



BSc/MSc Abschlussarbeit

Insekten als Nahrungsverfügbarkeit für Braunkehlchen

Hintergrund

Das Braunkehlchen (*Saxicola rubetra*) ist eine vom Aussterben bedrohte Vogelart des Offenlandes. Um die Art in Hessen wieder in einen günstigeren Erhaltungszustand zu bringen, wurde 2014 ein Artenhilfskonzept (AHK) für sie erstellt. Um die Brutplatzwahl sowie den Bruterfolg der Braunkehlchen in den letzten verbliebenen Vorkommensgebieten in Hessen zu untersuchen, sollen in 2024 und 2025 gezielte Erfassungen von Brutpaaren durchgeführt werden. Beauftragt durch die Staatliche Vogelschutzwarte Hessen (HLNUG, Dezernat N3) wird die Biotop- und Vegetationsausstattung der hessischen Braunkehlchen-Reviere untersucht.

Die Abschlussarbeit 2024 hat die Effekte von Landnutzung auf Insektenbiomasse in Braunkehlchen und nicht Braunkehlchenhabitaten untersucht. Ergänzend hierzu könnte man sich die Konstanz der gefundenen Effekte über zwei Jahre (2024 Daten werden zur Verfügung gestellt) oder die Effekte auf einzelne Ordnungen (i.e. über Biomasse hinaus) anschauen.

Voraussetzungen

- Bereitschaft Insektenproben zu wiegen und taxonomisch auf Ordnungs- und ggf. Artniveau zu sortieren und zu identifizieren
- Daten statistisch auswerten
- Feldarbeit von Mai bis Juli (Fallenaufbau Ende April, Fallenleerung alle zwei Wochen)

Untersuchungsgebiete

Insgesamt 20 Flächen mit Braunkehlchen-Brut und 20 Kontrollflächen untersucht werden in den Landkreisen Marburg-Biedenkopf, Lahn-Dill und Vogelsberg.

Kontakt

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MSc Abschlussarbeit

Bodennistende und blütenbesuchende Wildbienen im Nordschwarzwald

Hintergrund

Über die Hälfte aller Wildbienenarten nisten im Boden. Über ihre Nistaktivität, Standortwahl und Brutverhalten ist jedoch deutlich weniger bekannt als zu hohlräumnistenden, in Insektenhotels vorkommenden Bienen.

Ziel der Arbeit

Diese Arbeit wird auf den Projektflächen des Naturpark Schwarzwald Mitte/Nord realisiert und es soll getestet werden in wie weit Sandarien die Ansiedlung von bodennistenden Wildbienen fördern können. Daten von 2022-2024 mit denen auch der Einfluss des Jahres/Temperaturschwankungen/Niederschlag untersucht werden kann, liegen vor. Die Arbeit findet in Kooperation mit der Initiative ‚Blühende Naturparke‘ statt.

Voraussetzungen

- Bienen auf Artniveau bestimmen (Insekten-taxonomische Kenntnisse vorteilhaft)
- Daten statistisch analysieren und auswerten
- Feldarbeit von Mai bis Juli (1x im Monat über zwei Tage)

Kontakt

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MSc Thesis



Pollination in an ecological-economic model – improving INVEST

Background

The economic valuation of pollination services has been implemented in the model INVEST. In our project BEATLE we aim to use INVEST for an economic valuation, but want to improve the model's ecological estimates. So far the pollinator abundance is estimated based on habitats present and the habitat suitability for pollinators. All values are based on rough expert estimates.

We want to improve the index for habitat suitability and the estimate on how much of the pollination is attributed to managed pollinators, such as honey bees.

Objectives

(1) improve the index used in INVEST for linking habitat suitability to pollinator abundance (2) estimate the contribution of managed versus wild pollinators to crop pollination. A preliminary step is to identify the sensitivity of changing these estimates to the overall model outcome.

Requirements

- Dealing with indices (mathematical formulas) and an economic model
- Reading literature about habitat suitability for pollinator abundance

Literature

- Sharp et al. 2018 InVEST User's Guide Doi: [10.13140/RG.2.2.32693.78567](https://doi.org/10.13140/RG.2.2.32693.78567)
- Vigerstol, K.L. & Aukema, J.E. (2011). A comparison of tools for modeling freshwater ecosystem services. *J. Environ. Manage.*, 92, 2403–9.

Contact

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MSc Thesis

Effects of microclimatic changes along a forest-grassland gradient on soil insects and plant-pollinator interactions

Background

Communities change along gradients which is known for example for bee-wasp communities along an urban-rural gradient and for ground-beetles along a forest-grassland gradient. Here we hypothesize that soil-insect communities and pollinators also change along a forest-grassland gradient and suppose that the community is more dominated by bees in the grassland and wasps in the forest.

Objectives

We aim to identify diversity gradients and community compositional change of soil-insects and pollinators along a forest-grassland gradient.

Requirements

- Field work in the surroundings of Marburg
- Insect identification (taxonomic knowledge, especially of bees, is an advantage)

Literature

- Erdős, L., Ho, K.V., Bátori, Z., Kröel-Dulay, G., Ónodi, G., Tölgyesi, C., Török, P. & Lengyel, A. (2023). Taxonomic, functional and phylogenetic diversity peaks do not coincide along a compositional gradient in forest-grassland mosaics. *J. Ecol.*, 111, 182–197. <https://doi.org/10.1111/1365-2745.14025>
- Magura, T. (2017). Ignoring functional and phylogenetic features masks the edge influence on ground beetle diversity across forest-grassland gradient. *For. Ecol. Manage.*, 384, 371–377. <https://doi.org/10.1016/j.foreco.2016.10.056>

Contact

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Climate change effects on ground-nesting bees

Background

Climate change has an effect on temperature and precipitation regimes and thus the habitat of flora and fauna. In this study, we want to investigate the effects of overwintering temperature and moisture changes on two ground-nesting bee species.

Objectives

Does a moisture decrease or increase in winter influence the survival (and fitness) of ground-nesting bees?

Requirements

- Field work already in autumn/winter -> digging out bee cocoons
- Lab work – counting the survival of bees in different temperature/moisture regimes

Literature

- Fründ, J., Zieger, S. L., and Tschardt, T. (2013). Response diversity of wild bees to overwintering temperatures. *Oecologia*, 173(4), 1639-1648. <https://doi.org/10.1007/s00442-013-2729-1>
- Schenk, M., Mitesser, O., Hovestadt, T., and Holzschuh, A. (2018). Overwintering temperature and body condition shift emergence dates of spring-emerging solitary bees. *PeerJ*, 6, e4721. <https://doi.org/10.7717/peerj.4721>

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MSc Thesis



Pollinator efficiency – pollination during day versus night time

Background

There is a range of pollinators that are generalist and visit various flowers. Rapeseed yield increases with pollinator visits, but which pollinators are involved and the role of pollination during night is unknown. Here we want to do a cafeteria experiment using rapeseed as phytometer plant.

Objective

Identifying the contribution of daylight and nighttime pollination to rapeseed yield.

Requirements

- Field work in spring, phytometer plant raising in early spring

Literature

- Ellis, E., Edmondson, Jill L., Hipperson, Helen & Campbell, S.A. (2023). Negative effects of urbanisation on diurnal and nocturnal pollen-transport networks. *Ecol. Lett.*, 1–12.
- Jaca, J., Nogales, M. & Traveset, A. Effect of diurnal vs. nocturnal pollinators and flower position on the reproductive success of *Echium simplex*. *Arthropod-Plant Interactions* **14**, 409–419 (2020). <https://doi-org.ezproxy.ub.uni-marburg.de/10.1007/s11829-020-09759-4>

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MSc Thesis

Pollinator efficiency based on bee traits

Background

Pollinators visit plants and while doing so, pollen is sticking to their body and transferred to the next flower visited. How much pollen is transferred with each visit translates into 'pollinator efficiency' and this is determined by pollinator characteristics, i.e. traits.

Objective

Identifying bee traits that are important for pollination.

Requirements

- Field work in spring – collecting bees via aerial netting
- Lab work – measuring pollen loads, identifying the pollen and measuring bee traits (body size, hairiness...)

Literature

- Chase, M.H., Fraterrigo, J.M. & Harmon-Threatt, A. (2023). Bee functional traits and their relationship to pollination services depend on many factors: A meta-regression analysis. *Insect Conserv. Divers.*, 313–323.
- Roquer-Beni, L., Alins, G., Arnan, X., Boreux, V., García, D., Hambäck, P.A., Happe, A.K., Klein, A.M., Miñarro, M., Mody, K., Porcel, M., Rodrigo, A., Samnegård, U., Tasin, M. & Bosch, J. (2021). Management-dependent effects of pollinator functional diversity on apple pollination services: A response-effect trait approach. *J. Appl. Ecol.*, 58, 2843–2853.
- Roquer-Beni, L., Rodrigo, A., Arnan, X., Klein, A.M., Fornoff, F., Boreux, V. & Bosch, J. (2020). A novel method to measure hairiness in bees and other insect pollinators. *Ecol. Evol.*, 10, 2979–2990.

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Diversity of flower-visiting insects on Central European plants

Background

Flower visiting insects are important for pollen transfer among many plants. The diversity of visiting species however strongly varies among plants. Some plants are visited by more than 100 insect species while others are visited by only few. Some visitors are specialized to one or few plants, whilst others visit a very large numbers of plant species - for instance bumble bees. Here we will survey published data of flower visiting insect in order to build up a comprehensive insect flower-visiting data base. This data base will be used to address the following questions:

1. Which plants traits or ecological conditions are related to the diversity of flower-visiting insect species on Central European plants?
2. How does assemblage composition of flower-visiting insects vary among plants and what are the factors related to differences among assemblages?

Language

English

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The impact of drought on macrozoobenthos communities in headwaters: How resilient are freshwater ecosystems?

Background

In 2005 the macrozoobenthos communities from 40 headwaters and springs around Marburg were analyzed. These samples covered a broad ecological gradient from acidic to near neutral water conditions. The macrozoobenthos samples were subdivided into different feeding categories (grazers, herbivores and predators/omnivores) and analysed for differences in species richness and species composition. The study found that the water pH was the most important factor determining species richness and assemblage composition. Grazers and herbivores on average showed a stronger response to environmental gradients than predators/ omnivores.

In this study we will repeat the study from 2004 and compare the samples from 2004 with those from 2024 using an identical sampling protocol (the same headwaters, the same sampling methods, the same classification of species). With respect to past drought periods especially hot summers in the last 20 years we will address the following questions:

- 1.) Are species richness and community composition of headwaters between 2004 and 2024 different?
- 2.) What are the “winners” and what are the “losers”? Which species-specific traits characterizes “winners” and “losers”?
- 3.) How resilient are communities in terms of functional composition?

Requirements

Car and driving license are mandatory

Contact

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The causes and consequences of specialisation in pollen collecting bees

Background

Bees collect pollen to provide their offspring with nutrients. While some bees collect pollen from a large number of different plant species comprising different plant families or genera, others are highly specialized to one plant family or even one plant genus. The factors that explain such different degrees of specialization are largely unknown. Here we analyze at first the specialization of bee species (bee perspective) and second the average specialization of plant specific bee assemblages (plant perspective). Specifically, we will address the following questions:

- 1) Are larger bees less specialized than smaller bee species? Are more widely distributed species less specialized than geographically restricted species? Which other life history traits are related to species specialization (phenological niche breadth, habitat choice, etc.) Are these relationships independent from phylogeny?
- 2) Do plants affiliated with a larger assemblage of pollen collecting bees also exert assemblages that are more specialized? Which plants traits are related to the assemblage specialization of pollen collected bees?

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Colour lightness patterns of pollen collection bees in Central Europe

Background

Previous studies on bumblebees found large variation in color pattern and color lightness in bumblebees on a global scale. Several explanations have been put forward to explain the pattern including thermoregulation, crypsis and warning signals. Bumblebees however represent only a small fraction of the pollen collecting bees. Here we will analyze the color pattern from a large number of pollen collecting bees and relate the patterns to species traits (e.g. body size). Specifically, we will address the following questions:

1. Are larger species on average lighter in body coloration than smaller species?
2. Are darker species able to colonize habitats at higher altitudes (thermoregulation)
3. Does bee coloration match the color of visited flowers? (crypsis)

Contact

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Green island caused by leaf miners and gall makers

Background

Previous studies found that leaf litter with green island caused by miners and gall makers decompose faster than leaves without green islands. The implications on the leaf physiology are however only poorly understood. Here we will collect green island leaves and compare the effect of mining versus gall maker induced green islands. We will also test whether leaf parts outside the green islands are also affected in physiology.

1. Does the effect of green islands differ among miners and gall makers?
2. Do leaf parts outside the green island also decompose faster?
3. How does herbivory affect the effects of green island?

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Body size, colour pattern and host-plant specialisation in phytophagous insects

Background

Herbivory of insect on plant is an important ecosystem function. Herbivorous insects however strongly vary in terms of food plant utilization. While some are specialists others utilize a broad range of host plants. The causes and consequences of specialization are not well understood. Here we will use a comprehensive interaction data base and add to this data base body size and insect coloration data.

1. Do color patterns of insects match those of the utilized plants?
2. Are smaller insects more specialized than larger insects?
3. Does the average specialization of herbivore assemblages increase with the total number of insect species, e.g. are larger assemblages higher specialized?

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1. The use of audio recorders for biodiversity monitoring

Background

Humans have both direct and indirect effects on biodiversity. As such, there is an increasing need for accurate and cost-effective biodiversity monitoring. To this purpose technological applications, such as passive acoustic recorders, are increasingly implemented. However, how soundscapes relate to biodiversity remains unclear. This project aims to explore the relationship between acoustic diversity indices and observed species richness of birds, bats and insects. Audio recorders will be deployed along a gradient from open grassland to forest and data will be collected on the diversity of birds, bats and insects through transects and pitfall traps. This project involves field work and some elaborate computational work with R. However, good packages and guidelines for the analysis of sound data exist.



Requirements

- Field work with some driving
- Laboratory work involving species identification
- R programming skills or willingness to learn

Language

English preferred, German possible

Literature

Scarpelli, Marina D. A., David Tucker, Brendan Doohan, Paul Roe, and Susan Fuller. 2023. 'Spatial Dynamics of Soundscapes and Biodiversity in a Semi-Arid Landscape'. *Landscape Ecology* 38 (2): 463–78. <https://doi.org/10.1007/s10980-022-01568-9>.

Sethi, Sarab S., Avery Bick, Robert M. Ewers, Holger Klinck, Vijay Ramesh, Mao-Ning Tuanmu, and David A. Coomes. 2023. 'Limits to the Accurate and Generalizable Use of Soundscapes to Monitor Biodiversity'. *Nature Ecology & Evolution* 7 (9): 1373–78. <https://doi.org/10.1038/s41559-023-02148-z>.

Sueur, Jérôme, Almo Farina, Amandine Gasc, Nadia Pieretti, and Sandrine Pavoine. 2014. 'Acoustic Indices for Biodiversity Assessment and Landscape Investigation'. *Acta Acustica United with Acustica* 100 (4): 772–81. <https://doi.org/10.3813/AAA.918757>.

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MSc Thesis

2. The effect of wind turbines on ant communities and ant behaviour



Background

Technophony, sounds generated by machinery, is a main factor of vibratory noise pollution. Many people report that living close to wind turbines affects their mental and physical health due to the noise they generate. But how does noise and tremors from wind turbines affect animals? This has been mostly explored for bats, which use sound to communicate and navigate. But many other animals, including insects, also use sounds.

This study will investigate how wind turbines affect the distribution and abundance of ants and whether noise-induced changes in their behaviour are observed. Any changes to ant communities because of noise pollution could have cascading effects through the ecosystem due to the many ecosystem services ants provide. This project is part of a larger project called EcoMechanics in collaboration with researchers at the German Center for Integrative Biodiversity Research (iDiv).

Requirements

- Field work with some driving
- Laboratory work for species identification
- R programming skills or willingness to learn
- Opportunity to work with cameras and AI

Language

English preferred, German possible

Literature

Kaldellis JK, Kavadias KA, Paliatsos AG. 2003. Environmental impacts of wind energy applications: myth or reality? *Fresen Environ Bull*, 12:326–337.

Berberich G, Berberich M, Grumpe A, Wöhler C, Schreiber U. 2013. Early Results of Three-Year Monitoring of Red Wood Ants' Behavioral Changes and Their Possible Correlation with Earthquake Events. *Animals (Basel)*. 3(1):63–84.

Del Toro I, Berberich GM, Ribbons RR, Berberich MB, Sanders NJ, Ellison AM. 2017. Nests of red wood ants (*Formica rufa*-group) are positively associated with tectonic faults: a double-blind test. *PeerJ*. 5:e3903.

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MSc Thesis

3. Arthropod community composition in the Democratic Republic of Congo



Background

The Bonobo Diversity Project (<https://bondiv.org/>) is a large-scale collaborative research project that aims to investigate and document bonobo intraspecific diversity and behaviour. The main goals are to understand bonobo behavioral diversity, speciation, and ecology (including sympatric wildlife) and understand drivers of bonobo distribution and potential threats. As a part of BonDiv, data is also being collected on climate, vegetation, soil and insects. In 2024, pitfall sampling has been carried out at 5 sites to capture the diversity of soil arthropods living in the area and to investigate whether bonobos eat insects, as has been documented for chimpanzees.

As an initial step, this thesis will focus on the diversity and abundance of soil-associated arthropods and how this relates to local environmental factors including vegetation, climate and seasonality. Future work will involve exploring whether and how community composition of local arthropod assemblages is reflected in bonobo diet using molecular methods for DNA extraction from bonobo faecal samples and the pitfall traps.

Requirements

- Laboratory work sorting pitfall trap content to families and morphospecies level
- R programming skills or willingness to learn
- As we aim to apply for funding for a PhD student, this would be a good project for someone interested in pursuing a PhD.

Language

English preferred, German possible

Literature

Hamad, I., Delaporte, E., Raoult, D., & Bittar, F. (2014). Detection of termites and other insects consumed by African great apes using molecular fecal analysis. *Scientific reports*, 4(1), 4478.

Deblauwe, I., & Dekoninck, W. (2007). Diversity and distribution of ground-dwelling ants in a lowland rainforest in southeast Cameroon. *Insectes Sociaux*, 54, 334-342.

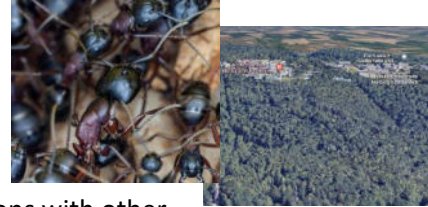
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MSc/BSc thesis

4. Changes in ant communities in a German forest over time



Background

Ants play a key role in many ecosystems because of their interactions with other species and the many services they deliver, including pollination, seed dispersal, biological control, bioturbation and nutrient cycling. Any changes to their community composition due to environmental change can have cascading effects throughout the ecosystem. In 1995, a master student mapped the ant communities in the Lahnberg forest. This project aims to re-sample the same sites to determine if and how the ant communities have changed over the past 30 years. Such re-sampling studies are classic for monitoring biodiversity change. Other questions could simultaneously be addressed such as how microclimatic conditions affect ant species richness.

Requirements

- Field work involving pitfall traps
- Laboratory work involving species identification
- R programming skills or willingness to learn

Language

English preferred, German possible

Literature

Grevé, M. E., Hager, J., Weisser, W. W., Schall, P., Gossner, M. M., & Feldhaar, H. (2018). Effect of forest management on temperate ant communities. *Ecosphere*, 9(6), e02303.

Seibold, S., Gossner, M. M., Simons, N. K., Blüthgen, N., Müller, J., Ambarlı, D., ... & Weisser, W. W. (2019). Arthropod decline in grasslands and forests is associated with landscape-level drivers. *Nature*, 574(7780), 671-674.

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5. Foraging activity, resource use and competition in ants



Background

Many ant species are territorial and feed on the same resources, which should lead to dominant species competitively excluding subordinate species (the dominance-impooverishment rule). However, many species seem to coexist within close proximity to each other. Trade-offs, such as between dominance and discovery ability or dominance and thermal tolerance, have been suggested to explain this coexistence, yet evidence is scattered and often contradictory.

This study aims to explore the foraging activity and resource use of ants at a fine temporal scale. The natural foraging activity of ants in a grassland community will be monitored using baiting stations and cameras, after which barriers will be built around ant nests to exclude other species from foraging in the area. Foraging activity will then be monitored again to see if ants shift their behaviour when competitors are excluded.

Requirements

- Willingness to work with a camera and AI
- Experimental field work involving baiting experiments
- Laboratory work involving species identification
- R programming skills or willingness to learn
- Python programming skills or willingness to learn

Language

English preferred, German possible

Literature

Van Oudenhove, L., Cerda, X., & Bernstein, C. (2018). Dominance-discovery and discovery-exploitation trade-offs promote diversity in ant communities. *PloS one*, 13(12), e0209596.

Sheard, J. K., Nelson, A. S., Berggreen, J. D., Boulay, R., Dunn, R. R., & Sanders, N. J. (2020). Testing trade-offs and the dominance–impooverishment rule among ant communities. *Journal of Biogeography*, 47(9), 1899-1909.

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6. Native and exotic species in the botanical garden



Background

Botanical gardens are hotspots for introductions of exotic species. In the botanical garden of Marburg at least 6 different species have been identified and exotic ants are attempted controlled by poison and natural means. Although these species have historically rarely spread into the surrounding areas, climate warming may enable populations to establish outside of greenhouses or, as a minimum, forage outside greenhouses during hot summers.

This study will map the distribution of native and exotic ants in the botanical garden greenhouses and immediate surrounding areas to identify the community composition, nest hotspots and test effective ways of biological control. This involves testing different types of baits and baiting methods. The botanical garden will also introduce geckos to the greenhouses in August and tests can be done to see if the geckos can act as biological controllers. Species distribution modelling could be carried out to determine the current and future risk of establishment of these non-native species in Germany.

Requirements

- Experimental field work
- Laboratory work involving species identification
- R programming skills or willingness to learn

Language

English preferred, German possible

Literature

Blatrix, R., Colin, T., Wegnez, P., Galkowski, C., & Geniez, P. (2018, July). Introduced ants (Hymenoptera: Formicidae) of mainland France and Belgium, with a focus on greenhouses. In *Annales de la Société entomologique de France (NS)* (Vol. 54, No. 4, pp. 293-308). Taylor & Francis.

Báthori, F., Herczeg, G., Vilizzi, L., Jégh, T., Kakas, C., Petrovics, M., & Csósz, S. (2024). A survey and risk screening of non-native ant species colonising greenhouses in Hungary. *Biological Invasions*, 1-12.

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