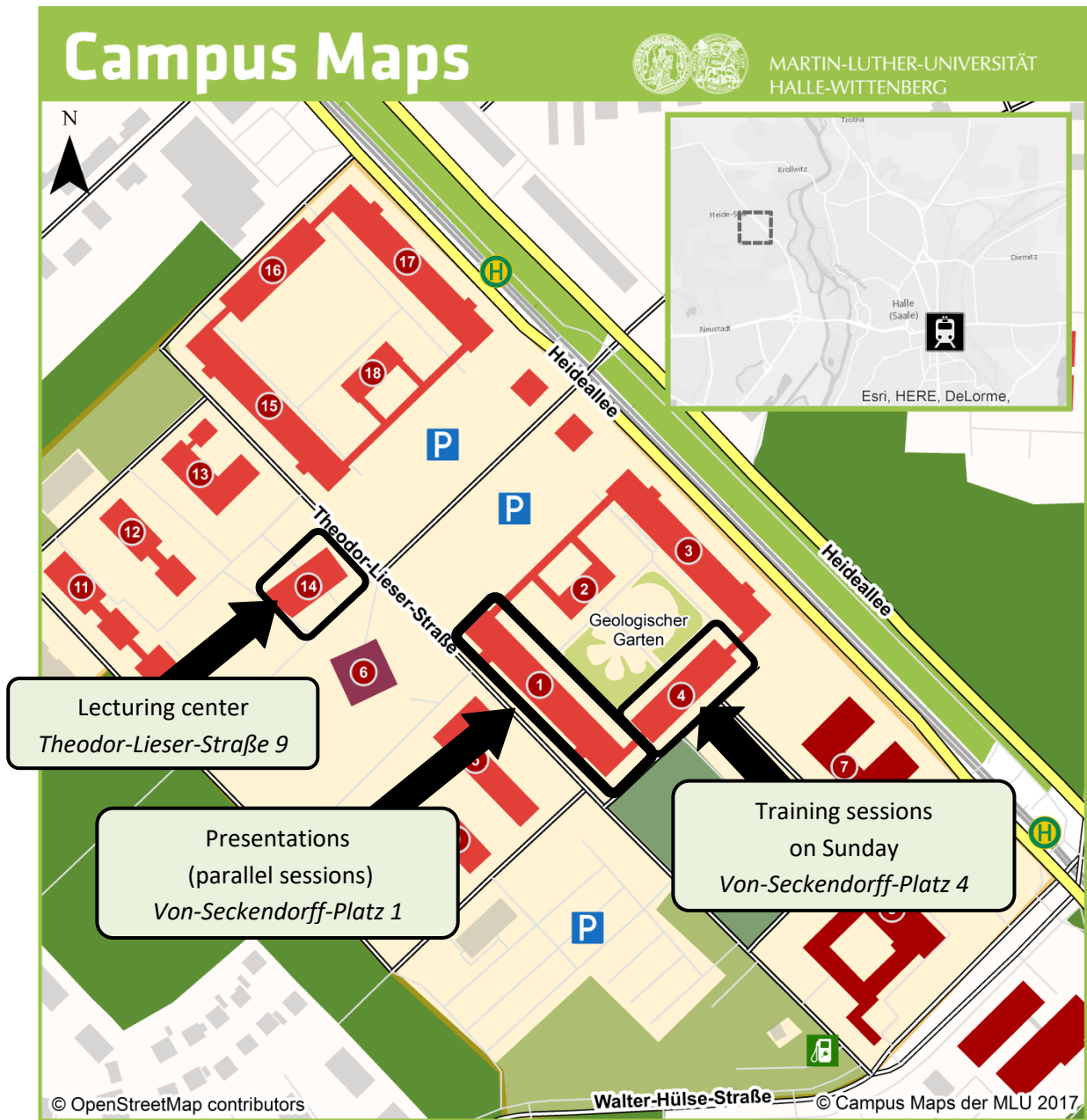
	Moderated discussion concerning to the online guidance tool. The tool aiming to assist in the implementation of ecosystem services (ES) concept in participatory planning. The tool will help new-comers in the application of ES concept in planning, to detect most suitable (similar) case studies to experience training by examples.	Cuenca, P.	How do Protected Landscapes Associated with High Biodiversity and Population Levels Change?
		Soliev, I.	What is special about benefit sharing in REDD+?
		Dufлот, R.	Understanding the complex relationships between landscape structure and various ecosystem services of agricultural woodlands
		Duguma, L. A.	The changing trends of ecosystem goods and services delivery resulting from Land cover-land use changes in Northwest Cameroon

Wednesday, the 27th September (Mid-Term Exkursion)	
08:30	start at the conference centre, Halle (Saale) <i>a bus trip to the south of Saxony-Anhalt, to the nature park Saale-Unstrut-Triasland</i>
10:00	hiking in the nature reserve "Tote Täler" (death valleys) <i>on beautiful paths through the nature, where orchids blossom in May and June</i>
13:00	lunch in the Zeddenbachmühle (mill of the Zeddenbach) <i>a meal in a working technical historical monument, fresh flour is available in the shop</i>
14:30	journey to Freyburg, a side trip into the old town, views of Neuenburg Castle <i>a short glance on the rich historical heritage of the Jahn-, wine- and champagne-town</i>
15:00	hiking to the Max-Klinger Weinberg Vineyard <i>Walking past the most beautiful vineyards of the Saale-Unstrut-Valley</i>
16:00	concluding the day in the Vineyard Cafe at the Max-Klinger Weinberg Vineyard <i>Sitting on the panorama terrace near the dwelling of the sculptor of Leipzig, died 1920</i>
17:00	return with a side trip to the "Steinerne Bilderbuch" (stone picture book) <i>12 large reliefs with biblical scenes, winegrowing and hunting, carved in the 18th c. in rock</i>
18:00	returning to Halle (Saale)

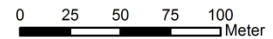
Thursday the 28th September			
Parallel sessions			
10:00 - 11:00	Louis Iverson / Dmitriy Marinskikh Forests and Landscapes - social-ecological systems, climate and global change impacts		Sandra Luque, Sylvie Durrieu Remote Sensing contribution towards the understanding of ecosystem functioning and ecosystem accounting. Part II
	Von Seckendorff-Platz 1, SR 1.02		Von Seckendorff-Platz 1, SR 1.27
	Sandlerskiy, R.	Climate-regulating services of landscapes in the southwest part of East European plain in Russia	Fuhr, M. Assessing forest structure by LiDAR for biodiversity conservation: three case studies

	De Zoysa, M.	Urbanization and climate change: transition for and transformation of urban forestry in Sri Lanka	Thierion, V.	French land cover map based on Sentinel-2 time series images to model species richness of hoverflies
	Sanders, T.	Saving the future forests – a global early warning system for forest decline via citizen science	Surkov, N.	Soil and vegetation water content monitoring using Landsat-8 and DEM data: a case study from Eastern Crimea
	Kireyeu, V.	Vulnerability hotspots associated with malfunctioning institutions of forest governance: exploring pattern, configuration, and path dependence	Vogt, P.	Classifying and mapping forest fragmentation using a multi-scale analysis scheme
11:00 - 11:30	Coffee Break			
11:30 - 12:30	Louis Iverson / Dmitriy Marinskikh Forests and Landscapes - social-ecological systems, climate and global change impacts		Sandra Luque, Sylvie Durrieu Remote Sensing contribution towards the understanding of ecosystem functioning and ecosystem accounting. Part II	
	Von Seckendorff-Platz 1, SR 1.02		Von Seckendorff-Platz 1, SR 1.27	
	Bui, T.	Applying system thinking in complex forest-related conflicts: case study of R'Teng 2 village, Lam Dong, Vietnam	Luque, S.	Earth Observation remote sensing systems providing solutions towards 2020 conservation targets
	Hermans, K.	Why do forest products become less available? A pan-tropical comparison of drivers of forest-resource degradation	de la Barrera, F.	Ecosystems affected by the recent mega fires in Chile: new hazards as a consequence of the loss of ecosystem services
	Surayya, T.	Innovative instruments for managing and conserving Urban Ecology - select case from India	Driss, H.	Spatial Indices and dynamic of forest land in the municipality of Ain Fezza, Northern of Algeria
	Deconchat, M.	Available wood in small forest patches and its links with plant diversity and ecosystem services	Glad, A.	Assessing object-oriented LiDAR metrics for characterizing bird habitat in a management perspective (Poster)
12:30 - 14:00	Lunch Break			
	Hörsaalzentrum (Lecturing Center, Theodor-Lieser Str. 9), room 1.03			
14:00 - 15:00	Christine Fürst, Luis Iverson, Jose Alberto Gobbi, João Azevedo, Marc Deconchat, Ken Sugimura Round Table Discussion and Concluding Session			
	Hörsaalzentrum (Lecturing Center, Theodor-Lieser Str. 9), Julius Kühn HS			
15:00 - 16:00	IUFRO LE WG Meeting - outlook for 2018			
16:00 - 16:30	Coffee Break			
	Hörsaalzentrum (Lecturing Center, Theodor-Lieser Str. 9), room 1.03			
16:30 - 17:30	ELI meeting			
	Von Seckendorff-Platz 1, SR 1.16			
17:45 - 18:30	Side meetings: 1. IALE WG meeting "Urban and peri-urban governance"			
18:30 on	Town Dinner or town excursion - on demand			

Conference Venue



Campus Heide Süd



Parken	Informatik/Mathematik	UFZ (Helmholtz)	AEW*
E-Tankstelle	Sportwiss./Unisport	IAMO (Leibniz)	Hörsaalgebäude
Haltestellen	Geologie/ULB Ha19	AEW*	Physik/AEW*
Universitätsgebäude	Geographie	AEW*	Chemie
Mensa	Mathematik/Prüfungsamt	AEW*	Chemie/Physik/ULB Ha4
Außeruniversitäre Forschung	Heidemensa	AEW*	AEW*
Campus Heide Süd			

*Agrar- und Ernährungswissenschaften

Herausgeber:
 Institut für Geowissenschaften und Geographie
 im Auftrag des Hochschulmarketings
 Kontakt: detlef.thuerkow@geo.uni-halle.de

Contents

LAND-Award	21
Plenary Keynotes	22
Pushpam, K. <i>Sustainable Development Goals: Looking through the Lens of Natural Capital</i>	23
Sanesi, G. <i>How green are our cities?</i>	24
Bodin, Ö. <i>People, species and habitats: social-ecological network approaches to study human-nature interactions</i>	25
Myers, S. <i>Ecology and Ecosystem Services – the nexus, some conclusions and a perspective from New Zealand</i>	26
Urban planning and new technologies in participation	27
Fan, P., Ouyang, Z., Basnou, C., Pino, J., Park, H., Chen, J. <i>Nature-based solutions for urban landscapes under post-industrialization and globalization: Barcelona versus Shanghai</i>	28
Gonçalves, A., Ornelas, G., Ribeiro, A. C., Feliciano, M. <i>Impact of Urban and Peri-urban Landscape on Local Climate Conditions – The Case Study of the City of Bragança (Portugal) - 2012-2016</i>	29
Salbitano, F., Castelli, G., Foderi, C., Kempff, Y., Bresci, E., Guzman, B. H., Ossoli, L., Bustos, S. <i>AGUACRUZ: Water, Landscape, and Cities. Hydrological and landscape ecology modelling for the green and blue future of Santa Cruz de la Sierra (Bolivia)</i>	30
Halka, P., Fürst, C. <i>Approaches for understanding and analyzing urban agglomerations - experiences from European and German spatial planning</i>	31
Nguyen, L., Teller, J. <i>Managing the urban colour: similarities and differences between European and Asian strategies</i>	32
Spyra, M., Inostroza, L., Hamerla, A., Bondaruk, J. <i>Ecosystem services deficit areas in urban cross-boundary landscape context: Insights into environmental governance</i>	33
Reyes-Paecke, S., Pastene, T., Puppo, A. <i>Challenges for riversides management across administrative borders: The Cautin River reclamation in Temuco and Padre Las Casas municipalities (Chile, South America)</i>	34
Sulkarnaeva, L. <i>The current state of knowledge of urban ecosystem services in Russia</i>	35
Lafortezza, R., Giannico, V. <i>Assessing the benefits of green spaces in urban areas by fusing remote sensing and social data</i>	36

Integrated forest landscape management: biodiversity conservation and ecosystem services 37

Paletto, A., De Meo, I., Guerrini, S. *Aesthetic value of peri-urban forest landscapes: the visitors' viewpoint in Monte Morello forest (Italy)* 38

Isaacs, P., Marin, W., Betancur, C., Waldron, T., Ochoa, V., Correa, C., Sierra, J., Franco, C., Gómez, M., Mrin, D., Echeverry, D., Ramírez, W. *Restoration priorities in Colombia using a landscape analyst. The roam protocol in a Posconflict scenario* 39

Khanina, L., Bobrovsky, M., Smirnov, V., Ivanova, N. *Integrated landscape management: vegetation patterns and biodiversity conservation on forest and abandoned agricultural lands in the Central European Russia* 40

Pamukcu-Albers, P., Lise, Y., Balkiz, O., Zeydanli, U. *How to integrate water related ecosystem services into forest management plans? – A case study in Mediterranean forests of Turkey* 41

Diaz-Maroto, I. J. *Biodiversity conservation and ecosystem services in highland landscapes: case study of Galician eastern mountain* 42

Schulz, J., Schröder, B. *Identifying suitable multifunctional Forest Landscape Restoration areas in Central Chile providing an efficient nexus between habitat connectivity, carbon sequestration and erosion prevention* 43

Diaz-Maroto, I. J. *Socio-economic and practical factors for the adaptation of natural hardwood forests of temperate areas in a context of global change* 44

Goginashvili, N., Asanidze, Z., Tvauri, I. *Study of the structure of populations of *Ostrya carpinifolia* Scop. in Colchic forests of Adjara region in Georgia, South Caucasus* 45

Wang, W., Fukamachi, K., Shibata, S. *Forests Resource Use and Landscape Formation Based on the Succession of Washi Paper Industry in Gokayama Heritage Village* 46

Ecosystem Services in Changing Forested Landscapes: tradeoffs and land use options at different scales 47

Luque, S. *Forest related ecosystem services and trade-offs in multifunctional systems* 48

Repo, A., Eyvindson, K., Mönkkönen, M. *Quantifying climate benefits and biodiversity loss of harvesting forest residues for bioenergy – an integrated assessment* 49

Lecina-Diaz, J., Alvarez, A., Paquette, A., Drapeau, P., Messier, C., Retana, J. *The positive relationship between forest carbon stocks and biodiversity: spatial distribution, concurrence and drivers across five climates in Spain and Quebec* 50

De Meo, I., Cantiani, P., Bianchetto, E., Maurizio, M., Paletto, A. *Relationships between forest management practices and ecosystem services: an analysis in black pine (*Pinus nigra* J.F.Arnold) forests in Central Italy* 51

Romero-Oliva, C. S., Quezada, M. L., Arroyo-Rodríguez, V., Pérez-Silva, E., Orellana, S., Sunum, R., Lana, M. <i>Saprophytic Litter Fungi and associated Coleoptera as bioindicators of land use change in fragmented landscapes from the Lachuá Eco-region, Alta Verapaz, Guatemala</i>	52
Gobbi, J., Atanasio Marcos, G. R., Roig, C. <i>Paying for ecosystem services to improve forest conservation in Northern Argentina</i>	53
Toraño Caicoya, A., Biber, P., Uhl, E., Zeller, L..... <i>GreenFutureForest: Landscape-scale forestry projections for biodiversity conservation</i>	54
Locher-Krause, K., Lautenbach, S., Volk, M. <i>Reconnecting landscapes: how corridors areas impact ecosystem services supply and its beneficiaries in Southern Chile</i>	55
Jerabkova, L., Millington, J., Mulligan, M. <i>Using Co\$ting Nature to forecast forest ecosystem services in the UK and other European countries</i>	56
Human Wildlife Conflicts in cultural landscapes: who pays the bill?	57
König, H. J., Hemminger, K., Reinke, H., Wenz, E., Keuling, O., Nilsson, L., Kramer-Schadt, S. <i>Human-Wildlife-Conflicts in Agricultural Landscapes: an integrated assessment approach</i>	58
Bastidas-Urrutia, A. M. <i>Impact of oil palm cultivation on deforestation rate over the last three decades in the southwest of Colombia</i>	59
Hemminger, K., König, H. J., Nilsson, L. <i>Cranes in agricultural landscapes: a review of scientific literature addressing human-wildlife interactions</i>	60
Spyra, M., Fürst, C., Grodzińska-Jurczak, M., Morelli, F., Benedetti, Y., Cent, J., Rechciński, M., Tryjanowski, P., Yakusheva, N., Halka, P., Stupariu, I., Stupariu, M. <i>Peri-urban landscapes as the arena of human - wildlife interactions: environmental governance recommendations</i>	61
Wenz, E., König, H. J., Peuker, P., Kramer-Schadt, S. <i>Reconciling people and predators? A review of current research related to wolf management in Europe</i>	62
Reinke, H., König, H. J., Keuling, O. <i>Wild boar (Sus scrofa L.) population monitoring methods and management practices: a review</i>	63
Fürst, C., Spyra, M., Schultze, M. <i>Human Wildlife Interactions - how to model future conflict hot-spots</i>	64
Biodiversity, Ecosystem Services and Natural Capital from multiple land uses	65
Wei, W., Chen, L. <i>Coupling role of terracing and reforestation in blue vs green water conversion and erosion control</i>	66
Lorz, C. <i>Non-wood-products - Ecosystem Services of Managed Forests</i>	67

Iverson, L. R., Peters, M. P., Matthews, S., Prasad, A. <i>Potential impacts of increasing drought and temperature on trees of the eastern United States</i>	68
Pamukcu-Albers, P., Erdem, N., Serengil, Y. <i>Impacts of Landscape Pattern on Water Flow Regulation Service of Forest Ecosystems</i>	69
Dietze, V., Jürges, N., Fürst, C. <i>Soil ecosystem services in agriculture farming systems. A case study from Saxony, Germany</i>	70
Applications of the ecosystem services concept in forest decision making: Landscape Forestry revisited	71
Bozkurt, S. G., Serengil, Y. <i>A Biotope Mapping Study Conducted in Gürün (Sivas) County and Its Potential to Contribute to Conservation of Biodiversity</i>	72
Sugimura, K., Torikai, H., Nagai, Y., Shima, T., Kawaguchi, H. <i>Forest management options to sustain forestry, tourism and rare species conservation in the Amami Oshima Island, Japan</i>	73
Tiemann, A., Ring, I. <i>Challenges of aligning forest function mapping and the ecosystem services concept in Germany</i>	74
Azevedo, J. C., Nunes, L., Pérez-Rodríguez, F. <i>Solving multi-objective problems for multi-functional management in maritime pine forest landscapes</i>	75
Pérez-Rodríguez, F., Sil, A., Honrado, J., Carvalho-Santos, C., Nunes, J. P., Azevedo, J. C.	
<i>Multi-objective forest landscape management based on expert opinion in Northeastern Portugal</i>	76
Iverson, L. R., Peters, M. P., Bartig, J., Rebbeck, J., Hutchinson, T., Matthews, S. N., Stout, S. <i>Restoring oak-hickory forests and their ecosystem services via targeted silviculture through landscape modeling</i>	77
Biodiversity, Ecosystem Services and Natural Capital from multiple land uses	78
Thamsakon, S., Papong, S., Mungkalasiri, J., Boonkum, P., Datchaneekul, K., Singrattanapan, P. <i>Adopting Ecosystem service to inform alternative rehabilitation of limestone quarries in Thailand</i>	79
Altamirano, A., Miranda, A., Di Bella, C., Prado, M., Peluso, F. <i>Differentiated forest loss in global biodiversity hotspots</i>	80
Ramírez, W., Isaacs, P., Marín, W., Betancur, C., Waldron, T., Sierra, J., Ochoa, V., Correa, C., Gómez, M., Marín, D., Franco, M. C., Echeverry, D. <i>Restoration Opportunities Assessment Methodology- ROAM, an opportunity for the postconflict conservation and restoration in Colombia. Prioritizing remaining areas in Antioquia for a sustainable use of the land</i>	81
Stępniewska, M., Abramowicz, D. <i>The impact of public investment on ecosystem services provided by blue-green infrastructure: The case of Szachty in Poznań, Poland</i>	82

Esquivel, J., Fuentes, R., Esparza, A., Saldana, A., Echeverria, C. <i>Spatio temporal evaluation of the link between functional diversity and the provision of hydrological regulation ecosystem service</i>	83
Modelling Social-ecological Systems Towards a Sustainable Management of Ecosystem Services: Frameworks, Approaches & Models	84
Merekalova, K., Kharitonova, A. <i>Landscapes general resilience and potentials: an assessment approach based on landscape components analysis</i>	85
Inkoom, J. N., Frank, S., Greve, K., Fürst, C. <i>Utilising landscape metrics and analytical hierarchy process to assess ecosystem services in West Africa</i>	86
Rozas-Vásquez, D., Fürst, C., Geneletti, D. <i>Participatory Identification and prioritization of ecosystem services for regional planning in Chile</i>	87
Montoya-Tangarife, C., De la Barrera, F., Salazar Burrows, A. <i>Ecosystem services, peri-urbanization and protected natural areas in an urban region in Chile</i>	88
Lenfers, U. A., Clemen, T. <i>From individuals to landscapes – large-scale modeling with a generic tree model blueprint</i>	89
Schultze, M., Fürst, C. <i>A Review of Social-Ecological System Frameworks to Support Decision-Making in Managing Ecosystem Services</i>	90
Matsuura, T., Sugimura, K. <i>Changes in the gathering pattern of edible wild plants/mushrooms after the Fukushima Dai-ichi Nuclear Power Plant accident</i>	91
Numbisi, F. N. <i>Understand spatial synergies in tree integration within cocoa agroforestry communities: a case in the forest transitional landscape in Central Cameroon</i>	92
Marinskikh, D. M. <i>Ecosystem Services and Landscape Ecology – congruent concepts or contradiction?</i>	93
Nature based solutions for urban green planning	94
Cortinovis, C., Geneletti, D. <i>Ecosystem services in urban planning: state, challenges, and ways forward, with a focus on urban regulating services</i>	95
Wang, J., Banzhaf, E. <i>Enhancing Green Infrastructure Concept Through its Multifunctionality as Nature-based Solutions</i>	96
Haase, D., Larondelle, N. <i>Back to nature! Or not? Urban dwellers and their forest in Berlin</i>	97
Lemoine-Rodriguez, R., Muñoz-Robles, C., MacGregor-Fors, I.	
<i>Six decades of sprawling in a neotropical city: A case study of Xalapa, Veracruz, México</i>	98

Inostroza, L., Zepp, H. <i>How healthy makes us the urban green? Spatial assessment of illness related frequency and green areas at neighborhood scale in Bochum and Essen, Germany</i>	99
Cortinovis, C., Zulian, G., Maes, J., Geneletti, D. <i>Assessing the recreation potential of green infrastructures in Trento (Italy): a city-scale application of the ESTIMAP model</i>	100
La Rosa, D., Takatori, C., Shimizu, H. <i>A planning framework to address the preferences from different social groups for accessibility to urban greenspaces</i>	101
van Vliet, J., Hersperger, A. M. <i>Alternative urbanization trajectories in Europe and their landscape ecological consequences</i>	102
Merekalova, K., Kharitonova, T. <i>Urban geosystems morphological pattern as a basement for landscape functions assessment</i>	103
Remote Sensing contribution towards the understanding of ecosystem functioning and ecosystem accounting. Part I	104
Baibar, A. S., Diakonov, K. N., Kharitonova, T. I. <i>Monitoring forest productivity by means of remote sensing, dendrochronology and eddy covariance measurements</i>	105
Duflot, R., Vialatte, A., Sheeren, D., Fauvel, M. <i>Predicting ecosystem services in agricultural woodlands from airborne hyperspectral images</i>	106
Guo, A., Coops, N. C., Gergel, S. E., Bater, C. W., Nielsen, S. E., Stadt, J. J., Drever, M. <i>A network-based approach to estimate habitat structural connectivity using airborne lidar remote sensing</i>	107
Bazew, M. N., Hussin, Y. A., Kloosterman, H. <i>Integrating Airborne LiDAR and Terrestrial Laser Scanner derived forest parameters for accurate estimation of above-ground biomass/carbon in Ayer Hitam tropical forest reserve, Malaysia</i>	108
Ecosystem services concept in participatory planning processes through new technologies	109
Spyra, M., Fürst, C., Kleemann, J., Palacios Agundez, I., Vázquez Navarrete, C. J., La Rosa, D., Cetin, I. N., Rozas, D., Geneletti, D., Adem Esmail, B., Albert, C., Picchi, P., Kopperoinen, L., König, H., Koo, H. <i>Ecosystem services – a new Esperanto to facilitate participatory planning processes?</i>	110
Ametzaga, I., Palacios-Agundez, I., Peña, L., Rodríguez-Loinaz, G., Fernandez de Manuel, B., Onaindia, M. <i>Ecosystem Services Assessment of the Basque Country contribution to the Basque Regional Planning Guideline</i>	111
Picchi, P., Geneletti, D., Verzaandvoort, S., Hendriks, K., Smith, A., Stremke, S. <i>Ecosystem services for participatory planning and design of sustainable energy landscapes: a case study from Zeeland, The Netherlands</i>	112

Koo, H., Fürst, C. <i>Impact assessment of land use changes and land use strategies on the provision of ecosystem services in sub-Saharan Africa</i>	113
The nexus – interfaces between land-uses and ecosystem services	114
Deconchat, M., Andrieu, E. <i>Forests for agriculture: new perspectives in European landscapes</i>	115
Betancur-Corredor, B., Loaiza-Usuga, J. C., Denich, M., Borgemeister, C..... <i>Lessons from farmers performing agroforestry for restoration of gold mine spoils in Colombia</i> ...	116
Grimaldi, J., Trambouze, W., Dufourcq, T., Vergnes, M., Pelletier, C., Helen, F., Fieuzal, R., Houet, T., Bustillo, V. <i>Can intercropped trees mitigate heat and drought effects on grapevines? A study of microclimate patterns in agroforestry vineyards, Southern France</i>	117
Amartuvshin, A., Lkhagdorj, B., Chen, J. <i>Raw cashmere price supply function, goat number and its impact on grazing</i>	118
Cuenca, P., Echeverria, C. <i>How do Protected Landscapes Associated with High Biodiversity and Population Levels Change?</i>	119
Soliev, I., Schramm, W., Theesfeld, I. <i>What is special about benefit sharing in REDD+?</i>	120
Duflot, R., San Cristobal, M., Fauvel, M., Vialatte, A. <i>Understanding the complex relationships between landscape structure and various ecosystem services of agricultural woodlands</i>	121
Duguma, L. A., Minang, P. A., Numbisi, F. N., Alemagi, D. <i>The changing trends of ecosystem goods and services delivery resulting from Land cover-land use changes in Northwest Cameroon</i>	122
Forests and Landscapes - social-ecological systems, climate and global change impacts ..	123
Sandlerskiy, R., Puzachenko, Y. G., Krenke, A. N. <i>Climate-regulating services of landscapes in the southwest part of East European plain in Russia</i>	124
De Zoysa, M. <i>Urbanization and climate change: transition for and transformation of urban forestry in Sri Lanka</i>	125
Sanders, T., Hauck, J., O'Brien, M., Altenbuchner, J., Jansen, S., Esquivel-Muelbert, A., van Waveren, C., Breda, N., Hauer, L., Bloemen, J., Medlyn, B., Marra, D., Sonnenschein, R., Mund, J.-P., Böhmer, J., West, A., Galvin, S., Kitzberger, T., Torres-Ruiz, J. M. <i>Saving the future forests – a global early warning system for forest decline via citizen science</i>	126
Kireyeu, V., Shkaruba, A. <i>Vulnerability hotspots associated with malfunctioning institutions of forest governance: exploring pattern, configuration, and path dependence</i>	127
Bui, T. <i>Applying system thinking in complex forest-related conflicts: case study of R'Teng 2 Village, Lam Dong, Vietnam</i>	128

Hermans-Neumann, K., Gerstner, K., Geijzendorffer, I. R., Herold, M., Seppelt, R., Wunder, S. <i>Why do forest products become less available? A pan-tropical comparison of drivers of forest-resource degradation</i>	129
Surayya, T. <i>Innovative instruments for managing and conserving Urban Ecology - select case from India</i>	130
Deconchat, M., Corcher, C., Vialatte, A. <i>Available wood in small forest patches and its links with plant diversity and ecosystem services</i>	131
Remote Sensing contribution towards the understanding of ecosystem functioning and ecosystem accounting. Part II	132
Fuhr, M., Glad, A., Durrieu, S., Monnet, J.-M., De Boissieu, F., Bouvier, M., Gosselin, F. <i>Assessing forest structure by Lidar for biodiversity conservation: three case studies</i>	133
Thierion, V., Herrault P.-A., Vincent, A., Inglada, J., Sheeren, D. <i>French land cover map based on Sentinel-2 time series images to model species richness of hoverflies</i>	134
Surkov, N. V., Kharitonova, T. I. <i>Soil and vegetation water content monitoring using Landsat-8 and DEM data: a case study from Eastern Crimea</i>	135
Vogt, P. <i>Classifying and mapping forest fragmentation using a multi-scale analysis scheme</i>	136
Luque, S. <i>Earth Observation remote sensing systems providing solutions towards 2020 conservation targets</i>	137
De la Barrera, F, Ruiz, V., Barraza, F., Favier, P., Quense, J. <i>Ecosystems affected by the recent mega fires in Chile: new hazards as a consequence of the loss of ecosystem services</i>	138
Driss, H. <i>Spatial Indices and dynamic of forest land in the municipality of Ain Fezza, Northern of Algeria</i>	139
Glad, A., Reineking, B., Monnet, J. M. <i>Assessing object-oriented LiDAR metrics for characterizing bird habitat in a management perspective</i>	140
Maps of the Campus and the City	141
Technologiepark Weinberg Campus	141
The City Centre of Halle (Saale).....	142

LAND-Award

Greeting of the LAND journal editor Prof. Dr. Andrew Millington:

The editor and team of the LAND journal are proud to convey his personal congrats to Ms. Chiara Cortinovis for her impressive research and oral presentation proposal at the IUFRO LE conference, 2017. It is the great pleasure of our journal to promote young, female and successful scientist to pursue their career and publish successfully at an internationally approved standard. We congratulate warmly Chiara and wish her the best success for her further graduation! And we look greatly forward to her further publications, making her known to and highly perceived in the international scientific community related to landscape ecology and land systems research!

LAND-Award Winner Chiara Cortinovis:

"Ecosystem services in urban planning: state, challenges, and ways forward, with a focus on urban regulating services"

Chiara Cortinovis is a PhD candidate at the University of Trento (Italy), where she is part of the PLANES group led by Prof. Davide Geneletti. The main focus of her research is on the role of spatial planning in promoting sustainable and resilient cities. Particularly, her current research activity explores the integration of ecosystem services in planning practices and tools, and the implementation of green infrastructure strategies and nature-based solutions at the urban scale. She mainly uses spatial data and models to support and assess planning decisions. On these topics, she has been involved in European projects including the H2020 CSA ESMEALDA, the urban pilot of MAES, and the European Commission's project EnRoute. In 2016, she was a visiting PhD at the Humboldt University of Berlin, hosted by the Landscape Ecology lab (Prof. Dagmar Haase). Chiara has work experience as a planning consultant for regional and local administrations and holds a MSc from the Polytechnic University of Milan.



Plenary Keynotes

Pushpam, K.

Sustainable Development Goals: Looking through the Lens of Natural Capital

Institution: United Nations Environment, Nairobi, Kenya

Most of the ecosystem services are natural capital or assets. After the United Nations General Assembly of 2015 and United Nations Environment Assembly of 2016 Sustainable Development Goals and Natural Capital are widely accepted paradigms. The environment dimension of SDGs flag off the message that goals are integrated, universal and indivisible and prosperity of people and planet are interlinked.



That clearly brings the mandate of mainstreaming Natural capital into broad paradigm of development design and implementation so that the SDGs can be achieved.

The related question now appears:

1. What are the pathways to bring ecosystems and natural capital closer to development decisions?
2. How to assess, value and account natural capital
3. If there are trade off amongst capitals how to handle them
4. What are major lessons learned on mainstreaming of natural capital-globally, regionally and nationally?

Sanesi, G.

How green are our cities?

Institution: University of Bari, Italy

Over the last decades many approaches and concepts have evolved and they have been addressed mainly on the basis of interdisciplinary knowledge. Urban forestry followed the same trajectory and along the last 40 years evolved and adopted a series of aside terms including community forest, ecosystem services, green infrastructure, and nature based solutions. Adopting this thinking evolution the use of urban forests and their multiple functions have recently grown. Today is a common approach for facing human health and well-being in urban context the trees and green spaces improvement;



Nowadays, trees and green spaces improvement is a common approach for facing human health and well-being in urban context; the main green indicators for our cities are canopy tree cover or green square meters per capita. At international, national and local level different public bodies adopted these green indicators for describing how it is possible to pursue a better quality of life by greening of our cities or facing some new inconveniences (effects related to global change). Science and evidence-based applied guidelines and solutions for integrating and implementing urban forestry practices and experiences are found in several international publications also in terms of nature based solutions. Are we really aware on the level of the 'greenness' of some solution for improving the quantity of green in our cities? Can some 'green solutions' be considered really positive in terms of CO₂ impact? Maybe we have to rethink how to establish or maintain green interventions in our cities, balancing the positive effects and the environmental impact provided by these interventions.

Bodin, Ö.

People, species and habitats: social-ecological network approaches to study human-nature interactions

Institution: Stockholm Resilience Center, Sweden

The network perspective is increasingly put forth as a broad and interdisciplinary analytical framework well suited to studying complex social-ecological systems. The last few years a number of studies have been conducted drawing on a social-ecological network approach. In this talk I will present some recent methodological and theoretical developments of this emerging line of research. I will demonstrate how a social-ecological network approach has been used to analyze complex patterns of actor/resource interdependencies in a small artisanal fishery in east Africa; the governance of fragmented forest patches in a rural agricultural landscape in Madagascar and in a large-scale biodiversity conservation initiative in Australia; and in land use planning of wetlands in the Stockholm County in Sweden.



Myers, S.

Ecology and Ecosystem Services – the nexus, some conclusions and a perspective from New Zealand

Institution: Myers Ecology, New Zealand

Biodiversity, and the ecosystem services that it provides, is critical to human survival. Prior to the arrival of humans, much of New Zealand was covered in ancient forest and extensive wetlands. High endemism of its flora and fauna gives New Zealand global prominence as a hotspot of biological diversity.



Large-scale environmental change has occurred over 700 years of human presence, and this has resulted in high numbers of threatened species, with a third of bird species threatened with extinction. One third of New Zealand, primarily the upland areas is held for conservation – the highest proportion of land protected for conservation purposes within OECD countries. The most threatened lowland ecosystems, forests and species however lie primarily on private farmland, and in urban areas. These environments are poorly represented in the protected area network and support a significant proportion of threatened biodiversity.

Economic dependence is on agriculture and tourism, and market branding is focused on being ‘Clean and Green’ and ‘100% Pure’, and relies on the protection of biodiversity and the maintenance of healthy ecosystem services. On private land, introduced pests and weeds are problematic, but the principal driver of loss is the intensification of agriculture and peri-urban expansion. Community-based conservation projects are proliferating. Protection and restoration of ecosystem services relies on effective regional policy implementation and on local community based conservation.

Two examples of managing the nexus and restoring forest habitat and ecosystem services in urban and rural areas will be discussed. Firstly, in an urban setting, Hamilton City Council is undertaking a Local Indigenous Biodiversity Strategy as a pilot project for the City. Local Indigenous Biodiversity Strategies seek to promote positive indigenous biodiversity outcomes, restore terrestrial ecological connectivity and for parties to work together collaboratively.

Secondly, the ecological and social outcomes of an initiative led by farmers in the Hoteo Catchment to protect indigenous biodiversity, restore clean water, and ecosystem services on private land are discussed. Landowners lead this model for protection of biodiversity on private land, and work with a variety of agencies for support. Innovative methods are being used including crowd funding, rural networks and workshops and working with local schools. Key factors include being community led, responsive to local needs, maintaining trust and ensuring support goes to ‘on the ground work’.

The value and effectiveness of regional policy based and local community based approaches in managing the nexus, and addressing provisioning services, regulating services and cultural services, in an urban and a rural setting will be investigated.

Urban planning and new technologies in participation

Fan, P., Ouyang, Z., Basnou, C., Pino, J., Park, H., Chen, J.

Nature-based solutions for urban landscapes under post-industrialization and globalization: Barcelona versus Shanghai

Institution: Michigan State University, United States

Keywords: urban green planning, urbanization, green space, economic development

Using Barcelona and Shanghai as case studies, we examined the nature-based solutions (NBS) in urban settings—specifically within cities experiencing post-industrialization and globalization. Our specific research questions are: (1) What are the spatiotemporal changes in urban built-up land and green space in Barcelona and Shanghai? (2) What are the relationships between economic development, exemplified by post-industrialization, globalization, and urban green space? Urban land use and green space change were evaluated using data derived from a variety of sources, including satellite images, landscape matrix indicators, and a land conversion matrix. The relationships between economic development, globalization, and environmental quality were analyzed through partial least squares structural equation modeling based on secondary statistical data. Both Barcelona and Shanghai have undergone rapid urbanization, with urban expansion in Barcelona beginning in the 1960s–1970s and in Shanghai in the last decade. While Barcelona’s urban green space and green space per capita began declining between the 1950s and 1990s, they increased slightly over the past two decades. Shanghai, however, has consistently and significantly improved urban green space and green space per capita over the past six decades, especially since the economic reform in 1978. Economic development has a direct and significant influence on urban green space for both cities and post-industrialization had served as the main driving force for urban landscape change in Barcelona and Shanghai. Based on secondary statistical and qualitative data from on-site observations and interviews with local experts, we highlighted the institution’s role in NBS planning. Furthermore, aspiration to become a global or globalizing city motivated both cities to use NBS planning as a place-making tool to attract global investment, which is reflected in various governing policies and regulations. The cities’ effort to achieve a higher status in the global city hierarchy may have contributed to the increase in total green space and urban green per capita. In addition, various institutional shifts, such as land property rights in a market economy vs. a transitional economy, may also have contributed to the differences in efficiency when expanding urban green space in Barcelona and Shanghai.

Gonçalves, A., Ornelas, G., Ribeiro, A. C., Feliciano, M.

Impact of Urban and Peri-urban Landscape on Local Climate Conditions – The Case Study of the City of Bragança (Portugal) - 2012-2016

Institution: CIMO - Instituto Politécnico de Bragança, Portugal

Keywords: green Infrastructure, urban climate, urban heat island

In cities, buildings and paved surfaces change local climate conditions, generating the so called urban climate (Oke, 2004). Urban climate is also influenced by local orography and regional climate. One of the most important urban effects on climate is known as the urban heat island effect (UHI), measured as the difference in temperature between the urban context and the rural surroundings. Research on city/climate interactions can be an important contribution for urban planning, helping to address the negative effects of urbanization (Oke, 2004; Ren et al., 2010) Starting in 2011, as part of a transnational project BIOURB (INTERREG-POCTEP), a study is being carried out aiming at analysing the urban climate of Bragança (Portugal) (Gonçalves et al., 2014), a city located in a mountain area with a complex terrain. This presentation focuses on demonstrating the local influence of the urban and periurban landscape on local climate and evaluating possible planning options that can help improving urban climate. The research consists on a cross-evaluation between meteorological data, gathered from a local network of sensors (23 temperature and humidity sensors, three wind speed and direction sensors and one automatic weather station) and a GIS analysis of the urban and topographical elements. This network covers seven local climate zones, including urban, peri-urban and rural sites. Results show that despite the small size of the city of Bragança (aprox. 25.000 hab. and 12 sq. km²) there is a mean UHI that reached 3 °C in the summer with extremes of up to 6° C. Such results are related with the characteristics of the monitored sites and, as expected, UHI is more intense in densely urbanized areas. Other local effects include the presence of an altitude gradient (corrected for UHI analysis) and dynamical processes, such as the nocturnal drainage of cold air. Reduced UHI intensity was achieved in Urban Green Spaces, more effective during summer periods, mostly motivated by the presence of deciduous trees. Despite these positive effects, the studied green spaces are still under the influence of the UHI, being warmer than peri-urban locations. The complex mountain terrain was responsible for differences related to landscape attributes which should be taken into consideration in planning. Therefore recommendations are presented, including the role of the urban green infrastructure as a tool to improve the local climate conditions in the city (summer cooling and attenuated cold temperature effects).

Gonçalves, A., Ribeiro, A. C., Maia, F., & Feliciano, M. (2014). Clima Urbano de Bragança. In A. Gonçalves (Ed.): Instituto Politécnico de Bragança. Oke, T. R. (2004). Initial guidance to obtain representative meteorological observations at urban sites: World Meteorological Organization Geneva. Ren, C., Ng, E. Y.-y., & Katschner, L. (2010). Urban climatic map studies: a review. *International Journal of Climatology*, n/a-n/a. doi: 10.1002/joc.2237

Salbitano, F., Castelli, G., Foderi, C., Kempff, Y., Bresci, E., Guzman, B. H., Ossoli, L., Bustos, S.

AGUACRUZ: Water, Landscape, and Cities. Hydrological and landscape ecology modelling for the green and blue future of Santa Cruz de la Sierra (Bolivia)

Institution: GESAAF - University of Florence, Italy

Keywords: landscape scenarios, hydrological modelling, green-blue infrastructure, urban forestry, agroforestry, rural-urban governance, nature-based solutions

The expansion of cities is an emerging and critical issue for the future of the planet. Cities and their residents depend on peri-urban and rural landscapes for ecosystem services as well as for economic and social benefits and, ultimately for health and quality of life. On the other hand, it is increasingly evident, in the world of science as well as for the actors of city governance, that urban environments need a green infrastructure approach in order to mitigate the critical state of the environment particularly in the fast growing cities of developing and industrialising countries. Water is one of the most important resources provided by the urban and periurban landscapes and directly or indirectly connected with the quality of environment and life. Santa Cruz de la Sierra is the first city in Bolivia (the second in Latin America) in population growth and soil sealing. It is estimated that over the next five years, the current 2.6 million people (2015) could double: food, energy and water requirements will be completely altered by this change. In particular, water available to the city, mostly from the Pirai river basin, is expected to be totally inadequate to support such a powerful urban development. The objectives of the project AGUACRUZ, financed by the Italian Agency for Cooperation and Development, were selected through a collaboration process between the Government of Santa Cruz de la Sierra, the NGO ICU (Italy) and the University of Florence. Main objectives were: a. to re-structure and harmonize the existing data on the landscape ecology, hydrological, and functional aspects of the Pirai river basin under the light of re-composing the urban rural divide; b. build hydrological scenarios for the future of the basin by introducing a landscape ecology approach to the simulation of actions for the sustainable management of the rural, urban and peri-urban landscape; c. involve stakeholders and local actors in decision-making processes oriented to increase the resilience of urban-rural landscape interconnected to the basin of the river Pirai and the city of Santa Cruz. Five scenarios have been tested by using SWAT (Soil and Water Assessment Tools) modules and assessing the changes in landscape metrics and hydrological determinants. The scenarios were selected along a rural to urban gradient by simulating actions of forest sustainable management, (re) afforestation, agroforestry, urban forestry, and implementation of green infrastructure components. The results indicate that the integrated actions in rural-urban system can lead to a substantial reversal of the trend towards a decline in water supply for the city. From a governance and planning perspective the proposed actions have been configured as to induce (i) an integrated Landscape Ecological Planning, seeking to maintain healthy ecosystems, reconnect fragmented natural and semi-natural areas and recover damaged habitats; (ii) the preparation and approval of departmental regulations for the incorporation of green infrastructure in the municipalities; (iii) the implementation of the socio-environmental challenges by developing and consolidating economic activities (as agroforestry systems) that generate satisfactory income in rural and periurban communities.

Halka, P., Fürst, C.

Approaches for understanding and analyzing urban agglomerations - experiences from European and German spatial planning

Institution: Sustainable Landscape Development, Martin-Luther-University Halle-Wittenberg, Germany

Keywords: spatial organization, metropolitan region, globalization, centre-periphery-relationship

Accompanying with the socioeconomic globalization, the nation states' spatial semantics become under review. Boundaries become blurred, systems melt together and synergies arise. In this network, capacitive and international integrated agglomerations and metropolitan regions form the nodes.

They merge as centres and service-key-areas not only the majority of population, but also of capital and added value within a country.

In this context, the specific task of spatial and urban planning is to intelligently organize the concept of metropolitan regions as a future-oriented model, to transform the urban space and the surrounding region into a spatial community in a responsible manner, and to integrate these via gateway infrastructures into cooperative (trans-) continental systems. New levels of good-exchange and information are then emerging, although the large metropolitan areas also symbolize cultural centers and social foci.

Out of the demographic and spatial developments in Germany, planning challenges arise at the level of cities and urban regions (agglomerations and metropolitan regions), e.g. Re-urbanization and consolidation (of population, functions, conflicts), social polarization (possibly up to segregation tendencies), ensuring the availability of affordable and (socially) acceptable housing, or securing mobility through intelligent (intermodal) transport systems (especially regarding public transport). On the other hand, tasks such as reconstruction of historic city centres or the preservation of recreation zones and public spaces, as well as the care of peripheral zones, are becoming increasingly important – just as the need for a "lean" administration in times of limited public budgets as well as an "open" planning process with extensive possibilities of participation.

Nevertheless, many questions remain open. What can spatial planning in agglomerations and metropolitan regions contribute to the – in many cases problematic - rural area? Does the predicate "metropolitan region" even conceal obvious planning deficiencies in the periphery as a result of surface expansion? And how is it possible to improve the situation of large cities and their peripheries within structurally weak regions or their position and attractiveness in national and international competition by the mix of instruments of territorial planning?

One goal of my scientific work is to address these questions and to formulate analytical approaches to the qualification and optimal spatial organization of agglomerations by findings from the German as well as European geographical school. First of all, it is of general interest, how to characterize metropolitan regions at all? Which current models exist to describe such areas in the European context? And are there already approaches of a consistent indicator system, which makes possible comparisons between and qualifications of large urban densely-populated zones?

Nguyen, L., Teller, J.

Managing the urban colour: similarities and differences between European and Asian strategies

Institution: LEMA (Local Environment Management and Analysis), University of Liège, Belgium

Keywords: colour, urban landscape, regulation, urban planning, management, colour plan

The information we receive from the urban landscape is triggered and defined by the sense of sight, in other words by visual sensations. Colour is a fundamental component of the visual sensations: it allows us to identify objects with the contrasts that defines the form and it helps to structure the urban environment. As an attribute of the urban morphology, colour informs us about the status and history of a place, through relations of integration, dominance, fragmentation, homogeneity or heterogeneity that can be observed between its built components. Moreover, additionally to functional roles, colour can promote heritage values through a collective identity and besides marking our eyesight out with signals, colour makes sense in our visual environment, through a semantic function. Public authorities are aware of the impact of colour as a factor that can influence the image and attractiveness of cities, and in many European countries the principles of territorial governance seek the valorization of specific and local colour palettes which are considered to belong to the cultural heritage of the city or the region. In this regulatory perspective, several municipalities in Europe use chromatic charts as guidance tools in order to preserve the dominant local tones. The main purpose in a colour regulation is most of the time to harmonize buildings in a territorial area. This need for harmonization, standardization, which is equivalent to morphological consistency for many, is often considered to be essential for maintaining the urban townscape character. Thus in China, the concept of "urban colour" is becoming increasingly important in the field of planning to make an elegant urban environment. In the context of rapid economic growth of the country, many Chinese cities, mostly located in the eastern part of the country, conduct research and implement specific tools such as urban colour plans. These tools allow to continue the urban colour context, in a way of historical heritage based on the dominant colour, essentially to control and guide the development of new construction zones. The aim of this paper is to highlight the main similarities and differences between the European and the Asian politics concerning the management of the urban colour: although they developed on the same theoretical base (specifically the "Geography of Colour" founded by Lenclos), they diverge from the point of view of purpose. The European approach is focused on the preservation and maintenance of the morphological specificities of urban tissues in terms of local colours, while in China, where built heritage tends to disappear in the urban regeneration under the real estate pressure, tools for the colour management are used mostly for the construction of new cities in order to keep the spatial coherence. The paper is illustrated with several European and Asian examples of concrete cases from both scientific and professional publications.

Spyra, M. ^a, Inostroza, L. ^b, Hamerla, A. ^c, Bondaruk, J. ^d

Ecosystem services deficit areas in urban cross-boundary landscape context: Insights into environmental governance

Institution (s): ^a Martin-Luther-University Halle-Wittenberg, Germany; ^b Institute of Geography, Ruhr University Bochum, Germany; ^c Upper Silesian Agency for Entrepreneurship and Development, Poland; ^d Central Mining Institute, Poland

Keywords: environmental governance, spatial indicators, urban landscape, cross-boundary landscape, ES provision

Green systems such as parks, green infrastructures, forest and the like, are fundamental for biodiversity and the quality of life of urban populations. They bring an ecological dimension which is still pending for proper attention within urban governance. Grey systems compounded by buildings, technical infrastructures and anthropogenic materials are the body of society. Sustainable urban development depends on the articulation of both and its adequate inclusion within spatial planning and urban governance frameworks. However up to date approaches integrating both green and grey systems are still underdeveloped.

This study carried out in the cross-boundary urban landscape of the city of Cieszyn (PL) and Český Těšín (CZ), forming one urban system divided with the border line frontier aims to (1) access and analyze the spatial structure urban green and grey systems and (2) analyze the potential provision of ecosystem services in the urban cross-boundary landscape. Land cover (LC) data prepared accordingly to INSPIRE regulation, was collected both from Polish and Czech sources. The LC classes were classified as belonging either to the green system or to the grey system separately for Český Těšín and Cieszyn. A spatial analysis using technomass and Normalized Difference Vegetation Index indicators was performed and combined with population data. The ratio between technomass, amount of inhabitants and NDVI, used as a proxy indicator for the provision of ES, was implemented for the identification of ecosystem services deficit areas.

The study shows significant spatial asymmetries indicated inter alia by the share of grey and green systems and the distribution of ES deficit areas. The spatial asymmetries of the urban cross-boundary landscape indicate the need of urban governance covering the green and grey systems located on both sides of the border as a spatial unity. This place challenges to current planning frameworks in cross boundary landscapes.

Reyes-Paecke, S., Pastene, T., Puppo, A.

***Challenges for riversides management across administrative borders:
The Cautin River reclamation in Temuco and Padre Las Casas municipalities
(Chile, South America)***

Institution: Pontificia Universidad Católica de Chile, Chile

Keywords: governance analysis, urban landscape, urban planning

The sustainable governance of urban landscapes in cross-boundary contexts requires proper tools and institutional arrangements, different than those commonly used in urban planning. The present research is focused on the challenges for an integrated management of rivers that are administrative boundaries between municipalities. The study was conducted in two Chilean cities: Temuco (460,824 inhabitants) and Padre Las Casas (75,255 inhabitants) whose administrative boundary is the Cautin River. Until 1995 Padre Las Casas was a Temuco neighborhood but in that year by an administrative reform it became a municipality. The municipal boundary was established along the river, formalizing a division that already existed in practice, due to the insufficient physical connection across the river, and a strong socio-economic differentiation. The Padre Las Casas population is mostly low-income, and belongs to the Mapuche ethnic group, which are the original people of this region. The Cautin River has historically been disconnected from the urban fabric. Landfills (legal and illegal), stones and gravel extraction for construction, and wastewater outfalls from both cities proliferated for decades. Since 2000 the Temuco municipality has closed the landfills, starting the riversides recovering by means of green spaces construction. These initiatives have been driven by two circumstances: the high green spaces deficit in both municipalities (aggravated by the population growth), and the decreasing in the Cautin river flow (caused by climate change and agricultural activities) that has increased the open spaces along the river. Despite the shared interest of both municipalities, there is no common project to Cautin riversides recovering. The research aims to identify the problems that hamper an integrated planning for the river, which could be the backbone of the blue-green infrastructure for both cities and a valuable resource for increasing urban resilience and inhabitant's well-being. The governance system is analyzed by characterizing the decision-making process, the involved agents and interactions between them, and the civil society role in the system. The current governance system does not favor interactions between municipalities; there are scarce communication between professionals of both two municipalities (technical level), and a total lack of coordination between political authorities. Temuco Municipality has more professionals and resources, and has been able to develop long-term planning (Land-Use Plan, Municipal Development Plan and Green Infrastructure Plan). Contrastingly, Padre Las Casas Municipality is mainly focused on projects and investments in social infrastructure, but lacking of a medium- or long-term planning. Both municipalities conceive the community as mere recipients of public policies, acting with a welfare approach, thus wasting the civil society capacities. Civil society approaches to municipalities with concrete demands, and it has not been able to build strong organizations that allow them to more actively participate in decision-making. Given the wide agreement between municipal professionals and civil society in both cities regarding the importance of the Cautin River recovering, the establishment of some mechanism for integrated planning (e.g. a municipal association) could not only recover the river but also establish a better communication between both Municipalities.

Sulkarnaeva, L.

The current state of knowledge of urban ecosystem services in Russia

Institution: University of Tyumen, Russia

Keywords: ecosystem services, urban ecosystem services, assessment of urban ecosystem services, russian cities

In January 2016, the "17 goals for the transformation of our world" officially came into force. Russian Federation adopted sustainable development goals and declared the 2017th as year of ecology. This fact shows the readiness of the Russian Federation to start active measures aimed at preserving the natural capital of the country. Currently, national programs for the protection of wild species of animals and plants, national processing and utilization waste system are implementing; national legislation is changing to ensure conservation of forest, water and land resources; a network of specially protected territories tending to be developed. The 2017th will be an important period for Russian cities. Such measures as creation of a green shield (a forest belt around cities), toughening of control over industrial enterprises are aimed to improve the ecological security of the urban environment. All these actions to some extent correspond to goal No. 11 "make cities inclusive, safe, resilient and sustainable". However, despite the fact that measures planned by the Russian Federation are unconditionally needed, they are inadequate to creating a truly resilient and comfortable city due to one-sided approach: focus on improving statistical environmental and sanitary-hygienic indicators, without paying enough attention on social, economic, cultural and other aspects. At the United Nations Conference on Housing and Sustainable Urban Development - Habitat III, held in Quito (Ecuador) in October 2016 a new urban development program was adopted to achieve sustainable development goal No. 11. This program brings together the best proposals to form truly comfortable and safe urban environment. Research report No. 16 "Urban Ecosystems and Resource Management" by Habitat III declared the key role of ecosystem services to create a resilient and comfortable urban environment and named urban planning a main tool for managing the urban environment. At the same time, more and more scientific publications and conferences are devoted specifically to the study of urban ecosystem services, which makes this area of research one of the main frontiers of modern science. Transitional state of Russian cities between industrial and post-industrial stage form an urgent need to revise existing approaches to their planning. In this context, together with a high concentration of the population in cities (over 100,000,000 people live in cities in Russia), accumulated environmental damage, the urban ecosystem services assessment investigation seems necessary for Russian cities. However, researches in this field are not numerous and include assessment of the specially protected areas (Tsibulnikova) within the city border and the translation of foreign experience in the assessment of urban ecosystem services (Dushkova). Noting the special way of forming and modern development of Russian cities, their diversity and diversity of leading processes, unique natural and climatic conditions, economic, technological and social prerequisites, and this approach is not fully correct. The accumulated experience of Soviet and Russian landscape studies and landscape-ecological mapping, new Russian research institutes (Strelka, VShU, Shaninka) should serve to adapt existing approaches to the assessment of urban ecosystem services to the realities of Russian cities.

Laforteza, R., Giannico, V.

Assessing the benefits of green spaces in urban areas by fusing remote sensing and social data

Institution: Dip. Scienze Agro-Ambientali e Territoriali, Università degli Studi di Bari - "Aldo Moro", Bari, Italy

Keywords: LiDAR, satellite images, ecosystem services, green infrastructure, nature-based solutions

Our paper aims to understand how the provision of ESS is spatially distributed within an urban system considering the structure and spatial arrangement of green spaces in relation to built-up areas and other infrastructures. For this purpose, we devised an approach to assess the ESS provided by urban green spaces through the integration of social data (i.e., people's perceptions of the multiple benefits of green spaces) with remotely sensed data, such as high-resolution satellite images and Laser Imaging Detection and Ranging (LiDAR) point-cloud. The overarching goal of this study is to develop a spatially explicit indicator (or metric) called Normalized Difference Green-Building Volume (NDGB), derived from remote sensing, that can be used to predict the way people perceive the benefits (ESS) conveyed by green spaces across the entire urban landscape (i.e., a multi-scale indicator). We designed the NDGB metric using the city of Bari, Southern Italy, as a case example where urbanization and impervious surface area have been increasing significantly over the last few years. Similarly to other European cities, Bari has recently launched a new strategic plan to create new green spaces in order to broaden the supply of ESS to respond to a larger proportion of the urban population. Therefore, the selection of the city of Bari as testbed for our study is justified not only by the possibility to develop a solid modeling approach but also to connect research findings to a real-world situation, such as the planning of new urban green spaces within a compact urban system.

Integrated forest landscape management: biodiversity conservation and ecosystem services

Paletto, A., De Meo, I., Guerrini, S.

Aesthetic value of peri-urban forest landscapes: the visitors' viewpoint in Monte Morello forest (Italy)

Institution: Council for Agricultural Research and Economics (CREA), Italy

Keywords: recreational activities, visual assessment, forest management practices

Peri-urban forests are characterized by multiple-use and various kinds of recreation activities. Pleasant landscape, physical and psychological benefits, and recreation opportunities provided by peri-urban forests are highly valued by people. Understanding people's demands for landscape attributes is a key element to support decision-makers and ensure proper management of peri-urban forests. The main aims of this study are: to investigate people's preferences for peri-urban forest landscapes resulting from different silvicultural treatments; to identify the preferred stand characteristics in terms of site attractiveness. The study was conducted in the Monte Morello peri-urban forest, in proximity of metropolitan area of Florence (Central Italy). At the current state the forest - characterized by a high demand for recreational and aesthetic opportunities - is degraded and characterized by poor regeneration, huge quantity of deadwood and a high degree of flammability. Two silvicultural treatments (forest management scenarios) have been tested in order to restore the ecological stability and enhance the resistance and resilience of Monte Morello forest. Then, people's preferences have been collected through the administration of a semi-structured questionnaire to a sample of 201 visitors (response rate: 75%). The respondents have compared in pairs - from the aesthetic point of view - a set of images of the peri-urban forest landscape of Monte Morello in three different forest management scenarios (after traditional thinning, after selective thinning and status quo/unmanaged forest scenario). The collected data were analyzed using the Analytic Hierarchy Process (AHP) approach in order to identify the preferred landscape. Besides, the respondents were asked to assess the site forest characteristics and the favorite recreational activities (hiking; landscape contemplation; sport activities). The results show that the preferred forest from the aesthetic point of view is a mixed forest (69.7% of total respondents) with a random distribution of trees in the space and a differentiated horizontal and vertical stand structure (54.7%). In addition, most respondents prefer the forests managed through the selective thinning (priority score of 0.5034), while the unmanaged urban forests (status quo scenario) are evaluated negatively from the aesthetic point of view (priority score of 0.2093). People consider the status quo scenario and the selective thinning scenario more suitable for the contemplation of landscape (respectively mean value of 3.16 and 3.97 in a 5-point Likert scale), while the traditional thinning scenario is considered more suitable for sport activities (mean value of 3.77).

Isaacs, P., Marin, W., Betancur, C., Waldron, T., Ochoa, V., Correa, C., Sierra, J., Franco, C., Gómez, M., Mrin, D., Echeverry, D., Ramírez, W.
Restoration priorities in Colombia using a landscape analyst. The roam protocol in a Posconflict scenario

Institution: Instituto Alexander von Humboldt, Colombia

Keywords: restoration priorities, spatial analyst, posconflict productive systems

An evaluation of restoration opportunities was carried out using the IUCN ROAM protocol in eastern Antioquia, Colombia. This area was heavily affected by the armed conflict, where there was a massive displacement of people leaving many areas in regeneration and conservation, with high levels of diversity reported. To date people have begun their return, for which the priority is to stop the expansion of the agricultural frontier and provide new opportunities to its inhabitants. Priority was given to 220,000 ha that are part of the puma corridor initiative, where corridors were modeled among existing protected areas, using human print analysis as resistance values and cores with more conservative coverages. Likewise, an analysis of livelihoods and ecosystem services was carried out using proxies to be able to spatialize them as data of the national agricultural census and coverage layers, water regulation and the perception of the inhabitants to value cultural services. Population surveys were conducted to obtain a cost - benefit analysis of traditional productive activities and others that promote conservation. Forest areas have positive social benefits due to the lack of technology that reduces impacts on soil and water, and reduces costs by being below technological packages. In the area there is a high potential for value-added activities for restoration such as beekeeping and ecotourism, as well as the integration of forestry activities in agroforestry and silvicultural systems. These reduce market risk and reduce dependency on other incentive schemes such as payments for services, which results in a greater possibility of systems sustainability. The spatial analysis, allows prioritizing areas for conservation, ecological corridors for the puma, as well as the proposal of productive reconversion and ecological restoration in the areas surrounding the corridors at a landscape level. This input is quite useful for decision-making in restoration and in evaluating opportunities in post-conflict zones, mainly to prioritize integral initiatives.

Khanina, L., Bobrovsky, M., Smirnov, V., Ivanova, N.

Integrated landscape management: vegetation patterns and biodiversity conservation on forest and abandoned agricultural lands in the Central European Russia

Institution: IMPB RAS - branch of the Keldysh IAM RAS, Russia

Keywords: abandoned agricultural land, plant diversity, soil, multivariate analysis, integrated management

Abandonment of agricultural land is often happening over the world and wide spread in European Russia. Integrated management of landscapes including forest and abandoned agricultural lands should be based on assessment of biodiversity and ecosystem services of all these dynamic changing patches. We have developed an approach to estimate landscape mosaic of such lands and to reveal areas to which expedient management efforts can be applied aiming to harmonize biodiversity conservation and land-use demands. A region of 673 km² located in the south of the Oka River in the Serpukhov district of the Moscow region was taken as a case study. Analysis of the medium spatial resolution data Landsat attended by field observations allowed us to develop GIS of actual land use of the region. About 40% of the area consists of abandoned agricultural lands; 20% consists of mature broad-leaved forests; 18 and 14% are occupied by arable lands and settlements, respectively; small rivers, lakes and meadows occupy the rest of the area. The middle size of patches of the landscape mosaic is rather small, amounts to a few square kilometers. We proposed that grass fires, which are typical in the region in spring, mainly defines structure and diversity of vegetation on the abandoned arable lands. To check this hypothesis we sampled vegetation and soil in three study areas (all located on loams) with 3 and 5 repetitions in mature broad-leaved forest and two neighboring biotopes with different fire history, respectively, both on former arable lands abandoned 25-30 years ago. We used two-way MANOVA to compare structure of vegetation between the study areas and the biotopes. Results showed that the biotope reflected the fire history was strongest statistically significant factor defining the vegetation structure, whereas a contribution of the study areas was negligible. Soil reaction, content of C, N and K were the main soil variables defining the variation of vegetation. Redundancy analysis of influence of soil variables on species abundance showed that variation of vegetation depended in more degree on characteristics of the biotopes than on characteristics of the study areas: soil and biotope together defined 19% of the total variation. Thus intensity of fire was the main factor defining the vegetation structure and together with soil characteristics influencing on species abundance. Analysis showed that areas unaffected by fire and which adjoin to mature broad-leaved forests can be left for spontaneous forest recovery; they have highest possibilities to conserve forest biodiversity. Agricultural lands can be restored on areas which are often affected by fires. Fire control should be realized in the region. Forests as a natural barrier to fires should be applied inasmuch as spatial analysis showed that small rivers and streams do not prevent the spread of fire, but forests are too humid to prevent fire spread and to provide real protection of lands.

Pamukcu-Albers, P., Lise, Y., Balkiz, O., Zeydanli, U.

How to integrate water related ecosystem services into forest management plans? – A case study in Mediterranean forests of Turkey

Institution: Nature Conservation Centre, Turkey

Keywords: forest ecosystem services, soil conservation, water provisioning, water flow regulation, forest management

Mediterranean forest ecosystems in Turkey provide several benefits to humans, including water flow regulation (flood-torrent risk prevention and water yield), freshwater provisioning and soil conservation (erosion risk prevention). In the forest districts of Gazipasa (Antalya province), Koycegiz (Mugla province), Pos (Adana province), Andirin (Kahramanmaras province) and Gulnar (Mersin province), Mediterranean forests cover between 50 to 80 percent of the land. Most of the forests are covered by maquis and Calabrian Pine (*Pinus brutia*). In the past, management plans of these forests focused mostly on timber production. Recently, the Nature Conservation Centre of Turkey has developed an approach to integrate biodiversity into forest management plans under a project financed by the Global Environment Facility (GEF). Yet, any approaches to integrate water related ecosystem services were largely missing. In this study, we assessed water flow regulation and soil conservation services from forest ecosystems at sub-watershed level. In five pilot forests, the first step was to determine how forest ecosystems affect other sectors (agriculture and livestock, fresh water production, tourism and recreation). We created a matrix to see interactions between forest ecosystem services and different sectors in Turkey. Secondly, we modelled these services and validated them through field surveys, stakeholder workshops and expert views. We quantified flood-torrent risk using hydrologic and topographic negative and positive factors and water flow regulation by determining flow coefficients for all land uses. We determined erosion risk prevention using Revised Universal Soil Loss Equation (RUSLE). The third step was final mapping of services in the pilot sites. In the end, we developed management actions to enhance water related forest ecosystem services in five pilot sites. These proposals included different silvi-cultural options on forest sub-stands. In Turkey, this innovative approach is implemented for the first time in the management planning process of forests. Our study showed how to integrate water related ecosystem services into forest management plans by involving other sectors. * This study was supported by UNDP/GEF project on “Integrated Approach to Management of Forests in Turkey, with Demonstration in High Conservation Value Forests in the Mediterranean Region”.

Diaz-Maroto, I. J.

Biodiversity conservation and ecosystem services in highland landscapes: case study of Galician eastern mountain

Institution: Departamento de Ingenieria Agroforestal, Universidad de Santiago de Compostela, Spain

Keywords: forest landscape, land sharing, land preservation, Galician mountains

At the present time there is great interest among all parts involved (scientists, forestry technicians, politicians and local actors) in the integrated management of forest landscape to meet the many challenges of rural areas, where the presence of different stakeholders seek likely interests related to food production, socio-economic development and the ecosystem conservation.

Forest landscape management is now being applied to address the wide range of existing challenges: i) biodiversity conservation; ii) restoration of human-modified landscapes; iii) management of ecosystem services; iv) climate change mitigation; v) REDD + (Reducing Emissions from Deforestation and Forest Degradation).

A lot of traditional highland landscapes have exceptional conservation importance. A protection policy in such lands should include financial incentives could continue traditional practices which have made possible their present existence. A conservation policy cannot be addressed in the short term, because these landscapes have evolved as socio-ecological systems. Perhaps traditional highland landscapes provide the best conditions for the biodiversity conservation. The location of these sceneries occurs in regions where agricultural and forestry practices have changed little over centuries. The agrosilvopastoral systems of the eastern mountains of Galicia are a good model. Landscape dynamics in this area ("Os Ancares" and "O Courel" mountains, Lugo and Ourense provinces, Galicia) is the consequence of influence anthropogenic during several times. Our paper analyzes the evolution and variations –environmental, socioeconomic and historical changes– that have happened here, and the aim is planning a set of actions for the conservation and landscape recovery of this region.

The work focused on the regression of the natural hardwood forests, intensively exploited since ancestral times. These forests were converted to agricultural land, felled for the naval, metallurgical and railway industries, joined with Church belongings, suffered forest fires, and were substituted by fast growing species, mainly coniferous, and now Eucalyptus spp. At present, they cover small and rugged sites where the topography often avoids other land-use type. Results point to that these steep sites have a modified landscape but with a slow transformation, where the biodiversity conservation and the cultural or environmental tourism have a high importance.

Integrated landscape management processes can support the configuration of forest production and ecosystem conservation on a variety of scales, including "land sharing" and "land preservation" approaches. A relevant challenge in the sustainable management of forests and forest landscapes is to connect and harmonize the availability of multiple services for multiple actors.

Schulz, J. ^a, Schröder, B. ^{b, c}

Identifying suitable multifunctional Forest Landscape Restoration areas in Central Chile providing an efficient nexus between habitat connectivity, carbon sequestration and erosion prevention

Institution (s): ^a University of Potsdam, Germany; ^b Technische Universität Braunschweig, Braunschweig, Germany; ^c Berlin-Brandenburg Institute of Advanced Biodiversity Research (BBIB), Berlin, Germany

Keywords: restoration planning, multifunctional synergies, biodiversity, habitat corridors, forest configuration, REDD+, forest regeneration

Large-scale deforestation has led to drastic alterations of landscapes worldwide, with serious declines of biodiversity and ecosystem functions, leading to impacts on humanity mainly through the decline of ecosystem services. While the impact on ecosystem functions and services ranges from the local to the global scale, the provision of ecosystem functions is not only determined by the extent of forests, but also by the spatial configuration of forests within the landscape. While places for ecosystem services provision are ultimately determined by the demand for services, ecosystem functions can be directly related to the existence or potential existence of an ecosystem structure in a specific location. Hence, the search for effective places to restore forest is based on the perspective that the natural landscape context provides opportunities as well as limitations on optimal locations for the enhancement of ecosystem functions. An approach that aims to restore forest functions on a landscape scale is Forest Landscape Restoration (FLR), with the purpose to regain ecological integrity and support human well-being. The landscape-scale approach aims to enhance the contribution of site-based restoration to larger-scale processes and functional synergies. Therefore, the identification of restoration areas within the landscape, where multiple functions operating on different scales can be enhanced, is a fundamental challenge for FLR. Equally important for planning FLR is the task of identifying areas requiring restoration. Proposed strategies include the assessment of current, past, and reference landscape states. However, integrative planning approaches combining historical and functional perspectives on a landscape scale are little developed. With this study we demonstrate how forest restoration areas can be identified that account for historical forest patterns while simultaneously achieving an effective nexus between multiple forest functions. We use a method developed for habitat suitability modelling based on recent historical forest occurrence and regeneration patterns from 1985 to 2008 in order to predict areas that are suitable for forest restoration, as well as areas where forest potentially recovers by natural regeneration. Separately, we map potential forest functions, i.e. functions that could be achieved through forest restoration, namely potential habitat function through potential biodiversity corridors, potential carbon sequestration and potential erosion prevention.

To identify spatial synergies of high function achievement through restoration, or “multifunctional hotspots”, we use spatial multi-criteria analysis. To finally derive a scenario of potential restoration areas, predicted maps of restoration suitability and regeneration potential are separately combined with a map depicting the degree of multifunctionality. We tested this approach for the dry forest landscape in Central Chile, an international biodiversity hotspot, which has undergone profound historical transformations and considerable deforestation in recent decades. With this study, we present a transparent planning approach contributing in an exemplary way to the operationalization of several international goals assembled under the Bonn Challenge: Aichi Target 15 considered through potential habitat corridors, UNFCCC REDD+, included through potential carbon storage and the Rio+20 land degradation neutrality goal through potential erosion prevention. The method supports an increase in efficiency of restoration through guiding the placement of site-based multifunctional restoration within a regional context.

Diaz-Maroto, I. J.

Socio-economic and practical factors for the adaptation of natural hard-wood forests of temperate areas in a context of global change

Institution: Departamento de Ingenieria Agroforestal, Universidad de Santiago de Compostela, Spain

Keywords: natural forests, greenhouse effect, European regions, sustainable forest management

Forests in general and particularly natural hardwood forests are being especially sensitive to climate variability, both in the northern regions like southern Europe. In the Mediterranean region, forests may be affected principally by increased droughts and forest fires. In northern Europe, is expected to intensification in rainfall is great enough to offset the increased evapotranspiration. On the other hand, increased precipitation, cloudiness and rain days and the reduced period of snow cover and soil frost may negatively have an effect on forestry and timber logging fixing lower profitability of forest production. Adaptation management strategies should be established as effective tools to try reducing the negative impact of climate change on forestry sector.

Goginashvili, N., Asanidze, Z., Tvauri, I.

Study of the structure of populations of *Ostrya carpinifolia* Scop. in Colchic forests of Adjara region in Georgia, South Caucasus

Institution: Scientific Research Center of Agriculture (SRCA), Agroforestry research division, Georgia

Keywords: *Ostrya carpinifolia*, Colchic forests, statistical analysis

Hop-hornbeam (*Ostrya carpinifolia* Scop.) is one of the Red List species of Georgia that triggers critical value of habitats in Colchic type of forests. Adjara region is located in the most humid area of the Colchis. Vegetation of Adjara is extremely rich in relict and endemic species common to Colchic forests, growing in various habitats located in the range from 0 to 2970 m a.s.l. The population of *O. carpinifolia* Scop. is located in the middle mountain forest belt covering three municipalities of the region: Keda, Shuakhevi and Khulo (150-980 m a.s.l.). The core of *O. carpinifolia* Scop. population formed as clear stand forest of hop-hornbeam is located on the territory of Shuakhevi (400-600 m a.s.l.). Hop-hornbeam forests are basically distributed along the basins of small and large rivers in Adjara and slightly mixed to broad-leaved and coniferous mixed forest, which is the major habitat distributed in the adjacent places where hop-hornbeam forests occur. The aim of the research was to study the structure of the population of *O. carpinifolia* Scop. and to determine environmental factors that affect its variability and distribution in order to locate the most degraded districts of hop-hornbeam forests in Adjara region. We measured substrate type: slope inclination; exposition; species richness; canopy cover; understory cover; amount of the forest layers; height of tree and amount of hop-hornbeam specimens in 28 plots with size of 100 m² along the altitudinal transect of distribution of *O. carpinifolia* Scop. The samples were taken in 4 plots per 7 sampling sites arranged from 150 to 1000 m a.s.l. with 150 m interval. The data collected in the field were analyzed with free downloadable bio-climate data and population data of the target municipalities obtained from local official sources. In statistical analysis were used multivariate ANOVA and nonparametric tests to find relationships between environmental and human population data and the variables featuring hop-hornbeam population. The results of the study revealed that the part of population of hop-hornbeam measured in Shuakhevi sites had significantly poorer structure. The number of hop-hornbeam specimens; forest canopy cover was lower and species richness was higher in forest understory there than in the other sampling sites. The annual precipitation in Shuakhevi is 920 mm, which on average is 21% lower than in Keda and Khulo. The number of the local human populations in Shuakhevi is 15.1 thousand people, which is 10.65% lower than in Keda and 35.74% lower than in Khulo. We expected high correlation between humidity, number of local population and variables of population of *O. carpinifolia* Scop., however the results showed the significant relationship only between the amount of annual precipitation and canopy cover of hop-hornbeam forest ($R^2=0.7$; $P<0.05$). The results of the study are important for development of the conservation strategy for hop-hornbeam (*O. carpinifolia* Scop.) in the region and methodology of measurement of the degradation indices for sensitive habitats.

Wang, W., Fukamachi, K., Shibata, S.

Forests Resource Use and Landscape Formation Based on the Succession of Washi Paper Industry in Gokayama Heritage Village

Institution: Kyoto University, Japan

Keywords: forests resource use, Washi paper, heritage village, village landscape

Washi is the traditional handmade paper that was first made in Japan, and was added to UNESCO's Intangible Cultural Heritage List in 2014. And there are paper mulberry, oriental paperbush, Gampi and hibiscus as main raw materials. As a respect, Gokayama washi paper has a long history with a success for over 1,200 years in Gokayama, Toyama Prefecture. And in Gokayama village described the World Heritage site in 1995, the conservation of forest resources which related to wash paper industry is more important.

However, with ups and downs of Gokayama washi paper industry due to the influence factors of policy and economy, forest resources have also been experienced several changes. Especially the modernization and touristy leading to these traditional utilization of forest resources and the cultural landscape changing and disappearing.

This study aims to clarifying the change of relevant forest resources utilization and the landscape formation based on the history of Gokayama washi paper industry, then discuss how to develop the management of forests and the conservation from landscape scale.

The following methods were employed: 1) Comprehending the history of Gokayama washi paper industry and dividing it into few stages from the point of industry through documents and interviews. 2) Clarifying the change of forest resources which are the raw materials of washi paper by investigation on the position, acreage, land use pattern each flora through documents, filed survey and aerial photos. 3) Analyzing the change of forests management by investigating the harvesting date, harvesting duration, logging amount, work force and policy through documents and interview. 4) Analyzing the change of landscape formation by comparing photos of each same site but in different periods of time.

The results indicated: 1) The development process of Gokayama washi paper can be divided into 4 stages ever since the industry was established from Edo period (A.D. 1603-1867). 2) The forest resources use has also been changed along with the 4 stages that the acreage increased and declined, and the local people logging from the remote forests but gradually they got the raw materials by planting the floras at where near farm land. 3) The management methods also changed from the spontaneous behavior of local people to communities and associations and policies has been improved but it is more and more difficult to have enough managers now. 4) The change of forest resources use leading to the change of land use patterns and landscape formation, and people hardly consider the forests as cultural landscape. Therefore, in an effort to conserve traditional washi paper craftsmanship, forests resources use and the unique village landscape, we suggest that new policy and work should be set up to stimulate the positivity of villagers and pay more attention to the conservation from landscape scale by leading people recognize the value of landscape in this heritage village.

Ecosystem Services in Changing Forested Landscapes: tradeoffs and land use options at different scales

Luque, S.

Forest related ecosystem services and trade-offs in multifunctional systems

Institution: Irstea, National Research Institute of Science and Technology for Environment and Agriculture, UMR TETIS Land, environment, remote sensing and spatial information, France

Keywords: cultural services, conservation targets, spatial bayesian belief networks, trade-offs, multifunctional landscapes, spatial planning

Forests cover more than one third of the total land area of the European Union. They represent a key natural resource, which has been managed for decades to meet growing societal demands for diverse forest ecosystem goods and services. Forest ecosystem services (ES), which are the benefits that humankind obtains from forests both directly and indirectly, are essential not only at regional levels but also at national and global scales (MA, 2005). The incorporation of the ES concept into the framework of forest management stems from a need to create a more holistic perception of forests, recognizing not only their economic value, but also their cultural and ecological values. Yet, despite improved understanding of the potential of landscapes and their land use systems to provide human well-being and socio-economic benefits, further conceptual and empirical work is needed to translate the concepts into operational frameworks for integrating ES into management and decision-making. Although landscape ecological assessment tools support the application of ES, sufficient information of stakeholders in evaluating decision alternatives at landscape scale is still challenging, particularly when it comes to an integration of the supply and demand side in ES.

Repo, A., Eyvindson, K., Mönkkönen, M.

Quantifying climate benefits and biodiversity loss of harvesting forest residues for bioenergy – an integrated assessment

Institution: Department of Biological and Environmental Science, University of Jyväskylä, Finland

Keywords: climate change mitigation, deadwood, bioenergy, boreal forest, landscape, simulation, trade-off

Increasing forest biomass harvests to combat climate change by replacing fossil fuels with bioenergy may pose a trade-off with climate regulation services of forests and biodiversity conservation. Previous studies focus mainly, either on effects on forest carbon cycle, or biodiversity impacts. These studies show that increased extraction of branches, stumps and other residual biomass from current levels decreases the carbon stock and the carbon sink capacity of forests, and has negative effects on species dependent on deadwood. We provide an integrated, dynamic, assessment to quantify the effects of forest residue harvesting on forest carbon balance and biodiversity in boreal forest landscapes. Through a modeling framework we simulated forest development in four real watersheds located in central Finland with two scenarios: i) with and ii) without forest residue harvesting for bioenergy for a 100-year time period. We simulated changes in the forest carbon stocks and the quality and quantity of deadwood resources, and combined this information with the information of species habitat associations based on expert judgments. In addition, we simulated the same forest landscapes with a set aside management option to study the conservation potential of these landscapes in the future. This study reveals how extensive forest harvest residue extraction for bioenergy affects forest carbon balance and the availability of suitable habitats for red-listed, saproxylic invertebrate and fungal species at the landscape scale. Furthermore, the results show the relationships between areas of high bioenergy potential and high conservation potential. We also discuss whether current recommendations for energy wood harvesting encourage to the least harmful harvesting practices. The findings of this study can be used in developing guidelines, practices and criteria to ensure the sustainability of forest bioenergy.

Lecina-Diaz, J., Alvarez, A., Paquette, A., Drapeau, P., Messier, C., Retana, J.
The positive relationship between forest carbon stocks and biodiversity: spatial distribution, concurrence and drivers across five climates in Spain and Quebec

Institution: Centre for Ecological Research and Forestry Applications (CREAF), Spain

Keywords: ecosystem services, carbon storage, biodiversity, spatial distribution, trade-offs, hotspots, drivers

Carbon storage (C) might offset global greenhouse gas emissions through C sequestration, whereas biodiversity (B) is required to support numerous ecosystem functions and services at multiple places and times. Several papers analyzed the relationship between C and B, their spatial correlation and their drivers, but the results varied widely depending on the scale of the study and the climate analyzed. We integrated information of the Forest Inventories and Breeding Bird Atlases from Spain and Quebec, covering five climates from steppe to boreal, with the purposes of (1) determining the spatial patterns of C stocks and B (bird richness and tree richness) and the factors that influence them; (2) establishing the relationships between C stocks and B; and (3) defining and characterizing the areas of high (hotspots) and low (coldspots) values of C and B. We have considered a wide range of forest stand, landscape and climatic variables. The highest values of C and B were located in the southern area of Quebec (temperate climate) and in the northern area of Spain (humid Mediterranean climate), where there was an increase in productivity as climatic conditions are less limiting. Density, structural diversity and slope had a strong positive effect on C stocks and on tree and overall biodiversity. Forests with high stem density can be more productive, while forests with a diverse structure might contain species that occupy different vertical and horizontal layers that used resources differently, thus supplying more food variety and nest sites for different bird species. Isolated and mountainous areas related with steeper slopes tend to have low or null management, which can have a positive effect on wood productivity and, therefore, on tree and bird richness. Conifers had a strong negative effect on C stocks, as they are less productive than the other forest types considered. As expected, the relationship between C stocks and biodiversity was positive because of the previous stated niche complementarity effects. But the spatial concurrence between hotspots and coldspots of C and B showed more synergies than trade-offs, which implies that management actions aiming at maintaining C stocks will also conserve biodiversity.

De Meo, I., Cantiani, P., Bianchetto, E., Maurizio, M., Paletto, A.

Relationships between forest management practices and ecosystem services: an analysis in black pine (*Pinus nigra* J.F.Arnold) forests in Central Italy

Institution: Council for Agricultural Research and Economics (CREA), Research Centre for Agriculture and Environment, Italy

Keywords: silvicultural treatments, thinning, ecosystem services assessment, Tuscany region

Ecosystem services are considered the conditions and processes through which natural ecosystems sustain and fulfill human life. Ecosystem services can be classified in four main categories: provisioning services (timber, fuelwood, food), regulating services (carbon and water regulation, natural hazards protection), cultural services (landscape, recreation, spiritual and cultural values), and supporting services (biodiversity and genetic resources). Ecosystem services provision is influenced by site and stand characteristics and forest management practices. The objective of this study is to analyze the ecosystem services provided by black pine forests under different silvicultural treatments. In order to analyze the influence of silvicultural treatments on the synergies and trade-offs between ecosystem services, two forests located in Central Italy were chosen. These forests have been established in the sixties of twentieth century for protection purpose but not managed during the rotation period. Two different silvicultural treatments (selective thinning and thinning from below) were applied in the study areas. Selective thinning is innovative in Italy in artificial black pine stands and was applied to compare its effects (economical, ecological and social) with the traditional thinning from below and with unmanaged areas. The selective is a localized action performed on the most promising trees per hectare, characterized by easy applicability and replicability. Four main ecosystem services - belonging to three categories - were assessed in the study areas: timber/bioenergy production, climate change mitigation, hydrogeological protection and biodiversity conservation. The biophysical assessment and trade-offs analysis of selected ecosystem services was then applied for each silvicultural treatment by using primary data and calculating one or more indicators ecosystem services. The results highlight that the selective thinning enhances the majority of ecosystems (timber/bioenergy production, climate change mitigation and hydrogeological protection) rather than the traditional thinning which has a slight positive influence on some components of the biodiversity.

Romero-Oliva, C. S., Quezada, M. L., Arroyo-Rodríguez, V., Pérez-Silva, E., Orellana, S., Sunum, R., Lana, M.

Saprophytic Litter Fungi and associated Coleoptera as bioindicators of land use change in fragmented landscapes from the Lachúa Eco-region, Alta Verapaz, Guatemala

Institution: Universidad de San Carlos de Guatemala, Guatemala

Keywords saprophytic litter fungi, coleoptera, landscape, land use type

Tropical rainforests are recognized for their high biodiversity and because of the several ecosystem services they provide. Despite their importance, rainforests of in the Neotropics display high deforestation due to the proximate causes of increment in human settlements and population density and specifically in the Lachúa Eco-region, Alta Verapaz, Guatemala related to subsistence annual crops (i.e. corn, beans and chili) by indigenous people (mainly ethnic Q'eqchi) and extensive cattle herding from non-indigenous people. Saprophytic Litter Fungi (SLF) in tropical rainforests are very diverse, serve as decomposers and recyclers of several organic compounds and help regulate climate thus could serve as good bioindicators of several processes at landscape level. In the present study, SLF and its associated Coleopteran species were used to monitor land use (LU) changes in fragmented landscapes from tropical rainforests of the Lachúa Eco-region, Guatemala. For this, α -, β - and γ -diversities of SLF and associated Coleoptera were transformed to the effective number of species and/or communities in two intact, variegated and relict landscapes and in three fragmented landscapes, respectively. Non-metric multidimensional scaling (NMDS) analyses were performed to determine spatial distribution patterns of both taxa, interactions between SLF and associated Coleoptera and SLF landscape bioindicator species as well as for land use (LU) types. Finally, association of SLF and associated Coleoptera were analyzed by regression models. Results showed that 1089 SLF were grouped in 258 morphospecies (msp), belonging to the Marasmiaceae and Polyporaceae families (n=785; 198 msp and n=304; 60 msp, respectively). Highest α -diversities of SLF were observed in one intact and one variegated landscapes; while highest heterogeneity (i.e. β -diversity) were observed in one variegated and one relict landscapes, respectively. In addition, highest species diversity from the Marasmiaceae family (62%, n=525) was observed in one of the intact landscapes, whereas for the Polyporaceae family (53%, n=160) in the relict landscape with LU type of high open area. In LU type of high forest cover additionally displayed the highest number of SLF unique species. Composition of SLF at landscapes and LU types were grouped in two, those with higher forest cover and those with highest open areas. To corroborate the effect of landscapes and LU types with other taxa, SLF associated Coleoptera collected summed a total of 44 msp and 33 msp of these were correlated to SLF (mainly to Marasmiaceae). SLF genus *Marasmius* presented the highest Coleoptera associated richness, followed by SLF *Favolus tenuiculus* (Polyporaceae). In correspondence, highest richness of SLF associated Coleoptera was observed in two intact and in one of the variegated landscapes (12.8 ± 3.5 msp), displaying the highest richness observed in the LU type with highest forest cover (24 msp, n=101). *Caripia montagnei*, *Marasmius helvolus*, *Polyporus guianensis*, *P. dictyopus*, *Polyporus* sp. 9 and *Earliella scabrosa*, *Funalia polizona*, *Lentinus strigosus*, *L.swartzii*, *Trametes villosa*, *Pycnoporus sanguineus*, are proposed as intact and fragmented/relict landscapes bioindicators; respectively. This is the first time to propose SLF as bioindicators of changes at landscape level.

Gobbi, J., Atanasio Marcos, G. R., Roig, C.

Paying for ecosystem services to improve forest conservation in Northern Argentina

Institution: Instituto Nacional de Tecnología Agropecuaria (INTA), Argentina

Keywords: PES, forests, ecosystem services, carbon, biodiversity, trade-offs, Chaco, Argentina

In Argentina, the National Law on Forest Conservation establishes a compensation to landowners developing management plans to ensure the provision of forest's ecosystem services to society. However, there are no experiences with payments for ecosystem services (PES) in the country. The Payment for Ecosystem Services Project is piloting the design and implementation of PES to improve forest's conservation status in Northern Argentina. The approach behind the PES is to equilibrate trade-offs between forest's ES provision and landowner's interests on production and income generation such that private and society goals can be coincident. To do so, the PES scheme compensates ranchers –who are mostly livestock producers– according to the conservation status (CS) of their forests as defined by a set of five indicators based on forest structure, composition and functionality. The PES scheme assumes a positive correlation between the CS of a forest and its level of provision of ecosystem services (i.e., carbon and biodiversity). Therefore, the PES scheme is centered in establishing categories of CS having differential payment levels such that a landowner that improves the CS of its forest by implementing sustainable forestry, silvopastoral and livestock practices will receive a higher payment for ES. Baselines on carbon and biodiversity have been established to assess the effect of management practices on ES provision. Likewise, production and income levels for different land use management options are being monitored such that trade-offs between conservation and production options can be estimated. Thirty-five medium sized, middle income landowners representing some 45,000 hectares have voluntarily entered the program and presented management plans to receive payments during a five-year period. The most common practices implemented by landowners relate to forest restoration and forage recuperation. Payments range between 11 US\$/ha and 32 u\$/ha per year. The PES Project is providing important lessons on how to devise policy instruments to enhance sustainable management of forests at different spatial scales and the trade-offs involved in their application.

Toraño Caicoya, A., Biber, P., Uhl, E., Zeller, L.

GreenFutureForest: Landscape-scale forestry projections for biodiversity conservation

Institution: Technical University of Munich (TUM), Germany

Keywords: forest stand simulation, forest structure, green infrastructure

The main objective of the GreenFutureForest project is the integrated simulation of future landscape scenarios to modify current forestry in order to secure both high future (sustainable) timber yield, an ecosystem service of major economic importance, and viable biodiversity of (meta)populations of forest animal species. The scenarios carried out in the project will consider as well current spatial green infrastructures - GI - (simulation starting conditions) and potential temporal GI changes during 100 years simulations. The GI changes result from the combination of current and future forestry and conservation actions of individual forest stands. Coupling population models with the forest simulator SILVA will allow future users of the software tools to investigate how different species may be affected by different forestry strategies. A forest simulator, which is currently used for a wide range of applications, ensures that developed models will be available for practical use. SILVA is used as a standard planning tool on the 800,000 ha forest area owned by the federal German state of Bavaria. It is valid for the most important tree species in central Europe in pure and mixed stands; with local adjustment, e.g. based on inventory data, it can be tuned for about 80% of the central European forests. Thus, within GreenFutureForest, a concept for large-scale forestry using the forest planning software tool SILVA will be presented, based on the upscaling of forest-stand-strata results into the landscape level. In order to define the management practices simulated by SILVA, a model for the future worldwide timber demand, provided by IIASA (International Institute for Applied System Analysis), which considers both socioeconomic and climatic aspects, is downscaled to adjust the results to Bavaria, and specifically to the highly productive region of Augsburg Western Forests. The test site's landscape is characterized by a heterogeneous forest-agriculture interface and many important ecosystem services, like timber production, recreation, biodiversity, water and soil protection. Specifically, with this presentation we will introduce the first steps in the estimation of forest structures for assessing potential biodiversity. Indicator calculations will be performed for the Augsburg Western Forests case study region. Promising biodiversity-related structure indicators like the Species Profile Index (Pretzsch, 2009), the K-function, indexes for horizontal aggregation Indexes and tree species intermingling will be presented. Three management scenarios, adapted to the downscaled global yield model, are simulated: business as usual, intensive and extensive. Thus, management recommendations can be drawn depending on the structural parameters achieved for each scenario. (Meta)Population models, currently under development, will be linked in the next steps to the simulated forest stand conditions through the above-mentioned structure indicators.

Locher-Krause, K., Lautenbach, S., Volk, M.

Reconnecting landscapes: how corridors areas impact ecosystem services supply and its beneficiaries in Southern Chile

Institution: Helmholtz Centre for Environmental Research GmbH – UFZ, Germany

Keywords: forest ecosystem service, beneficiaries, Southern Chile

Landscape connectivity has been proved to have a critical role in keeping ecological system functions, enhance resilience as well as maintain ecosystem service provisioning. Spatial and temporal changes in landscape configuration modify the ability of ecosystems to provide multiple services. One way to mitigate the effects of landscape fragmentation is through the definition and improvement of landscape elements such as corridors. Corridors, in especial riparian corridors are highly relevant elements to consider in landscape management strategies. These kinds of elements are particularly relevant in areas that undergone through a strong landscape transformation process, and which also coupled with a particular geomorphology as the case of Southern Chile. This area is characterized by two mountain range separated for an intensively anthropized central valley which disconnect the landscape. We identify the ecosystem service supply trajectory for 6 ecosystem services: provisioning (forest plantation production index), regulating (carbon storage, sediment retention, phosphorus retention) and cultural (aesthetic value, forest recreation) from 1985 to 2011, together with the beneficiaries of these services. To modeled and mapped ecosystem services supply, we used land cover/land use information, together with auxiliary data using the spatially explicit model InVEST. The ecosystem services beneficiaries were mapped based on different proxies as population distribution, drinking water extraction; number visitants to access protected areas, among others proxies. Our results showed that these areas provide a high amount of services as carbon storage and sediment retention, and also shows how important this area are for their beneficiaries at a regional scale. Our approach highlight the importance of these areas to keep the ecological functions, maintain landscape connectivity and its relevance to the local population. This information is crucial in order to develop a more sustainable land use planning strategy for the region.

Jerabkova, L., Millington, J., Mulligan, M.

Using Co\$ting Nature to forecast forest ecosystem services in the UK and other European countries

Institution: Department of Geography, King's College London, United Kingdom

Keywords: ecosystem services, forest restoration, climate change, environmental models, land use, NAIAD

The UK has a low total area of woodlands compared to most European countries, and their functioning is often further impaired by their individual small size and isolation. At the same time, woodlands satisfy a number of vital societal needs such as clean air, flood protection, and timber. Considered as ecosystem services, an increase in the size of woodlands or improvement in their condition may enhance these benefits. We assess possible outcomes of different scenarios of woodland restoration and management in terms of the flow of ecosystem services under future climate. The project is linked with the NATURE Insurance value: Assessment and Demonstration (NAIAD) project. The NAIAD project aims to operationalise the insurance value of ecosystems and addresses the role of green infrastructure in reducing risk of flooding and drought. We focus on the co-benefits supplied by the same green infrastructure alongside of the flood risk mitigation. We assess the provision of ecosystem services at two scales: at country level and landscape level, at three case study sites. The first case study site is South Downs National Park along southern coast of England, constituting part of the Thames Basin, one of NAIAD's demonstration basins. The other two case studies are The National Forest in England and The Great Trossachs Forest in Scotland. We integrate a suite of simulation modelling tools in a spatially explicit approach to project long-term landscape-scale dynamics of existing and potential woodlands. We use Co\$tingNature to quantify the ecosystem services associated with each scenario, and assess sensitivity of the models to structural and environmental factors (e.g. size, age, forest type of woodland patches) to discern relative role of different drivers. The target ecosystem services include timber production, renewable energy, biodiversity, nutrient retention, carbon sequestration, erosion control, water retention, air quality, and recreation and education. The project aims to fill a significant knowledge gap through its approach to multifunctional, dynamic projections of ecosystem services provision over time, integrated with spatial analyses and strengthened by use of multiple tools and scales. We will compare the results to trends in other EU countries with similar (temperate) and different (Mediterranean) conditions. It will improve our understanding of the drivers underlying the changes in ecosystem services provision, and provide salient information to managers and policy makers for decisions in the face of future uncertainties.

Human Wildlife Conflicts in cultural landscapes: who pays the bill?

König, H. J., Hemminger, K., Reinke, H., Wenz, E., Keuling, O., Nilsson, L., Kramer-Schadt, S.

Human-Wildlife-Conflicts in Agricultural Landscapes: an integrated assessment approach

Institution: Leibniz Centre for Agricultural Landscape Research (ZALF), Germany

Keywords: wildlife, migration, damage prevention, conservation biology, impact assessment

Human wildlife interactions have long been debated controversially among different interest groups. While conservationists often argue that the dramatic losses of habitat and biodiversity threatens the survival of many species on the one hand; land users, on the other hand, who directly experience economic losses by wildlife damages argue that losses should be compensated, effective prevention measures subsidized and wildlife management be adapted. However, in many cases, interactions and related conflict pattern between human and wildlife are often not known. Research-based evidence to support sound decision making for adapted land management, the design and implementation of damage prevention measures is yet rarely considered. Therefore, we propose the use of an integrated assessment framework that combines participatory approaches with spatially explicit indicator-systems to address this challenge. Methodological aspects as well as practical outputs for wildlife management in human-dominated landscapes will be discussed.

Bastidas-Urrutia, A. M.

Impact of oil palm cultivation on deforestation rate over the last three decades in the southwest of Colombia

Institution: Ludwig-Maximilian-Universität München, Germany

Keywords: deforestation, oil palm cultivation, tropical forest, Colombia

The demand of oil palm increases consecutively in different areas of the planet. According with economic reports, in the last two years Colombia increased the production of palm oil 11% with a projection to continue growing. Researches analyze how the creation of these cultures has generated social displacement and deforestation. Forest clearance to establish the crops, the construction of roads and infrastructure to improve the access to the crops, and economic and social individual interests are some of the causes. However, despite this information, there are not many studies that show consistently how the land cover has been changed throughout the years. Using the classification of Landsat images, it was possible to classify, identify and assess land use changes, fluctuation in carbon stock and deforestation in the study area in three different periods of time (1985-2000-2015). In this sense, this research is aims to contribute to identify the impacts of the oil palm agriculture in the south west of Colombia over 30 years. The changes in the use of the land show a general view and how the presence of human intervention is an important cause affecting the natural land cover, deforestation and therefore causing loss of biodiversity. This study identified that the main land cover of the deforested areas were shrubs and growing soil; land covers that are associated with the soil preparation stage for future palm oil plantations. The data showed that the amount of oil palms increased the last 30 years, growing from zero to 8,557 ha with a rate of 260 ha/year. Moreover, it reveals that deforestation in the south west of Colombia has generated the loss of 74.514 ha of forest and the transformation of 37.3% of the landscape. Additionally, the loss of this forest area had generated a carbon emission of 11,177,115 tC per year. Several publications show that the years of proliferation of the cultures and subsequent deforestation are associated with the economic situation of the country, and new policies supporting the investments in oil palm crops and guaranteeing better conditions to the farmers who decided to cultivate oil palm. On the other hand, there still remain 111,860 ha of tropical forest that conserve the minimal condition of size, shape and proximity among them to maintain the biodiversity and the species assembly of this area. The importance of this forest is because this region has been described as a biodiversity hotspot because it presents high endemism levels and it is important as human heritage since this region is home to several indigenous reserves, community councils (afro-descendant), nature reserves and national parks. For these reasons, identifying the main causes of the deforestation is the first step to find strategies that allow sustainable development in this sector. The lack of these kinds of findings that show how this expansion and production has affected the biodiversity, obstruct authorities and statutes to take suitable decisions to improve the current situation.

Hemminger, K., König, H. J., Nilsson, L.

Cranes in agricultural landscapes: a review of scientific literature addressing human-wildlife interactions

Institution: Institute of Land Use Systems, Leibniz Centre for Agricultural Landscape Research (ZALF), Germany

Keywords: human-wildlife-conflicts, ecosystem services, ecosystem disservices, land use, prevention measures, crop damage, gruidae

The IUCN Red List of Threatened Species categorizes eleven of the world's 15 cranes species as endangered and the remaining four with a conservation status of least concern. As natural wetlands have been destroyed, the ability of cranes to exploit agricultural land for foraging provides them with vital energy resources. Sandhill cranes in Nebraska, for example, derive up to 80% of feed intake from agriculturally produced corn. Yet this ability to forage on agricultural fields is also reason for conflicts with farmers. Some examples: In South Africa, incidences of threatened blue cranes being poisoned by landowners are reported. In Europe, the growing population of common cranes has led to an incline in crop damages and in costs for damage prevention measures and compensation payments. The aim of this paper is to provide a structured overview of topics addressed and different scientific methods used in peer reviewed research studies on interactions of cranes and humans in agricultural landscapes. We identified that most publications used quantitative methods and were written within a single discipline, i.e. lead by agricultural and biological sciences, followed by environmental sciences. We discuss how the Ecosystem Service framework could be used to combine and streamline the diverse existing knowledge for effective information needed for sustainable wildlife management.

Spyra, M. ^a, Fürst, C. ^a, Grodzińska-Jurczak, M. ^b, Morelli, F. ^c, Benedetti, Y. ^c, Cent, J. ^b, Rechciński, M. ^b, Tryjanowski, P. ^d, Yakusheva, N. ^e, Halka, P. ^a, Stupariu, I. ^f, Stupariu, M. ^f

Peri-urban landscapes as the arena of human - wildlife interactions: environmental governance recommendations

Institution (s): ^a Martin-Luther-University Halle-Wittenberg, Germany; ^b Jagiellonian University, Cracow, Poland; ^c Czech University of Life Sciences Prague; ^d Poznań University of Live Sciences, Poland; ^e University of Helsinki, Finland; ^f University of Bucharest, Romania

Keywords: human wildlife interactions, peri urban areas, environmental governance

The Anthropocene era is going along with many and intensive human interventions into nature and landscapes so that wildlife faced tremendous changes in habitats, their quality, processes and connectivity. However, many species, among them the most “iconic” ones such as wolf, lynx, bear, beaver, deer or wild boar, have developed highly adaptive behavior and start even obtaining even some benefits from anthropogenic landscapes. Consequently, there is a rising need to better understand human–wildlife interactions in dynamically changing landscapes. Peri-urban landscapes (PUL), are a particular example of landscape types emerging from increasingly anthropogenically shaped environments. They are characterized by a dense mosaic of different potential habitats, among them gardens or urban green space with extremely diverse vegetation pattern, brownfields that are only sparsely frequented by human beings and thus are attractive residence areas for wildlife during daylight and dump sites at which fodder can be easily collected. Green infrastructure connects the urban fringe with rural areas so that migration pathways between cities and their surroundings facilitate the movement of wildlife into cities. In this paper, we focus on human – wildlife interactions (HWI) in peri-urban landscapes, with a particular focus on iconic species. We hypothesize that PULs gain in increasing relevance and importance as arenas of intensified HWI. These may have a biased character: the experience to observe some iconic species as deer close to or within urban areas can be considered as a cultural service, providing inspiration and education. On the other hand, spatial closeness between humans and wildlife can lead to dangerous and unpleasant situations, which are often perceived or experienced as disservice. In conclusion, adapted concepts of spatial guidance of wildlife and humans are required to maintain the service side of HWI and reduce or mitigate the potential problems. Governance approaches that include actions and agreements between different planning actors can be seen as a complementary tool in spatial planning, avoiding too schematic spatial organization concepts such as Euclidian functional zones. Adaptive governance is here understood as a multilevel process linking the social (actors, actor groups and their networks) with the ecological sub-systems. By offering a comprehensive up-to-date opportunities for a broad and effective public engagement and use of novel-innovative research concepts such as citizen science, multi-channel enhanced communication, HWI governance could provide solutions basing on a higher degree of awareness, dialogue and eventual real participation of actors then classic spatial planning approaches in the context of PULs. We will investigated existing HWI governance approaches and discussed their potentials to be transferred to the context of PULs, analysing their capacities to enable a high level of participation and continuity in the further development of HWIs.

Wenz, E., König, H. J., Peuker, P., Kramer-Schadt, S.

Reconciling people and predators? A review of current research related to wolf management in Europe

Institution: Institute of Land Use Systems Leibniz Centre for Agricultural Landscape Research (ZALF), Germany

Keywords: human-wildlife interaction, *Canis lupus*, livestock, management, depredation, conservation, multidisciplinary

Wolves were once abundant in most parts of Europe, but the species' numbers have decreased strongly. Since the 19th century, wolves have been extirpated in large areas especially in Western Europe. Factors like the establishment of legal protection, land-use changes and a shift of rural populations to cities have led to a recovery of wolf populations and a recolonization of some regions. Where wolves and humans interact and especially where wolves return to their former range, they evoke a wide range of emotions in different stakeholder groups. On the one hand, wolves are an iconic species and generate sympathies; they are conservation flagships and provide ecosystem services e.g. regarding the control of prey populations. On the other hand, factors like livestock depredation, competition for game and fear of attacks on humans cause conflict and lead to a more critical perception especially in rural areas. Topics of wolf management are therefore often accompanied by a heated societal debate. For this study, we carried out a review of the scientific literature on questions of wolf management, monitoring and related socio-cultural and legal aspects in Europe and delineate factors that contribute to successful management. The evolution of topics and methods is discussed and regional differences in wolf management and stakeholder perceptions are analyzed. Approaches to wolf management vary dependent of national and regional characteristics. Monitoring methods to determine presence and numbers of wolves range from sign surveys (e.g. collection of feces, howling survey) to genetic analyses and tracking with GPS collars. Management instruments/ practices include the use of damage prevention measures, compensation payments in case of livestock depredation, and regulated hunting of wolves. Juridical questions come into play for example regarding licensed wolf hunting in some countries, which can conflict with the protection status under the EU Habitats Directive. Besides ecological and legal questions, feasibility and effectivity of management approaches depend on stakeholders' and the general public's opinion. Negative attitudes can lead to an undermining of management goals, at worst through illegal wolf killings, which have led to a decline of wolf numbers in some areas. Therefore, besides evidence-based management decisions also sociological aspects must be taken into account to understand public opinions and how they are formed. An integrated, holistic approach is needed to address wolf management issues, considering research both in the fields of natural and social sciences.

Reinke, H. ^a, König, H. J. ^a, Keuling, O. ^b

Wild boar (*Sus scrofa* L.) population monitoring methods and management practices: a review

Institution (s): ^a Institute of Land Use Systems Leibniz Centre for Agricultural Landscape Research (ZALF), Germany; ^b Institute for Terrestrial and Aquatic Wildlife Research (ITAW), University of Veterinary Medicine Hanover, Foundation, Germany

Keywords: population dynamics, habitats, monitoring, land use, wildlife management, *Sus scrofa*

Rapid increases of wild boar populations can be observed in many parts of the world due to intensification in agricultural production (i.e. increase in energy rich crop types, increase in area sizes etc.), climate factors (e.g. milder winters, dryer springs etc.), less effective wildlife management or hunting practices (e.g. increasingly difficult area management, demographic changes of hunters, legal limitations etc.). Consequently, wild boar-related damage incidents in agricultural crops and grasslands occur more frequently and lead to an increased level of conflict. Recent hunting bag statistics in Germany, for example, show evidence in continuously increasing numbers of wild boars shot annually, which doubled from 300.000 in the late 1990s to more than 600.000 in the hunting season 2015/16. However, it is known that annual reproduction rates of wild boar are highly variable and can reach up to 300%. Therefore, robust monitoring techniques and adapted management strategies are required. The aim of our study is to analyze population dynamics and management strategies of wild boar for the case of the UNESCO-Biosphere Reserve Schaalsee in northern Germany. We selected the Schaalsee region for our case study as it can be considered an ideal habitat for wild boar with large areas of intensive crop production, forests, grassland, lakes and wetlands. The specific regional problem related to wild boar within the Biosphere Reserve refers to seasonal damages in grasslands (mainly in spring and autumn) and limitations in land management due to specific regulations in this conservation area. The main questions we will focus on are: what are the underlying factors for wild boar population dynamics in this reserve and what are effective strategies to manage the regional wild boar population and related farm damages. In order to develop a suitable and robust research design, we conducted a broad review to identify state-of-the-art research/monitoring techniques for analyzing the spatio-temporal wild boar population dynamics. Those can be distinguished into direct (e.g. line transects, camera trapping, drive counts) and indirect methods (e.g. pellet counts, snow tracking), hunting bag statistics, statistical modelling and genetic approaches. Furthermore we reviewed the literature for alternative management strategies, such as adapted land use strategies (e.g. adapted cultivation plans, deflection areas around crops with high damage risk etc.), adapted hunting (intensification, specification, implementation of new techniques, reconsideration of traditional behavior etc.) or prevention methods (e.g. fencing, deterrence etc.). Strengths and limitations of the different monitoring techniques and management strategies will be discussed.

Fürst, C., Spyra, M., Schultze, M.

Human Wildlife Interactions - how to model future conflict hot-spots

Institution: Martin-Luther-University Halle-Wittenberg, Germany

Keywords: iconic species, 2-D and 3-D metrics, land-use and land-cover change models

The survival and resettlement of iconic species such as wolf, lynx, bear, bison, red deer is considered to be highly desirable to restore natural food chains and contribute to a renaturation of our land systems. On the other hand, these species can provoke severe conflicts with local actors through endangering livestock, browsing and bark peeling, or evoking traditional societal fears and thus restricting mentally the enjoyment of nature. While wildlife management measures are set-up for places where such species are currently abundant, preventive measures and management policies are much more difficult to develop since information on migration corridors and habitat selection is not available for spatial planning. From wildlife research, it is known that the movement and selection of habitats depends not only on food and water availability, but also on criteria such as closeness to and quality of hideaways. All these criteria underlie seasonal, but also medium to long-term changes through management measures or CC. To guide the migration and resettlement of iconic species, it is indispensable to understand the species-specific perception of suitable corridors and habitats and their spatio-temporal dynamics including tipping points for critical or synergetic landscape compositions and configurations, and to involve this information in spatial planning.

The presentation will introduce a conceptual approach for making use of “2-D- and 3-D landscape metrics to identify preferable corridors and hotspots for the movement and (re-)settlement of iconic species that are equally preferred by people for leisure activities or conflicting land uses (agriculture, hunting). Furthermore, the question how to implement models that help to explore future movement corridors and suitable habitats including seasonal vegetation dynamics and land-use / land-cover changes particularly in peri-urban environments is addressed.

Biodiversity, Ecosystem Services and Natural Capital from multiple land uses

Wei, W., Chen, L.

Coupling role of terracing and reforestation in blue vs green water conversion and erosion control

Institution: RCEES, Chinese Academy of Sciences, China

Keywords: terracing, reforestation, blue water, green water, ecosystem

In many dryland regions of the world, fresh water always remains the most key restriction for plant growth and vegetation restoration. Improving the actual capacity of water supply to plants in the specific sites thus is significant for fighting against drought and enhancing ecosystem succession. In this study, we mainly are interested in discussing the role of terracing techniques and reforestation in the conversions between blue water and green water, as well as runoff retention and erosion control in the typical loess hilly region of China. Field consecutive measurements at plot and hillslope scales were conducted for collecting first hand data for further analysis. Meanwhile, we also try to explore their roles from larger scales (e.g., catchment and regional) based on literature synthesis from different similar regions. The following main findings were captured. (1) Terracing and land preparation methods are proved to be crucial in increasing the survival rates of afforestation and reforestation, which help to enhance the carbon sequestration and vegetation rehabilitation. The blue water capacity (soil moisture) generally can be increased by 1.2 to over 5 times, while the mean reduction of runoff (blue water) can reach about 4.39 times. Soil fertility, erosion control efficiency and biomass accumulation also can be increased by about 1.68, 13.8, 2.53 times, respectively. (2) Reforestation also can help to control blue water loss (runoff) and soil erosion issues. However, such extensive plantation projects also deteriorated the green water conditions by too much evapotranspiration, particularly in the water-limited drylands. Long-term monitoring in the Dingxi Region of Chinese Loess Plateau showed that dry soil layers in the deep loess soil have formed in all the selected artificial plants, and the reasons are very closely with the dense plantation density and improper plant species selection. (3) The interactions between terracing techniques and vegetation however, need more concern. Most importantly, we need to know which kinds of terracing technique, including its size, distribution and pattern may suit for the specific planted vegetation. How to combine the density and species with the right terracing, to achieve the real tradeoff of blue water and green water remain a big challenge. And this is no doubt significant for ecosystem restoration in those degraded lands.

Lorz, C.

Non-wood-products - Ecosystem Services of Managed Forests

Institution: HS Weihenstephan-Triesdorf University of Applied Sciences, Germany

Keywords: ecosystem services, managed forests

Forests in Germany came in the focus of the ecosystem service approach because many services are provided by forests. A major aspect of ecosystem services of forests is the impact on water resources (water services), e.g. runoff regulation and provision of water with high quality. The paper focuses on two major aspects (i) external pressures and forest management have both the potential to affect water services substantially and (ii) the monetarization of these services provided by forests. Examples are shown and discussed. In conclusion, simple and transparent approaches for the compensation of forest owners for the provision and improvement of these services are still missing.

Iverson, L. R., Peters, M. P., Matthews, S., Prasad, A.

Potential impacts of increasing drought and temperature on trees of the eastern United States

Institution: Northern Research Station, US Forest Service, United States

Keywords: drought, climate change, Quercus, trees, IPCC, model

Temperatures are rising and precipitation events are becoming increasingly variable, with both more droughts and more heavy rainfall events; the Intergovernmental Panel on Climate Change predicts these trends will accelerate throughout this century. To characterize past drought for 1960-1986 and 1987-2013, we calculate a Cumulative Drought Severity Index (CDSI) which combines both scores of monthly drought intensity and frequency based on the Palmer Drought Severity Index (PDSI). Future CDSI values for 2010-2039, 2040-2069, 2070-2099 were also estimated using a self-calibrated PDSI from daily outputs from two scenarios of climate change (CCSM4 and Hadley GEM2) with two levels of Representative Concentration Pathways (4.5 and 8.5). For display and comparison, data were mapped at 1x1 degree grid for the conterminous United States. These data show quite large increases in drought in recent times for the western and southeastern United States (as has been evidenced by increasing wildfire and tree mortality), but much greater drought predicted for the future. We then used forest inventory data and environmental variables (10x10 km resolution) within a Random Forest modeling framework to model and map potential changes in suitable habitat for 130 tree species in the eastern United States; the analysis also allowed for an assessment of reliability for each model. A literature assessment of biological and disturbance tolerance traits allowed us to assess the potential adaptability of the species to a changing climate. By combining these outputs with the current abundance of the species, we provide an overall assessment classification of the capability of each species to deal with the scenarios of climate change. We then summarize potential changes for each 1x1 degree location within the eastern United States to give managers, researchers, and publics indications as to whether species habitats in their region are likely to increase, decrease, or remain fairly stable in this century. Overall, trends show many species with shrinking habitat but also many, mostly southern species with drought tolerance such as several oaks (*Quercus* spp.), with increasing habitat in coming decades.

Pamukcu-Albers, P. ^a, Erdem, N. ^b, Serengil, Y. ^c

Impacts of Landscape Pattern on Water Flow Regulation Service of Forest Ecosystems

Institution (s): ^a Nature Conservation Centre, Ankara, Turkey; ^b Istanbul University Faculty of Forestry, Department of Landscape Architecture, Istanbul, Turkey; ^c Istanbul University Faculty of Forestry, Department of Watershed Management, Istanbul, Turkey

Keywords: water flow regulation, forest ecosystem services, landscape planning, landscape patterns

Landscape patterns are being changed by humans on an ever-growing scale. The changes for land use preference potentially influence ecosystems and ecologic cycles including water. Yet, forest ecosystems provide a large number of benefits to humans, including water flow regulation. Vegetation is a major factor in forest ecosystems to regulate water production and water quality protection. These positive impacts can decrease when forests are fragmented. A relationship exists between water flow regulation service and landscape patterns, and this regulation service can be quantified for different types of ecosystems. In this study, we assessed water flow regulation services from forest ecosystems at sub-watershed level in semi urban landscapes using landscape patterns. We quantified water flow regulation by determining flow coefficients for all land uses, including forests. To determine relationships between water flow regulation and landscape patterns we used metrics (PLAND, LPI, ENN_MN, and AI). Results show that landscape structure impacts water flow regulation. Hydrologic responses and their implications to water resources vary among different land uses. Determining flow coefficients in forest areas has shown a negative correlation between water yield and PLAND and LPI. Results also show a positive correlation between water yield and ENN_MN and AI due to forest fragmentation.

This study was supported by TUBITAK (The Scientific and Technological Research Council of Turkey) with project number of 112Y096 and Istanbul University with project number of 35512.

Dietze, V. ^a, Jürges, N. ^a, Fürst, C. ^b

Soil ecosystem services in agriculture farming systems. A case study from Saxony, Germany

Institution (s): ^a Helmholtz Centre for Environmental Research GmbH – UFZ, Germany;
^b Martin-Luther-University Halle-Wittenberg, Germany

Keywords: soil ecosystem services, soil protection, policy analysis, agri-environmental policy, agricultural management practices

Soil degradation are one of the largest problems for agricultural areas and endanger the global food security of a growing world population and the stock of ecosystem services which have a direct influence on the human well-being. Due to the fact of the importance of ecosystem services for the human well-being, ecosystem services are still insufficient considered in agriculture and soil policies and in agriculture practices. The lecture will be a representation of the results of the master thesis “Soil ecosystem services in agriculture farming systems. A case study from Saxony, Germany”. The master thesis analyzed how the concept of ecosystem services is established in agriculture practices. Therefor interviews with farmers in Saxony, Germany were conducted. The results of the interviews show what kind of knowledge the farmers have about the concept of ecosystem services and how they consider various ecosystem services in their agriculture management practices. Another topic of the interviews was the evaluation of the actual existing agriculture policies. Likewise could be identified what kind of policy incentives the farmers could be offered in order to consider more ecosystem services in their agricultural practices. Thereby a sustainable preservation of ecosystem services is possible.

Applications of the ecosystem services concept in forest decision making: Landscape Forestry revisited

Bozkurt, S. G., Serengil, Y.

A Biotope Mapping Study Conducted in Gürün (Sivas) County and Its Potential to Contribute to Conservation of Biodiversity

Institution: Istanbul Universitesi Orman Fakultesi, Turkey

Keywords: nature conservation, landscape planning, biotope mapping, ecological planning, Gürün county

As a result of extensive and inappropriate consumption of natural resources, natural balance started to impair and threaten human life. Thereupon, along with development of environmental awareness, the issue of nature conservation has gained importance all over the world since 1960s. Biotope mapping studies developed for the conservation of natural resources has been diffusely used in planning studies in cities especially of developed countries. It has been predicted that these studies, which are being conducted at academic level for now in our country, will form an essential basis for conservation of biodiversity and landscape planning studies. In this study it is aimed to determine and map biotopes, which differ from each other in regard to etiological factors, for conservation of natural resources and biodiversity in the centre and neighbourhood of Gürün County. In the field, totally 47 biotope types, 13 being main biotopes and 34 being sub-biotopes, were classified and mapped. With this study conducted, determination of natural resources existing in the field and biodiversity, in regard to flora, was performed. In nearly-natural and cultural biotopes, totally 666 plant taxons, 84 being endemic, were detected. It was emphasized that conservation-consumption balance should be taken into consideration in planning in order to ensure continuation of the biotope types determined in consequence of the study, their areal distributions, and plant and wild animal species they include and to hand down the next generations. Especially in urban biotopes where human interference is more intensive, recommendations for areal use consistent with nature, planning, regulation and improvement were brought forward in order to ensure continuity of living life.

Sugimura, K., Torikai, H., Nagai, Y., Shima, T., Kawaguchi, H.

Forest management options to sustain forestry, tourism and rare species conservation in the Amami Oshima Island, Japan

Institution: Nagasaki University, Faculty of Environmental Science, Japan

Keywords: rotation age, Amami rabbit, acorn production, tree cavity

Clear cutting for pulpwood production in the Amami Oshima Island has reduced the area of old forests. These forests provide qualified habitat for many endangered species, while forestry and ecotourism give employment opportunities. In order to find a compromising management options among forestry, tourism and species conservation, we collected information on the location and area of forest cutting, popular forest tourism sites, employment in the forestry and tourism sectors and habitat requirements of some endangered species. We found that cutting has been nearly limited in the western part and tourism is most popular in the central part of the island. 17% of the forests were prohibited from cutting and 33% were classified as the buffer zones according to the national park zoning. We identified the long-haired rat *Diplothrix legata* as the indicator species for the old forests to be protected, which provide cavity nesting sites and relatively high acorn production. The most popular species in tourism was the Amami rabbit *Pentalagus furnessi*, which prefers young forests located next to old forests according to previous studies. Based on these findings we proposed three forest management options and evaluated them in terms of forestry and the abundance level of the two species. The options focus rotation age; (A) emphasizing forestry, in which most of the forests are to be under short rotation, 45 years, outside the protected areas, (B) coexistence of forestry and conservation, in which the majority is under long rotation, 100 or 200 years, (C) emphasizing forest protection, in which all the forests are either to be uncut or under long rotation. We evaluated each option, supposing that the forest age composition is stabilized in a sufficient time period. We also assumed that the rat requires forests over 80 years old, which provide nesting sites, and that the rabbit prefers a mixture of young forests under 10 years old for grasses and forests over 50 years for acorn. As a result, the option (A) let the forests over 80 years decrease by three quarters of the present, presumably causing significant population declines of the rat and rabbit, while giving advantages for forestry. The option (C) increased the old forests in area approximately seven times, securing the rat habitat quality and leaving the smallest area for forestry. The option (B) gave an intermediate evaluation for forestry and the rat, while the best for the rabbit. Now that (B) allows a larger area of cutting than the areas actually cut in the recent years and that the foresters do not argue that the cutting area should be increased even though it is far smaller than before, (B) appears to be the most acceptable. The buffer zones of the national park are supposed to lead to coexistence of forestry and conservation, but the government has not solved this matter of debate yet. We suggest that it is time for both foresters and conservationists to take long rotation forest management into account.

Tiemann, A., Ring, I.

Challenges of aligning forest function mapping and the ecosystem services concept in Germany

Institution (s): Chair of Ecosystem Services, Technische Universität Dresden, Germany; International Institute Zittau, Germany

Keywords: ecosystem services, forest function mapping, CICES, Germany, Accounting

The ecosystem services concept is steadily increasing in importance, not least in the context of considering natural capital in public and private decision making. This also holds for the forest sector in Germany. This development leads to the need of a harmonised set of terminology for central technical terms being used in the forest sector on the one hand and the ecosystem service classification on the other. In Germany, a common way to assess the vast multifunctional benefits of forests is the forest function mapping method. Due to the federal multi-level governance system in Germany, each state (Land) in Germany has its own classification of forest functions and subsequently mapping. Even though there are fundamental commonalities and baseline recommendations in characterizing and mapping forest functions, there are also significant differences in the practical application. Differences particularly relate to the terminology used and the way of considering forest functions at the management level. Hence, there is no consistent framework in applying these functions. Recent literature reviewed and compared the concepts of ecosystem services and forest functions, pointing out the necessity to consider both concepts. A first objective of this contribution will be to examine and to align forest function categories across German states in view of making them compatible with the ecosystem services concept. This bottom-up approach will be combined with a top-down approach, building on the Common International Classification of Ecosystem Services (CICES). CICES represents the common standard in the European Union for identifying, classifying and mapping ecosystem services and eventually including them in public and private accounting systems. It will be analysed to what extent the different forest function mapping approaches in German states are compatible with the structure of CICES and where a common denominator could be for national reporting requirements of Germany's forest-related ecosystem services, as part of implementing Target 2 and Action 5 of the EU's Biodiversity Strategy to 2020. Building on these results, a second objective is to exemplify in more detail the challenges, conflicts, development potentials and benefits of the ecosystem services concept for forest management by way of example of a concrete German state forest enterprise, the "Saxony State Forestry Service". The aim is to develop a harmonized, methodological framework that ultimately will be suitable for accounting forest-related ecosystem services.

Azevedo, J. C., Nunes, L., Pérez-Rodríguez, F.

Solving multi-objective problems for multi-functional management in maritime pine forest landscapes

Institution: CIMO, Instituto Politécnico de Bragança, Portugal

Keywords: FlorNExT Pro[®], Portugal, forest mobilization, technology transfer, decision support systems

Forest management has followed many different concepts and philosophies over the last decades, the most recent of which favor the integration of multiple criteria and objectives in the management of forest ecosystems, ranging from the multiple use concept of the 1960's to the current multifunctionality and ecosystem services paradigms. These concepts require reliable and user friendly tools to be put into practice, in particular in regions where models and other decision support systems are not available. In this study we used FlorNExT Pro[®], an operational research tool developed to facilitate management in socially and environmentally complex forest landscapes in the Northeastern region of Portugal, to solve multi-criteria problems. The tool was conceived to be easy to operate and to be able to produce management plans for groups of forest stands within this region according to varying objectives and restrictions. FlorNExT Pro[®] integrates forest growth, yield and management models with spatial data concerning management units within a certain management area, including the limits of all the forest stands, and alphanumeric information on current forest stand attributes. The tool requires that all possible management options (thinning and final cut) for each stand are established which is done through the definition of the number and duration of management periods by the user. Considering also general restrictions (minimum and maximum thinning and minimum final cut), limits (maximum final cut area, maximum thinning area, minimum and maximum volume per period), and management objectives (Net Present Value (NPV), volume, carbon sequestration, fire hazard) the tool solves the complex optimization problem through linear programming methods. We applied FlorNExT Pro[®] in the Lomba ZIF area (Vinhais municipality, Northeastern Portugal) to find optimal management solutions for particular objectives addressed individually (maximum biomass production, maximum large size timber production, minimum forest fire hazard, maximum carbon sequestration) and for combinations of objectives (e.g., balanced production of biomass, timber, and low fire hazard). Individual and multiple-objective solutions were compared based on indicators such as net present value (NPV), net carbon captured, and probability of fire occurrence, among others. Results show that the process of optimizing forest management at the landscape level is easily handled in FlorNExT Pro[®]. The tool proven to be a reliable and flexible tool to integrate multiple criteria and objectives into solving spatially explicit complex management problems which makes it particularly suitable for the preparation of forest management plans at the landscape level to address multifunctionality and to overcome technical planning problems in multi-owned or communal land. FlorNExT Pro[®] facilitates technology transfer to promote forest management in areas lacking decision support tools.

Pérez-Rodríguez, F., Sil, A., Honrado, J., Carvalho-Santos, C., Nunes, J. P., Azevedo, J. C.

Multi-objective forest landscape management based on expert opinion in Northeastern Portugal

Institution: CIMO, Instituto Politécnico de Bragança, Portugal

Keywords: maritime pine, forest decision support system, Bragança, ecosystem services

Forest management planning is a complex process of defining and coordinating forest management activities according to particular goals and objectives. Spatial heterogeneity, either resulting from environmental variability and disturbance or from societal variables (ownership, governance, preferences), contributes to increase the complexity of management problems and the solutions that can be found for particular targets. The trend to address several ecosystem services simultaneously as management criteria and objectives accounting for the way these vary in space, make the process even more complex. Tools to integrate this diversity of conditions, criteria and objectives have received strong interest in recent years and several applications are now available in academic and professional environments in several parts of the world. In the region of Bragança, North-eastern Portugal, operational research tools recently developed with the goal of increasing management and wood mobilization in the local forest sector, allow ecosystem services to be addressed from heuristics, multi-criteria and multi-objective perspectives.

In this study we addressed the management of maritime pine stands in the region of Bragança to optimize the supply of timber, water and mushrooms. For that we used a modified version of the forest management decision support system tool AppTitude[®], based on a heuristic approach and combining forest growth and yield dynamic models, expert opinion and multi-criteria decision making methods on a spatially explicit basis. The tool considers supply, demand and supply-demand interactions for timber, water yield and mushrooms in forest stands. It considers also user-defined scenarios that are based on constraints and limits (minimum and maximum) to find the best solutions for the supply of the three ecosystem services addressed. Expert opinion was used in the valuation of maritime pine wood from the point of view of the industry demand, mushrooms production and water yield, based on questionnaires build with several criteria and sub-criteria selected for each of the services. Analytic Hierarchy Process (AHP) was used to calculate weights for each criterion in a decision tree and Multy-attribute utility theory (MAUT) to link weights with the weight utility model for each attribute in the spatial dataset of the Bragança region. The combination of these methods results in suitability maps for the three ecosystem services in the entire region. The interactions between supply and demand solutions were found through linear programming based on consensus among value, price and/or quantity according to the rules applied yearly in every unit of the Bragança region grid for a simulation horizon of 20 years. We present and evaluate the results of the simulations run in AppTitude[®] providing the best solution scenarios for the forest management problems in the Bragança region, balancing timber, mushrooms production and water yield. We discuss also the effects of multi-objective management approaches on wood supply in the region.

Iverson, L. R., Peters, M. P., Bartig, J., Rebbeck, J., Hutchinson, T.,
Matthews, S. N., Stout, S.

Restoring oak-hickory forests and their ecosystem services via targeted silviculture through landscape modeling

Institution: Northern Research Station, US Forest Service, United States

Keywords: oak-hickory forests, moisture modeling, prescribed fire, silviculture

Oak (*Quercus* spp.) and hickory (*Carya* spp.) forests in the eastern United States provide a host of ecosystem services as their mast are extremely valuable for wildlife, the timber is valuable, and they are generally more tolerant of weather extremes under a changing climate. They are, however, undergoing a severe decline in prominence throughout the region, yielding to more mesic and shade tolerant, largely maple-dominated forests. Two decades of research in Ohio have shown that opening the canopy, through prescribed fire and thinning, can promote oak and hickory regeneration, most successfully on drier ridges and south- and southwest-facing slopes. We present a methodology to target areas across a 17-county region (~22,000 km²) that may be more receptive, and thus more cost effective, to successful regeneration following silvicultural treatment. The GIS model is based primarily on the topography (digital elevation model) as topography and soils drive the overall moisture regime. It uses transformed aspect, slope angle, topographic position index, and slope position as inputs, with outputs into six classes for landform: ridge, SW upper slopes, SW lower slopes, NE upper slopes, NE lower slopes, and bottomland. The first three were combined into the Dry Oak Forest class that forms the core of area that has a higher probability to be restored with silviculture, provided some understory oak-hickory seedlings and saplings are present. To determine whether sufficient stocking is present for adequate regeneration, we use small (SILVAH) plots distributed among the stands of interest which map out as classes of 'oakiness' in the overstory and understory. Managers use this information to help determine their 'zones of investment' for maximum value with their limited resources.

Biodiversity, Ecosystem Services and Natural Capital from multiple land uses

Thamsakon, S., Papong, S., Mungkalasiri, J., Boonkum, P., Datchaneekul, K., Singrattanapan, P.

Adopting Ecosystem service to inform alternative rehabilitation of limestone quarries in Thailand

Institution: Life Cycle Assessment Lab., National Metal and Materials Technology Center, Thailand

Keywords: ecosystem service, quarry, limestone, rehabilitation, biodiversity

With fast urbanization and limitation of natural resources, quarrying activities often entails various environmental impacts and affect landscape with irreversible. Quarry rehabilitation is a process of returning a disturbed piece of land to a productive state. Therefore, the cement industry has sought to restore the ecosystem of the limestone quarry in order to enhance biodiversity and ecosystem services that underpin local tourism. The ecosystem services (ES) are the benefits people obtain from ecosystem functions, the benefits may defined in four categories-supporting, provisioning, regulating, and cultural. Regarding the purpose of quarry rehabilitation, to assess the benefits that would be generated by each rehabilitation plan not only the extrinsic purpose such as landscape improvement but the benefits to human society should be also accounted. This paper aims to propose adoption of ecosystem services assessment and valuation to inform post-mining management plan in Thailand. Some lessons and challenges on the development of integrated valuation methodologies are discussed. SCG Cement, the cement company in Thailand, is the volunteer to implement ES. SCG Cement has innovated to operate “semi-open cut” mining which is environmental friendly, reduce impact to landscape and surrounding communities. Quarry Management Plan is in place from design, operation, rehabilitation, biodiversity and closure plan.

Altamirano, A., Miranda, A., Di Bella, C., Prado, M., Peluso, F.

Differentiated forest loss in global biodiversity hotspots

Institution: Universidad de La Frontera, Forest Landscape Ecology Lab, Chile

Keywords: land use, land cover, remote sensing, native forest, tree plantations

The most of forest global assessments use the FAO definition of forest which aggregates tree plantations and native forests. Tree plantations are so distinct from native forests in their role in the biosphere especially in terms of biodiversity conservation and the ecosystem services that native forests provide. Therefore these two types of tree cover need to be carefully differentiated especially in high importance biodiversity areas where it has many implications for human wellbeing. We estimated native and exotic forest cover losses for the period from 2000 to 2014 in all global biodiversity hotspots. To identify forest loss areas between the years 2000 and 2014 we used Hansen et al. (2013) forest cover global database. Forest loss patches from Hansen et al. (2013) do not identified differentiated forest loss of native or exotic forest. To do this we performed a random sampling of forest patches lost in the period 2000-2014. We defined a minimum forest loss patch of 50 ha. Information of forest loss patches of each biodiversity hotspot was assessed by local experts. For each patch local experts identified the native and exotic forest and its proportion in the year 2000 using Google earth historical images. Also they identified the final land cover in the year 2014 for each forest patch lost. Preliminary in this abstract we report results for the Chilean biodiversity hotspot. The results reveal that Hansen et al. (2013) database mostly identified tree plantation patches loss accounting for 90% of forest loss. The most of tree plantations patches recovered the vegetation being this about 70% and remaining the land cover. Native forest loss might be underestimated because the minimum forest loss patch unit used. Therefore, further analyses improving the resolution will be necessary.

Ramírez, W., Isaacs, P., Marín, W., Betancur, C., Waldron, T., Sierra, J., Ochoa, V., Correa, C., Gómez, M., Marin, D., Franco, M. C., Echeverry, D.

Restoration Opportunities Assessment Methodology- ROAM, an opportunity for the posconflict conservation and restoration in Colombia. Prioritizing remaining areas in Antioquia for a sustainable use of the land

Institution: Instituto de Investigación de Recursos Biológicos Alexander von Humboldt, Colombia

Keywords: restoration, opportunities, connectivity, spatial analyst, economic valuation, livelihoods

Colombia announced its one million hectares pledge to the Bonn Challenge in to the governmental commitment to 2020. As a part of the strategy we are applying the ROAM, developed by IUCN and WRI, focuses on the eastern department of Antioquia, in the municipalities of San Carlos, San Luis, San Francisco, Carmén de Viboral and Sonsón that form part of a proposed Puma corridor, an initiative led by the regional environmental authority – CORNARE, a partner in the restoration opportunity assessment alongside the Catholic University of Antioquia. The area has experienced one of the highest deforestation rates in the country and armed conflict, however, it still has enormous potential for the conservation of a high biodiversity and ecosystem services, especially in relation to water quality and quantity. We prioritized the area based on the quality of the forest in terms of shapes, size, landuse conflict and drainages and mainly has the importance of the patches to the connectivity. We include a socio-economic analysis based on the cost benefit of the restoration and the productive systems, the livelihoods of the population, the prioritization of ecosystem services through the social valuation of the landscape, to obtain a spatial zonification based on social and ecological values of the landscape. We want to bring new opportunities to the return of people displaced by the armed conflict, as well as the reintegration of guerrillas having signed an end to the conflict with the FARC. This presents an opportunity, whereby restoration and other sustainable activities such as ecotourism and beekeeping that offers new livelihood options for these populations. The ongoing restoration assessment processes can play a significant role in reducing further degradation and deforestation in Antioquia, and potentially improving the performance-based payments for forest conservation and preservation in Colombia.

Stępniewska, M., Abramowicz, D.

The impact of public investment on ecosystem services provided by blue-green infrastructure: The case of Szachty in Poznań, Poland

Institution: Adam Mickiewicz University in Poznań, Poland

Keywords: ecosystem services, policy-making, public investment, urban areas

The development of blue-green areas in cities is related to the possibility of shaping the structure and the level of ecosystem services (ES). If managed correctly, these areas can provide a broad bundle of ES. The public investment strategy leads to stimulating or weakening some ES, and, as a result, influences the potential to provide diverse social and ecological benefits by urban ecosystems. The study site (Szachty) is located in the city of Poznań and covers an area of 114 ha. For over 100 years extraction of ceramic materials was conducted here. After the discontinuation of mining activities, the Szachty area was not subjected to reclamation actions. However, the natural succession process led to positive landscape changes, which resulted in a mosaic of water bodies, waterlogged areas, grass vegetation and woods. At present, the study site is a significant element of the green infrastructure in Poznań. It is mostly the city's inhabitants that cause changes in the landscape, as the Szachty area is a place where various forms of open-air rest and recreation are undertaken by them. The objectives of the study included: (1) recognition of the size and directions of public investment as regards the arrangement and maintenance of the Szachty area; (2) determination of satisfaction of Szachty users resulting from implemented investment projects; (3) identification of impact of investments on key ES; (4) providing recommendations to policy-makers for shaping a further public investment strategy. To fulfill the objectives, we have collected information about investments implemented on the study area by local authorities in the years 2013-2016. Next, we analysed the financial expenditures regarding the type of the investments (permanent investments; ongoing maintenance), the costs, investment appraisal by users (positive; negative) and the influence on ES (stimulating; weakening). The following findings offer valuable insight to policy-makers towards enhancing the efficiency of public investment: (1) Current directions of public investment on the Szachty area mostly include the construction of infrastructure that enhances cultural ES, such as small infrastructure objects (e.g. benches, pedestrian and cycling paths), viewing terraces. (2) Users of the Szachty area appreciate this type of investments as they improve the place of recreation. (3) Users attach less importance to investments enhancing the regulating ES, e.g. renovation of culverts between ponds. That indicates the need to educate, which would increase the perception of the ecological benefits provided by the Szachty area. (4) The investments that have been implemented so far usually weaken the regulating ES; this creates the need for the safeguarding of these services at the stage of planning and implementing investments. The results of the study may help to better weight the synergies and trade-offs between different management options and to tie the users' needs and desires with preserving the integrity and ecological stability of the whole ecosystem. Therefore, the study can constitute a point of reference for other cities standing in front of a challenge to integrate the social and environmental perspective and make the financial decisions that comprehensively capture the relation between urban blue-green infrastructure and human well-being.

Esquivel, J., Fuentes, R., Esparza, A., Saldana, A., Echeverria, C.

Spatio temporal evaluation of the link between functional diversity and the provision of hydrological regulation ecosystem service

Institution: University of Concepción, Chile

Keywords: biodiversity and ecosystem services link, Functional diversity, water regulation service

Ecosystem services are a direct or indirect contribution of ecosystems to human well-being, and are based on many interactions of complex systems at different ecological levels. The strong link between biodiversity and ecosystem services is an important argument for ecosystem management and biodiversity conservation. This link has been evaluated in many investigations in the last two decades, mainly at local scales. Thanks to this, we can asseverate: ecosystems with high biodiversity are more productive and stable through time than other less diverse and provide more services. Species richness is the indicator usually used to evaluate biodiversity at ecosystem level. However, more species is not necessarily an indicator of niche differentiation and this can implies ecological redundancy. Functional diversity, defined as the distribution and relative abundance of the functional traits, of the species that make up a particular community or ecosystem, has been considered as a better indicator of the biological diversity. Functional diversity is often evaluated at ecosystem level, but we can expect an effect of this value at landscape scale?. Is it an important indicator to evaluate the effect of biodiversity on ecosystem services at the landscape scale? The first effort is to quantify biodiversity, considering functional diversity as an important component, given by the influence of functional traits of the organisms on ecosystem functioning. The second effort is quantify an ecosystem service at landscape level, in this case, water regulation service. We evaluate functional diversity of different forest ecosystems, considering functional divergence of dominant trees, as an indicator of functional diversity. This approach was evaluated in two contrasting landscapes of Chile. Coastal landscape has been severely affected by land use change, and Andes landscape that has initial process of change. Analysis was made for 1986 and 2011, to understand the temporal variable in this evaluation. With the functional diversity value of each type of ecosystem, we estimate the weighted average functional diversity value for each watershed of both landscapes. Finally, we analyzed the spatial relationship between watershed's functional diversity and the water regulation service. The results indicate a positive link between the functional diversity of forest ecosystems and the provision of the water regulation service. Greater functional diversity is spatially associated with greater service provision. However, at low levels of functional biodiversity, we have observed that the water regulation service prevails, although to a lower magnitude. This can be related to the presence of monospecific forest plantations, which although they have zero diversity, from the point of view of the divergence of functional traits, fulfill important functions in the hydrological cycle thanks to its structure. We can conclude that the functional diversity evaluated at the ecosystem level shows a spatial link with the water regulation service, which operates a watershed scale and is the result of the interaction of the ecosystems present in it. Therefore, this type of analysis would allow us to evaluate the thresholds of biodiversity necessary to maintain the magnitude of the service over time in a given river basin.

Modelling Social-ecological Systems Towards a Sustainable Management of Ecosystem Services: Frameworks, Approaches & Models

Merekalova, K., Kharitonova, A.

Landscapes general resilience and potentials: an assessment approach based on landscape components analysis

Institution: Lomonosov Moscow State University, Faculty of Geography, Russia

Keywords: landscape potentials, general resilience, landscape components, multi-criteria evaluation

The landscape response to the anthropogenic impact depends on its resilience. As landscape resilience we understand the general resilience of natural landscapes to external influence (potential resilience). This integral approach is not differentiated in relation to affecting factors but is universal and allows characterizing the acceptable levels of human activity in study area. Landscape resilience is an important part of landscape natural potentials that means the suitability of a landscape to carry different forms of land use. Our task was to examine the possibility of initial evaluation of landscape general resilience and potentials based on remote sensing imagery, topographic data and field investigations. The case study is performed for a key area in south-eastern part of Crimea peninsula. We studied the semi-natural landscapes of the Karadag natural reserve and transformed landscapes of surrounding territory. The research area is characterized by considerable diversity of landforms and landscape cover types. There are semi-indigenous forests of *Quercus pubescens*, planting pine forests, sparse woodlands and shrubs, steppes, arable lands and vineyards over the territory. All of these landscape units have different resilience to external impact – either natural or anthropogenic, and, as a result, different potentials. For landscape resilience assessment we used multi-criteria evaluation (MCE) technique based on hierarchical assessment of holistic geosystems resilience through the sum of partial assessments of their components resilience. At first step we selected the properties of landscape components that determine their resilience and detected the specific regional criteria for every indicator. On the basis of quantitative analysis of digital terrain model, multi-spectral satellite images and field data we evaluated the resilience of landforms, vegetation and soils. Then we summarized partial assessments of landscape components resilience and derived general (potential) landscape resilience. At the last step joint comparison of partial resilience evaluations of relief, vegetation and soils made us possible to identify the territories stable or unstable for all the components, as well as the territories that are stable in respect to one component and unstable in respect of the others. In general, stable landscapes are suitable for a wide range of land use activities. Unstable landscapes require a gentle regime of land use with strict limitations. And the land use of areas which have different resilience of different landscape components should be planned in such a way that the impact has been directed mainly to a stable component of the landscape. This approach could be useful in landscape planning and strategic environmental management.

Inkoom, J. N. ^a, Frank, S. ^a, Greve, K. ^a, Fürst, C. ^b

Utilising landscape metrics and analytical hierarchy process to assess ecosystem services in West Africa

Institution (s): ^a Centre for Development University of Bonn (ZEF), Germany, ^b Martin-Luther-University Halle-Wittenberg, Germany

Keywords: agriculture landscape, regulating services, AHP, GISCAM, Ghana

Agriculture landscapes in West Africa are one of the world's most vulnerable areas to the impact of climate change. This is partly due to the over reliance of it inhabitant to rainfed agriculture and less innovative agricultural management practices. Periodically, inappropriate land and land use management practices impede the capacity of the agricultural landscapes to provide ecosystem services needed to provide landscape resilience. Lack of practical framework to evaluate the landscape's capacity to provide regulating ecosystem services (ES) remains a challenge in this landscape. In this research, we propose an integrative spatial and non-spatial assessment framework to assess the landscape capacity to provide regulating ES including flood control, climate control, wind erosion control, and pest and disease control. Non-spatial approaches employed included the analytical hierarchical process and Likert scale approaches for stakeholder assessment. Spatially, we used the hemeroby concept coupled with landscape metric assessment applied on a 2013 classified RapidEye image. We tested our assessment using the multicriteria evaluation and landscape structural module in GISCAM. Expert's judgements were validated using the degree of uncertainty approach. Our assessment framework was tested on four selected sites in the Veua catchment, Upper East Region, Ghana. In total, 56 experts from different department related to land use and landscape management participated in the assessment. The outcome of our study establish that while heterogeneous landscapes (e.g. L4) possess the potential capacity to provide pest and disease control, partial spatially heterogeneous working landscapes (e.g. L3) possess higher potential capacity to provide. Further, we found about 15% more improvement in the landscapes potential to provide ecosystem services after applying landscape metric-based assessment. We conclude that while our result could inform agricultural land management regulations and land use planning, our frameworks presents a novel approach for adoption across West Africa. The use of other ES types such as food provisioning with our proposed assessment framework is highly recommended.

Rozas-Vásquez, D. ^a, Fürst, C. ^b, Geneletti, D. ^a

Participatory Identification and prioritization of ecosystem services for regional planning in Chile

Institution (s): ^a Centre for Development University of Bonn (ZEF), Germany, ^b Martin-Luther-University Halle-Wittenberg, Germany

Keywords: prioritization of ES, consensus building, regional planning

The integration of ES in spatial planning is a promising approach for improving information and communication, as well as for facilitating consensus building among different actors because it provides a basis for multi-sectoral and interdisciplinary collaboration. In this research we used the ecosystem services (ES) approach to support the preparation of the Regional Plan of La Araucania in Chile. The objective was the identification and prioritization of ES which are needed for the present and future development of the region in order to create a set of alternative scenarios. The identification and prioritization of ES was carried out by involving actors from different Government institutions that are in charge of the plan elaboration. The identification was based on the actual ES provision that actors recognize as relevant for regional development in each land cover present in the region, considering also potential benefits and beneficiaries. Subsequently, the prioritization was focused on the relevance of the previously identified ES for supporting specific regional objectives and the impact of these objectives on the performance of each ES. The results show that the actors identified a total of 27 different types of ES, where the most important land uses in terms of supplying these ES were wetlands, young native forest and old growth native forest. Regulation and maintenance ES was the predominant section (41.5%) followed by provisioning (30.9%) and finally cultural ES (27.6%). Out of the list of 27 ES, we generated an arbitrary ranking with the top 10 priority ES. The most relevant ES were related to “maintaining nursery populations” and “mass stabilization and control of erosion rates” (first and second place of priority), both contained in the Regulation and Maintenance ES section. However, Provisioning ES section was the most representative, with 50% of the top 10 priority ES.

With this reduced set of priority ES, the next step is the generation and evaluation of different spatial scenarios for future regional development.

Montoya-Tangarife, C.^a, De la Barrera, F.^{b, c}, Salazar Burrows, A.^{a, c}

Ecosystem services, peri-urbanization and protected natural areas in an urban region in Chile

Institution (s): ^a Institute of Geography, P. Catholic University of Chile, Santiago, Chile; ^b Faculty of Architecture, Urbanism and Geography, University of Concepcion, Concepcion, Chile; ^c Center for Sustainable Urban Sustainability, Santiago, Chile

Keywords: ecosystem services, peri-urbanization, protected natural areas, urban regions, Chile

Thanks to the numerous contributions made by the scientific community, research into the use of ecosystem services as a tool for territorial management has become important for decision makers. In metropolitan environments, where urban-rural gradients and their dynamic processes of change continue regardless, it has become essential to understand the determining factors of sustainable development. Different forms of land occupation, temporal-spatial changes to land coverage and their effects on the offer of ecosystem services are an integral part of these factors. As a result, the understanding of transformative processes, and the subsequent visualization of the importance and value of nature in human wellbeing, facilitate the creation of public policies that safeguard and maintain these benefits in the long term. The present study analyzes landscape transformation in two peri-urban areas of urban region Santiago-Valparaiso in Chile, and how they relate to the offer of potential ecosystem services at a local scale. The borders of the areas analyzed in this study were determined based on the inclusion of protected natural areas in the surrounding territory and nearby peri-urban development. The areas analyzed in this study underwent spatial temporal analysis for the 2002 to 2015 period. The analysis itself was based on the initial digitalization of land use/coverage at a scale of 1/5000 using Google Earth images. Land use/coverage was assessed via a variation of the method proposed by Burkhard et al. (2014), which allows the researcher to identify the potential offer in these areas. The main results, as evidenced in the analysis, shed light on differences in the magnitude and predominance of certain land uses/coverage and the potential offer of ecosystem services. The unit Peñuelas, characterized by the predominance of Forestry activities at 30% of the territory and no agricultural activities, assigned barely 0.19% of the territory to peri-urban development and only 5% to urban development. The unit has a limited potential for ecosystem services (“medium low”) and despite undergoing change to 30% of the territory, the changes only constitute a 0.01 unit variation in the scoring range. The unit Cantillana, with 0.12% of its territory assigned to forestry activities and 4% of the territory used for agriculture, 3.4% and 1% of the territory are used for peri-urban and urban development respectively. This unit, ranked “medium high” for ecosystem services, manifested no variation in the potential offer of these services in the study period. Both units offer limited potential for ecosystem services (medium range) even though both boast valuable environmental ecosystems in their surroundings. The presence of protected natural areas in the study zone appears to be insufficient to guarantee a high offer of potential ecosystem services. Considering that the needs of residents are ultimately reflected in landscape transformations, to contribute to sustainable territorial planning in the region it is imperative to redefine ecosystem services as key elements to improving planning instruments and environmental management at a local and regional scale. In addition, planning tools must also incorporate concrete action toward recovering and providing multiple ecosystem services in the long term.

Lenfers, U. A., Clemen, T.

From individuals to landscapes – large-scale modeling with a generic tree model blueprint

Institution: HAW Hamburg University of Applied Sciences, Germany

Keywords: multi-agent simulation, multi-scale modeling, generic tree model, African savannas

A wide conceptual and operational gap exists between models on a smaller scale, e.g. for leaf physiology, and models that are intended to cover whole regions or even continents like digital vegetation models. Environmental management demands a cross-scale approach due to the complexity of social-ecological interactions between individuals and their environment. Multi-agent models have a well-proven record of successful application in this field of interest.

A massive multi-agent framework, MARS, developed at the Hamburg University of Applied Sciences, provides a mechanism to bridge spatial scales from the individual level up to landscapes, e.g. covering the entire Kruger National Park, South Africa.

In this presentation, a generic tree model is introduced. It will be used as a blueprint for describing 5 million individual marula trees (*Sclerocarya birrea*) and how they are impacted by roaming elephants. This approach can also be utilized to describe human-tree interaction, e.g. the collection of firewood.

Our initial results show that 1) simple rule-based multi-agent models are capable of describing complex adaptive systems on a broad range of scales, and 2) high-performance simulation frameworks that allow simulation studies on very large scales are freely available. These results form the foundation for real-time decision support in environmental management.

Schultze, M., Fürst, C.

A Review of Social-Ecological System Frameworks to Support Decision-Making in Managing Ecosystem Services

Institution: Institute of Geosciences and Geography, Martin-Luther-University Halle-Wittenberg, Germany

Keywords: social-ecological systems, decision theories, ecosystem management

Understanding the concept of social-ecological systems is a major research priority for a sustainable land management to ensure healthy ecosystems. Despite significant progress has been achieved in characterizing coupled human-nature relationships, the impact of management practices at different scales remains poorly understood. While management decisions are related to individual experiences, desires or abilities, decision-making is also nested within hierarchical structures, such as farming and forest management or regional to national policy-making. This creates conflicts between socio-cultural, political-economic and environmental goals that can cause soil degradation or reducing crop productivity.

The importance of considering human behavior in social-ecological research frameworks is increasingly recognized and the key ability to support decision-making. However, modelling and implementing good decisions in management practices depend on multiple challenges: (I) there are many theories dealing with human behavior (II) lots of approaches include only particular characteristics of decision-making and (III) the multi-scale feedback mechanisms between stakeholder and institutional perspectives are often not specified.

In this presentation we review scholarly literature on existing social-ecological research frameworks and how different conceptual approaches can support an effective decision-making in managing ecosystem services. We will discuss the importance of sustainable human behavior in social-ecological concepts by comparing decision theories that underpin how people make choices. As a first step in tackling the above-named challenges, novel transdisciplinary methods are being considered with examples from land-use change dynamics. This talk concludes with a discussion how the behavior of individuals or social groups can be aggregated to complex collective land management decisions bridging local to national scales.

Matsuura, T., Sugimura, K.

Changes in the gathering pattern of edible wild plants/mushrooms after the Fukushima Dai-ichi Nuclear Power Plant accident

Institution: Forestry and Forest Products Research Institute, Japan

Keywords: ecosystem services, radioactive contamination, nontimber forest products, questionnaire survey, GIS

Radioactive contamination due to the Fukushima Dai-ichi Nuclear Power Plant (FDNPP) accident had negatively affected a wide range of forest ecosystem services (provisioning and cultural services) in eastern Japan, particularly the gathering of edible wild plants/mushrooms (EWPM). However, assessing the changes in the pattern of gathering EWPM is rather difficult because this local activity is done primarily by individual residents, which generally has not been well-recorded in governmental statistics. To determine these changes, we first conducted a household questionnaire survey in the western and eastern parts of Fukushima Prefecture that had different levels of air radiation. The survey included questions about the changes in the frequency of gathering EWPM by the local residents before and after the accident and their reasons. We then interviewed experienced local gatherers about the environmental features (e.g., vegetation, topography, and proximity to roads) of their former gathering sites and mapped their spatial distribution using a multi-criteria evaluation (MCE) technique and geographic information system (GIS). Subsequently, we overlaid this map with the air radiation map taken by airborne monitoring and determined the areas where gathering has been difficult due to high radiation levels. Finally, we projected the future changes in the number of gatherers and the aerial extents of gathering sites, taking into consideration the declining trends in air radiation levels as indicated by the physical decay of radiocesium, as well as the aging and declining trend of the local population. From the questionnaire survey, we found a sharp decline in the number of gatherers and their frequency of gathering, particularly in communities closer to the FDNPP. While the aging and decrease of the local population were also important factors, the FDNPP accident had accelerated the decline in the gathering of EWPM. From the GIS analysis, we found a large decrease in the area of gathering sites particularly in communities closer to the FDNPP. Air radiation level continues to be high in some areas. In other areas, air radiation level is lower even within the same municipality due to the spatial heterogeneity in radiocesium contamination. The demographic trend based on the recent census shows that population decline and aging will continue in remote villages. This will likely accelerate the shrinking trends in the number of gatherers and their frequency of gathering. Our results show that there is difficulty in maintaining the local culture of EWPM gathering in highly radioactive-contaminated areas. However, our results also show that gathering of EWPM can be continued in less contaminated areas with the continuous monitoring of radiocesium contamination.

Numbisi, F. N.

Understand spatial synergies in tree integration within cocoa agroforestry communities: a case in the forest transitional landscape in Central Cameroon

Institution: Ghent University, World Agroforestry Centre (ICRAF), Belgium

Keywords: agroforestry, Basal Area, landscape transition, rejuvenation, shade, spatial point process, traditional cocoa farms, tree association

Agroforestry practices sustain important and varying degree of ecosystem services, often through tree management in successions. In the forest-savannah transition landscape of Cameroon, cocoa agroforestry systems remain an important land use and livelihood practice. In this landscape, characterized by a mosaic of savannah and forest patches, tenure constraints incited innovative approach of cocoa agroforest practice in both forested and savannah land. Though, current erratic weather pattern in this region exacerbate existing cocoa production and tree management challenges - with observed impact of prolonged drought period is most felt by small-scale rural farmers. In such dynamic landscapes, observable landscape trade-offs may result from aggregations of farm level synergies. In the Bakoa landscape, “traditional” cocoa farms comprising cocoa trees of variable ages and varying extent of tree association types – to meet often differing objectives and needs. And, tree management recommendations are yet without measureable and operational proxies for shade measurement within farms. Recent efforts in understanding farm practices and temporal tree management experience in the landscape exclude basal area changes due tree succession interaction and change in dominant tree stand components. This paper presents quantitative farm-scale insights of, and contributing to, tree management synergies in agroforestry landscape. We use proxies for both temporal and spatial variance in tree succession practices by small-scale farmers, to ascertain cocoa agroforestry plot management and rejuvenation. We implement a spatial point process as a reliable surrogate for tree integration, in relation to plot age gradient and farm-specific dissimilarities in biophysical characteristics. Young, and well as old, cocoa trees are observable in close vicinity of associated woody species (AWS). However, they exhibit opposing change in intensities, with increasing distance from AWS. The estimated intensity of young cocoa trees (DBH < 6cm) is about 3 trees per 100 meters square and, decreases by a factor of 0.9624405 for every additional meter away for an AWS, while increasing by an average factor of 1.0239114 and 1.0146391 for every meter away from respectively medium (DBH 6-10cm) and large (DBH > 10cm) cocoa trees. The magnitude of change in intensity of young cocoa trees, in relation to distance from AWS, vary more between plots of similar management age, than across those of different age. The above variability relate to both ecological and management experiences, which is most often farm- and landscape-specific. Understanding such farm –scale spatial differences and adaption practices contribute to effective integration of stakeholders’ interests in landscape management and global incentive mechanism.

Marinskikh, D. M.

Ecosystem Services and Landscape Ecology – congruent concepts or contradiction?

Institution: University of Tyumen, Tyumen, Russia

Keywords: ecosystem and landscape services, understanding, landscape ecology, landscape science, earth system science, land system science, anthropocene science, socio-ecological system, cultural landscape, transdisciplinarity, integrative landscape research, polygeosystem analysis and synthesis, case study, Western Siberia, Russia

Ecosystem services (ES) are considered to be a holistic concept to assess the impact of the state of art and of changes in the environment on human health and well-being. Motivated by the idea that such a concept would make it easier to argue the value of nature in policy processes and spatial planning, it is still an item of discussion how far ES support the integration of landscape as a reference entity for ecological and social processes in environmental policies. The report seeks for presentations that discuss critically how scaling issues and social-ecological interactions could be better integrated in ES assessments and how these could be better communicated in planning and policy consulting.

The report discusses the possibilities and limitations of a transdisciplinary study of landscapes for planning and management in Russian conditions. The necessity of formation of exploratory trajectory from geographic to biophysical landscape is discussed. We supposed to consider landscape as an object of integrative landscape research, which is understood holistically as a unity of natural, socio-cultural and perceptual-aesthetic aspects and its services, which corresponds to the first scientific definition of the landscape by Alexander von Humboldt as "the total nature of the Earth's terrain." The problem field of landscape research in the context of "Anthropocene science" is considered. The importance of conceptualization of the landscape as a socio-ecological system and as a cultural landscape is proved, supposed its study on the basis of integration of structures and processes of the biophysical components of the landscape with a human and his activity, studied on the basis of sociocultural approaches. Transdisciplinary interaction in landscape research of representatives of natural and social sciences and humanities, policies and practices (stakeholders) is assumed, as well as involvement in research procedures of the population to solve problems of the "real world" using participatory approaches. Transdisciplinarity is illustrated by example of ecosystem services at a landscape scale in a global, national and regional context. It is proposed to use the methodology of polygeosystem analysis and synthesis (according to VS Mikheev) for landscape analysis and landscape-ecological support of practical problems for integrative landscape research. The framework scheme is discussed according to cultural landscape: landscape as a "matterscape", landscape as a "mindscape" and landscape as a "powerscape". The thematic focus of the report is on landscape (ecosystem) services, functions, potential, value, resilience, landscape adaptability in connection with problems of spatial planning, multifunctional land use, sustainable development (including sustainable development goals 2030), landscape management (landscape governance). The possibilities and limitations of these theoretical approaches, their prospects in relation to the landscape conditions of Western Siberia are illustrated by local and regional plots and cases of author landscape studies in the context of the modernization agenda and challenges of the postindustrial world.

Nature based solutions for urban green planning

Cortinovis, C., Geneletti, D.

Ecosystem services in urban planning: state, challenges, and ways forward, with a focus on urban regulating services

Institution: University of Trento, Italy

Keywords: urban ecosystem services, urban planning, regulating services

The presentation focuses on the integration of the ecosystem service concept and approach in urban planning practices, and it is composed of two parts. The first part presents the main results of a review that investigated the inclusion of ecosystem services in current urban plans. The objective was to understand if and how information on urban ecosystem services is used, and what gaps remain. The review considered nine urban ecosystem services across three plan components. The analysis showed a high number of actions to address urban ecosystem services and a variety of tools for implementation. However, only some urban ecosystem services (i.e. recreation and few regulating services) are widely addressed, while others are hardly considered, and a solid information base to support actions is often missing. Future urban plans would benefit from a further appropriation of the ecosystem service approach, particularly in terms of i) consideration for a wider range of urban ecosystem services, ii) definition of strategic objectives for ecosystem service provision, and iii) identification of demand and beneficiaries. At the same time, shortcomings can be partly ascribed to gaps in the scientific literature. Usable methods and tools are still needed to assess urban ecosystem services at the appropriate scale while also accounting for the multi-functionality of urban green infrastructures and the relation between supply and demand. To this aim, the second part of the presentation introduces a framework to guide planners toward the integration of urban regulating services in current practices. Despite the importance of regulating services for human health and wellbeing, such integration is made difficult by the complexity of the mechanisms underpinning service provision and by the large amount of data and information required for the assessment. The framework identifies the key elements that determine the spatial distribution of regulating services and related benefits within the city, and describes their interactions in the process of service provision and use. The framework was applied to the spatial analysis of seven urban regulating services: micro-climate regulation, air purification, noise reduction, run-off mitigation and flood protection, waste treatment, moderation of extremes events, and carbon sequestration. The application revealed the key properties of urban green infrastructures related to the different services, and the presence of thresholds and non-linearities in the supply. Further, it identified the different components of the demand, their spatial distribution within the city, and the different typologies and scales of relation between green infrastructures and the areas benefitting from their services. Finally, it highlighted the role of environmental conditions and of their variability in space and time. The usability of the framework and its usefulness in supporting urban planners are discussed in relation with the findings of the review and with the main challenges of the science-policy interface.

Wang, J., Banzhaf, E.

Enhancing Green Infrastructure Concept Through its Multifunctionality as Nature-based Solutions

Institution: Helmholtz Centre for Environmental Research GmbH – UFZ, Germany

Keywords: ecosystem services, green infrastructure mapping, multifunctionality, urban planning, resilient cities, nature-based solutions, urban green infrastructure

In the light of a comprehensive analysis of key definitions of Green Infrastructure (GI) and their conceptual evolution, we present an exhaustive review of current GI mapping approaches at multiple spatial scales and their associated functional analyses. Hence, we deemed GI as an approach used to combine ecosystem services and human well-being to realize an efficient and sustainable use of spaces, hereafter named “GI concept”. We identified multifunctionality for depicting the ‘state of the art’ of the evolving GI concept and meanwhile as the solution best suited to enhance the GI concept and to open up potential avenues for urban GI research. Within these theoretical bases, we are convinced that it is significant to measure urban GI at multi-spatial levels and assess their functions at different spatial scales as it provides various urban ecosystem services. In order to enhance GI concept through its multifunctionality, we are testing in case study, i.e. the City of Leipzig, Germany, to get a better picture of pros and cons of GI promotion in urban contexts as nature-based solutions. As the first result, grounded on data from specific remote sensing techniques, the Object Based Image Analysis (OBIA), we distinguish classes such as urban trees, shrubs and lawn, and obtain detailed differentiation of Green Infrastructure in an urbanized environment for the City of Leipzig. It offers a possibility to measure and assess Urban GI at higher spatial resolutions, and thereafter link Urban GI to its particular functions to name precisely the multifunctional GI. In order to achieve measures for a sustainable urban development towards more resilient cities, our following research will focus on multiple functions at different spatial scales, beginning with our local mapping approach (urban structure types, at less than 1 meter ground resolution). Simultaneously, we will apply the GI concept, especially its multifunctionality, in our case study areas, in order to develop an indicator-based urban GI concept. As a result, we will enhance our GI concept through its multifunctionality for nature-based solutions and find the answer to what are reasonable scenarios to employ GI as nature-based solutions to realize multifunctionality and sustainability.

Haase, D.^{a,b}, Larondelle, N.^a

Back to nature! Or not? Urban dwellers and their forest in Berlin

Institution (s): ^a Humboldt-Universität zu Berlin, Germany; ^b Helmholtz Centre for Environmental Research GmbH – UFZ, Germany

Keywords: urban forest, Berlin, survey, nature perception, urban forest management

What type of urban nature do urban dwellers prefer? Contributing to this ongoing discussion, this study presents the results of an internet and on-site field survey on general use and visitation pattern conducted in Grunewald Forest via a questionnaire; this is a 3000 ha area southwest of Berlin, Germany. The questions were developed in close cooperation with the local forestry administration and targeted the uncovering of user-specific needs and climate change-related conflicts. More than 1,300 valid answers were analyzed, which made it possible to (1) identify and characterize different visitor groups, (2) identify reasons for an urban forest visit, (3) uncover the needs for infrastructure and information, (4) reflect on the survey methods used. The interesting findings include (I) the reasons for a visit highly coincide with forest-related properties in particular; however, the infrastructure preferences reveal the desire for managed greenspace; and (II) the answers obtained from the field differ significantly from those obtained online in various respects. The differences found suggest that the survey, with both online and on-site answers, is a major advantage for future studies regarding urban green infrastructure use. These results can be fruitfully used to inform urban forest management regarding user needs and create a better forestry information policy in the future.

Lemoine-Rodriguez, R., Muñoz-Robles, C., MacGregor-Fors, I.

Six decades of sprawling in a neotropical city: A case study of Xalapa, Veracruz, México

Institution: Geographisches Institut, Fakultät für Geowissenschaften, Ruhr-Universität Bochum, Germany

Keywords: urban sprawl, Green urban areas, Latin America, Land use change

The urban expansion process in Latin America takes place in absence of adequate urban planning, mostly driver by economic growth and motorization rate. Sprawled patterns of urban development can directly affect surrounding ecosystems, open space and green urban areas. In this study a dynamic analysis of urban expansion patterns in the neotropical city of Xalapa, Mexico was developed using GIS and Remote sensing means. The analysis focuses on: (1) a spatio-temporal analysis to quantify the urban expansion process from 1950's to 2010's, (2) change analysis of woody vegetation cover within the urban boundaries, and (3) land use/land cover change to measure urban sprawl from 1980's to 2010's. Digital imagery(i.e., ortho-photos and SPOT images), classified, processed and integrated into a geographic information system were used to identify the urban area (polygon) of the city, quantify land cover changes/land use changes in hinterland of the city from 1950's to 2010's. We found that, over the past six decades, the city of Xalapa has grown in similar proportions per decade, following linear growth patterns, mostly concentrated southward. Woody cover within the city maintained a similar proportion (14.7–29.9%) with respect to the city area in the study period because of the addition of patches from former surrounded areas of woody vegetation. Land use change in the surrounding area of the city went from having a transition of different uses (e.g., woody vegetation to cropland to urban; 1980's–2000's), to a direct change from woody vegetation to urban use (2000's–2010's). Landscape fragmentation over the period of study increased significantly. These results integrating remotely-sensed data and landscape metrics to monitor urban patterns and processes can be directly incorporated into urban planning and management, in a context with strong lack of spatially explicit quality information.

Inostroza, L. ^{a,b}, Zepp, H. ^b

How healthy makes us the urban green? Spatial assessment of illness related frequency and green areas at neighborhood scale in Bochum and Essen, Germany

Institution (s): ^a Universidad Autonoma de Chile, Chile; ^b Institute of Geography, Ruhr University Bochum, Germany

Keywords: NDVI, SAVI, stress, human health

The built environment mainly compounded by buildings, infrastructure, and green spaces constitutes the ecosystem for human beings. Yet, little is known about the relationships between urban form and urban health. Up to date research on urban health and epidemiologic issues runs parallel and disconnected from the central issues concerning urban planning and design, i. e. disciplines determining the morphological aspects in the built environment experienced by urban dwellers. Indeed, there is a strong lack of practical, operational and theoretical linkages between health and planning, where more empirically oriented research is deeply needed. In this research, a spatial assessment of urban health and urban form was attempted. The objective was to find spatial linkages between specific aspects of urban form at the neighborhood scale and certain health problems monitored in a population sample. The analysis focused on the positive effect of urban green over a set of specific illnesses. The method was fully implemented in a spatial information system, using geographically weighted regression modeling to isolate the possible effect – yet to be better understood from a theoretical point of view– of green areas on urban health. Our approach is oriented towards urban planning, for which the environmental properties of urban green were assessed by the quantification of characteristics of the urban green, in a manner ready to be used in urban planning. While a straightforward causality is not possible to establish between urban form and health, we found substantial empirical evidence of the positive influence of green over health conditions of the tested population. However, it is a scale dependent problem where an adequate representation of green at small scales matters.

Cortinovis, C. ^a, Zulian, G. ^b, Maes, J. ^b, Geneletti, D. ^a

***Assessing the recreation potential of green infrastructures in Trento (Italy):
a city-scale application of the ESTIMAP model***

Institution (s): ^a University of Trento, Department of Civil, Environmental and Mechanical Engineering; ^b European Commission, Joint Research Centre (JRC), Directorate D - Sustainable Resources, Unit D3 - Land Resources, Italy

Keywords: recreation potential, urban green infrastructures, ESTIMAP, local scale

Urban green infrastructures, including urban parks and natural areas around the city, are important places for close-to-home recreation. Here, urban residents find opportunities for a wide range of outdoor activities that promote physical health and mental restoration, thus enhancing wellbeing and quality of life. Assessing the potential of urban green infrastructures to support recreation is difficult, since natural values, presence of man-made structures, location, and accessibility, all have an influence on recreation potential.

The ESTIMAP recreation model was developed to map nature-based recreation potential at the European scale. The model is based on three consecutive steps that assess:

1. the Recreation Potential, i.e. the suitability to support different types of recreation activities based on the intrinsic characteristics of the areas;
2. the Recreation Opportunity Spectrum, which combines the Recreation Potential with information about accessibility, i.e. proximity to residential areas and transport infrastructure;
3. the Number of potential trips, which adds information about the distribution of the potential users.

The research investigates the applicability of the model to the city of Trento (IT). Due to its location, Trento offers a wide range of opportunities for nature-based recreation, from activities typically conducted in urban parks to activities carried out in nearby forests and mountain areas (e.g., hiking, mountain-biking, climbing). Therefore, the city represents an interesting case to test the applicability of the model to urban contexts characterized by easily accessible nature-based recreation options beyond the urban boundaries.

Input data used to run the model and maps obtained through the application are presented and discussed, also in comparison with other ongoing case studies and with the results of the EU-wide assessment. The research offers a preliminary evaluation of the model as a tool for planning and management of urban green infrastructures across different contexts.

La Rosa, D., Takatori, C., Shimizu, H.

A planning framework to address the preferences from different social groups for accessibility to urban greenspaces

Institution: University of Catania, Italy

Keywords: greenspaces, urban planning, indicators, framework

The role of urban greenspaces is widely considered having positive implications for health and providing a complete set of ecosystem services in cities. This paper presents a planning framework for urban greenspaces that considers needs and demands of accessibility from different social groups (e.g. children and elderly people). It is designed to achieve different objectives in terms of the planning and design of GSs and to be used in different urban contexts. The framework is structured in four interrelated phases that take place during a general urban planning process of greenspaces: the definition of the planning objectives, the modelling of accessibility to the new or existing greenspaces, the interpretation of results from the accessibility modeling and finally the definition of planning decisions that are made to achieve the objectives that have been defined. A set of spatially explicit indicators as proxies to measure the accessibility to existing open spaces is proposed, combining socio-economic data derived from census with land-use and road network information, so to take into account existing interactions between social demands, urban environment and the present semi-natural features in cities. Two applications of the framework are proposed for the city of Catania (Italy) and Nagoya (Japan), cities characterized by different configurations of greenspaces and high density urban contexts and the presence of particular social groups. Planning implications for the 2 case studies are discussed.

van Vliet, J., Hersperger, A. M.

Alternative urbanization trajectories in Europe and their landscape ecological consequences

Institution: VU University Amsterdam, The Netherlands

Keywords: land use change, urban systems, model, peri-urbanization

Model-based assessments have frequently been used to assess future land change scenarios and the impact of policies on this. Land use classes in these models often include a rural-urban dichotomy, where both are mutually exclusive and where urban land has no ecological function. While this simplification might hold in some world regions, it cannot meaningfully represent most of Europe, which can be characterized by a mosaic of urban and rural land uses. Moreover, such simplistic land use representation is not able to assess the multiple different trajectories urbanization can take. We present a model-based assessment of urban land-change trajectories in Europe and assess the impact of different trajectories using a number of landscape ecological indicators. In this assessment, urban land is characterized by its land cover composition as well as by its population density. With this more nuanced characterizations we assess two different scenarios for urbanization with otherwise similar land use demands: one that is characterized by urban expansion and one that is characterized by urban densification. We assess the outcomes in terms of urban land take, impervious surface, and forest cover, and find large differences between both scenarios, but also between different countries. As urban land area and population density are included in the characterization of land systems, the urbanization trajectories as well as landscape ecological consequences are endogenous to the model.

Merekalova, K., Kharitonova, T.

Urban geosystems morphological pattern as a basement for landscape functions assessment

Institution: Lomonosov Moscow State University, Faculty of Geography, Russia

Keywords: urban geosystems, landscape morphometry, integral value, landscape functions

City management should benefit from adequate representation and assessment of urban territory. Structural organization of nature environment and local tangible and intangible culture may be represented by means of urban geosystem mapping. Conception of urban geosystems is based on geosystem theory and represents both natural and anthropogenic landscape pattern. Urban geosystem description includes parent material, relief, geological processes, moisture content, soil sealing, vegetation and building density, height, functionality, architectural look and condition, littering and aesthetic value. The main factor of an urban geosystem formation and functioning may vary along the city – in some geosystems natural processes are mostly controlled by relief, in other – by building density or vegetation. The mapping and assessment of urban geosystems were carried out in a historical residential town Tarusa (Central Russia) on the base of field research, analysis of DEM and satellite data. All urban geosystems were classified according to anthropogenic transformation degree (from natural landscapes to industrial zones) and relief morphology (from flat moraine planes to ravines and steep valley slopes affected by landslides). Integral value of urban geosystems is derived from independent ecological, cultural-historical and aesthetic values and assessment of natural risks. Indicators of ecological value (as criteria for ecological assessment) we consider environment littering, the state of vegetation and soil sealing which shows the rate of disruption of natural circulations. Cultural-historical value is defined from historical documents, poetry and paintings assigned to a place and its current condition – architectural heterogeneity and disturbance. Aesthetic attractiveness includes perspective, visibility, attractive points et al. Assessment of natural risks considers erosion, karst, river flooding, waterlogging and landslide and is based on the character of parent material, relief analysis and surface water reallocation caused by buildings and soil sealing. Assessment of Tarusa urban geosystems integral value has identified the problematic sites of the town and specified the areas for prior attention of urban planners. The zones with lowest building density and at the same time with lowest natural risks, lowest ecological and cultural-historical values were recommended for urban development. The territories with high ecological, aesthetical and cultural-historical value were suggested to receive the status of protected areas. The sites with high natural risks and low ecological value were specified for restoration, greening and transformation into recreational zones. Various combinations of particular values give us the best options for spatial analysis of landscape functions and landscape planning of urban territory.

Remote Sensing contribution towards the understanding of ecosystem functioning and ecosystem accounting. Part I

Baibar, A. S., Diakonov, K. N., Kharitonova, T. I.

Monitoring forest productivity by means of remote sensing, dendrochronology and eddy covariance measurements

Institution: Lomonosov Moscow State University, Russia

Keywords: remote sensing, NDVI, dendrochronology, eddy covariance

The remote sensing and dendrochronological analysis are well developed methods widely used for monitoring forest productivity. Both methods are indirect and applicable for monitoring of different forest elements. Satellite data better corresponds to canopy biomass, dendrochronological data describes timber increment, while forest is a complex ecosystem with different plant life forms and stratification. Since both data collection is rather quick and easy the use of this methods is very appealing. Analysis of joint dynamics of Normal Difference Vegetation Index (NDVI) and tree ring growth and its comparison to corresponding values of Net Ecosystem production (NEP) derived from eddy covariance measurements should verify accuracy of this methods for estimation of the whole ecosystem productivity. Timber sampling was carried on in Central Forest Nature Reserve, Russia, at four coniferous forest ecosystems in close proximity to eddy covariance towers. For further analysis the curve of annual tree increment was split into low-, middle- and high frequency fluctuations. NDVI were calculated for each site using Landsat images 4-5, 8. The series of NDVI values are 23-years long (from 1985 to 2015 with 7 gap years due to high cloudiness) and characterize the canopy state in the period of highest vegetation (July, 15-25). The series of NEP values are 16-years long (from 1998 to 2014). The research revealed the reliable negative correlation (0.5-0.75) between middle frequency dynamics of NDVI which has a tendency to decline over three last decades, and annual radial increment, which is growing. High frequency fluctuations of parameters proved to be absolutely independent, any correlation of radial growth with NDVI of previous vegetation period also wasn't found. Though pair correlation between NEP and NDVI and NEP and tree ring growth is sufficiently high which allows to use multiple regression analysis. Analysis shows that joint contribution of NDVI and annual radial increment to NEP describes only 56% of its variation. Which proves reliability but inconsistency of both indirect methods, while eddy covariance measurements is inaccessible for wide use.

Duflot, R., Vialatte, A., Sheeren, D., Fauvel, M.

Predicting ecosystem services in agricultural woodlands from airborne hyperspectral images

Institution (s): Dynafor, INRA, ENSAT - INP Toulouse, France

Keywords: remote-sensing, hyperspectral images, ecosystem services, woodland, agricultural landscape

Ecosystem services has become a major sociological, ecological and economic issue worldwide. Woodlands of agricultural landscapes provide valuable services although there are often underestimated and poorly used. Identifying and mapping these services at large scale is an important step to locate the available resources and to plan future management. However, accurate mapping of these services remains challenging. Remotely-sensed data enable to cover large area and to describe in a novel way agricultural landscapes, offering a possibility to predict ecosystem services at wide scale. This seems particularly relevant, as ecosystem services of isolated, small agricultural woodlands may strongly depends on landscape-level processes. We assessed the contribution of vegetation indices derived from high spatial resolution hyperspectral images in predicting ecosystem services provided by agricultural woodlands, as compared to predictions based on land cover. 28 woodland patches were sampled for supporting, regulating and producing ecosystem services. Airborne hyperspectral images were acquired for the study area, at a 2m resolution. Usually, hyperspectral-derived vegetation indices are reduced (many pixels to plot or landscape-level indices) using descriptive statistics (mean, standard deviation, minimum and maximum values). However, this approach may lose a lot of information, especially at landscapes scale, where several objects with various spectral signatures are present. We propose a hyperspectral landscape description based on the full distribution of vegetation indices across landscapes. We used gaussian mixture models (gmm) of pixel distributions within each landscapes, and introduced a L2 distance based on these approximated distributions. Finally, we used a k-nearest neighbors approach to predict ecosystem services (similarity-based prediction). The quality of predictions were compared across three landscape representations: land-cover, descriptive statistics of hyperspectral data, and gmm-based description of hyperspectral data. Preliminary results suggest that gmm are much better proxies than descriptive statistics for estimating the distributions of vegetation indices across landscapes and seems to be better predictors of ecosystem services.

Guo, A., Coops, N. C., Gergel, S. E., Bater, C. W., Nielsen, S. E., Stadt, J. J., Drever, M.

A network-based approach to estimate habitat structural connectivity using airborne lidar remote sensing

Institution: University of British Columbia, Canada

Keywords: LiDAR, habitat structure, network analysis, landscape connectivity, spatial prioritization, biodiversity monitoring

Structurally complex forests provide a variety of niches for species with different habitat specializations. Forest stands with high structural complexity have been identified as critical habitat for biodiversity monitoring and sustainable forest management practices. Landscape-level, spatially-connected habitat patches sustain ecological processes and species persistence, which are essential for regional conservation planning and the maintenance of biodiversity values. Anthropogenic disturbances, such as forest harvesting, result in losses of available habitat area and landscape connectivity. Therefore, forest resources management should incorporate spatial prioritization to reduce the negative impact of anthropogenic disturbances on habitat suitability. Using a regional airborne light detection and ranging (LiDAR) dataset, we identified critical habitat structure in order to create a habitat network for graph-based network analysis. The point cloud data derived from airborne LiDAR in the managed forests of the province of Alberta, Canada, were summarized into six structure-related LiDAR metrics for a two-step cluster analysis that resulted in eight unique vegetation structure types. The structure type with high structural complexity in deciduous forest in the study area was used to identify critical habitat patches to construct the habitat network. Network connectivity analysis was applied to compare the conservation outcomes of two spatial prioritization schemes based on habitat area and inter-patch connectivity. Patch importance were ranked according to connectivity metrics and used as criteria for formulating two conservation prioritizations focusing on protecting large habitat patches only, or both habitat area and connectivity. Land cover change scenarios using the two different prioritization schemes were simulated to model changes in network connectivity. The two simulation scenarios resulted in different spatial configurations and change dynamics. We found the conservation prioritization scheme that protected both large, core habitats and critical connector patches resulted in a more connected habitat network. In this study, we present a framework that integrates LiDAR - derived habitat structural attributes with network connectivity analysis at landscape level in order to prioritize the conservation of important forest habitat patches. Both habitat area and inter-patch connectivity are critical factors in maintaining habitat connectivity. This multi-disciplinary approach can serve as a prototype for multi-criteria monitoring and optimization of forest resources management and conservation planning.

Bazezew, M. N. ^a, Hussin, Y. A. ^b, Kloosterman, H. ^b

Integrating Airborne LiDAR and Terrestrial Laser Scanner derived forest parameters for accurate estimation of above-ground biomass/carbon in Ayer Hitam tropical forest reserve, Malaysia

Institution (s): ^a Department of Natural Resources, College of Agriculture and Natural Resources, Dilla University, Ethiopia; ^b Department of Natural Resources, Faculty of Geo-information Science and Earth Observation (ITC), University of Twente, The Netherlands

Keywords: ALS, canopy, CHM, multi-resolution segmentation, point cloud data, TLS

Parameters of individual trees can be measured from Airborne LiDAR scanner (ALS) point cloud data provided that the laser point is dense enough and trees in multiple canopy layers are visible from the top. However, retrieving tree parameters in a complex biophysical environment of tropical forests using single LiDAR technology could still be inadequate. This paper presents new approaches of acquiring tree parameters for estimating above-ground biomass (AGB) through integrating ALS and Terrestrial laser scanner (TLS). Two ways of data acquiring were implemented: ALS data was used to detect and extract upper canopy tree parameters while TLS complemented for tree stems and lower canopy trees height measurements. Initially, multi-resolution segmentation of ALS canopy height model (CHM) was executed to delineate individual tree crowns of upper canopy trees. The result showed segmentation accuracy of 73% and 1:1 correspondence of 78% with the reference tree crowns. About 62% of trees were delineated from ALS-CHM while the remaining lower canopy trees were identified from TLS data. ALS detected trees were then co-registered and linked with the corresponding tree stems detected by TLS for diameter at breast height (DBH) use; 93.5% of the field recorded trees were recognized from TLS data for DBH measurements. DBH derived from TLS was validated using manually measured-field DBH, and coefficient of determination (R^2) of 0.989 and root mean square error (RMSE) of 1.30 cm (6.52%) were achieved. Two-way tree height validations were implemented; upper and lower canopies tree heights. The R^2 and RMSE between field and ALS-measured upper canopy trees height were found to be 0.61 and 3.24 m (20.18%), respectively. R^2 of 0.69 and RMSE of 1.45 m (14.77%) were achieved between field and TLS-based lower canopy trees height. The AGB or carbon regression model that the relationship between AGB derived from remote sensing (ALS + TLS) and traditional field method at the plot level resulted in R^2 of 0.97 and RMSE of 0.62 Mg (7.64%) where field method underestimates with the bias of -0.289 (-3.53%) Mg.

Ecosystem services concept in participatory planning processes through new technologies

Spyra, M. ^a, Fürst, C. ^a, Kleemann, J. ^b, Palacios Agundez, I. ^c, Vázquez Navarrete, C. J. ^d, La Rosa, D. ^e, Cetin, I. N. ^f, Rozas, D. ^g, Geneletti, D. ^h, Adem Esmail, B. ^h, Albert, C. ⁱ, Picchi, P. ^h, Kopperoinen, L. ^j, König, H. ^k, Koo, H. ^g

Ecosystem services – a new Esperanto to facilitate participatory planning processes?

Institution (s): ^a Martin Luther University Halle-Wittenberg, Germany; ^b Helmholtz-Centre for Environmental Research, Germany; ^c University of the Basque Country, Spain; ^d The Colegio de Postgraduados, Mexico; ^e University of Catania; ^f Gebze Technical University, Turkey; ^g University of Bonn, Germany; ^h University of Trento, Italy; ⁱ Leibniz Universität Hannover, Germany; ^j Finnish Environment Institute SYKE, Helsinki, Finland; ^k Leibniz Centre for Agricultural Landscape Research (ZALF), Germany

Keywords: ecosystem services, participatory planning, planning tools

Current research indicates that the ecosystem services (ES) framework was not yet systematically enough integrated in planning. Even though first case studies highlight the benefit of ES in supporting the communication between diverse actors, thus providing support in participatory planning processes. Consequently, we formulate the hypothesis that ES have the potential to be the new “Esperanto” to facilitate the translation of different actor perceptions and objectives into harmonized planning goals. The objective of our study is to showcase how ES can be made operational to support participatory planning processes and how to learn from successful examples. This research started in the EcoSummit conference 2016 held in Montpellier, France, during a side event titled “Generating practical outputs from ES studies-an interdisciplinary exchange” organized by the authors. The study is based on a survey conducted from October 2016 to January 2017 among a team of researchers and practitioners, who participated in the side event and are currently working with the implementation of the ES concept in participatory planning. We collected eleven case studies, which were characterized according to the planning context, planning scale, ES framework used, participatory planning methodology and practical outcomes obtained from planning. Later each of the case studies underwent an assessment by a standardized balanced score card, which is a matrix with questions related to the risk and advantage of using the ES concept in the participatory planning process, e.g. with regard to knowledge sharing, social networking, shared vision, actor inequality, supply-demand relationships, and the involvement of socio-ecological-economic system aspects into planning. The research method allowed us to objectively detect success or failure criteria in using ES in participatory planning. We plan to subsequently implement both, characterization of the case studies and balanced score card in an online user guidance tool that helps new-comers in the application of ES in planning to detect most suitable (similar) case studies to experience training by examples. We are going to present this tool and its application opportunities as an additional service in the context of the Thematic Working Group Planning and Management in the Ecosystem Service Partnership.

Ametzaga, I., Palacios-Agundez, I., Peña, L., Rodríguez-Loinaz, G., Fernandez de Manuel, B., Onaindia, M.

Ecosystem Services Assessment of the Basque Country contribution to the Basque Regional Planning Guideline

Institution: University of the Basque Country UPV/EHU, Spain

Keywords: transdisciplinary, community of practice, governance, planning guidelines

The Basque Country is a region of 7.230 Km² and around 2.200.000 inhabitants in the north of the Iberian Peninsula. The governance system is quite structured and compartmentalised, leading to organizational inconsistencies that make difficult the necessary transversality in the planning. Moreover, the landscape, the economy and the social characteristics are quite diverse across the territory. The main land use is forest exotic plantations (28%) autochthonous forest (18%) and crops-pastures (27%). The highest hierarchy in landscape planning is Regional Planning Guidelines under the Basque Government their priority being (1) Territorial cohesion; (2) Nature protection mechanism in urban planning; (3) Spatial planning for sustainable, integrative and participative territory.

The Ecosystem Services Assessment of the Basque Country started in 2011 (and previously we carried out an assessment in Biscay county), but the specific contribution to the Basque Regional Planning Guidelines started two years ago.

In the assessment, an active transdisciplinary core team integrated by politicians, technicians of different administration bodies, researchers specialized in the region and local NGO representatives was established from the outset. This transdisciplinary core team works actively as a community of practice setting objectives and research questions, sharing data, identifying data availability as well as data needs, finding solutions to identified problems and more importantly, creating an iterative learning and practice process. Many relevant experts and politicians have been added along the way. Our working methodology has both, a clear coordination strategy that facilitates fruitful steps, and a flexible and fluent mechanism that allows creativity and facilitates real implementation of the assessment results and findings.

Our assessment has gained relevance among local policy-makers and stakeholders thanks to the obtained international linkages and scientific recognition. Our collaborative and participatory working approach has been crucial for gaining relevance and acceptance among stakeholders, as well as for making possible the real implementation in management of the assessment results and findings. The applied organization structure and working approach helps to create bridges between science, society and policy-making, and has lead us to participate in the renewal of the Regional Planning Guidelines incorporating the Ecosystem Services concept and content. On one hand, we have participated on the Expert focus group discussion specific to the formulation of the Regional Planning Guidelines. On the other hand, we have carried out diverse activities from the Basque Assessment that have contributed to the inclusion of ES concepts and results in the Regional Planning Guidelines. Concretely: 1) a workshop with experts of different administration bodies (technicians) and politicians, after which politicians decided to include ES in the Regional Planning Guidelines; 2) transdisciplinary working group on landscape planning with experts of different administration bodies (technicians), where in depth work is carried out to include ES in planning; 3) Technical collaborative work with people involved in the elaboration of the guidelines facilitating ES maps and other relevant information.

All this collaborative work has led to the inclusion of Ecosystem Services in the Regional Planning Guidelines of the Basque Country, which is the main landscape planning instrument of the region.

Picchi, P., Geneletti, D., Verzandvoort, S., Hendriks, K., Smith, A., Stremke, S.
Ecosystem services for participatory planning and design of sustainable energy landscapes: a case study from Zeeland, The Netherlands

Institution: DICAM, University of Trento, Italy

Keywords: renewable energy, ecosystem services, participatory mapping, trade-off

The transition to a low carbon future is unavoidable and it needs procedural and substantial knowledge for planning and designing the landscape in a sustainable way, where renewable energy technologies must not cause crucial trade-offs between the provision of energy and the supply of other ecosystem services. The definition of sustainable energy landscape contemplates the ecosystem services framework. The sustainability is properly based on the fact that the renewable energy supply should not cause crucial trade-offs with other ecosystem services. A method for achieving sustainable energy landscapes has been recently formulated and is based on the application of long term visions for planning and design the landscape: the Five-step Approach (FSA). The increase of trans-disciplinary procedures in managing the energy transition requires that ecosystem services values are in effect included in planning and design. We included an ecosystem services assessment in the FSA. The aim of this contribution is to show how the introduction of an ecosystem services approach to long term visions for planning and design sustainable energy landscapes can have added value. To this end, the assessment of ecosystem services as well as the siting of renewable energy technologies are conducted in workshop by means of participatory mapping for an island in the Province of Zeeland, the Netherlands. Results of the case study indicate that the participatory mapping of ecosystem services supports the local community in understanding the present conditions and in the assessment of future scenarios when possible spatial trade-off among ecosystem services are considered.

Koo, H. ^a, Fürst, C. ^b

Impact assessment of land use changes and land use strategies on the provision of ecosystem services in sub-Saharan Africa

Institution (s): ^a Center for Development Research (ZEF), University of Bonn, Germany, ^b Martin-Luther-University Halle-Wittenberg, Germany

Keywords: land use change, ecosystem service, stakeholder engagement, trade-offs, land use strategy, Ghana

Understanding the relationship between land use patterns and the provision of various ecosystem services (ES) allows to consider the multifaceted effects of anticipated land use changes. In this study, we analyzed potential impacts of urbanization and deforestation, which were considered as major land use changes in northern Ghana, on the locally important ES provision. Then, we tested potential land use strategies to supplement probable trade-off effects between the services caused by the land use changes. Urbanization was defined as spatial expansion of urban/artificial surfaces to fulfill increased demand for access to diverse economic activities and infrastructure. Deforestation here was characterized as transition of tree/forest cover to other land use types to meet the land demand for cultivation, housing and infrastructure. How these conversions could influence ES supply was assessed using the GISCAME platform, which combines a Cellular Automaton (CA) and GIS modules. Especially, the CA performed as a key to spatial expression of the impact of the land use changes by reconstructing overall land use patterns synchronously conforming to rule-sets. The rule-sets to control transition conditions were defined based on the perception of the local stakeholders in order to reflect local context. The newly generated land use patterns by the CA were combined with an assessment matrix that presents the capacity of the land use types to provide ES in the GISCAME platform, which visualized land use change impacts on the ES balance in a spider chart. As an attempt to seek a countermeasure to relieve undesirable trade-offs led by the changes, land use strategies that were perceived to be effective to enhance ES by local stakeholders were simulated on the converted land use patterns. The effects of implementing the strategies were displayed as an increase or a decrease in the local ES balance compared to the status of the land use changes. Therefore, the results could offer an insight into how to cope with possibly triggered ramifications by the major land use changes in a way to avoid ES losses or minimize trade-offs.

The nexus – interfaces between land-uses and ecosystem services

Deconchat, M., Andrieu, E.

Forests for agriculture: new perspectives in European landscapes

Institution: INRA-Dynafor, France

Keywords: forest, agriculture, landscape

During the last centuries, most of the European landscapes have been strongly impacted by the increasing disconnection between farming and forestry. When agriculture developed, it was to the detriment of the forest, and even in regulations, forest and agriculture were rarely considered as linked issues. This disconnection is also true for scientific research, as agronomy and forest sciences followed parallel routes for decades. However, landscape ecology is one of the few disciplines where both were almost equally considered as components of a same complex system. In this presentation, we argue that in the future, stronger links between forest and agriculture will become more important and that we need to engage our research towards a better understanding of how these two landscape components interact. We identified 4 types of links between agriculture and forests. The first one is that classical forest wood-based products (timber, firewood) could become parts of farming activities. The demand for wood-based energy is forecasted to increase in the near future, as it is a renewable source of energy easily available. Farmers can benefit from additional economic resources provided by wood product sale, and they have also the need for energy. They have an access to this scattered resource, and they have the relevant skills to use the equipment for logging. Thus, the role of farmers in the increase of forest harvesting, and its consequences, must be anticipated. The second one is the ability of forests to produce useful resources for agriculture. There are several examples, such as the use of fence posts, of wood chips as litter for living stocks, or of charcoal in crops. With a better knowledge of these resources, farmers may reduce their dependency to external sources and contribute to local markets. Ecosystems services is the third, and very important, interaction. There is a growing literature that shows how many very important ecosystem services for agriculture are related to the surrounding natural habitats, and especially forests. They are shelters for organisms who help pest regulation in crops, or for pollinators, or for local climate buffering. Landscape ecology has a lot to say about these ecosystemic interactions and should focus more on how forest management may be modified to provide better services to nearby agriculture. Finally, many of the agroecological recommendations are basically inspired by the functioning of forests and how these ecosystems are able to stay productive and resilient. Agriculture has a lot to learn from forest science, and these scientific links must be supported. These perspectives open up new questions for landscape ecology and they are arguments for a more systemic understanding of the complexity of landscapes, including equally forest and agriculture (and other land uses), towards a better management of the full range of available natural resources.

Betancur-Corredor, B., Loaiza-Usuga, J. C., Denich, M., Borgemeister, C.
Lessons from farmers performing agroforestry for restoration of gold mine spoils in Colombia

Institution: Center for Development Research (ZEF) - University of Bonn, Germany

Keywords: agroforestry, farmers knowledge, mining, restoration, land management

Alluvial gold mining generates a vast amount of deposits that cover the natural soil and negatively impacts riverbeds and valleys, causing loss of livelihood opportunities for farmers of these regions. In Colombia, more than 79,000 ha are affected by alluvial gold mining, therefore developing strategies to return this land to productivity is of crucial importance for the country. A novel restoration strategy has been created by a mining company, where the land is restored through the establishment of agroforestry systems, in which agricultural crops and livestock are combined to complement reforestation in the area. The purpose of this study is to capture the knowledge of farmers who perform agroforestry in areas with deposits created by alluvial gold mining activities. Semi structured interviews were conducted with farmers with regard to the following: indicators of soil fertility, management practices, soil heterogeneity, pest outbreaks and weeds. In order to compare the perceptions of soil fertility of farmers with physicochemical properties of soils, the farmers were asked to identify spots within their farms that have exhibited good and poor yields. Soil samples were collected in order to correlate farmer's perceptions with soil physicochemical properties. The findings suggest that the main challenge that farmers face is the identification of fertile soil for crop establishment. They identify the fertile soil through visually analyzing soil color and compaction as well as the use of spontaneous growth of specific plants as indicator of soil fertility. For less fertile areas, nitrogen fixing plants are used as green manure to restore soil fertility for crop establishment. The findings of this study imply that if gold mining is followed by reclamation practices that involve the successful establishment of productive farmlands, agricultural productivity of these lands might improve, increasing food security of the affected communities.

Grimaldi, J., Trambouze, W., Dufourcq, T., Vergnes, M., Pelletier, C., Helen, F., Fieuzal, R., Houet, T., Bustillo, V.

Can intercropped trees mitigate heat and drought effects on grapevines?

A study of microclimate patterns in agroforestry vineyards, Southern France

Institution: CESBIO Center for Spatial Studies of the Biosphere, France

Keywords: agroforestry, viticulture, water stress, microclimate, landscape structure

The vineyards located in Southern France frequently undergo heat waves and droughts, which may become even more frequent and intense with global warming. Water stress has ambiguous impact in viticulture as it both influences the yield in grape and the wine quality of berries, and potentially with opposite trends. Among agroecological approaches, agroforestry practices used to be frequent with wine cultivation but suffer poor. It consists in intercropping trees inside the vine rows or at hedges. The intercropped trees can modify the microclimate and potentially the vine response to water stress through three mechanisms: shading, wind breaking and evapotranspiration. In this context, we investigate the impacts of intercropping trees on vine heat stress and their potential consequences on grapevine yield and vine quality. Different types of plantings are considered in order to assess the variability of tree impacts depending on the tree morphology and their landscape organization. For this purpose, three modern types of agroforestry vineyards were surveyed in 2016 at Lagardere, Lapouyade and Restinclières, respectively. They include tree rows of either timber wood trees or fruit trees that were planted from 9 to 20 years ago, simultaneously with *Vitis vinifera* cv Sauvignon gris, Merlot and Grenach respectively. At every study sites, Infrared Thermal (IRT) images of centimetric spatial resolution were captured in July and August, as well as stereoscopic orthophotos and multispectral reflectances, through Unmanned Aerial Vehicle flights. Moreover, air temperature and relative humidity inside the canopy as well as vine vigor, grape yield and grape chemical composition at harvest (September) were carried out in every sites on a selection of about 50 vine stocks. Grapevine canopy was mapped with supervised random forest classification and a connected component segmentation. The grapevine canopy maps that we obtain were used i) as filters to calculate a Crop Water Stress Index from IRT images, ii) and to calculate landscape metrics such as the 3D density of vegetation and the landscape grain. At Lagardere- the youngest and most widely spaced vineyard we studied- CWSI showed no correlation with grapevine response, either in terms of yield or of grape composition. Two hypotheses are proposed: water stress may not have been sufficient enough during summer 2016 to induce a physiological response of the grapevine, or the intercropped trees may not play significant effect on the vine water regime at this stage of development. Also at Lagardere, patterns of cool maxima air temperatures were observed inside the grapevine canopy of the first vine rows neighboring the tree rows, especially when evaporative demand was high. Statistical analysis showed good correlation between these temperature patterns and the landscape grain metrics: the coolest daily maxima were reached where the vineyard landscape was more open (highest landscape grain) than the rest of the vineyard, suggesting that the young tree rows may open the vineyard landscape and help cooler air to flow until the inner grapevines. Similar analysis will be performed on the two other vineyards in order to compare these preliminary results with different vegetation and pedoclimatic contexts.

Amartuvshin, A., Lkhagdorj, B., Chen, J.

Raw cashmere price supply function, goat number and its impact on grazing

Institution: University of the Humanities, Mongolia

Keywords: raw cashmere price, supply function of raw cashmere, goat population, EVI indices, grazing, Mongolia

Mongolia is a small open country in the world raw cashmere market and price of raw cashmere will lead goats heads increase incessantly. Cashmere produces high end products at the world market which resulted aggressive increase in goat heads since 1990 in Mongolia since main herders-producers cash income come from raw cashmere sales. This study focused on how market force drives raw cashmere supply by estimating raw cashmere supply function. We used simply OLS regression analysis to estimate supply function of raw cashmere and price elasticity of the supply. Further, we checked how raise of goat heads is correlated with EVI indices. Statistical analysis conducted to see how EVI indices and goat heads increase related estimating simple correlation coefficients. Even though the coefficients do not build any causal relationship among the variables, we can clearly see how they varies systematically on different economic regimes.

Cuenca, P., Echeverria, C.

How do Protected Landscapes Associated with High Biodiversity and Population Levels Change?

Institution: Ikiam University, Ecuador

Keywords: landcover change, protected areas, fragmentation, deforestation, drivers

Most protected areas (PA) try to limit logging of forests by means of restrictions on access and use, especially in areas where local communities coexist with the forests and depend on resources derived from PAs. In such contexts, achieving full or effective protection of the forests is almost impossible. This fact has led to researching beyond PAs boundaries in order to examine large surrounding landscapes with multiple forms of properties and restriction on forests use. The present study assessed the change in forest cover and fragmentation between 1990 and 2014, in addition to the drivers that explain such changes in a landscape with the presence of PAs and high-density population belonging to the Choco-Darien biodiversity hotspot. Results indicated differences in the extent and spatial patterns of change in forest cover of PAs and their surrounding landscapes. Two PAs exhibited a tendency to increase fragmentation and lose their forests in comparison with the stable protection of the forests in other PAs during this period. However, the greatest change in forest cover and fragmentation was observed in the surrounding landscapes, where the best connection to markets and transport networks were the dominating deforestation drivers. Our findings corroborated that the PAs were a shield against the deforestation of the tropical Andean forest, especially in landscapes with high-density population. However, the fragmentation of the forest cannot be avoided around the PAs limits. It is expected that, if this tendency continues in the future, the biodiversity in the Choco-Darien hotspot will be seriously affected.

Soliev, I., Schramm, W., Theesfeld, I.

What is special about benefit sharing in REDD+?

Institution: Department of Agricultural, Environmental and Food Policy, Germany

Keywords: benefit sharing, REDD plus, forests, water, land, biodiversity

In the light of growing pressure on shared natural resources, the concept of benefit sharing has been gaining an increasing importance. Benefit sharing within the REDD+ initiative (reducing emissions from deforestation and forest degradation and the enhancement of forest carbon stocks) under the UN Framework Convention on Climate Change (UNFCCC) has been proposed recently, and knowledge about the processes and outcomes of REDD+ projects is still scarce. Through the lens of benefit sharing systems in other resource domains (water, biodiversity, land), we aim to initiate discussion on how economic, social and environmental dimensions of benefit sharing are emphasized in REDD+ in supporting various green and blue services of forests landscapes. The notion of benefit sharing is actively discussed within the context of transboundary water governance, biodiversity conservation, and large land acquisition deals. Mostly these discussions are independent from one another and there is little awareness of benefit sharing across the disciplines. The origins of the concept can be traced back to the earlier game theoretic concepts such as Pareto improvement, as well as the negotiation research of the 1980s. The main idea of benefit sharing is to find solutions that will allow augmentation of total benefits derivable from shared resources so that each implicated party could gain more benefits than if they did without collaboration. At the same time, the “getting people to one table and talk” is promoted through the concept, stimulating constructive approach in problem-solving among different groups on various levels. We investigate emerging benefit sharing trends within REDD+ and look more closely at examples from Ghana, Tanzania, and Uganda. In the context of REDD+, the emphasis on economic, social or environmental dimensions seems to be determined at the national level that could be explained by the less tangible and measurable outcomes of carbon sink activities and climate change mitigation. REDD+ benefit sharing clearly refers to the distribution of both monetary and non-monetary benefits generated through the implementation of REDD+ projects. In Ghana, the main challenge of REDD+ as well as of the envisioned benefit sharing is identified as those related to unclear and complex land tenure arrangements. It poses also the question of carbon rights that have no legal framework in Ghana. A second example is Tanzania whose REDD+ strategy is closely integrated into national development policies. The impacts of REDD+ here are weakened by different well-funded initiatives stimulating agricultural activity that collide with the conservation of forests. In Uganda, equitable sharing between all actors is the main emphasis, where “loss” of benefits by the powerful actors constitutes the main challenge. Even though the main idea derives from the environmental considerations of reducing emissions from deforestation, it is the system with economic returns that makes REDD+ attractive. Comparing REDD+ with trends in the other resource domains, here environmental benefits regarding climate change are mostly impossible to observe, despite environmental concern being the theoretical starting point of REDD+ benefit sharing. Therefore, social equity in terms of implications and economic returns remain the strongest drivers for REDD+ implementation.

Duflot, R., San Cristobal, M., Fauvel, M., Vialatte, A.

Understanding the complex relationships between landscape structure and various ecosystem services of agricultural woodlands

Institution (s): Dynafor, INRA, ENSAT - INP Toulouse, France

Keywords: agricultural landscape, ecosystem functioning, ecosystem services, woodland, PLS-PM

Biodiversity and ecosystem services have become major sociological, ecological and economic issues worldwide. However, understanding the complex relationships between landscape structure, biodiversity, management, ecological functions, and ecosystem services remains a challenging research question.

An important example of such complexity is the small, fragmented woodlands of agricultural landscapes, which might be influenced by both local factors (e.g. management), and the surrounding landscape, including other wooded habitats and the farmland matrix. In this work, we investigated how several aspects of agricultural landscape, woodland ecosystem and ecosystem services interact, using partial least square - path modelling (PLS-PM).

28 woodland patches were sampled for biodiversity, management intensity, and supporting, regulating and producing ecosystem services. The 1km² landscape surrounding the sampled woodland patches were described as well, using 3 landscape representations: the usual anthropological landscape (land cover/ land use), the bio-physical continuous landscape (based on remote-sensing data), and the ecological landscape (as perceived by bird communities). All three representations accounted for the farmland mosaic heterogeneity. PLS-PM was constructed as a set of linear relationships between woodland ecosystem components: biodiversity, management, ecological functions, and ecosystem services. Each conceptual block is represented by a latent variable (the concept) linked to manifest variables (the observed measures). PLS-PM enable to account for correlations and crossed relationships between the latent variables and to assess the direct and indirect effects of a latent variable on another. We compared the results obtained from the different landscape representations.

Preliminary results showed that relevant and significant PLS-PM models can be constructed and that significant relationship exist between biodiversity, ecosystem functions and ecosystem services.

Duguma, L. A., Minang, P. A., Numbisi, F. N., Alemagi, D.

The changing trends of ecosystem goods and services delivery resulting from Land cover-land use changes in Northwest Cameroon

Institution: World Agroforestry Centre (ICRAF), Kenya

Keywords: ecosystem goods and services, multifunctionality, degradation, land cover Land use (LCLU)

In rural landscapes, the delivery of ecosystem goods and services (EGSs) depends on effective management of land cover and land uses (LCLUs). Rural landscapes are experiencing significant changes of LCLUs mainly aggravated by an increase in human and livestock population as well as increased levels of ecosystem degradation. The aim of this study is to link LCLU with ecosystem services and derive the extent to which multifunctionality of landscapes is changing overtime. The study was conducted in Bamenjing landscape in Cameroon. We employed standard GIS and remote sensing techniques to capture the changes in LCLUs from 1978 to 2013. Through focus group discussions, residents of the landscape associated the LCLUs with types of EGSs delivered by the landscape. Specific groups of the community (particularly the elderly members) were also interviewed to understand how their own plots have shifted from one LULC to the other since 1970s. Based on the changes reported and computed using GIS-RS techniques, the conversion and degradation probabilities of LCLUs was assessed. The results revealed: 1) Areas providing water services, construction materials, conservation and feed (pasture) functions shrank by 14, 29, 30 and 20% respectively between 1978 to 2013. 2) Areas providing residential and commercial function, food crop production and cash crop production increased by 180, 25 and 33% respectively from 1978 to 2013. 3) The highest LCLU conversion probabilities were for forest and savannah with 41 and 76% respectively. 4) The highest degradation probabilities were recorded for forest (52%) and savannah (24%). Overall, there was significant decline in the extent of multifunctionality in Bamenjing landscape due to the observed conversion and degradation trends. Reversing this problem requires devising incentive infrastructure that can motivate residents to maintain LCLUs that provide multiple EGSs or at least maintain the balance between maintaining those that provide diverse benefits and the rest that are driven by necessity.

Forests and Landscapes - social-ecological systems, climate and global change impacts

Sandlerskiy, R., Puzachenko, Y. G., Krenke, A. N.

Climate-regulating services of landscapes in the southwest part of East European plain in Russia

Institution: A.N. Severtsov Institute of Ecology and Evolution RAS, Russia

Keywords: remote sensing data, land cover climate, sustainability

Ecosystem services actually show the relationships of various forms of human interaction with different properties of nature, integrated into the conception of the landscape. Supporting ecosystem services - the natural processes that are material basis for services directly used by human in his material information interaction with nature. The most important supporting services are physical and geographical conditions, and first of all, the climate in all of the numerous direct and indirect effects on human and the effectiveness of his social and economic activities at the existing technological level of development. Forest ecosystems are the source of a large number of providing ecosystem services (resources directly consumed by society - wood, wild plants, etc.). Technologies for the evaluation of these services are relatively developed in forestry (forest taxation and inventory). Evaluation of supporting and providing services requires a deeper knowledge of the mechanisms of ecosystem functioning and, above all, the interaction of the landscape cover, as a combination of ecosystems, and the climate. Regulation services include regulation of local climate, water regime, erosion processes. Remote sensing data allows estimating the main parameters of solar energy transformation over a wide range of scales and, accordingly, to estimate the spatial heterogeneity of the landscape structure that determines the local air circulation. Analysis of digital elevation models on different hierarchical levels makes possible to estimate the contribution of the relief to the formation of the field of these parameters. Calculation of the relationship between the average annual climate parameters (incoming solar radiation, temperature, precipitation, wind speed, etc.) from databases of different spatial scales allows quantifying the contribution of different communities (active surfaces and their combinations) to the formation of a temperature and precipitation field. A method to assess the ecosystems services on regional scale using MODIS multispectral measurements (MOD09GA) was developed. It was applied to describe the spatial variability of relation between supporting ecosystem services (biological productivity, heat flux, evapotranspiration costs) and climatic conditions (temperature and precipitations from Worldclim database). Analysis has shown a high contribution to the regulation of heat flux (temperature) and precipitation by forest vegetation. The contour of positive feedback between the forest and precipitation generates a trigger effect and a sharp boundary in the transition from the forest to the steppe. The obtained results allow to state that the forest is the main factor of self-regulation in the "biosphere and climate" system. It is shown that the evaporation cost is closely related to the average temperature of the month and to a lesser extent with precipitation according to WordClim. However, this relationship is expressed only for the forest zone. The relationship between energy variables and climate variables is such that they allow us to conclude that there is a significant positive feedback between the forest and the atmosphere, which, inter alia, determines the discreteness of the boundary between the forest and the forestless areas.

De Zoysa, M.

Urbanization and climate change: transition for and transformation of urban forestry in Sri Lanka

Institution: University of Ruhuna, Sri Lanka

Keywords: livelihoods strategies, land use practices, forest connectivity

Rapid urbanization in Sri Lanka shows that 50% of its projected 22 million population expected to be living in cities by 2020. The concept of climate resilient cities is applied on countrywide townships maintaining its ecosystem services and functional integrity. Urban exposure to climate change in Sri Lanka is changing the patterns and ecological consequences of the process of urban forest are in transition. Urbanization and climate change impacts on cities is altering livelihoods strategies and land use practices while demanding: provisioning, regulating, supporting, preserving and cultural services of the ecosystems. Transformation of urban forest on climate change and urbanization is based on ecological, institutional, political, social and economic dimensions in Sri Lanka. Urban forests have a diverse structure where trees are found in stands, arranged in lines along streets, and as single trees. Urban forests are consisted of remnants of native forests and deliberately grown trees with vary in composition, diversity age, health status and ownership patterns. Climate change mitigation and adaptation by urban forests sustain ecosystem services including flood in rainfall intensive areas; carbon sequestration; micro-climate moderation to reduce urban heat island effects; and reduction of GHG emissions from landfills by uptake of wastes for recycling. Biodiversity and conservation planning of urban forests are concerning connectivity of gardens, forest and wild margins in urban landscapes. Urban forests reduce the vulnerability of the urban poor and enhance their coping capacity by reducing the incidence of environmental hazards and creating green jobs. Sustainable urban forest management integrated into urban planning could play an important role in mitigation and adaptation of climate change impacts in urban areas of Sri Lanka.

Sanders, T., Hauck, J., O'Brien, M., Altenbuchner, J., Jansen, S., Esquivel-Muelbert, A., van Waveren, C., Breda, N., Hauer, L., Bloemen, J., Medlyn, B., Marra, D., Sonnenschein, R., Mund, J.-P., Böhmer, J., West, A., Galvin, S., Kitzberger, T., Torres-Ruiz, J. M.

Saving the future forests – a global early warning system for forest decline via citizen science

Institution: Thuenen-Institute of Forest Ecosystems, Germany

Keywords: global tree mortality, forest decline, forest dynamics, citizen science

Over the last decades, there have been alarming reports of an increase in tree decline and mortality world-wide. This global phenomenon poses a threat to human wellbeing by putting the ecosystem services provided by forests, such as water provision and climate change mitigation, at risk. Despite scientific and technical advances in areas of remote sensing and long-term forest monitoring networks, data on tree mortality is still limited mainly due to the small spatial scale at which it occurs, as well as its stochastic nature. These limitations inhibit our understanding of where, when, and how severe forest decline occurs across the globe, which in turn limits science, conservation, and management of these important resources. The use of local data and knowledge by non-scientific experts, such as small landowners, forest managers, and national park rangers offers immense potential for informing forest monitoring. However, this information is rarely obtained in a systematic way and seldom transmitted to the greater scientific community and decision makers. In addition, the integration of citizens into a cohesive monitoring network has untapped potential as people tend to care about the trees in their surrounding environment. The use of apps in citizen science is a well-established approach and has proven to be highly successful. However, most integration of such techniques are only local or national, focusing on input from literate/educated citizens in specific ecosystems. Our idea is to expand this concept to the global scale aiming to integrate citizens effectively into a global forest monitoring network to detect and understand forest mortality and decline. At the heart of our idea is the development and testing of a free-of-charge, open source, visually enhanced mobile app for smartphones (potential to move into other platforms). To allow for data collection in remote areas the data collection process is not web-based, i.e. data can be stored offline and uploaded once internet is available. The app will use pictograms to allow citizens all over the world to participate, regardless of their language or academic level. The app will be based on Sapelli (www.ucl.ac.uk/excites/software/sapelli), a new mobile sharing platform that allows data collection through customizable, icon-driven user interfaces. Experts involved are based in Australia, Argentina, Belgium, Brazil, Fiji, France, Germany, Guatemala, Malaysia, Spain, South Africa and the United States. Questions and challenges, we would like to discuss are, for example: • How can we encourage citizens and non-scientific experts to use the app? • How can we deal with low data quality and spatial bias? • How can the app cover different places, tree responses to climatic changes (e.g. range of responses from leaf, branch, whole tree, whole forest), taxa? • How do people perceive and interact with the forest and trees in different cultures, economies, etc.?

Kireyeu, V., Shkaruba, A.

Vulnerability hotspots associated with malfunctioning institutions of forest governance: exploring pattern, configuration, and path dependence

Institution (s): EKAPRAEKT NGO, Belarus; Siberian Federal University, Russia

Keywords: vulnerability, forest governance, social-ecological systems, institutional Inertia, Belarus

In this paper we are exploring the spatial dimension of biodiversity governance in forested nature protection areas, and establish the links between patterns and spatio-temporal dynamics of “forest governance landscapes” (Shkaruba, Kireyeu, 2013) on one side, and their vulnerability to environmental change on another one. Our methodological framework was inspired by the Ostrom’s institutional design principles (Ostrom, 1990) and her revised institutional diagnostic framework (Ostrom, Cox, 2010). We recognise the validity of these conceptual approaches for identifying the sensitivity and adaptive capacity of an institutional set-ups built around a socio-ecological system (SES); the concept of “focal situations” (Ostrom, Cox, 2010) fits particularly well the objective of identifying and mapping “vulnerability hotspots” associated with malfunctioning governance regimes. To define our mappable units, we adopted the Paavola’s et al (2009) notion of “governance regimes”, encompassing “...the whole range of customs, norms and rules that shape a particular object (e.g. the levels of biodiversity that are in fact realized)” (2009:149), implying that such objects can be geographically defined within a socio-ecological system or their group. Such governance regimes are usually representative of broader framing conditions (occurring at a national or provincial scale), and therefore can be categorised and mapped, i.e. bound to conservation mandate, ownership and/or administrative status of protected areas. In addition, SES-specific institutional set-ups are also configured according to local contexts, including the spatial properties and institutional legacies related to past configurations. In order to understand generic and location-specific dimensions of the “institutional vulnerability”, we explored misfits (e.g. spatial, temporal, functional (Young, 2002)) occurring between the institutions of biodiversity / forest governance and local biophysical and socio-economic contexts, in particular, the misfits associated with their spatial configuration and institutional inertia. The area taken to test our research assumptions, was the Bielavieža Primeval Forest (BPF). It was divided in 1944 between Belarus and Poland. We focused on the larger and more spatially diverse Belarusian part, which is almost entirely occupied by Bielaviežskaja Pušča National Park (with a UNESCO heritage site in the core zone since 1992) that went through a series of reorganisations, expansions (from 87,600 to 152,200 ha), and re-conceptualizations of the mission and conservation priorities. The period chosen for the analysis was 1950-2015. We looked at such spatial properties of institutional set-ups, as size and shape of ranger districts, configurations of boundaries (including fragmentation of areas with various conservation mandates), metric distance to HQ of Bielaviežskaja Pušča National Park and average distance from a forest block to its ranger’s office. All of them appeared to have direct implications on management routine, and such parameters as continuity of conservation mandates (indicated by a number of mandate changes over 1950-2015 and manifested by persistent management legacies), spatial fragmentation of areas under the same mandate and fuzzy borders of such areas (manifested by the level of social conflict) were the most important drivers. Based on the analysis of spatial-temporal dynamics of governance set-ups, we have mapped in BFR the vulnerability hotspots related to malfunctioning institutions, including the explored and the potential (predicted) ones.

Bui, T.

Applying system thinking in complex forest-related conflicts: case study of R'Teng 2 Village, Lam Dong, Vietnam

Institution: Institute for Technology and Resources Management in the Tropics and Subtropics, Germany

Keywords: forest-related conflicts, forest governance, system dynamics

Overall purpose of the proposed project is to seek a fresh approach to handle complex forest-related conflicts through triggering behavioral and mental changes of key actors. Viet Nam preserves 44% of total land with forest cover. The Government implements wide range of national forestry programs and joins global initiatives to improve forest governance. However, forest-related conflicts are recorded in different scales and forms. Classical approach of conflict resolution and management achieved to reduce negative effects, but not underlying causes. This proposed project will be conducted in R'teng 2 village - Lam Dong province, where several forest governance initiatives (REDD+, Payment for Forest and Environmental Services - PFES, reforestation projects) are overlapped. A recent study by the author discovered areas where forest-related conflicts appeared, that decreased the level of trust and cooperation in the society. In response, the proposed project aims to (1) demonstrate the application of System Thinking and its methodology of System Dynamics into forest-related conflicts; (2) propose an analytical framework of complex forest-related conflict systems to re-define the understanding of conflicts, search for conflict archetypes, and facilitate the identification of leverage points where potential interventions for positive behavioral and mental changes could be placed. Primary qualitative data will be collected through interviews with individuals and focus groups, then analyzed with grounded theory and discourse analysis. Participatory approach will be used compatibly during field trips. Results are expected to provide an effective approach to deal with potential conflicts for local facilitators and forestry development programs in Viet Nam.

Hermans-Neumann, K., Gerstner, K., Geijzendorffer, I. R., Herold, M., Seppelt, R., Wunder, S.

Why do forest products become less available? A pan-tropical comparison of drivers of forest-resource degradation

Institution: Helmholtz Centre for Environmental Research GmbH – UFZ, Germany

Keywords: pan-tropics, forest resources, dynamics, drivers

Forest products provide an important source of income and wellbeing for rural smallholder communities across the tropics. Although tropical forest products frequently become over-exploited, only few studies explicitly address the dynamics of degradation in response to socio-economic drivers. Our study addresses this gap by analyzing the factors driving changes in tropical forest products in the perception of rural smallholder communities. Using the Poverty and Environment Network (PEN) global dataset, we studied recent trends of perceived forest product availability considering firewood, charcoal, timber, food, medicine, forage and other forest products. We looked at 233 pan-tropical villages with forest access. Our results show that 90% of the villages experienced declining availability of forest resources over the last five years. Timber and other wood products (fuelwood) together with forest foods were featured as the most strongly affected, though with marked differences across continents. In contrast, availability of at least one main forest product increased in only 39% of the villages. Furthermore, the growing local use of forest resources is seen as the main culprit for the decline. In villages with both growing forest resource use and immigration – vividly illustrating demographic pressures – the strongest forest resources degradation was observed. Conversely, villages with little or no population growth and a decreased use of forest resources were most likely to see significant forest-resource increases. Our results thus suggest that perceived resource declines have only exceptionally triggered adaptations in local resource-use patterns to deal with scarcity, thus at the margin supporting neo-Malthusian over neo-Boserupian explanations of local resource-use dynamics.

Surayya, T.

Innovative instruments for managing and conserving Urban Ecology - select case from India

Institution: Adikavi Nannaya University, India

Keywords: ecology, sustainable development, conservation, green city

Sustainable urban ecological development warrants Greening cities (surroundings). This drive can be materialized at two levels viz. 1) organizational / institutional level and 2) Individual households. That requires financial outlays. Apart from traditional exchequer budget allocations, innovative financial instruments to raise funds includes levying cess on building plan approval tax by local administrative bodies (municipal corporation and Municipalities), provisioning in Corporate Social Responsibility (CSR) and Individual Social (S. Teki-2011) Responsibility (ISR), Public, Private and People Participation (PPPPs) and soft loans to individual households etc. Urban agriculture, including growing fruits, vegetables, cereals, pulses, flowers, corn etc., on roof / window tops, on balconies. This would render multi benefits viz. a) supply of fresh and pure food stuffs and flowers, b) financial gains, empirical evidence shows, with about Rs. 12,000 capital expenditure and about Rs. 8000, revenue / maintenance expenditure (per annum) one can get 5 to 6 times returns, c) contributes for sustainable city development and d) managing climate change.

Deconchat, M., Corcher, C., Vialatte, A.

Available wood in small forest patches and its links with plant diversity and ecosystem services

Institution: INRA-Dynafor, France

Keywords: small scale forestry, ecosystem services, plant diversity, wood production

Small forest patches, smaller than 10 ha, are very common in many European landscapes and may represent a significant amount of wood available for logging, but also a support of important parts of biodiversity and of many ecosystem services. Few is known about the status of these quantities, because of the difficulty to sample such small habitats. In this presentation, we measured the amount of wood available, according to several classes of quality, in a sample of very small forest patches in southwestern France. In the same places, plant diversity and a set of related ecosystem services were also measured. The results showed a huge variability between patches regarding the amount of available wood, with some of them with a very dense stock of wood, comparatively with national references. Plant diversity was higher in patches with intermediate level of wood stocks, the lowest richness was in the densest patches, but the plant species were then more typical of large forest flora. It seems that allowing older and bigger trees in small patches could reduce the negative impact of the small size of the patch on plant composition. Few of the other ecosystem services were related to the amount of wood but these complex relationships need more detailed analyses. These preliminary results showed that small forest patches represent a significant amount of wood that may be harvested in the future is the demand continue to increase, but this may have consequences on their conservation value for plants, but apparently not for many other ecosystem services. Management practices are also a factor that need to be considered in the future as it may modify strongly the structure of these forests.

Remote Sensing contribution towards the understanding of ecosystem functioning and ecosystem accounting. Part II

Fuhr, M., Glad, A., Durrieu, S., Monnet, J.-M., De Boissieu, F., Bouvier, M., Gosselin, F.

Assessing forest structure by Lidar for biodiversity conservation: three case studies

Institution: IRSTEA, National Research Institute of Science and Technology for Environment and Agriculture, France

Keywords: biodiversity modeling, biodiversity indicators, LiDAR, forest structure, forest maturity, Capercaillie

LiDAR (Light Detection And Ranging) is an active remote sensing technology with a unique capacity to measure forest structure. It has been successfully used to predict structural attributes at stand and tree levels, focusing on attributes (density, basal area, volume) that are mostly linked to wood production or protection against natural hazards. Stand structure also affects the biodiversity potential of a forest. However, structural attributes that are determinant for biodiversity differ from those that are determinant for other ecosystem services. Consequently, the ability of Lidar to assess biodiversity, either directly or indirectly through specific attributes, has still to be investigated. We illustrate through three case studies the potential of LiDAR to assess forest biodiversity. The first study aims at identifying mature forests at a regional scale. Mature forests are rich in very large trees, large snags and large pieces of deadwood, attributes that are crucial for species that depend on forest cover continuity and deadwood. The second study aims at improving Bayesian models linking indicators of floristic diversity to abiotic factors by introducing Lidar-based biotic factors describing vegetation structure and light penetration. The third study aims at producing a predictive Species Distribution Model for an emblematic species in the French Jura Mountains (the Capercaillie, *Tetrao urogallus*) using specific LiDAR oriented-object metrics that are relevant for the Capercaillie and easy to interpret for forest managers. For each study, we derived a set of metrics from LiDAR data, including classical point cloud metrics and additional metrics derived from a canopy height model or after a tree detection process. Beyond the capacity of assessing features hardly measurable in the field, one of the foreseen advantages of LiDAR data is the possibility to compute at several scales metrics describing the 3D distribution of vegetation, gaps or light penetration. Stepwise regressions with cross validations, Bayesian models fitted through an adaptive Markov Chain Monte Carlo (MCMC) or maximum-entropy approaches were then conducted on a set of metrics, depending on the study and the model constraints. Preliminary results concerning mature forests identification are encouraging. Focusing on the dominant forest type in the French Prealps (mixed stands associating beech and fir), we get a model that predict with a quite good accuracy a maturity index combining key maturity attributes. Regarding floristic diversity models, several Lidar metrics were found to have both significant and non-negligible relationships with diversity indicators. Metrics computed over areas larger than field plots were found to be relevant to describe forest structure in abundance and richness models, thus highlighting the probable impact of surrounding structure on diversity indicators measured at plot level. Preliminary results on the use of object-oriented metrics in Capercaillie distribution models showed that the predictive capacity of these metrics was as good as that of common point clouds metrics and that the most contributing variables were concordant with the knowledge on Capercaillie habitat needs. The three studies highlight the potential of LiDAR data to compute variables characterizing forest structure at various scales that are highly relevant to biodiversity and habitat modeling.

Thierion, V., Herrault P.-A., Vincent, A., Inglada, J., Sheeren, D.

French land cover map based on Sentinel-2 time series images to model species richness of hoverflies

Institution (s): INRA - Dynafor / CESBIO, France

Keywords: land cover, predictive modeling, remote-sensing, spatial uncertainty, landscape ecology

A refreshed knowledge of the land cover is crucial for many scientific and operational applications. In this sense, it provides data useful to derivate several essential biodiversity variables (EBV), such as ecosystem extend and fragmentation, and habitat structure, well-known as linked to landscape biodiversity. Land cover is thus an essential input of predictive models or landscape modeling approaches relatives to landscape ecology researches. Nowadays, several global land cover map databases exist, such as Corine Land Cover (CLC) at the European scale or BD TOPO® (IGN) at the French national scale. These two databases offer powerful capabilities to describe land cover with rich nomenclature on large areas. However, they suffer of a lack of timelines. For example, CLC 2012 was published in 2015. In parallel, the BD TOPO® (IGN) database accurately describes permanent classes of landscape but annual classes (e.g. annual crops) are not present or well described. The new availability of Sentinel-2 time series images with its 5-day revisit cycle with 2 satellites and 10m decametric spatial resolution on the whole of Earth's surface give new opportunities in producing accurate and up-to-date land cover maps on large areas. Its frequent revisiting capability makes possible to analyze temporal dynamics of classes and thus improve their discrimination while improving timeliness. In the framework of Land Cover Scientific Expertise Centre (CES OSO) of French Theia Land Data Centre, CESBIO with contributions from Dynafor (INRA) developed an operational supervised classification methodology (iota2) for the fully automatic production of land cover maps at country scale using Sentinel-2 and Landsat-8 images. The produced map, called CES OSO land cover map, has 17 land cover classes representing main land cover types (urban, agricultural and semi-natural) with a 10m spatial resolution and a minimal mapping unit (MMU) of 0.01 ha. The classification accuracy around 90% enables its use in operational and scientific decision-making context. Firstly, this presentation will describe the characteristics of this product, the methodology to produce it and its statistical accuracy. Secondly, and not the least, the spatial uncertainty of this product, which can affect dependant ecological modeling, will be tackled. A comparative study has been indeed developed between predictive models based on forest map digitized by hand and several forest maps extracted from CES OSO land cover map (raw and generalized maps). The original predictive model (one based on hand-made map) is a species-habitat model which investigates effect of woodland area, structural heterogeneity and connectivity on the species richness of forest-specialist hoverflies. Results seem to show negligible impact of geometrical inaccuracies on models performance while automatic land cover mapping (from remote-sensing methods) provides a new interesting perspective to analyze the effect of the whole of landscape matrix on species richness.

Surkov, N. V., Kharitonova, T. I.

Soil and vegetation water content monitoring using Landsat-8 and DEM data: a case study from Eastern Crimea

Institution: Moscow State University, faculty of geography, Russia

Keywords: soil moisture, vegetation moisture, remote sensing, relief morphology, Landsat-8, NDWI, Karadag Reserve

Spatial distribution of soil and vegetation water content is one of the factors that controls the regulatory function of a landscape. The Crimean peninsula requires a tool for soil and vegetation moisture monitoring, because this territory belongs to areas of insufficient moistening. The aim of the study is to construct a statistical model that would allow remote mapping of soil and vegetation cover water content for Karadag and Echkidag Reserves in the Eastern Crimea. The fieldwork results include the data of moisture content of the upper soil layer, sod cover, leaf and grass biomass. The data were used to verify the Normalized Difference Water Index (NDWI) calculated with the help of multispectral images Landsat 8 and Sentinel-2 [2]. The pixel value is determined by reflection power of the entire area which corresponds to pixel. We need to calculate the integral value of soil and vegetation water content then to take into consideration non-homogeneity of a pixel area. Then comparison of areas with different land cover will be possible. NDWI describes the integral soil and vegetation water content with a determination coefficient $r^2 = 0.73$ at the beginning of a dry period and $r^2 = 0.89$ at the end of dry period for the selected area. The season dynamics of soil and vegetation water content was estimated by the NDWI difference at the beginning and the end of a dry period. Land unit types were determined by the supervised classification of principal components and its combination with DEM. They have different trends of water content dynamics during a dry season. The loss of water content depends on soil moisture dynamics at the beginning of a dry period and biomass water content changes at the end of it. The correlation between NDWI difference and SWI reach to 0,74 (in general), and 0,9 in several land unit types. Several of them are able to retain water content during the hot season. Normalized Difference Vegetation Index (NDVI) in September and SWI could distinguish them. NDVI need to correct NDWI values and to adapt the model to different land unit types [3]. Land cover and unit classification could be used for extrapolation the results from the model area. The most important factors determining the seasonal changes of NDWI values are amount of active biomass, topographic position, potential incoming solar radiation and the soil-vegetation water supply in the summer beginning. These factors were included to the multiple regression model of NDWI seasonal dynamics. It describes 67% of the NDWI difference values in forests, 89% in steppes and 94% in vineyards. The results could be used to recognize fire-hazardous areas in steppes and woodlands, as well as to soil moisture monitoring of vineyards. It is possible to use other data (for example, radar data) to describe the real distribution of moisture and to create a tool for monitoring of moisture content. The results of this research are useful for solution of the problems of forest and steppe fires or to remote interpretation of land cover types.

Vogt, P.

Classifying and mapping forest fragmentation using a multi-scale analysis scheme

Institution: European Commission, Joint Research Centre, Ispra, Italy

Keywords: fragmentation, forest monitoring, image analysis, spatial analysis

The typical reporting on forest fragmentation are patch based summary indices derived from forest inventory plot data or from digital forest maps based on remote sensing data. Yet, this kind of reporting scheme is subject to the intrinsic limitations of any summary index derived over a given area: By design, patch-based summary indices are insensitive to variation in time and space because they do not account for the spatial arrangement and configuration of forest cover. As a direct consequence, these indices may be of limited use for landscape planning or risk assessment studies, where the detection of hotspots and the information of spatial heterogeneity is an essential prerequisite. Because patch-based metrics do not account for the spatial distance between different patches they may provide limited, or even misleading information to decision makers. The same is true for progress monitoring in political directives, where simple indices may average out spatial details that provide important indications for the successful implementation of dedicated landscape planning measures. Measuring forest fragmentation must include the spatial information inherent in forest map products and should be derived from the principle aspect of forest cover, which is the amount of forest. This study illustrates a method for measuring, mapping and reporting forest fragmentation at five different observation scales and providing six fragmentation classes intact, interior, dominant, transitional, patchy and rare forest. Based on the analysis of forest area density, the proposed methodology simultaneously measures the area of continuous forest extent as well as the spatial arrangement of forest patches separated by non-forest land. With reporting fragmentation at multiple scales, foresters can make their own choice and decide which scale best suits their field of application. The intuitive fragmentation naming scheme has a direct relation to habitat and biodiversity related studies. Reporting Interior for illustration in tables and maps may be of interest because the literature indicates forest area density above 90 % is a reasonable threshold for core habitat. Reporting Dominant may be interesting because it describes transitions from mostly forested to patchy forest landscapes. A geographic map of fragmentation classes is not only visually appealing but it permits localizing fragmentation hotspots. Comparing maps of fragmentation over time can show where and how much fragmentation has decreased/increased or where it has not changed. The proposed multi-scale fragmentation analysis is available in the free software GuidosToolbox (<http://forest.jrc.ec.europa.eu/download/software/guidos>). It is based on geometric principles only and can be applied to any kind of forest raster maps, independent of their spatial resolution or the definition of forest.

Luque, S.

Earth Observation remote sensing systems providing solutions towards 2020 conservation targets

Institution: Irstea, National Research Institute of Science and Technology for Environment and Agriculture, UMR TETIS Land, environment, remote sensing and spatial information, France

Keywords: forested landscapes, EOS, new capabilities, high resolution, sensors, operational solutions

New developments in remote sensing such as very high resolution satellite imagery, LiDAR techniques that support the measuring of vegetation structure among others parameters, can really help nowadays to speed up the process of biodiversity monitoring and vegetation mapping at very fine scales. In addition, current free and open data policy will have a dramatic impact on our ability to understand how biodiversity and other ecological attributes and processes are being affected by anthropogenic pressures. In all, more satellite imagery is becoming available as open data, such as the imagery from the European SENTINELS, providing essential and harmonized information for different thematic questions, across political boundaries, and at multiple scales. We need to gain knowledge on the status of degraded systems that play key roles in the trade-off between provision of goods and maintenance of carbon stocks, biodiversity, and other related environmental services. Using a mixture of remote sensing and field methods requires ecologists and remote sensing experts to collaborate closely with the newest capabilities and modelling approaches. In this presentation, I will highlight examples in different regions of new capabilities on coupling remote sensing field observation and models in answer to operational solutions towards a better understanding of natural systems to mitigate global change and related anthropogenic impacts.

De la Barrera, F. ^{a, b}, Ruiz, V. ^c, Barraza, F. ^c, Favier, P. ^d, Quense, J. ^c

Ecosystems affected by the recent mega fires in Chile: new hazards as a consequence of the loss of ecosystem services

Institution (s): ^a Faculty of Architecture, Urbanism and Geography, University of Concepcion, Concepcion, Chile; ^b Center for Sustainable Urban Sustainability, Santiago, Chile; ^c Institute of Geography, P. Catholic University of Chile, Santiago, Chile; ^d Research Center for Integrated Disaster Risk Management, Santiago, Chile

Keywords: mega fires, hazards, ecosystem services

During the summer of 2017 severe mega-fires affected South-Central Chile. Native and exotic forests burned intensely in a short period of time, with the damage extending to 518.000 ha. Globally mega-fires are a natural phenomenon, but in Chile wildfires are not a natural occurrence, and their impacts on ecosystem functioning are more severe than in other countries. Wildfires are happening more and more frequently in Chile, but the data on the damage they cause to ecosystem services is insufficient and the identification of socio-natural hazards triggered by the newly deforested areas is limited. During the 2017 wildfires, the available information from official reports were focused on: i) the number of wildfires ii) their extension, iii) the affected ecosystems, iv) human deaths directly caused by the wildfires, and v) the number of destroyed homes. An estimation of geospatial and temporal levels of damage resulting from the 2017 wildfires in Chile is sorely needed. In response to that necessity we performed a detailed temporal and geographical characterization of the areas affected by the wildfires, and the affected ecosystem taking into consideration the 3D structure (topography) of the landscape. We also explored the socio-natural hazards of possible landslides and flooding. To achieve this, we ran remote sensing analyses by calculating the Normalized Burned Ratio from Landsat 8, active fires product from MODIS datasets and ASTER GDEM. Socio-natural hazards were qualitatively classified based on multi-criteria analyses combining proximity to extensive severely burned areas, potential flow of water and sediments based on a DEM, drainage networks and the location of populated areas. We identified 91 burned areas covering a total of 529,794 ha. Four burned areas were bigger than 40,000 ha and seven over 10,000 ha. Our results show that exotic forest areas were the most affected ecosystems in terms of extension, and the amount affected considering their total coverage in South Central Chile (225,000 ha, 15%). 205,000 ha of native ecosystems were lost representing less than 10% of its extension prior to the mega fires. Using the 3D landscape structure, the total area of affected ecosystems rises to 555,381 ha. We also identified 18 inhabited areas with an increased risk of landslides and flooding hazards product of the recently denuded landscapes (vegetation burned away by the wildfires). Eleven of them are dangerously exposed; indeed, in the austral winter some of them experienced flooding caused by overflowing streams and canals. These results can be used to add a new point to Chilean wildfire suppression strategy. The strategy currently aims to prevent the destruction of homes and very valuable species and ecosystems. We propose that the strategy should also focus on preventing the effects of potential landslide and flooding hazards in the next wildfire season. Wild land fire management must prevent impact on a large spatial scale. Improved ecosystem appraisals will help design restoration plans and mitigate the negative impacts of the lost ecosystem services.

Driss, H.

Spatial Indices and dynamic of forest land in the municipality of Ain Fezza, Northern of Algeria

Institution: Department of Forest Ressources, University of Tlemcen, Algeria

Keywords: spatial index, remote sensing, environmental impact, forest land, Algeria

To a sustainable development, a better understanding of landscape dynamics remains a major concern for areas whose ecosystems are severely degraded and have direct implications for the availability of natural resources. Indeed, this study takes into worthiness the degradation characteristic of the forest environment by the analysis of a diachronic evolution, which will translate the environmental response to the anthropic pressions and to the climatic changes. To make it into achievement, we have focused-on a methodological approach based on a spatial-temporal analysis that allowed us to evaluate the environmental changes in the study area (Municipality of Ain Fezza, wilaya of Tlemcen), in particular the diachronic evolution of green cover. The data used are satellite images taken by the TM sensor of Landsat 5 (1984) and the ETM + sensor of Landsat 8 (2016) with a spatial resolution of 30 m and a Digital Elevation Model (DEM) with the same spatial resolution. Different improvement treatments (colored compositions and filters) and specific (supervised classifications) were performed on these bi-dates data. The informatics treatments of optical satellites images with bi-dates [1984-2016] have made into evidence and with efficient practice the generalized degradation of the green cover, where the socio-economical impact is marquee by the reduction rate of natural resources and the diminution of the forest areas. In this side and for example, the « degraded hills » class is high increasing, due to different anthropic incredulous actions (over grazing, forest fire, package, expansion of stone-pit ...etc), is noticed.

Glad, A., Reineking, B., Monnet, J. M.

Assessing object-oriented LiDAR metrics for characterizing bird habitat in a management perspective

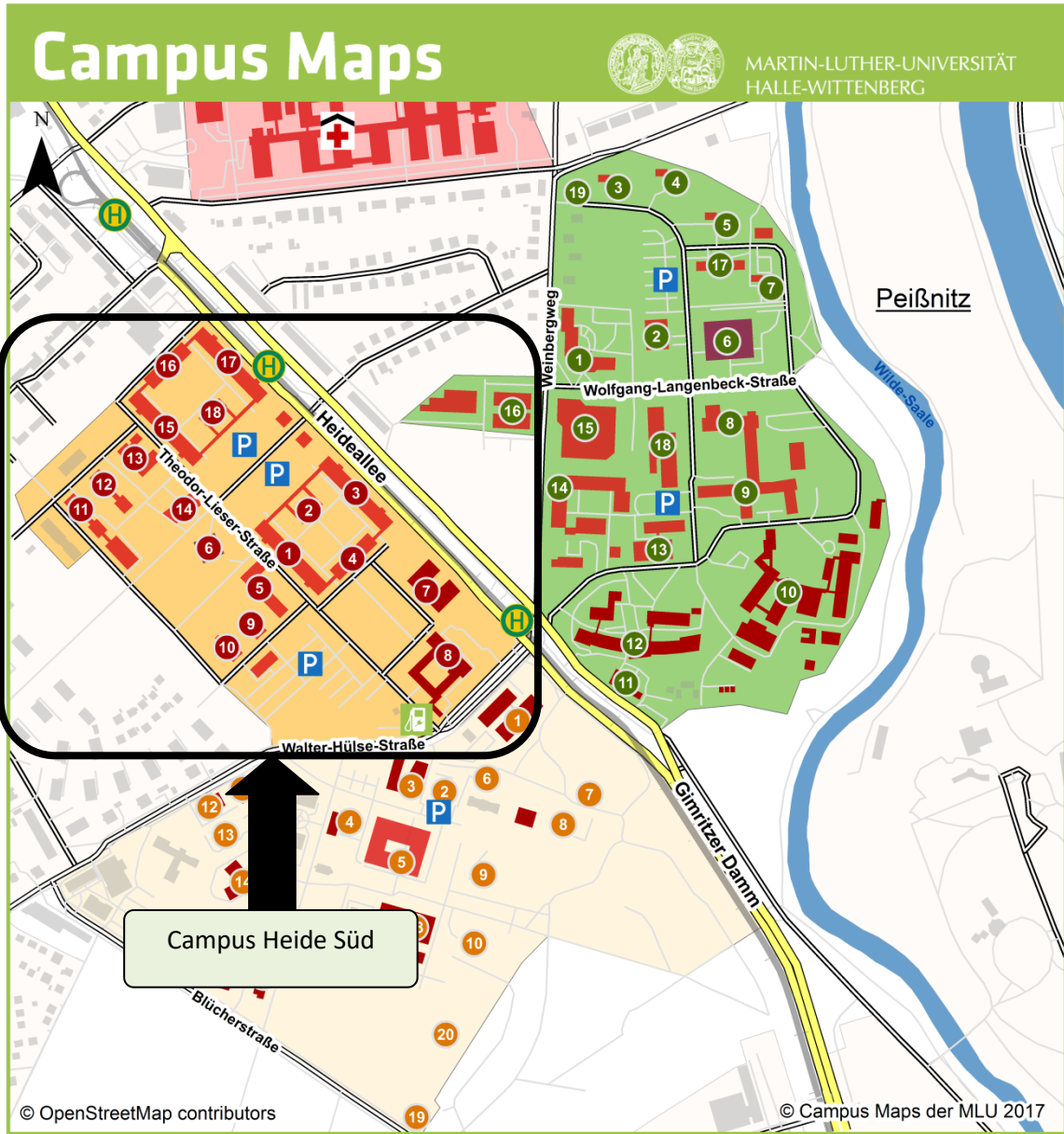
Institution: Irstea, National Research Institute of Science and Technology for Environment and Agriculture, Grenoble center, France

Keywords: LiDAR, Capercaillie, management, species distribution models

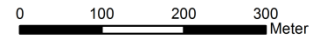
Light Detection and Ranging (LiDAR) provides detailed information on the three dimensional structure of the environment, and is increasingly used in habitat modeling for a wide variety of species including birds (Rechsteiner et al. 2017; Bae et al. 2014; Zellweger et al. 2014). LiDAR has been shown to improve predictive performance of species distribution models (Tattoni et al. 2012, He et al. 2015). It is recommended that explanatory variables in habitat models should be meaningful from the species point of view in order to best explain species distribution within a landscape (Johnson and Gillingham 2005). However, is good predictive performance of a habitat suitability model sufficient to impact local conservation actions? In order to take appropriate and more efficient management decisions, we hypothesize that the metrics explaining the species distribution need to be also meaningful for managers. While some LiDAR metrics such as canopy cover (Graf et al. 2007), can be readily understood, many of the LiDAR metrics currently used in SDMs, such as the standard-deviation of penetration ratio between 0.5-10m (Bae et al. 2014) or the proportion of echo above five meters (Melin et al. 2016), are not easy to interpret. However, metrics extracted using object-oriented methods may fill this gap by giving metrics based on existing landscape components. Instead of calculating metrics over a surface unit (the pixel), an object-based classification group together neighboring points because they belong to the same overall structure which define an object type (tree, road, building, gap). Afterwards, metrics within each object (height, surface, location) and among all of them (number, density, diversity) can be calculated. The aim of this study is to improve forest management planning by using LiDAR predictors meaningful for both the species and managers. We are here focusing on the case of the Capercaillie (*Tetrao urogallus*), an avian species of conservation concern occurring in the French Jura Mountains. Capercaillies favor old mixed forest with a mosaic of structurally different habitats (gap openings, moderate canopy cover area, isolated resting trees, presence of shelters) and the species is threatened by habitat loss and degradation. Habitat restoration planning is thus a fundamental aspect of species conservation actions. We extracted a range of object-oriented metrics from LiDAR datasets, defined with the support of conservation experts and forest managers. We then compare habitat suitability models based on inhomogeneous point process models, such as Maxent (Phillips, Anderson, and Schapire 2006), fitted with either commonly used "points cloud" or new "object-oriented" LiDAR metrics. Preliminary results indicate that both categories of metrics yield similarly accurate predictions of Capercaillie habitat suitability. Thus, we hope that the use of object-oriented metrics, with their likely improved interpretability, will allow for more practical recommendations supporting forest management planning in favor of Capercaillie conservation.

Maps of the Campus and the City

Technologiepark Weinberg Campus



Technologiepark Weinberg Campus



- | | | | | | | | | |
|--------------------------|------------------|-------------------------|-----------------------|--------------------------|---------------------------|--------------------------|--------------------------|----------------------|
| 1 Informatik/Mathematik | 7 UFZ (Heimholz) | 13 AEW* | 1 TGZ | 7 Wohnheim IV | 13 UVZ | 1 Fraunhofer-Institut | 8 GMBU e.V. | 15 MZG Bio-Zentrum |
| 2 Sportwiss./Unisport | 8 IAMO (Leibniz) | 14 Hörsaalgebäude | 2 Sporthalle Weinberg | 8 Institut für Pharmazie | 14 Institut für Biochemie | 2 Bio-Zentrum Verwaltung | 9 point electronic GmbH | 16 MZG II |
| 3 Geologie/ULB Ha19 | 9 AEW* | 15 Physik/AEW* | 3 Wohnheim I | 9 Institut für Chemie | 15 Biozentrum | 3 TGZ | 10 a&m creative services | 17 Bio-Nano-Zentrum |
| 4 Geographie | 10 AEW* | 16 Chemie | 4 Wohnheim II | 10 Leibniz-Institut | 16 Biologium | 4 TGZ | 11 PROLOGA GmbH | 18 Fraunhofer-Center |
| 5 Mathematik/Prüfungsamt | 11 AEW* | 17 Chemie/Physik/ULB H4 | 5 Wohnheim III | 11 Fraunhofer-Institut | 17 Kita | 5 Bio-Nano Zentrum | 12 PKH | 19 Lettow TV |
| 6 Heidemensa | 12 AEW* | 18 AEW* | 6 Weinberg Mensa | 12 Max-Planck-Institut | 18 Proteinzentrum | 6 Ingenieurbüro Hesse | 13 BWSA | 20 Zonetlight GmbH |
| | | | | 19 Spätkindergarten | 7 Atelier Bau GmbH | 14 Verwaltungsgebäude | | |

*Agrar- und Ernährungswissenschaften

Herausgeber:
 Institut für Geowissenschaften und Geographie
 im Auftrag des Hochschulmarketings
 Kontakt: detlef.thuerkow@geo.uni-halle.de

The City Centre of Halle (Saale)

Complete map:

<https://mlu.maps.arcgis.com/apps/webappviewer/index.html?id=677b9afc714c48e98af9845f7f6a5da7>

