



FRIEDRICH-SCHILLER-
UNIVERSITÄT
JENA



HELMHOLTZ
CENTRE FOR
ENVIRONMENTAL
RESEARCH - UFZ



UNIVERSITÄT
LEIPZIG



MARTIN-LUTHER-UNIVERSITÄT
HALLE-WITTENBERG



Universität
Rostock

sMon – Trend analysis of German biodiversity data

David Eichenberg, Diana Bowler, Helge Bruelheide,
Florian Jansen, Marten Winter & Aletta Bonn

10th ICEI Symposium 24.9.2018 Jena

**Deutsches Zentrum für integrative Biodiversitätsforschung (iDiv)
Halle-Jena-Leipzig**



What's the issue?

 PLOS ONE

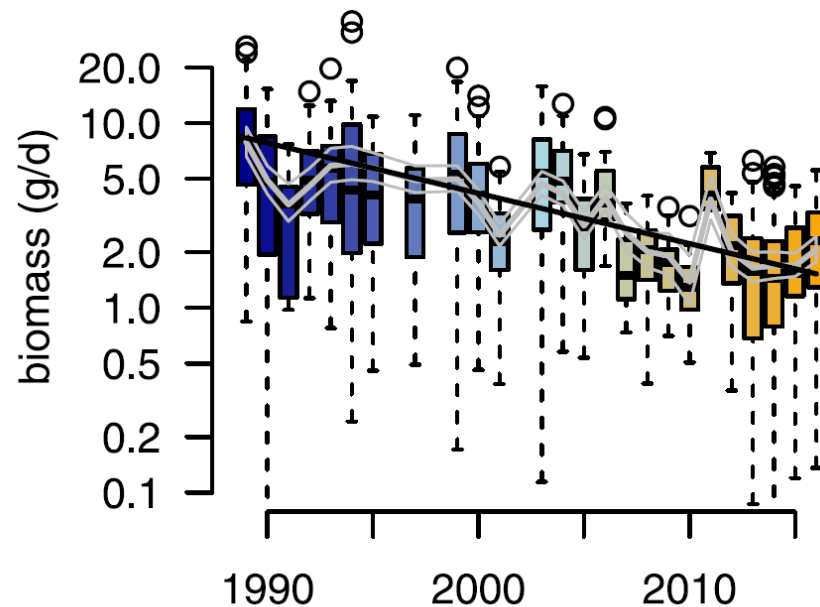
RESEARCH ARTICLE

More than 75 percent decline over 27 years in total flying insect biomass in protected areas

Caspar A. Hallmann^{1*}, Martin Sorg², Eelke Jongejans¹, Henk Siepel¹, Nick Hoffland¹, Heinz Schwan², Werner Stenmans², Andreas Müller², Hubert Sumser², Thomas Hörrén², Dave Goulson³, Hans de Kroon¹

¹ Radboud University, Institute for Water and Wetland Research, Animal Ecology and Physiology & Experimental Plant Ecology, PO Box 9100, 6500 GL Nijmegen, The Netherlands, ² Entomological Society Krefeld e.V., Entomological Collections Krefeld, Marktstrasse 159, 47798 Krefeld, Germany, ³ University of Sussex, School of Life Sciences, Falmer, Brighton BN1 9QG, United Kingdom

* c.hallmann@science.ru.nl



We have a lot of data and knowledge...



Ökologische Baubegleitung Biosphärenreservate
Eingriffs-Erfolgskontrollen Verbreitungsatlantent
Zufallsfunde BUND/NABU Kartierungen
Apps Ehrenamt Sammlungen
FFH-Kartierungen Gutachten
ELER Fachbegleitende Maßnahmen
Fachgruppen Graue Literatur
Qualifizierungsarbeiten Präsenzmonitoring
Amphibienzäune Private Meldungen

Diverse and heterogeneous data

sMon – working group in iDiv



Third workshop: December 2018

Kickoff workshop: November 2017



39 Participants

Representatives of **13 federal state agencies and the national conservation agency BfN**, as well as natural history society for amphibia (**DGHT**), dargonflies (**GdO**) and scientists of different institutes

Second workshop: January 2018



22 Participants

Work on specific data re amphibia and dragonflies as well as repeat biotope mapping data; Evaluation of data structures and first analyses

<https://www.idiv.de/smon.html>

Main challenge:

non-detection does not equal true absence



Occupancy \sim Detection

In sMon we collate and harmonize different datasets and evaluate methods and ways to analyze these data

1. Occupancy-Detection models
2. Frequency scaling
3. Species-area relationships
4. co-occurrence models
- ...

sMon - Trend analyses

Ökologische Baubegleitung Biosphärenreservate
Eingriffs-Erfolgskontrollen Verbreitungsatlanen
Zufallsfunde BUND/NABU Kartierungen
Apps Ehrenamt Sammlungen
FFH-Kartierungen Gutachten
ELER Fachbegleitende Maßnahmen
Fachgruppen Graue Literatur
Qualifizierungsarbeiten Präsenzmonitoring
Amphibienzäune Private Meldungen



Novel statistical methods for heterogeneous data

Methods in Ecology and Evolution

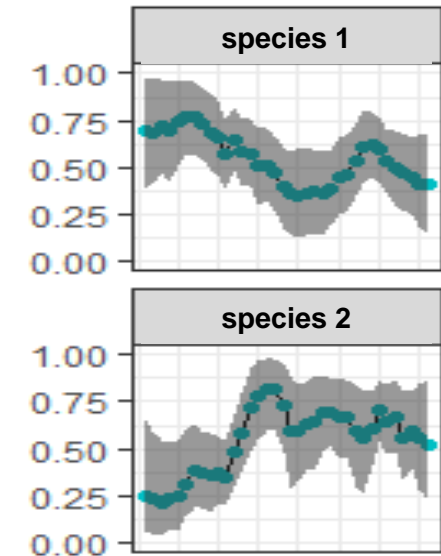
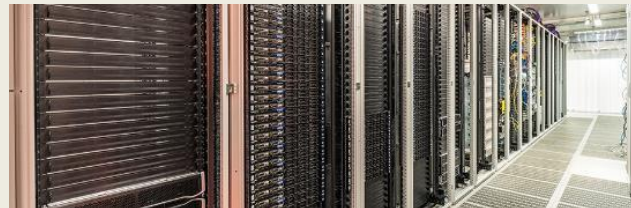
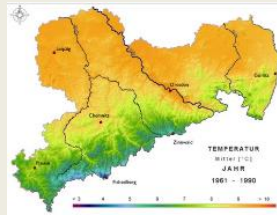
Methods in Ecology and Evolution 2014, 5, 1052–1060 doi: 10.1111/2041-210X.12254

Statistics for citizen science: extracting signals of change from noisy ecological data

Nick J. B. Isaac^{1*}, Arco J. van Strien², Tom A. August¹, Marnix P. de Zeeuw² and David B. Roy¹

¹NERC Centre for Ecology & Hydrology, Crowmarsh Gifford, Madingley Building, Wallingford, OX10 8BB, UK, and ²Statistiek Netherlands, PO Box 24500, 2450 HA The Hague, The Netherlands

Spatial environmental data as correlates



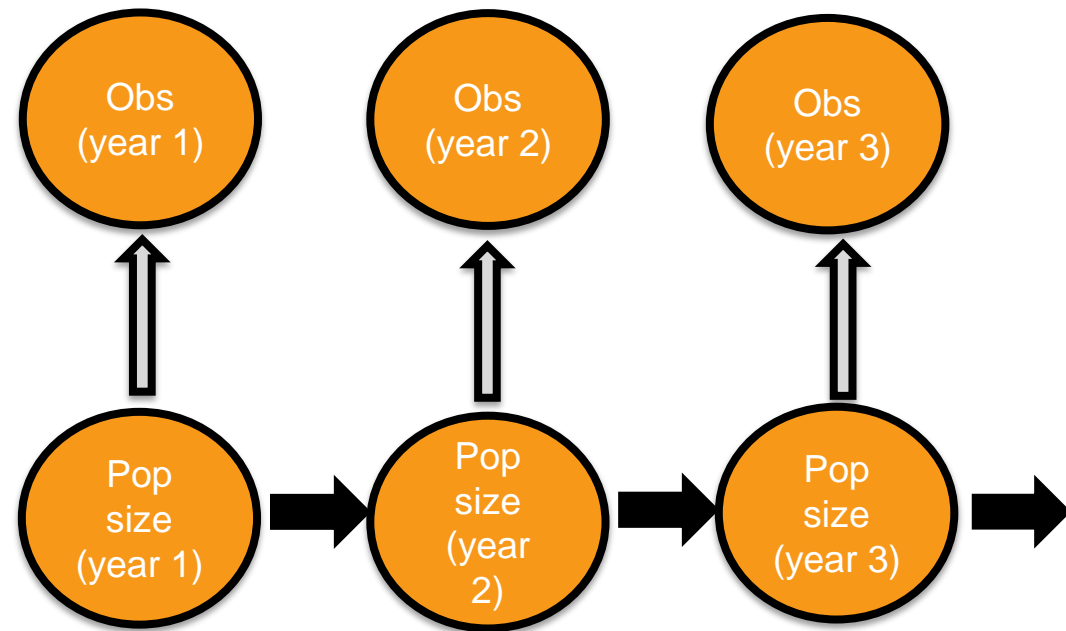
Occupancy-Detection models

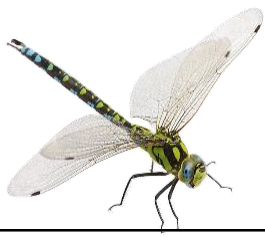
Occupancy \sim Detection

Joint analysis of occupancy and detection in a Hierarchical (bayesian) framework

Observation processes:
(observations affected by survey effort, sampling sites, observer skill, survey type)

Ecological processes:
(true abundances are temporally autocorrelated and affected by environmental change, and do not depend on survey type)



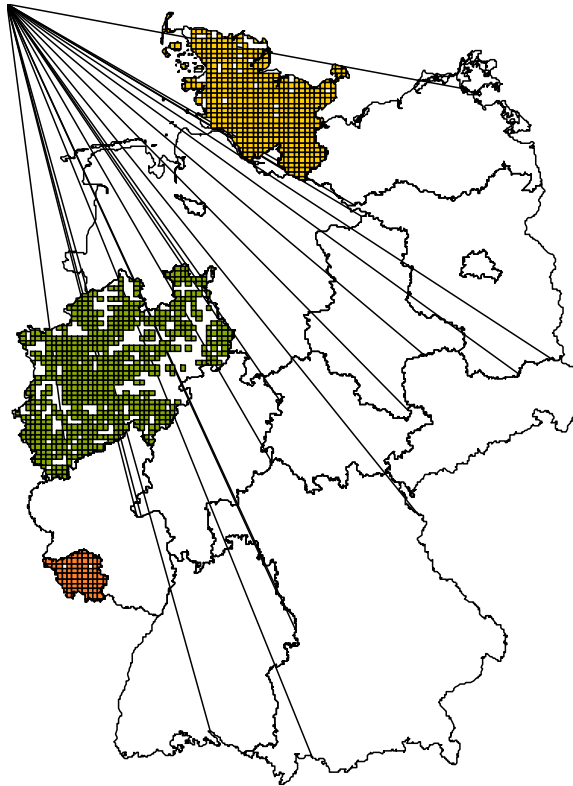


Trend analyses - Odonata

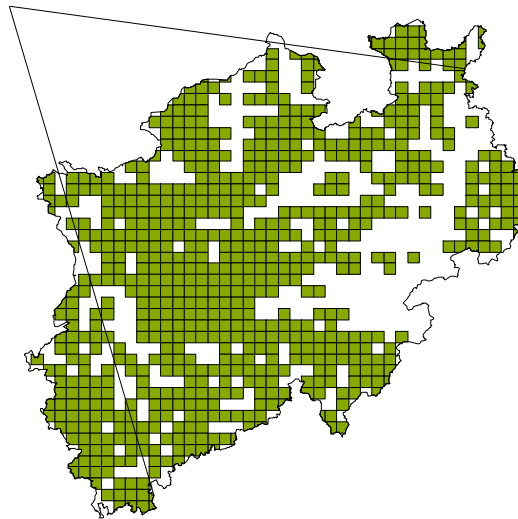


3 federal states:

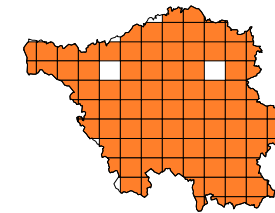
Scale: Grid cells (approx 4 x 4 km)



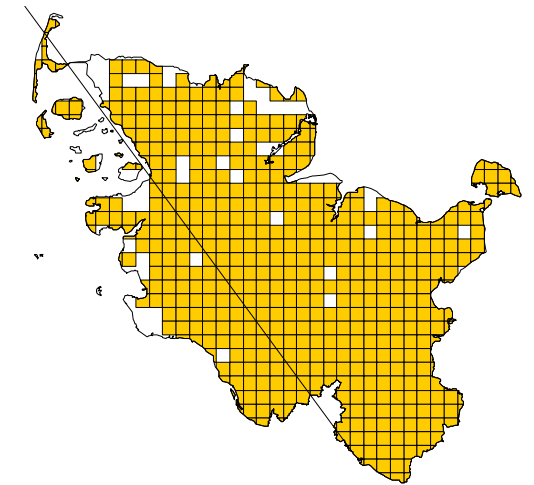
Saarland
North Rhine Westphalia
Schleswig-Holstein



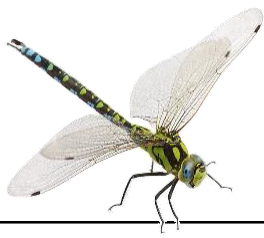
61% coverage



90% coverage



85% coverage



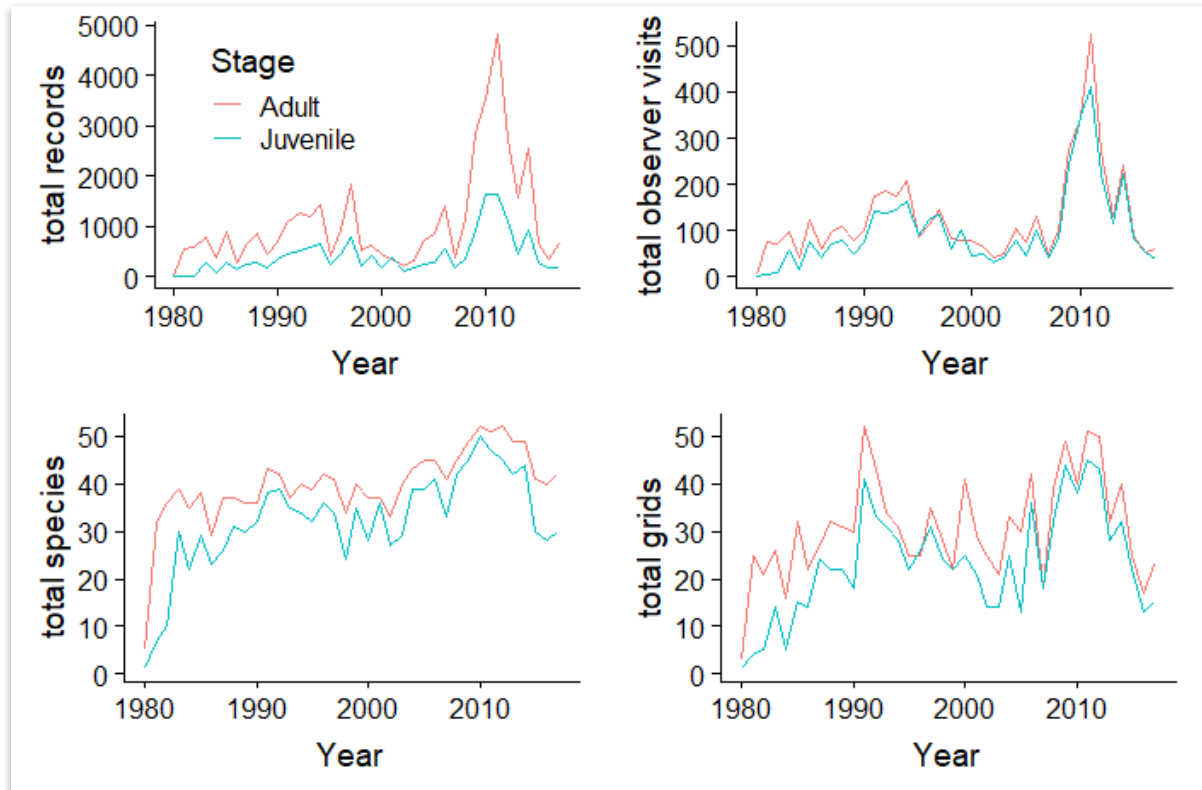
Saarland data



Occupancy \sim Detection

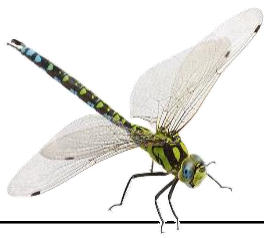


Observation processes:
(observations affected by **survey effort**,
sampling sites, observer skill, **survey type**)



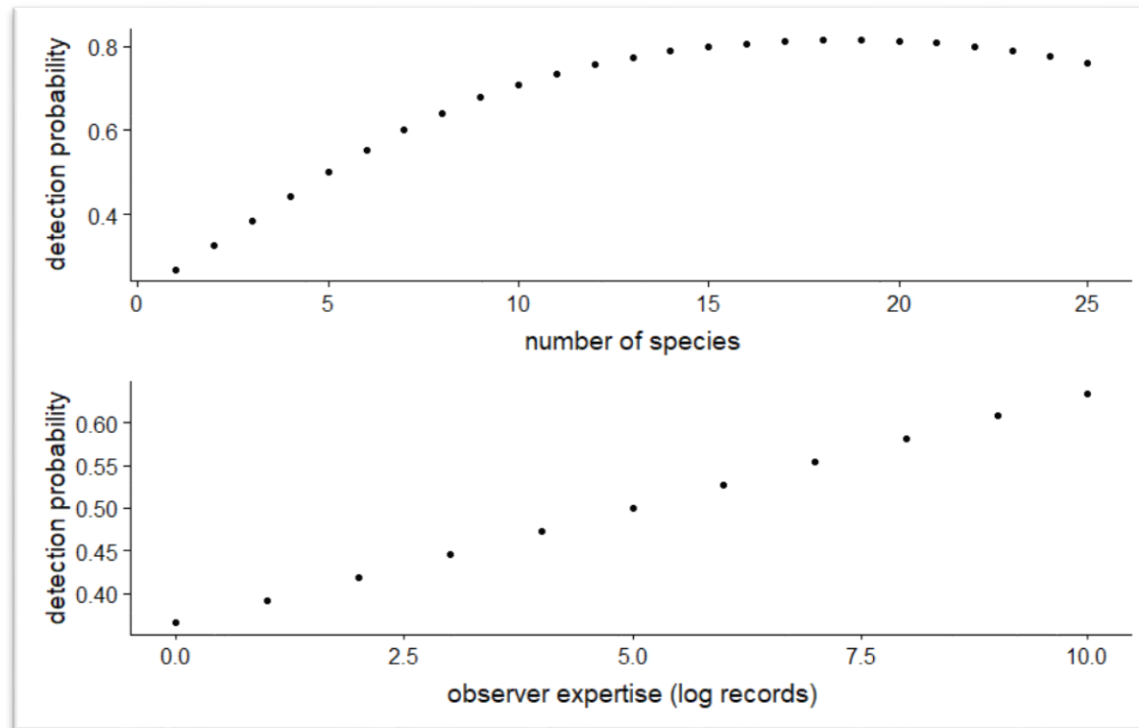
Sampling effort increased over time

Adults are recorded **more often** than **juveniles**



Saarland data

Detection \sim Observation process

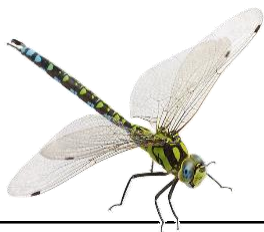


- Survey effort
- Survey type



Observer skill

Detection probability of *Ischnura elegans* as a function of number of species reported (upper) and log number of records by observer (lower).



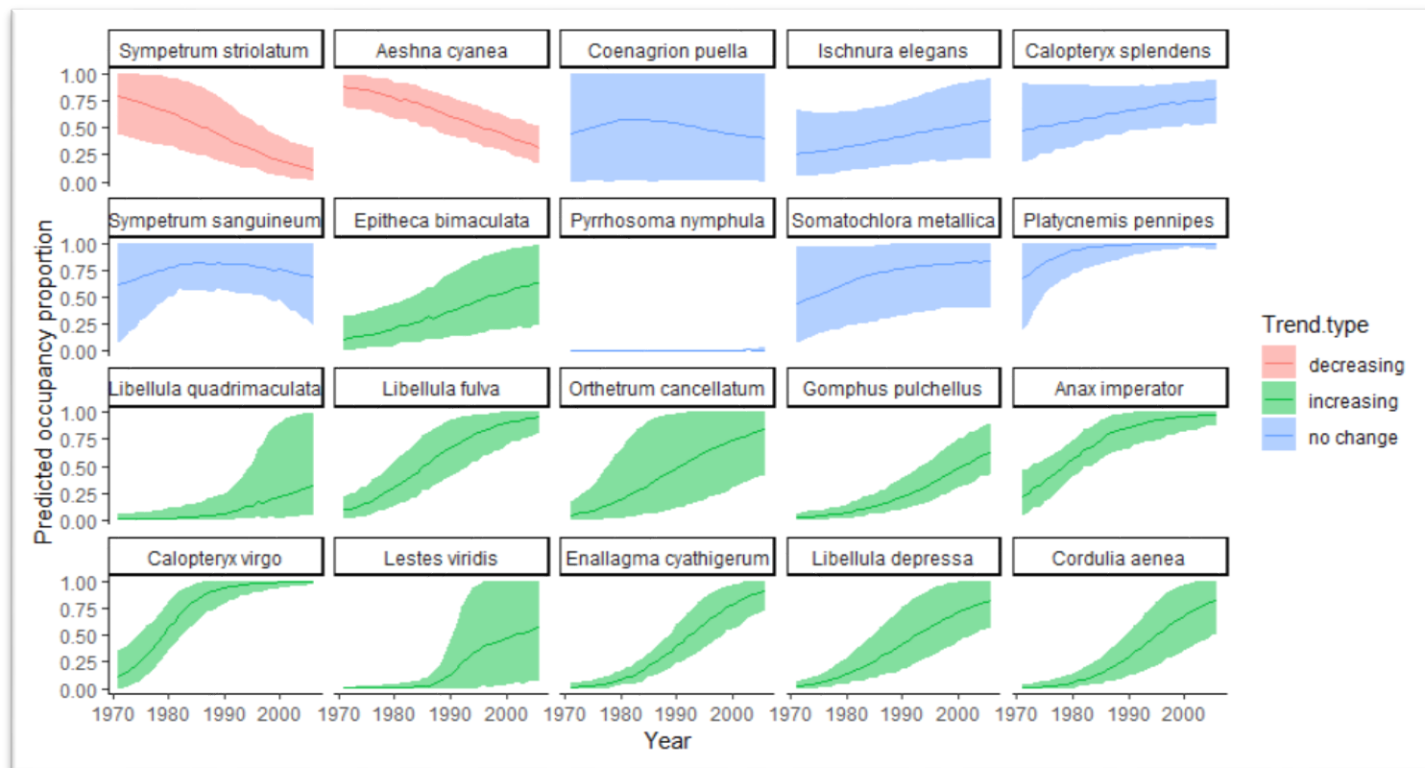
Saarland data

Preliminary results:

$$\text{Spec. nr seen} \sim \text{occupancy} * \text{detection prob.}$$



~ survey effort + observer skills



- We have winners,
- We have losers,
- We have species remaining constant

Reasons for observed trends will be studied in the near future

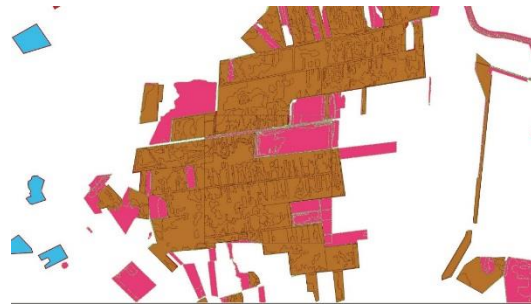
Example: 20 most common species in Saarland



Trend analyses - plants



1. Repeated biotope mapping in Schleswig-Holstein (Bruehlheide et al, in prep.)

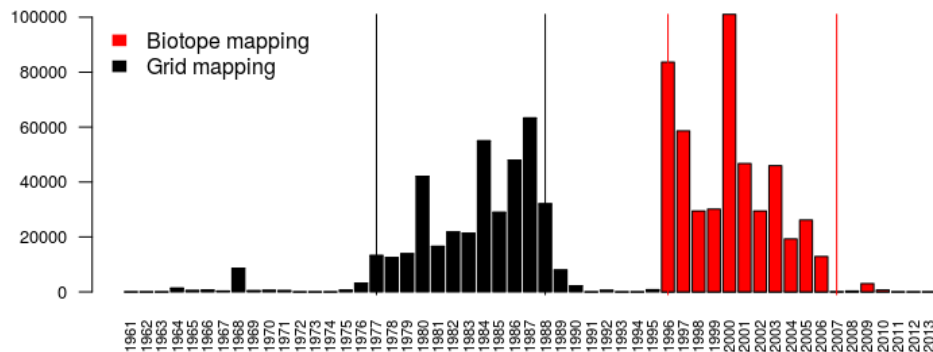


Source: LLUR Schleswig Holstein

1st mapping campaign (1978 – 1992)

2nd mapping campaign (2014 – date)

2. Intersect grid and biotope mapping data in Mecklenburg Western Pomerania (Jansen et al, in prep.)



Grid mapping (ca. 1977 – 1988)

Biotope mapping (ca. 1996 – 2007)



Trend analyses - plants



1. Repeated biotope mapping (Bruelheide et al, in prep)



Source: LLUR Schleswig Holstein

Cyan: 1st mapping campaign (1978 – 1992)
Magenta: 2nd mapping campaign (2014 – date)
Brown: overlapp

non-detection does not equal true absence

- Intersect re-surveyed biotopes (spatially explicit)
- Complement species lists with Beals smoothing (i.e. co-occurrence probabilities of species)

➔ **Conservative measure**

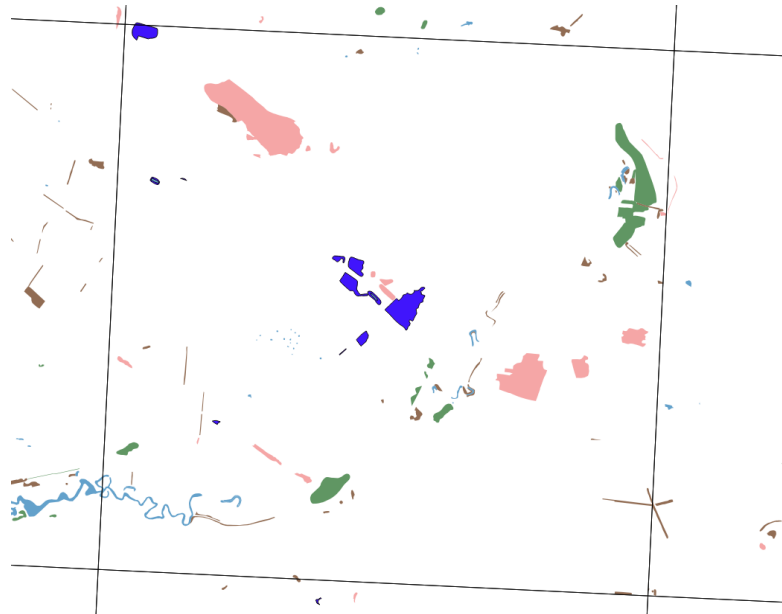
- Preliminary results:**
- **There are winners** (e.g. species formerly extinct in Germany)
 - **There are losers** (e.g. endangered species but also moderately common species)



Trend analyses - plants



2. Intersect Grid and Biotope mapping data (Jansen et al, in prep)



Source: LUNG Mecklenburg-Vorpommern

Grid: German grid cell (ca. 4 x 4 km)
Colors: Biotope types

non-detection does not equal true absence

Occurrence probabilities as a combination of:

- Frequency scaling (local and biotope type specific)
- Species area relationships
- Probabilities scaled to area of Biotopes in Grid cell



Highest occurrence probability of those measures

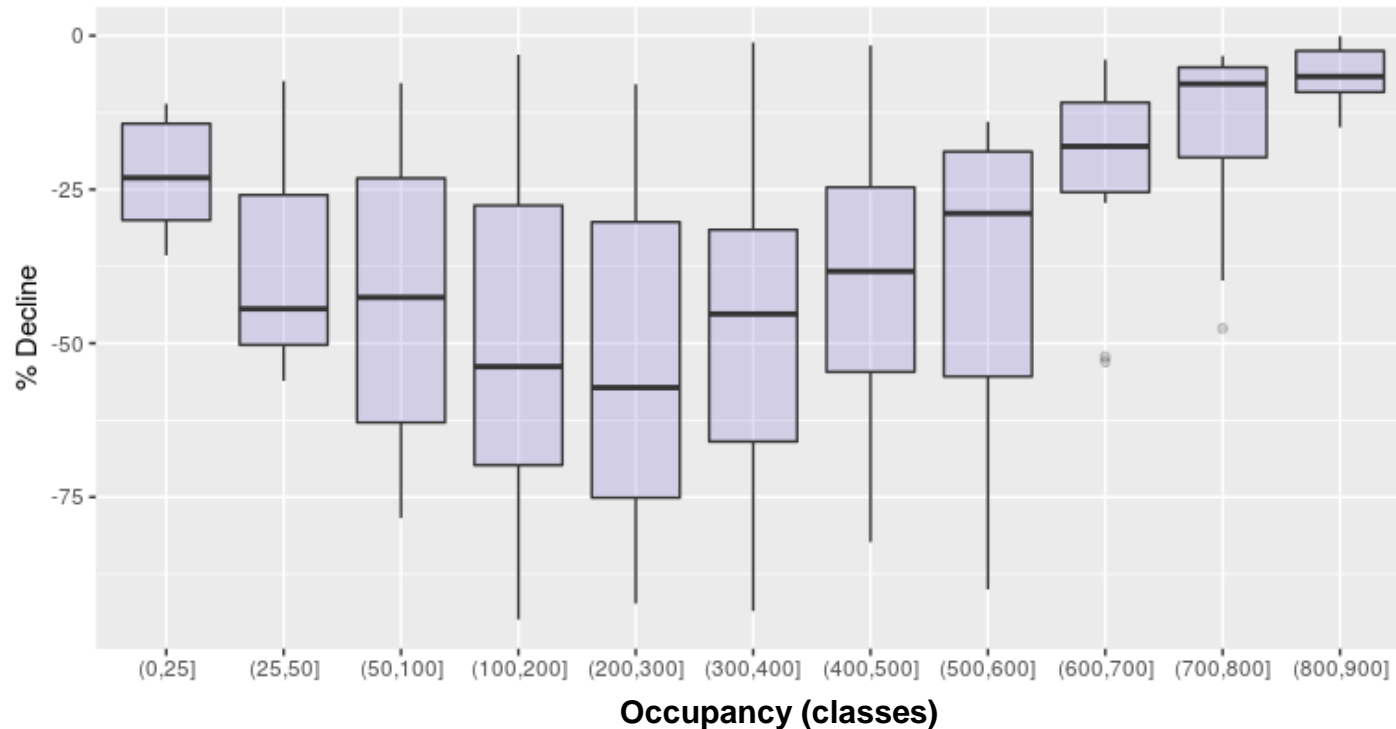
Conservative measure



Trend analyses - plants

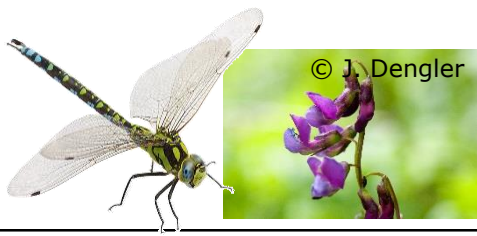


Preliminary results:



➔ **Moderately common to common species suffer the most (e.g. habitat generalists)**

- Points to:**
- **Protection strategies work (RL0 species, Brueheide et al., in prep)**
 - **Homogenisation of species pools in different ecosystems (Bruehleide et al, in prep ; Jansen et al, in prep)**

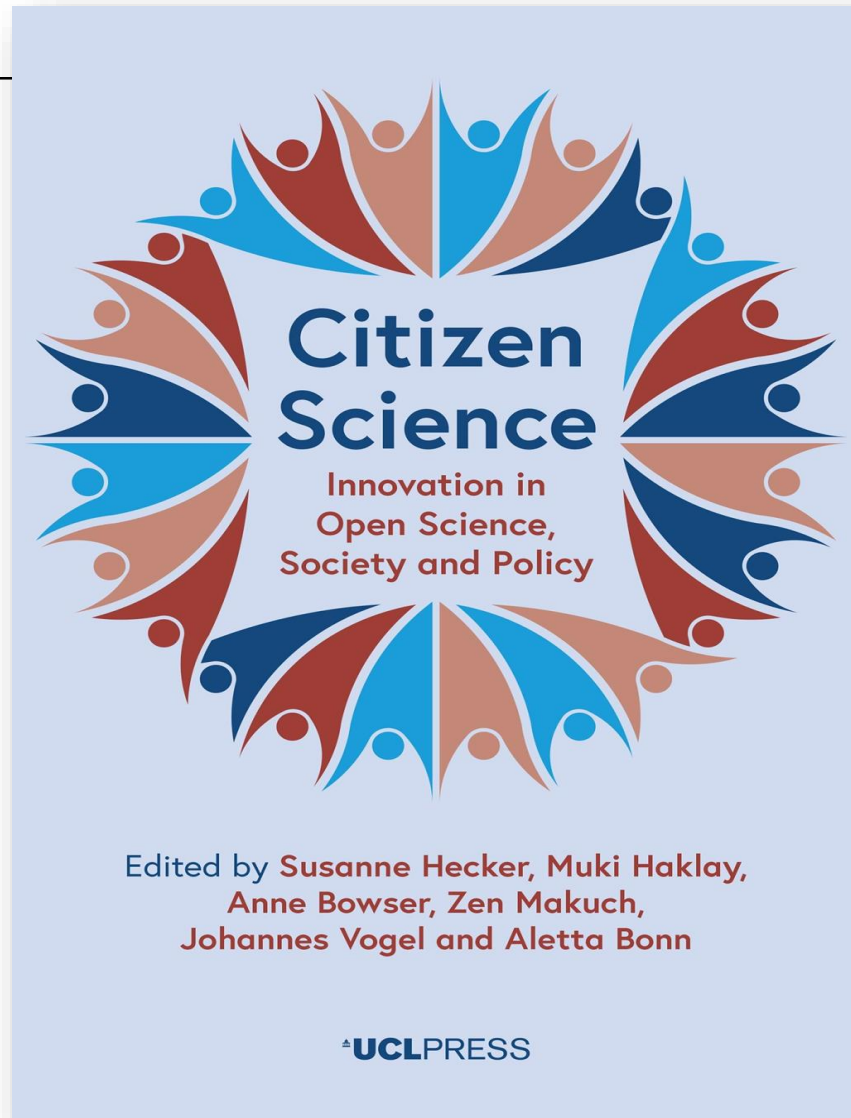


Trend analyses



Next steps

- Assess robustness of results to other metrics of survey effort/occurrence probabilities,
- Extend data analysis to the rest of Germany,
- Test the role of species traits,
- Include information on environmental change (temperature change, land-use),
- Identify areas where more data are needed.



Coming soon!

Open Access

www.ucl.ac.uk/ucl-press



Thank you!

**Deutsches Zentrum für integrative
Biodiversitätsforschung (iDiv) Halle-Jena-Leipzig**



Landesamt für Natur,
Umwelt und Verbraucherschutz
Nordrhein-Westfalen



Naturschutz
Berlin-Malchow



THÜNEN



Citclops

Bürger
schaffen
Wissen



Die Citizen Science Plattform



Hochschule Bremen
Biodiversitätsatlas

Bund für
Umwelt und
Naturschutz
Deutschland



BUND
FRIENDS OF THE EARTH GERMANY



Ministerium für
Umwelt und
Verbraucherschutz

SAARLAND



BIO-Diverse
INFORMATION - KOMMUNIKATION - BILDUNG



Umwelt
Bundesamt



Institut für Naturkunde
in Südwestdeutschland



stiftung
naturschutz
berlin



museum für
naturkunde
berlin



SENCKENBERG
world of biodiversity