

MSc Thesis



Insect communities in whinchat breeding grounds

Background

Whinchats (Braunkehlchen, *Saxicola rubetra*) are threatened by extinction. Several measures to protect their breeding habitats have been installed in Hesse to prevent their extinction. So far less well known are the feeding habits and their needs while breeding. Whinchats feed on insects but whether they prefer a certain taxonomic order or whether the existence and abundance of specific insect species can even influence their breeding site choice shall be investigated with this study. Therefore insects have been and will be sampled with Malaise traps in 20 whinchat breeding sites and 20 control sites without whinchats.

The goal of this study is to identify species in specific taxonomic groups, e.g. Hymenoptera and Orthoptera, and analyze whether their community composition differs if whinchats are present.

Requirements

Willingness to identify insects in the laboratory (ethanol samples) with help of dichotomous keys

Language

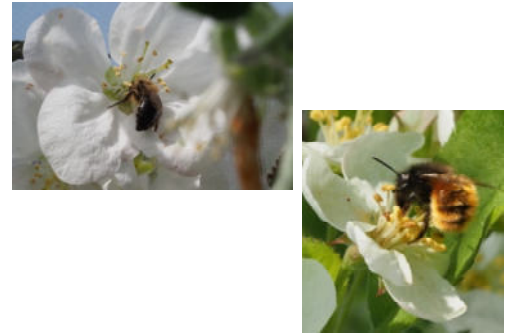
English or German

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MSc Thesis



Pollinator dependency of crops

Background

Bees and other flower-visiting insects pollinate crops (e.g. apples). The pollinator dependency of these crops (a simple ratio of yield with and without pollinators) has been estimated in a famous and multiple times cited publication from Alexandra Klein in 2007 (Klein et al. 2007 Proc B). This pollinator dependency has been at the baseline for various economic models and is an important estimator for yield predictions. Since then many new studies and approaches on how to improve an estimate for pollinator-dependency of crops have been published (e.g. Feuerbacher et al. 2024, Rader et al. 2016, Garratt et al. 2014, Gimenez-Garica et al. 2023), but no update of the pollinator dependency has been provided so far.

The goal of this MSc thesis is to provide an update of pollinator dependencies for selected crops, while at the same time improving the method used to quantify pollinator dependency.

Requirements

Willing to read literature

Language

English at preference; German is possible

Literature

Feuerbacher et al. (2024). The Economic Value of Pollination Services for Seed Production : A Blind Spot Deserving Attention. *Environ. Resour. Econ.*

Giménez-García et al. (2023). Pollination supply models from a local to global scale. *Web Ecol.*, 23, 99–129.

Garratt et al. (2014). Avoiding a bad apple: Insect pollination enhances fruit quality and economic value. *Agric. Ecosyst. Environ.*, 184, 34–40.

Klein et al. (2007). Importance of pollinators in changing landscapes for world crops. *Proc. R. Soc. B*, 274, 303–313.

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Pollination benefit in an ecological-economic models – 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 index used to estimate pollinator abundance. 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 pollination is attributed to managed pollinators, such as honey bees purposefully put next to crops, such as apple orchards and rapeseed plantations.

Goals: (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

The thesis can focus on both goals or either or.

Requirements

Willingness to deal with indices (mathematical formulas) and an economic model, Willingness to read literature about habitat suitability for pollinator abundance.

Language

English or German

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.

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MSc Thesis



Network Meta Analysis – Comparing drivers of insect decline

Background

Declining insect diversity has led to a large public attention especially since 2017 with public petitions across Germany and politics responding with an ‘Aktionsprogramm Insektenschutz’. While many studies (e.g. Hallmann et al. 2017, Seibold et al. 2019) identify declines, an analysis of the drivers leading to insect decline is more challenging, particularly when comparing them across many studies. Network meta-analysis is a synthesis method from the medical field with help of which studies looking at different drivers can be combined in one analysis.

The goal of this MSc thesis is to use existing literature and synthesize it with help of a network meta-analysis to identify the most important drivers leading to insect decline.

Requirements

Willingness to read literature, willingness to read about and understand network meta-analysis, and analyse data in R

Language

English or German

Literature

Hallmann, C.A., Sorg, M., Jongejans, E., Siepel, H., Hofland, N., Schwan, H., Stenmans, W., Müller, A., Sumser, H., Hörren, T., Goulson, D. & de Kroon, H. (2017). More than 75 percent decline over 27 years in total flying insect biomass in protected areas. *PLoS One*, 12, e0185809.

Seibold, S., Gossner, M.M., Simons, N.K., Blüthgen, N., Ambarl, D., Ammer, C., Bauhus, J., Fischer, M., Habel, C., Linsenmair, K.E., Nauss, T. & Penone, C. (2019). Arthropod decline in grasslands and forests is associated with drivers at landscape level. *Nature*, 574, 671–674.

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MSc Thesis

The effect of anthropogenic disturbance on forest soundscapes



Background

It is well known that humans have both a direct and indirect effect on biodiversity, but it is less understood how humans affect the composition of natural soundscapes composed of sounds from vocalising taxa such as birds, bats, and insects. This project aims to understand how humans affect soundscapes through forest management. Audio recorders will be deployed in forests representing a disturbance gradient from very natural, diverse forests to beech tree production forests and pine tree plantations. The project will investigate how the diversity and composition of sounds varies across time and space using different sound indices. The project could be further expanded by investigating how listening to soundscapes from the different forest types affects humans' mental health and whether photos taken in the different forests at different times of day and year influence the perceived restorativeness of listening to natural sounds. E.g., is a sound recording from a pine tree plantation perceived more positively when listened to while viewing a photo of a natural forest at sunset in spring than when viewing a photo of a pine tree plantation at mid-day in Winter? This project will involve field work in forests and some more elaborate computational work with R. However good packages and guidelines for the analysis of sound data exist. This project is part of a larger project on soundscapes across Sweden, Denmark, and Germany.

Requirements

- Willing to read literature
- Field work with some driving
- 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>.

Uebel, Konrad, Melissa Marselle, Angela J. Dean, Jonathan R. Rhodes, and Aletta Bonn. 2021. 'Urban Green Space Soundscapes and Their Perceived Restorativeness'. *People and Nature* 3 (3): 756–69. <https://doi.org/10.1002/pan3.10215>.

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MSc Thesis

The effect of wind turbines on ant communities and ant behavior



Background

Technophony, sounds that are 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 the noise and tremor 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 to communicate. Drumming and stridulation, two behaviours to emit vibrations, have been used by insects for more than 230 million years, which places them among the earliest forms of communication. These forms of communication may be disrupted by wind turbines.

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, in particular their ability to move biomass and recycle nutrients. This project is part of a larger project called EcoMechanics in collaboration with researchers at the German Center for Integrative Biodiversity Research (iDiv).

Requirements

- Willing to read literature
- Field work with some driving
- Laboratory work
- R programming skills or willingness to learn

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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