



**Talks and Posters of BioMove members at the  
Ecology Across Borders: Joint Annual Meeting 2017  
of BES, GFÖ, NecoV and EEF  
Gent, Belgium, 11.-14. December 2017**

*Session TT1*

**Estimating individual responses to conspecifics in movement behaviour of bank voles**

Ulrike Schlägel

(University of Potsdam)

Co-Authors: Antje Herde (University of Potsdam), Melanie Dammhahn (University of Potsdam), Florian Jeltsch (University of Potsdam), Sophie Eden (University of Potsdam), Jana Eccard (University of Potsdam)

Individual responses to the external environment are crucial in shaping movement, resulting space-use patterns, and ultimately fitness. Besides resources or predators, conspecifics are an important part of the external environment. For example, an individual may be attracted to conspecifics for mating or collective foraging, or it may keep away from other individuals to avoid aggressive encounters or infanticide. With modern animal tracking technology, more and more data sets are emerging that allow to investigate such interactions between free-ranging individuals from fine-scale movement data. However, few methods exist for making inference from these data. We developed an approach based on step-selection functions to analyze how individuals react during their daily movements to the dynamic space-use of conspecifics. For this, we used telemetry data from simultaneously tracked bank voles (*Myodes glareolus*) moving in 0.25-ha outdoor enclosures. We tested (i) how strongly individuals avoid or are attracted to areas that other individuals have recently used, (ii) how these responses depend on sexes of the involved individuals. Although we present our method for single-species data, it can similarly be used to study interspecific interactions in competitive or predator-prey situations.

*Session S61*

**Land sharing vs. land sparing: How much does landscape diversity contribute to yield in winter-wheat fields?**

Larissa Schaub

(University of Potsdam)

Co-Authors: Karin Pirhofer-Walzl (Freie Universität Berlin), Christoph Scherber (Westfälische Wilhelms-Universität Münster), Jasmin Joshi (Universität Potsdam)

Agricultural landscapes are often dominated by large monocultures adjacent to one another. Consequently, regulating services such as nutrient cycling and pest control often have to be provided by the farmers directly. Biodiversity could supply a certain share of those services. Therefore, an intermixing of natural habitats within intensively used agricultural fields may balance putative yield losses caused by assigning land to natural habitats rather than to intense agricultural production and lead to a more sustainable landscape management. Our study takes up this land sharing vs. land sparing debate by examining the contribution of landscape structure to the production of winter wheat in an intense agricultural landscape north of Berlin (Germany). We recorded yields of sown *Triticum aestivum*, variety Julius (phytometer plants), along transects from natural habitats into wheat fields taking measurements at four distances from the natural habitat. Around each sampling point landscape composition and configuration metrics were assessed at several spatial scales. To quantify nutrient cycling and pest control we determined abiotic soil properties, earthworm abundance, leaf herbivory and leaf as well as seed-pathogen infection rates. Seed biomass increased with the distance to a natural habitat independently of habitat type and decreased with landscape diversity. Pests as well as nutrient cyclers benefit by more complex landscapes: Fungal infection rates on phytometer leaves and earthworm abundance were higher in more heterogeneous landscapes. Earthworm abundance increased along the transects whereas total soil nitrogen, total soil carbon and available phosphorus decreased from the natural habitats into the field. Hence, in our landscapes, intensively managed by farmers through fertilizer and plant protection applications, crop yield was stronger correlated with landscape structure than with small-scale biotic drivers.

Session S63

## **Is individual fitness influenced by space use and personality in common voles?**

Antje Herde

(University of Potsdam)

Co-Authors: Andrea Schuster (University of Potsdam), Thilo Liesenjohann (BioConsult SH), Tatjana Knopp (University of Potsdam), Melanie Dammhahn (University of Potsdam), Gerald Heckel (University of Bern), Jana Eccard (University of Potsdam)

Animal movement strategies, e.g. during dispersal or migration, and space use are known to impact the fitness of individuals. Besides, consistent among-individual differences in behaviour, i.e. animal personality, may influence both, space use and fitness, and may therefore also have ecological and evolutionary consequences. However, the interactions between space use, animal personality and fitness are still rarely explored.

The aim of this study was to investigate whether the fitness of common vole (*Microtus arvalis*) individuals was affected by space use and behavioural phenotype under natural conditions. The behavioural phenotype (boldness and activity) of each individual was quantified in standard behavioural tests in the laboratory. Afterwards, we monitored the movement of 113 individuals of 14 experimental populations via automated radio telemetry in large outdoor enclosures. We measured individual survival and reproductive success over the experimental period of five weeks for both sexes.

Our results indicate that the number of offspring produced was influenced by individual's space use: Individuals that ranged further within 24 hours produced more offspring. This points out how important individual space use can be for population dynamics and other ecological processes. We also found impacts of personality on space use and fitness, but effects were opposite for males and females: We found that shy males used more space than bold males, whereas shy females used less space than bold females. Shyer animals produced in general more offspring, but inactive females had more offspring than active females while active males had more offspring than inactive males. Survival was not influenced by the individuals' fitness or behavioural phenotype. Differential parental effort of males and females, and differences in

mating strategies may explain sex differences in personality-related fitness consequences of common voles.

*Poster H2.5*

**sOAR: An open-source software for modelling optimal animal life-history strategies in periodic environments**

Merlin Schaefer

(University of Potsdam & Leibnitz Centre for Agricultural Landscape Research)

Co-Authors: Stephan Menz (University of Potsdam), Florian Jeltsch (University of Potsdam), Damaris Zurell (Swiss Federal Research Institute WSL)

We present sOAR, the first open-source software for studying optimal behavioural strategies of animals in periodic environments. sOAR builds on the well-established framework of optimal annual routine modelling. Computing state-based optimal life-history strategies and simulating population dynamics under the found optimal strategy using stochastic dynamic programming, it provides an important tool for theoretical ecology. It is particularly suited for studying bird migration and includes options to integrate wind effects on flight energetics and to differentiate between costs of active and passive flight. Our illustrative examples demonstrate the wide range of potential applications of sOAR, for example in theoretical studies on the optimal timing of important life-history events, the optimal number of reproduction cycles or carry-over effects at population level. sOAR has the potential to improve our understanding of how complex behaviours evolve and how internal and external constraints experienced by the animal shape its behavioural decisions. Such knowledge is crucial for predicting potential species' response to global change.

*Poster N2.5*

**Mammal communities under fear: perceived predation risk shapes prey diversity**

Lisa Teckentrup

(University of Potsdam)

Co-Authors: Volker Grimm (Helmholtz Centre for Environmental Research – UFZ), Stephanie Kramer-Schadt (Leibniz Institute for Zoo and Wildlife Research), Florian Jeltsch (University of Potsdam)

Non-consumptive effects of predators on prey have been investigated regarding behavioral adaptations of individual prey species or regarding cascading effects on other trophic levels. However, an understanding of non-consumptive predator effects on the prey community is crucial for predicting community structure and composition as well as for conservation and management. We used an individual-based, spatially-explicit modelling approach to investigate the consequences of landscapes of fear on prey community metrics. The model scales up from individual home range formation based on food availability and perceived predation risk to consequences on prey community structure and composition. This mechanistic approach allowed us to explore how important factors such as refuge availability and foraging strategy under fear affect prey community metrics. Prey animals modified their space use and home range formation under perceived predation risk by increasing their use of refuges. Adaptations in space use scaled up to the community level and shaped prey community structure and composition. Refuge availability in the landscape and foraging strategy were identified as two driving mechanisms of community response to predation risk. For low refuge availability, perceived predation risk significantly decreased the diversity and total biomass of the prey community by shifting the body mass distribution of individuals in the community from large to small body masses. In contrast, high refuge availability promoted species diversity, especially in communities where individuals followed a risk-

averse foraging strategy. Our findings reveal that non-consumptive predator effects can have important implications for prey community diversity and should therefore be considered in the context of conservation and nature management.

*Poster N2.22*

### **The fourth dimension in animal movement – the effect of temporal resolution on the predictive power of movement models**

Stephanie Kramer-Schadt

(Leibniz Institute for Zoo and Wildlife Research)

Co-Authors: Johannes Signer (University of Goettingen), Ulrike Schlaegel (University of Potsdam)

GPS-telemetry and biologging techniques to track the position of animals have advanced to the point where we can obtain vast amounts of movement data at fine spatial and temporal resolutions, e.g. temporal resolutions at the order of minutes or seconds are becoming normal. These new data sets provide opportunities to address new questions, but also challenge existing analyses methods. Apart from “classical” correlational movement models (e.g. resource-selection functions RSF and step-selection functions SSF), mechanistic movement models (either in discrete or continuous time) can also be used for statistical inferences on movement behaviour (e.g. movement-based resource selection, cognitive-based movement strategies). Differences between these methods do not only pertain to the underlying statistical procedure (regression-type vs. likelihood-based fitting of statistical-mechanistic model) but also to the behavioural scales analysed (RSF on the home range scale, SSF on the movement path scale). But are these models still suitable for high-resolution movement data? Here, we compare the predictive power of RSF, SSF and a 1-step fitting procedure of SSFs in correctly estimating animal resource selection using simulated and empirical data on different temporal resolutions, while keeping the resolution of the environmental data constant.