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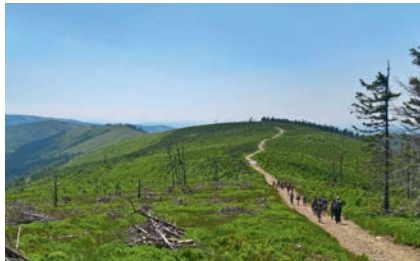
Transboundary ecological connectivity -
modelling landscapes and ecological flows

International workshop on ecological connectivity modelling

Kraków 2018



Book
of Abstracts



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modelling landscapes and ecological flows

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• Visegrad Fund
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Katarzyna Ostapowicz, Robert Pazur, Wojciech Łachowski (eds.)

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Kraków, 2018

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Kraków 2018

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Preface

This volume is based on the outcomes of events organised within the framework of the CON@SK.PL project. Most recent was the ecological connectivity modelling workshop for young scientists which took place at the Jagiellonian University in Kraków, in March 2018. Over three days, graduate students and postdocs from the fields of Geography, Ecology and Biology had opportunities to present and discuss the state-of-the art and current research on techniques and methods used for assessment of both structural and functional connectivity. Through keynote lectures and practical exercises, the students learned and debated recent developments in remote sensing as a new area in biodiversity monitoring and assessment. Moreover, the workshop focused on the understanding and design of species distribution models as well as recent methods for connectivity modelling and assessment. The keynote lectures and practical sessions were rounded out with a scientific poster session and field trip making for a busy and productive three day workshop.

Furthermore, before the workshop for young scientists, two important CON@SK.PL events took place. First, the stakeholders' meeting in Stará Lesná organised by the Slovak Academy of Sciences in June 2017. This stakeholders' meeting was an excellent opportunity to bring together researchers and practitioners and exchange knowledge and experience particularly in large mammal monitoring in the protected areas along the Slovakian and Polish border in the Carpathians.

Secondly, a symposium was organised as a part of the IALE Europe Congress in Ghent, in September 2017. Within this symposium, we explored and discussed recent developments in methods and techniques for assessment and modelling of the relationships between structural and functional connectivity in human-dominated landscapes.

The materials in this volume summarise the outcomes of the CONSK.PL project's events. Included are students' abstracts from the young scientists workshop, and the stakeholders meeting and IALE session summaries. The materials highlight not only the rapid increase over the last decade in the number of studies, methods, and applications relating to ecological connectivity and growing research interest in this topic but also the further need for collaboration between researchers and stakeholders.

We thank everyone who made these events possible through attendance, various inputs, organisational help, advice and another forms of support. We are grateful to the Visegrad Fund for supporting of all activities within the CON@SK.PL project. We hope that everyone learned at least as much as we did from the experience.

Kraków, 9. March 2018

Katarzyna Ostapowicz
Robert Pazur

The CON@SK.PL project aims to better understand the habitat connectivity in the Northern Carpathians of Slovakia and Poland. Our international team works on multispecies connectivity assessment for the brown bear (*Ursus arctos*) and European bison (*Bison bonasus*). Using the state-of-the-art approaches allow us to substantially contributed to pressing conservation issues related to these species.

REASONS THAT MOTIVATED US TO START THE PROJECT

The loss of ecological connectivity in increasingly fragmented human-dominated landscapes threatens the long-term persistence of many species. The Northern Carpathians are a European hotspot of natural wildness harbouring the umbrella species, e.g. brown bear or European bison, particularly the border zone between Slovakia and Poland. Until now, most of the connectivity assessments in this region were done at a national level or on one side of the border. Moreover, existing studies were also limited by focusing on the distribution of only one species. We intend to bring together scientists and stakeholders from both sides of the border and work on solutions for better ecological connectivity assessment allowing to improve conservation efforts and environment management in transboundary areas.

SOLUTION

In the project, we develop an interdisciplinary, innovative 3D ecological connectivity assessment approach at the regional scale based on GPS telemetry and remote sensing data and knowledge transfer among scientists and practitioners. We develop models and guidelines for functional 3D connectivity assessment using 3D landscape structure with telemetry data for species movement, which result in a new and powerful, spatially explicit connectivity assessment.

Furthermore, we review the current state of the art in connectivity assessment using scientific databases and guidelines already published by organisations such as the Carpathian Convention. Baseline information in the models is developed together with stakeholders to mitigate conflicts of conservation management.

REGIONAL RELEVANCE

Migrating wildlife does not respect country borders. We focus on the area around the Polish and Slovakia border (40 km from the border in both countries, along the whole border), i.e. a part of the main ridge of the Carpathians – being one of the main natural migrating corridors of the continent, harbors some of the largest densities of large mammals in Europe. Most of them have home ranges of about 100 km², often shared by both neighbouring countries.

This project is emblematic for studying the trans-boundary species movement and identification of their potential and realised habitat. The primary outcomes of the project (i.e., models and maps of ecological connectivity) may improve spatial planning and management but also our knowledge about given species within the region.

Project website: <http://www.geography.sav.sk/conskpl/index.php>

The Visegrad Fund supported this project (No. 21640051).



Workshop

Ecological connectivity is essential for maintaining resilient and viable populations of many species, particularly of those restricted to fragmented habitats or metapopulations facing climate change. Participants in this workshop will gain an understanding of the current state of the art in techniques and methods used for assessment of both structural connectivity (physical distribution of favourable habitat patches) and functional connectivity (how for a given species habitat patches facilitate the movement of individuals and their genes).

The workshop was organised around four major topics related to four main steps in connectivity assessment:

Topic 1: REMOTE SENSING FOR CONNECTIVITY ASSESSMENT

Topic 2: HABITAT MODELLING

Topic 3: CONNECTIVITY MODELLING

Topic 4: CONNECTIVITY INDICES And THEIR PROPERTIES

During the keynote lectures and practical classes graduate students and postdocs learned how to analyse and handle species distribution and environmental data and to apply state of the art techniques for modelling habitats, connectivity and species flow as well as assessing connectivity value for given species, including instruction in the use of source software such as R, QGIS, MaxEnt, Circuitscape, ArcGIS and others.

The workshop was opened to young scientists, PhD students and postdocs. During the workshop, there was a poster session where participants have the opportunity to present their current relevant research work (please check the posters' abstracts in this book).

Teachers

The workshop was conducted by an interdisciplinary group of scientists from research institutions all over Europe (Germany, Poland, Slovakia, and Switzerland). The expertise of this group ranges from remote sensing to ecology, with a focus on land system science and ecosystem functioning.



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Organising committee

The workshop was organised with the great help of a young scientists group from the Institute of Geography and Spatial Management at the Jagiellonian University in Kraków.



EWA GRABSKA



**KATARZYNA
STASZYŃSKA**



ANNA ZIELONKA



WOJCIECH ŁACHOWSKI
(Chair)

Workshop program

TUESDAY, 06/03/2018

18:00– 20:00 POSTER SESSION & ICE-BREAK, IG&SM JU, second floor

Janine Bolliger, Swiss Federal Research Institute WSL, Switzerland

Bronwyn Price, Swiss Federal Research Institute WSL, Switzerland

WEDNESDAY, 07/03/2018

From 8:30: Coffee break, IG&SM JU, second floor

9:00 – 9:15 WELCOME, IG&SM, first floor, classroom 1.21

Bolesław Domański, Dean of the Faculty of Geography and Geology, Jagiellonian University, Poland

Marek Drewnik, Director of the Institute of Geography and Spatial Management, Jagiellonian University, Poland

9:15 – 10:15: KEYNOTE LECTURE, IG&SM JU, first floor, classroom 1.21

New remote sensing opportunities for understanding habitat dynamics of large mammals

Tobias Kuemmerle, Geography Department, Humboldt-Universität zu Berlin, Germany

10:15 – 10:30: *Coffee break, IG&SM JU, second floor*

10:30 – 12:00: **LAB. CLASSES, IG&SM JU, first floor, classroom 1.24**

Topic 1: REMOTE SENSING FOR CONNECTIVITY ASSESSMENT

Katarzyna Ostapowicz, Institute of Geography and Spatial Management, Jagiellonian University, Poland

Robert Pazur, Slovak Academy of Sciences, Slovakia & WSL, Switzerland

12:00 – 13:00: *Lunch, IG&SM JU, second floor*

13:00 – 14:30: **LAB. CLASSES, IG&SM JU, first floor, classroom 1.24**

Topic 1: REMOTE SENSING FOR CONNECTIVITY ASSESSMENT

Katarzyna Ostapowicz, Institute of Geography and Spatial Management, Jagiellonian University, Poland

Robert Pazur, Slovak Academy of Sciences, Slovakia & WSL, Switzerland

14:30 – 15:00: *Coffee break, IG&SM JU, second floor*

15:00 – 16:30: **LAB. CLASSES, IG&SM JU, first floor, classroom 1.24**

Topic 2: HABITAT MODELLING

Benjamin Bleyhl, Geography Department, Humboldt-Universität zu Berlin, Germany

Tobias Kuemmerle, Geography Department, Humboldt-Universität zu Berlin, Germany

16:30 – 17:00: *Coffee break, IG&SM JU, second floor*

17:00 – 18:30: **LAB. CLASSES, IG&SM JU, first floor, classroom 1.24**

Topic 2: HABITAT MODELLING

Benjamin Bleyhl, Geography Department, Humboldt-Universität zu Berlin, Germany

Tobias Kuemmerle, Geography Department, Humboldt-Universität zu Berlin, Germany

19:30 – ... *Dinner, Restaurant Chimera, Św. Anny 3, Kraków*

THURSDAY, 08/03/2018

From 8:30: Coffee break, IG&SM JU, second floor

9:15 – 10:15: **KEYNOTE LECTURE, IG&SM JU, first floor, classroom 1.21**

Tracking wildlife and identifying barriers to connectivity

Nuria Selva, Institute of Nature Conservation, Polish Academy of Sciences, Poland

10:15 – 10:30: *Coffee break, IG&SM JU, second floor*

10:30 – 12:00: **LAB. CLASSES, IG&SM JU, first floor, classroom 1.24**

Topic 3: CONNECTIVITY MODELLING

Janine Bolliger, Swiss Federal Research Institute WSL, Switzerland

Bronwyn Price, Swiss Federal Research Institute WSL, Switzerland

12:00 – 13:00: *Lunch, IG&SM JU, second floor*

13:00 – 14:30: **LAB. CLASSES, IG&SM JU, first floor, classroom 1.24**

Topic 3: CONNECTIVITY MODELLING

Janine Bolliger, Swiss Federal Research Institute WSL, Switzerland

Bronwyn Price, Swiss Federal Research Institute WSL, Switzerland

14:30 – 15:00: *Coffee break, IG&SM JU, second floor*

15:00 – 16:30: LAB. CLASSES, IG&SM JU, first floor, classroom 1.24

Topic 4: CONNECTIVITY INDICES And THEIR PROPERTIES

Katarzyna Ostapowicz, Institute of Geography and Spatial Management, Jagiellonian University, Poland

Elżbieta Ziótkowska, Institute of Environmental Sciences, Jagiellonian University, Poland

16:30 – 17:00: Coffee break, IG&SM, second floor

17:00 – 18:30: LAB. CLASSES, IG&SM JU, first floor, classroom 1.24

Topic 4: CONNECTIVITY INDICES And THEIR PROPERTIES

Katarzyna Ostapowicz, Institute of Geography and Spatial Management, Jagiellonian University, Poland

Elżbieta Ziótkowska, Institute of Environmental Sciences, Jagiellonian University, Poland

18:30 – 19:00: CLOSING SESSION, IG&SM JU, first floor, classroom 1.24

Robert Pazur, Slovak Academy of Sciences, Slovakia & WSL, Switzerland

FRIDAY, 09/03/2018

8:00 – 17:00: FIELD TRIP: Tatra National Park, Poland

Starting point: Kampus JU, Gronostajowa 7, Kraków

Venue

The workshop was hosted by the Institute of Geography and Spatial Management at the Jagiellonian University, Gronostajowa 7, 30-387 Kraków, Poland.

The workshop webpage:

<http://www.geography.sav.sk/conskpl/index.php/events>



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Abstracts



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What landscape variables best predict the occurrence of brown bear damage to apiaries in Bieszczady Mountains?

Carlos Bautista

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The conflicts arising from large carnivore damage undermine conservation efforts, raising concerns and challenges for conservationists worldwide. Thus, predicting where and when damages are more likely to occur is pivotal to prevent and mitigate conflicts and promote large carnivore conservation. This study aims to identify and map areas vulnerable to future brown bear (*Ursus arctos*) damage to apiaries in the Bieszczady Mountains (SE Poland). Diverse ecological and anthropogenic variables were calculated in 246 cells in a 5x5 km grid overlapping bear distribution. We run generalised linear models with the mean number of damage in 2007-2014 as the response variable. Results showed that bear damage to apiaries tended to occur in places with a large number of beehives and a high probability of bear presence, which, in turn, was related to the proportion of forest cover. The density of urban areas had a small negative influence on the number of damage, and the availability of natural resources had none. In a next step, we plan to model the probability of apiary presence in the study area. Finally, we will map the risk of bear damage to apiaries in relation to the probability of the presence of bears and apiaries. We will discuss the management implications of this study and give recommendations to managers and policy makers to minimise bear damage occurrence and enable a peaceful coexistence between bears and people.

Trees don't make a forest: Large-scale model of *Cucujus cinnaberinus* niche reveals a key role of ecological continuity in survival of saproxylic specialists

Michał Betcik

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Last centuries of intensive utilisation of forest resources in Europe has resulted in dramatic loss of forest coverage and deep simplification of persistent woodlands. Due to historical circumstances, some forest fragments located in eastern part of Poland did not lose permanent ecological continuity through the centuries, whereas forests located in western regions were heavily transformed and currently encompasses mainly restored secondary forests. Our main goal was to build the large-scale model of niche suitability for the flag saproxylic umbrella species – *Cucujus cinnaberinus* by using Maximum Entropy Method. We found that distribution pattern of the studied species strongly corresponds to the occurrence of old-growth forests with a long ecological continuity. Optimal habitats may be found in some parts of the Carpathian Forests and north-eastern Poland, in particular, the Białowieża Primeval Forest, which encompass the best-preserved forests in whole Europe. Other suitable habitats were highly scattered, but mostly coincided with the distribution of old-growth forest remains, especially long-term protected areas of national parks and nature reserves. Secondary forests of western Poland were almost completely unsuitable for the harbour of *Cucujus cinnaberinus* population, despite the large area and high coverage. Among all environmental variables used in the species distribution model, the distance to the protected areas and mean diameter of forest stand was found to be the most important habitat contributors. Our findings underscore the importance of old-growth forest remains as key hotspots of biodiversity and provoke the questions about the effectiveness of rewilding concept as a tool for conservation, for forest specialists.

Barriers of noise and light pollution and their influence on ecological connectivity

Barbara Bożętka

Nicolaus Copernicus University

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The study is devoted to the concern of anthropogenic barriers for ecological connectivity, and especially, to barriers of noise and light pollution. Properties of these barriers (they form physical structure of a landscape, but are unframed, often unstable, with changeable, time-depending boundaries) sets them apart from hard structures such as roads, fencing or energy infrastructure. Importantly, noise and light pollution not only change habitat conditions but also (as a result of alteration of organisms' distribution) impact landscape structure. With regard to an elementary division of consequences of the presence of ecological barriers, which distinguishes physical and psychophysical effects (e.g., Kurek, 2010), the role of noise and light pollution should be marked in both spheres.

Although the examined barriers tend to be treated rather marginally in connectivity assessment and are sometimes described as 'potential barriers', it can be noticed that their importance has been raised in the awareness of scientists and practitioners recently (see, e.g. McRae *et al.*, 2012, Rudnick *et al.*, 2012). The research provides information on the character of the influence of noise and light pollution on wildlife movement, delivering some relevant examples. Overall, it stresses the issue of barrier analysis and claims for more pronounced incorporation of assessment of noise and light pollution into planning for connectivity and into connectivity design.

References

Kurek R.T., 2010, Poradnik projektowania przejść dla zwierząt i działań ograniczających śmiertelność fauny przy drogach, Stowarzyszenie Pracownia na rzecz Wszystkich Istot, Bystra

McRae B.H., Hall S.A, Beier P., Theobald D.M., 2012, Where to restore ecological connectivity? Detecting barriers and quantifying restoration benefits, PLoS One, 2012; 7(12); e52604

Rudnick D.A, et al., 2012, The role of landscape connectivity in planning and implementing conservation and restoration priorities, Issues in Ecology ESA, Report n° 16 (Fall 2012)

Birds and people in the city: assessing the effect of human presence on urban birds

Michela Corsini

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An urban environment is an extreme form of land-use where humans play the role of keystone species: thus, an important dimension that sets the urban space conspicuously at odds with a natural forest environment is the high abundance of people. However, little is known about the effect of human presence per se on avian fitness. Our research focuses on the effect of human presence on the life – history of two passerine species adapted to inhabit the urban environment: great tits *Parus major* and blue tits *Cyanistes caeruleus*. We estimated human presence by inferring the number of people in a 15m radius from each nestbox, and by calculating nestbox distance to the nearest path and nearest road. We used ground-based and GIS-based approaches to quantify human presence which generated highly repeatable results. We found no effect of the number of people around each nestbox on tit life-history traits and reproductive success. However, great tit and blue tit nestbox occupancy was significantly higher and lay date was significantly earlier in nestboxes further away from roads. Our first results suggest that it is paths and roads rather than human presence that was found to play a greater role in reproductive trait variation. We are now performing some simulations to improve our human presence protocol in the field: this method will furnish a new tool to quantify human presence per se in sites which are regularly visited by people, allowing to test for potential effects on wildlife at the nest level.

The potential habitat of invasive plant species. Conservative and innovative approach

Elżbieta Jędrzejczak¹, Małgorzata Jaźwa², Ewelina Klichowska³, Artur Pliszko

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Invasion by alien plant species can significantly affect the diversity of natural communities thus the interest in biological invasions has increased substantially over the past few decades. While the recent study focuses on the spread and potential distribution of exotic invasive plants, there is no model of the available habitat hybrid between invasive and native species. This study aimed to investigate and compare the potential distribution area of *Solidago* × *niederederi*, a natural hybrid between North American *S. canadensis* and European *S. virgaurea* in Poland, using two different ways. The conservative way, based on maps of locality of both parental occurrence and available habitat from Corine Land Cover program, was generated using the ArcGIS application. The innovative way, based on climate data, was constructed using the MaxEnt program and assumed the reproduction of hybrid species. Both independent approaches show a high probability of occurrence for *Solidago* × *niederederi* in the south, north and north-east of Poland. Despite parental species occurrence and relevant habitat, the MaxEnt program didn't find any climate niches in the Mazovian Lowland. Additionally, the innovative method allows to predict distribution in the neighbouring countries, where the habitat or parental distribution data were not available.

Comparison of ecological niche across closely-related taxa from *Stipa pennata* complex

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Stipa pennata, commonly known as feather grass is distributed in open grasslands and steppes, especially in the warm temperate regions of Asia and East Europe. In Central Europe species reach the northwestern limit of its geographical range of distribution. Species grow here mostly in semi-natural grasslands, with more or less xerothermic conditions. Over the last few decades, changes in land use in Europe, connected with the abandonment of extensively cultivated grasslands and afforestation results in xerothermic habitats fragmentation.

The aim of this work was to map the potential distribution as well as to analyse differences in ecological niche used by taxa from *S. pennata* complex. We assessed main environmental drivers of distribution of four studied taxa at the north edge of their geographic range.

Our results show that suitable environmental space is wider than the currently known distribution of studied taxa at the north edge of their geographic range – these regions should be treated as top-priority survey areas. The main factors affecting the distribution of taxa from *S. pennata* complex are mean temperature of driest quarter and precipitation of coldest quarter. Similar niche characterises almost all studied taxa; only one presents a unique combination of environmental factors.

Assessment of the status and integrity of ecological network in highly intensified agricultural region (case study Trnava region, Slovakia)

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Habitats fragmentation as a result of land use intensification and urban sprawl represent a serious ecological problem, which threatens global biodiversity conservation. One of the main strategies used to alleviate this negative effect is to maintain habitat landscape connectivity (Estavillo, et al., 2013).

In presented contribution, we have reconstructed and analysed the ecological network on a regional level and identified main barriers and constraints in the maintenance of landscape connectivity. To assess the integrity of the ecological network, we have used the MSPA method integrated within the GuidosToolbox. In the next step, we assessed these elements of ecological network defined by MSPA from their current utilisation and their potential for reconstruction or enhancement of the ecological network connectivity. We have also analysed to which degree individual network components facilitate or impede the overall landscape connectivity. Besides the assessment of the status of the ecological network on a regional level, the results could also be used to guide conservation planning to enhance the landscape connectivity.

References

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Modelling wildlife corridors across heterogeneous mountain landscape

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The Carpathian Mountains forming an arc roughly 1.500 km across seven states provide the habitat for some of the largest European populations of brown bears, grey wolves and Eurasian lynx, with the highest concentration in Romania. However, Ukrainian, Romanian and even Slovakian parts of Carpathians suffer from the lack of the functional nature protection and the effective landscape management. Several protected areas including a large number of NATURA 2000 sites have been declared, but their spatial design recalls rather patchwork instead of the coherent network.

Populations of large carnivores with enormous spatial requirements and extensive dispersal and migratory needs are widely endangered by the rapid development of roads and motorways creating long impermeable barriers across the Carpathians. As new traffic projects are planned on the supra-national level, the same scale is needed for designing an extensive system of wildlife corridors. Habitat suitability models for brown bear, grey wolf and Eurasian lynx were used to delineate core habitat areas and stepping stones important for dispersal. The Circuit Theory was applied for assessment of landscape connectivity and finally, a coherent network of wildlife corridors was designed.

Proposal of such green infrastructure was presented to regional authorities and stakeholders, to provide them with relevant information for negotiations with road and motorways planners.

Terrestrial isopod assemblages in shallow underground of forested scree slopes of Western Carpathians (Slovakia)

Jan Rudy¹, Andrej Mock¹, Michal Rendoš²

¹ Pavol Jozef Šafárik University, Faculty of Science, Institute of Biology and Ecology, Košice, Slovakia

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Terrestrial isopods represent a unique group of organisms, in which transition from sea to land can be well observed. Forested scree slopes are interesting habitats for the study of this taxon. Tangle of crevices, fissures and fragmented rocks, with almost total absence of daylight and stable microclimatic conditions caused by topsoil, and quite rich food resources income originating from fallen leaves of a forest above the scree slopes, are often visited, but sometimes completely inhabited, by terrestrial isopods and in some cases, we can observe morphological, ecological, physiological and behavioural adaptations to this habitat. We have continuously studied isopod communities on eight different study sites in five geomorphological units in Slovakia, between years 2008 and 2016. One study site was in the western; four were in the central and three were in the eastern part of southern half of Slovakia. These sites vary in bedrock (basalt/limestone/granitoid closely connected to limestone), slope exposure (north/west/northeast/southwest), forest type and structure of the scree. To collect fauna, subterranean pitfall traps were used. The traps consist of a plastic tube with circumferential drillings at 10 depth levels (5, 15, 25...95 cm). Set of plastic cups connected to each other on the metal rod is inserted into the plastic tube and each cup is collecting fauna from separate depth level. Formaldehyde or ethylene glycol are used as a fixating agent in these cups. Three pitfall traps with 50 cm spacing are situated on one site, and trapping lasts at least one year. Material from traps is collected continuously to cover climate seasons during the whole year. Among many other taxa, we have recorded 252 individuals of terrestrial isopods, belonging to 11 species. Most dominant and common species was *Mesoniscus graniger* (Frivaldszky, 1865), only subterranean isopod we have found, with 137 specimens, recorded on six study sites, but not on the study site

on granitoid bedrock. Higher specimen counts were recorded on study sites on limestone bedrock (18-95 specimens). On study sites on basalt and granitoid bedrock, only nine specimens were sampled. five species were recorded from only one study site. *Trachelipus ratzeburgii* (granitoid bedrock), *Ligidium hypnorum*, *Ligidium germanicum*, *Orthometopon planum*, *Porcellium conspersum* (different study sites on limestone bedrock). Sadly, thorough statistical evaluation of results was not possible, due to the low specimen counts. Most of the sampled isopod species can be ecologically classified as forest surface dwellers, that may occur in the small depths (up to 15 cm) of soil, mostly to roam the humus or leaf litter, trying to overcome unsuitable climatic conditions, hiding before the predators, or to obtain nutrients and food resources.

Assessment of the impact of landscape structure on the occurrence of lynx in Central Europe

Michaela Sladová

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Large predators are a traditional group of bioindicative species, whose presence shows the state of environment and landscape within a region. As these animals recolonise the cultural landscapes of Central Europe, it is important to understand their space requirements and habitat preferences. I developed a habitat suitability model with a maximum entropy approach for Central Europe using independent records of lynx from radio tracking monitoring in the Bohemian Forest Ecosystem (Germany, Czech Republic), Alpine region (Slovenia, Austria) and in Bialowieza Forest (Poland). The underlying dataset contained more than 14 322 locations, with each individual contributing a maximum of one position per calendar day to limit both temporal and spatial autocorrelation of the telemetry data. For the 62 lynxes monitored in the study area, I calculated home ranges as minimum convex polygons (MCP) and kernel home range (KHR). In the Bohemian Forest Ecosystem and Kalkalpen National Park lynx had significantly larger spatial area requirements for their home ranges than in Slovenia and Bialowieza Forest. A comparison of the model results with the current distribution of lynx confirms that a lot of suitable habitats areas are not permanently occupied. This indicates that long-term viability of the lynx population is – besides poaching or illegal hunting – negatively associated with ongoing fragmentation of the landscape. One of the possible solutions of negative impacts is delineation and protection of landscape permeability through habitat corridors.

Predictive Modeling and Mapping of the Tawny Pipit *Anthus campestris* Distribution in the southwestern part Slovakia Using Maximum Entropy

Miriam Vlachovicova

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Tawny Pipit has declined significantly in Slovakia and in Europe. Changes in land use and farming practices, seem to be responsible for such decline. We examined the habitat selection and modelled the potential distribution of the Tawny Pipit in the southwestern part of Slovakia using the Maxent algorithm. Maximum Entropy (Maxent) is a modelling method that can be successfully calibrated using a relatively small number of records. Species Distribution Models (SDMs) were created at 100 m resolution. The Tawny Pipit is a habitat specialist. Our results showed that Tawny Pipit prefers lowlands, vineyards – areas with a mosaic of bare ground and low vegetation, orchards and areas with sandy soils and fine-sandy loess. Buildings and water courses were negative predictors of Tawny Pipit occurrence.

Acknowledgement

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The habitat connectivity of the grey wolf (*Canis lupus*) in Central Europe

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Have you ever thought that your neighbour is so close to you like your relative? However, other neighbours are sometimes estranged from you. Similarly to this contrast, we can express the situation of the wolf population in Central Europe. In some cases, wolf subpopulations, which have been already identified by experts (Hulva et al., 2017), inhabit only the limited area of mountains. On the contrary, some individuals from different subpopulations are moving across Europe (e.g. Pilot et al., 2006). The various subpopulations of the wolf have been already identified in the Central European area. But is there an obvious boundary between subpopulations? Can we distinguish other aspects of identifying boundaries than genetics? What influence can be expected from the landscape structure? For example, the Western Carpathians hosts several isolated subpopulations of wolves, which are in some cases only a few kilometres apart. There is no genetic exchange between them despite the short distance. If we combine three different approaches to the subpopulation distance (Euclidean, least-cost path and genetic), can we identify any landscape elements that prevent individuals from mingling? Thanks to the interconnection of genetic and landscape-ecological analyses, we seek a new perspective on the current issue of the wolf's spread in Central Europe.

Before the workshop



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Transboundary ecological connectivity -
modelling landscapes and ecological flows

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Workshop for stakeholders

It is increasingly common for researchers to engage with stakeholders in workshops. Our project focuses on connectivity modelling for large mammals. Therefore, in June 2017 we invited stakeholders, in particular from the national parks from both sides of the Polish-Slovakian border within the Carpathians, to Stará Lesná and discussed with them the current state-of-the-art and challenges facing the monitoring of large mammal movement particularly within protected areas. We also exchanged ideas about the further use of the field data collected with





a variety of different techniques, e.g. GSP tracking and phototraps, and possible methods for connectivity modelling in cross-border areas.

During the workshop, with more than ten presentations contributed from stakeholders and researchers, a broad picture of animal movement monitoring in the region, in particular with phototraps but also with GPS collars, was drawn. An important next step now is defining the proper use of this data. Some examples of case studies, possible solutions and good practices were already shown during our meeting. Moreover, the more intensive use of spatial data in connectivity modelling studies, in particular usefulness of 3D approaches which can be implemented with, for example, LiDAR data, was discussed.

Venue

The workshop was hosted by *the Slovak Academy of Sciences* in Stará Lesná, Slovakia.

The meeting webpage:

<http://www.geography.sav.sk/conskpl/index.php/events>

Symposium: Connectivity in human-dominated landscapes: current status, new approaches, and future challenges

In September 2017, about 310 landscape ecologists gathered in Ghent (Belgium) for the IALE 2017 European Congress. The congress theme reflected that landscape ecology is a meeting point – where pattern and process meet people and action – seen as a way of thinking when dealing with European landscapes. As a part of this conference Robert Pazur, Katarzyna Ostapowicz and Janine Bolliger proposed a symposium: Connectivity in human-dominated landscapes: current status, new approaches, and future challenges.

The main objectives of this symposium included:

- to provide an overview of current state-of-the-art tools and methods to assess habitat and functional connectivity in dynamic, heterogeneous landscapes;
- to identify the potential of current remote sensing data and connectivity modelling methods for assessment of different habitats and landscape structure;
- to explore challenges and future needs in implementing functional connectivity concepts in human-dominated landscapes and to assess options to mitigate or reconcile likely conflicts.

During three sessions participants learned and discussed:

- understanding of past and future landscape structure on functional connectivity,
- integration of different disciplines, e.g., landscape genetics, population biology, remote sensing, spatial analysis and analytical modelling, to pursue joint connectivity analyses successfully,
- the utilities of connectivity assessments, e.g. with use of 3D landscape metrics, for conservation management and mitigate related challenges and conflicts to mitigate and reconcile challenges and conflicts associated with the implementation of, e.g., Green and Blue Infrastructure (GBI) concepts.

The symposium with more than twenty contributions provided a unique opportunity for discussion and cooperation of scientists from different regions and research fields among others landscape genetics, remote sensing, quantitative landscape analysis. The interaction of scientists encouraged further cooperation with practical outcomes in the context of GBI.

Venue

The symposium was a part of the IALE Europe Congress 2017 organised by the Department of Geography of Ghent University, Ghent, Belgium.

The symposium webpage:

<http://www.iale-europe.eu/iale2017/connectivity-human-dominated-landscapes-current-status-new-approaches-and-future-challenges>

