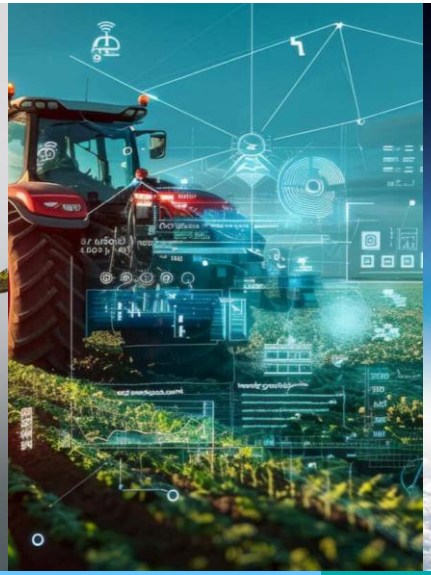
Leveraging data from IACS, EO and Citizen Science in Germany's farmland biodiversity monitoring (MonViA)

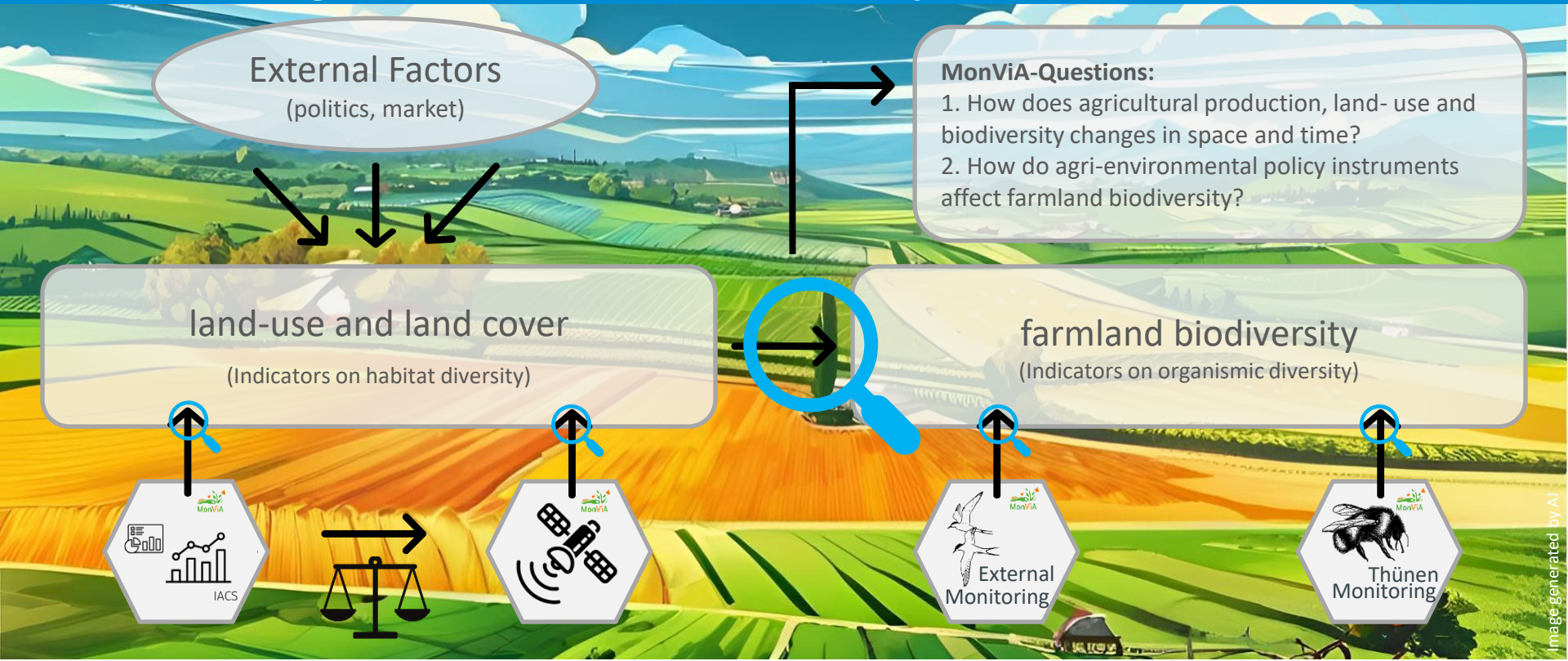
Sophie Ogan et al. (Thünen MonViA, Thünen Institute)



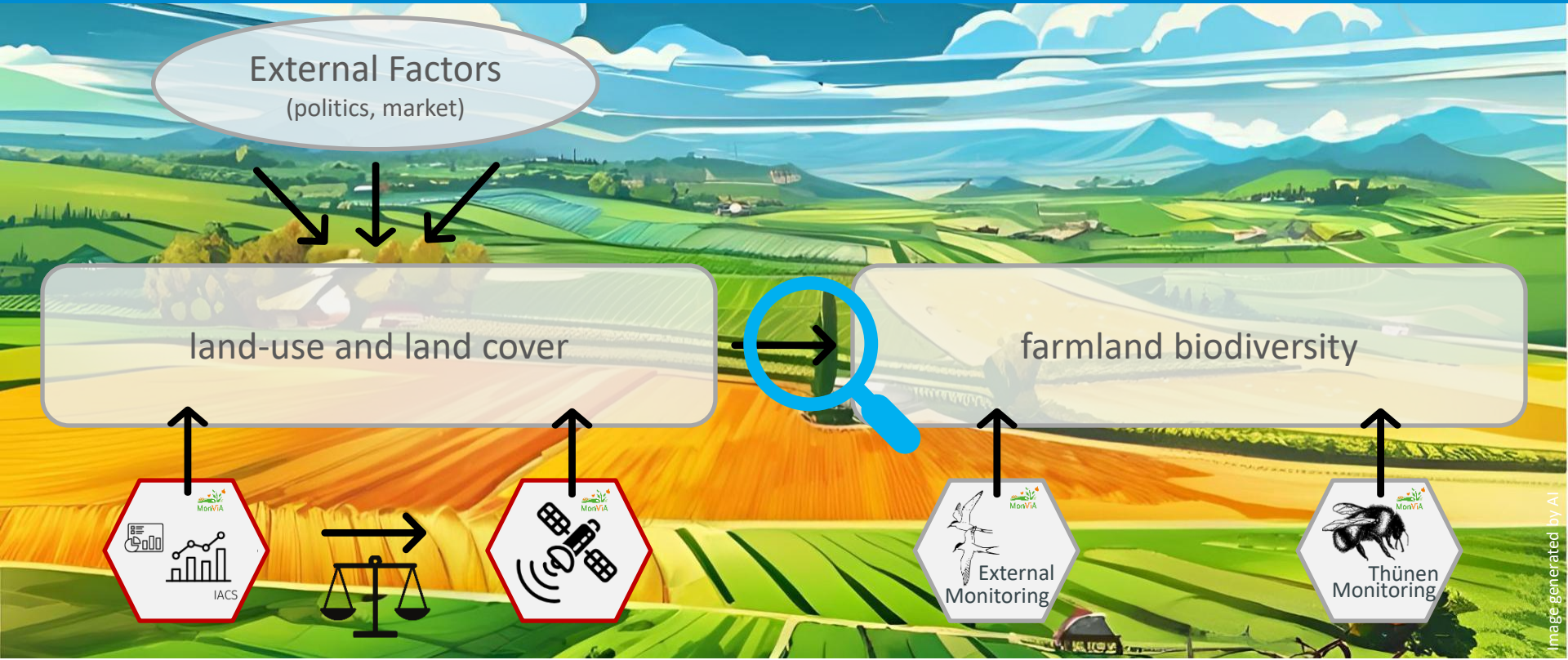



Hannover, 12.-13. June 2025

Understanding Status and Trends of Biodiversity under Land Use / Land Cover



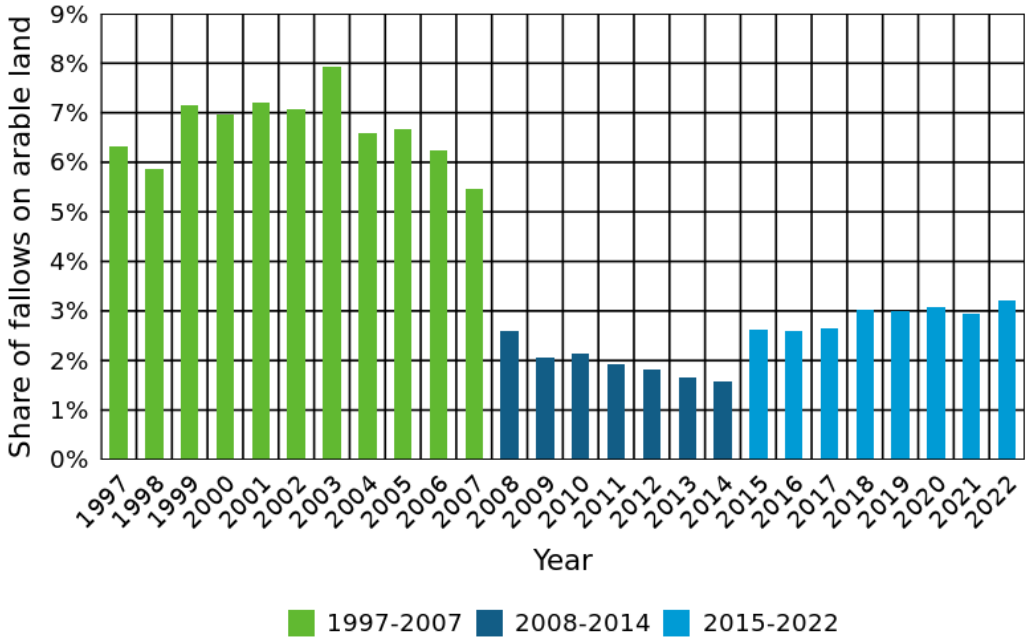
Understanding Status and Trends of Biodiversity under Land Use / Land Cover



MonViA- IACS / Agricultural statistics

Implementation of fallows on arable land (who, where, how): A result of political decisions

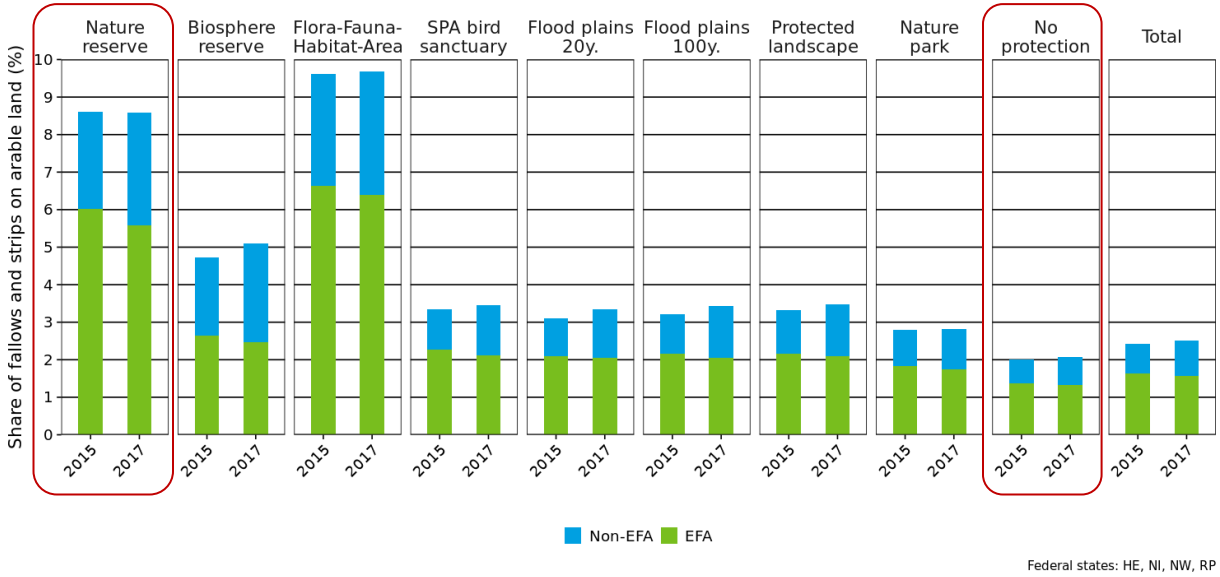
- **Who?**
  Within EFA - fallows and strips were especially implemented by farms:
  - With low added value per hectare (~ low profitability of arable farming)
  - With More than 30 ha arable land



MonViA- IACS / Agricultural statistics

Implementation of fallows on arable land: a result of political decisions

- **Where?**
  In protected areas

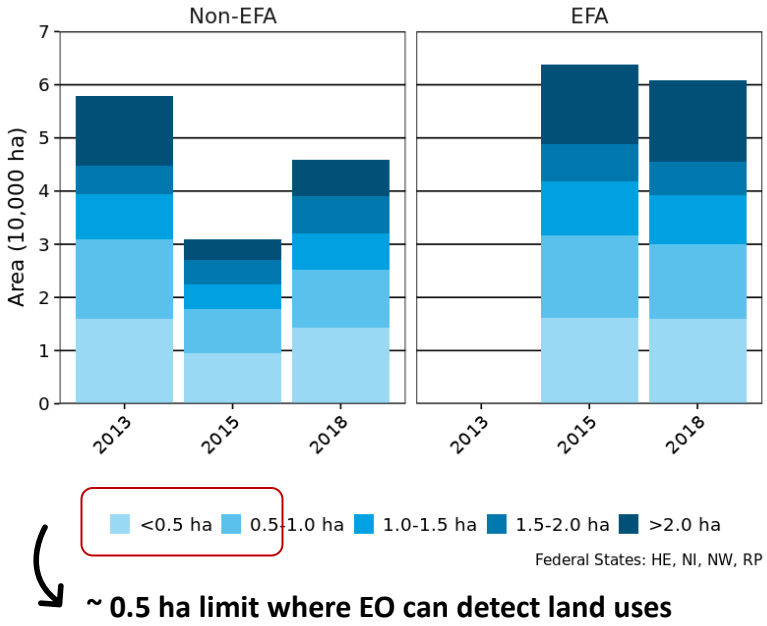


Federal states: HE, NI, NW, RP

MonViA- IACS / Agricultural statistics

Implementation of fallows on arable land: a result of political decisions

- **How?**
  Predominantly small and smallest parcels (even without size restrictions)



~ 0.5 ha limit where EO can detect land uses

MonViA-Earth Observation

→ area-wide

→ (free & open)

Land use & change:

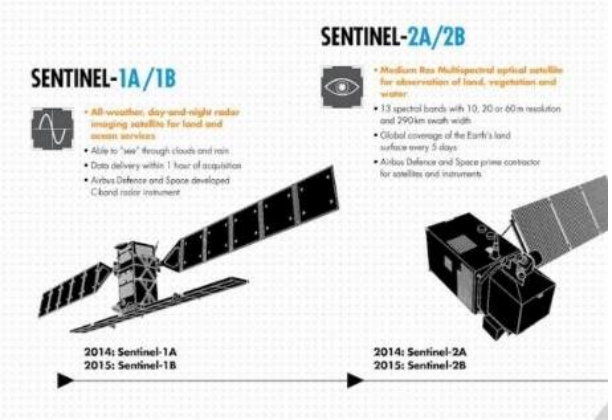
→ **Agricultural land use** (cropland / grassland): identification, delineation

→ **Temporal patterns** (seasonal, annual, multi-year)

→ **Soil management / cover (cropland)**

→ **Grassland management**: type / intensity

→ **Status and condition** of land (phenology, stress, diseases)



Fundament for all work:

✓ *Satellite Image Time Series (SITS)*

✓ *Deep learning models*

✓ *In-situ data…*

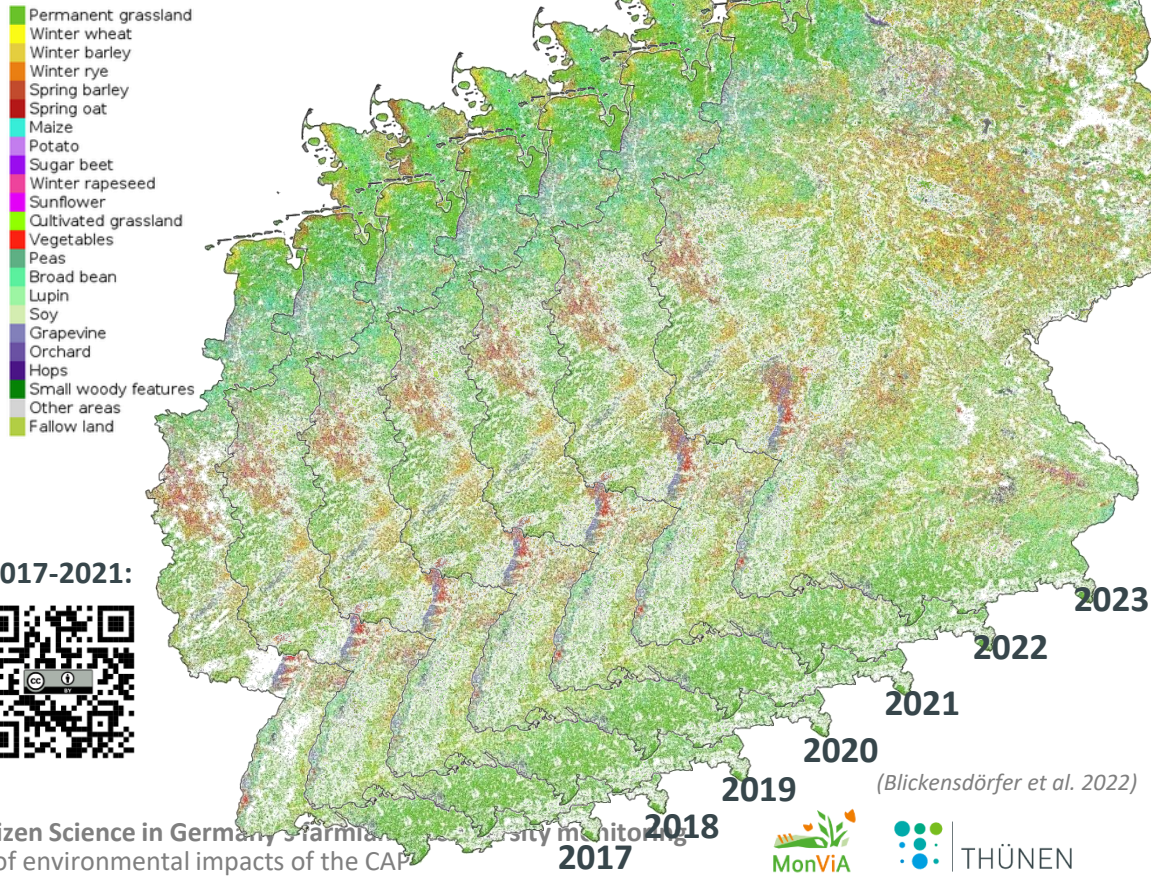
MonViA-Earth Observation

Agricultural land use:

- Area-wide annual **maps**

→High consistency with agricultural statistics

→ Dependency on **IACS data** for validation and training!

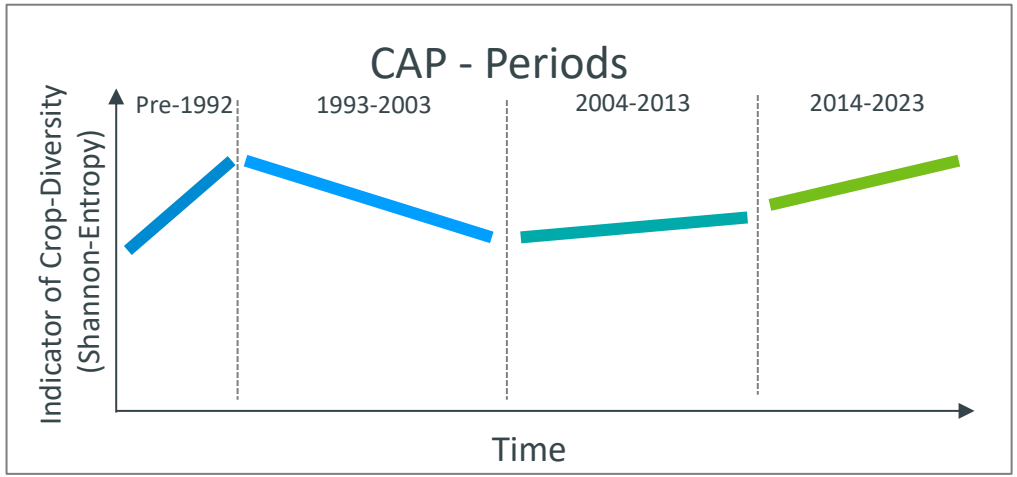


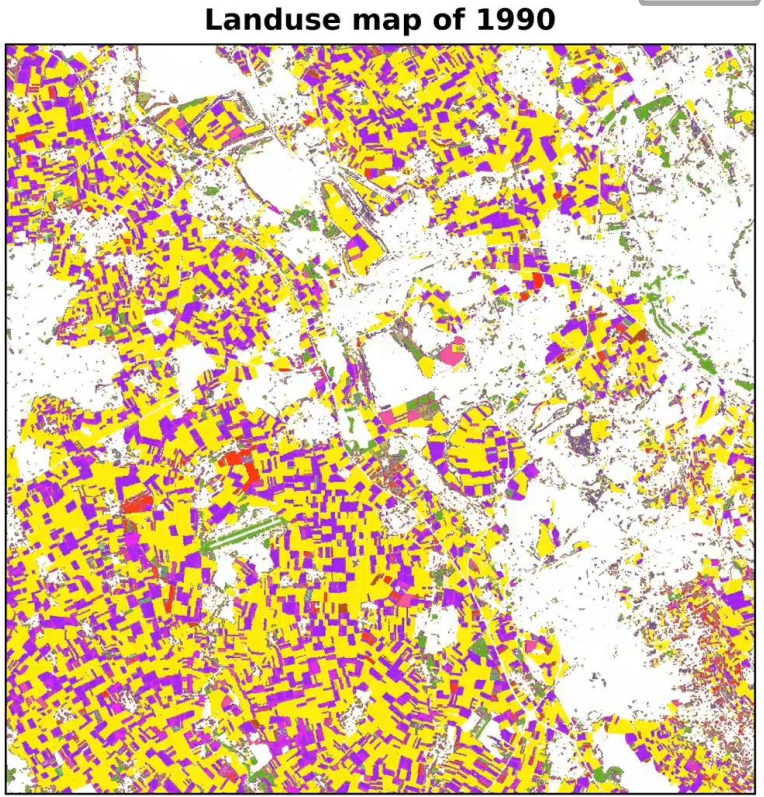
(Blickensdörfer et al. 2022)

MonViA-Earth Observation

Agricultural land use from 1990 to present:

- long time-series of cropland maps
- Spatial / temporal crop diversity patterns
- **Example**: Impact assessment of CAP reforms

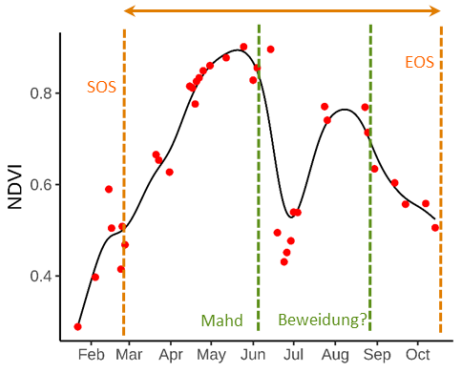




MonViA-Earth Observation

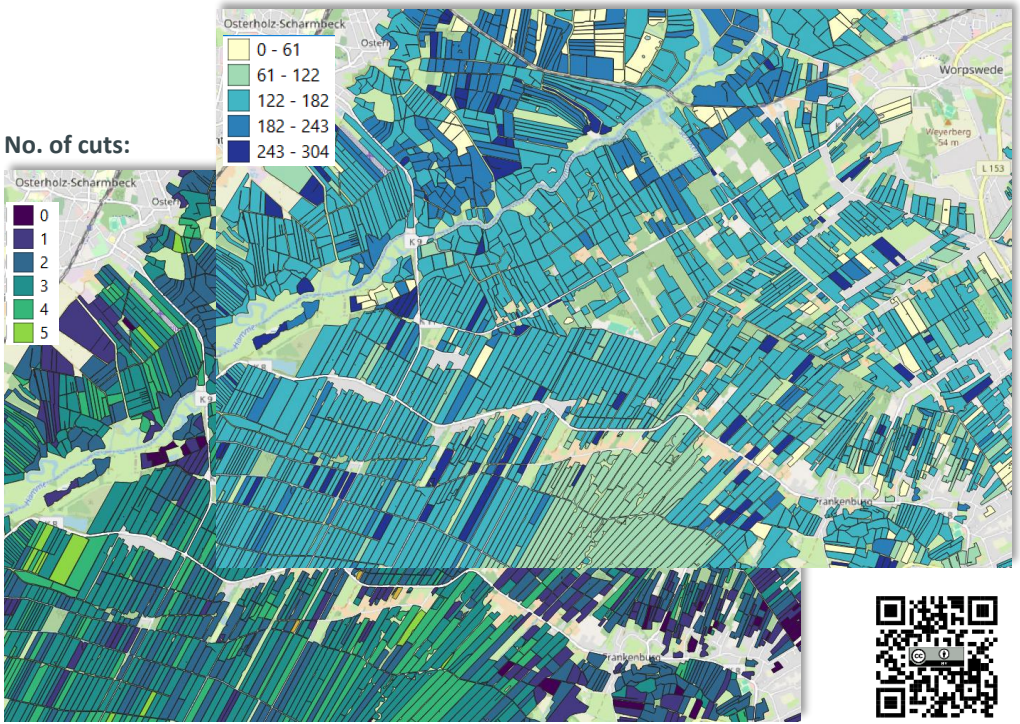
Grassland management:

- Mowing frequency & dates
- Grassland history
- **Challenges** – Detecting mown meadows

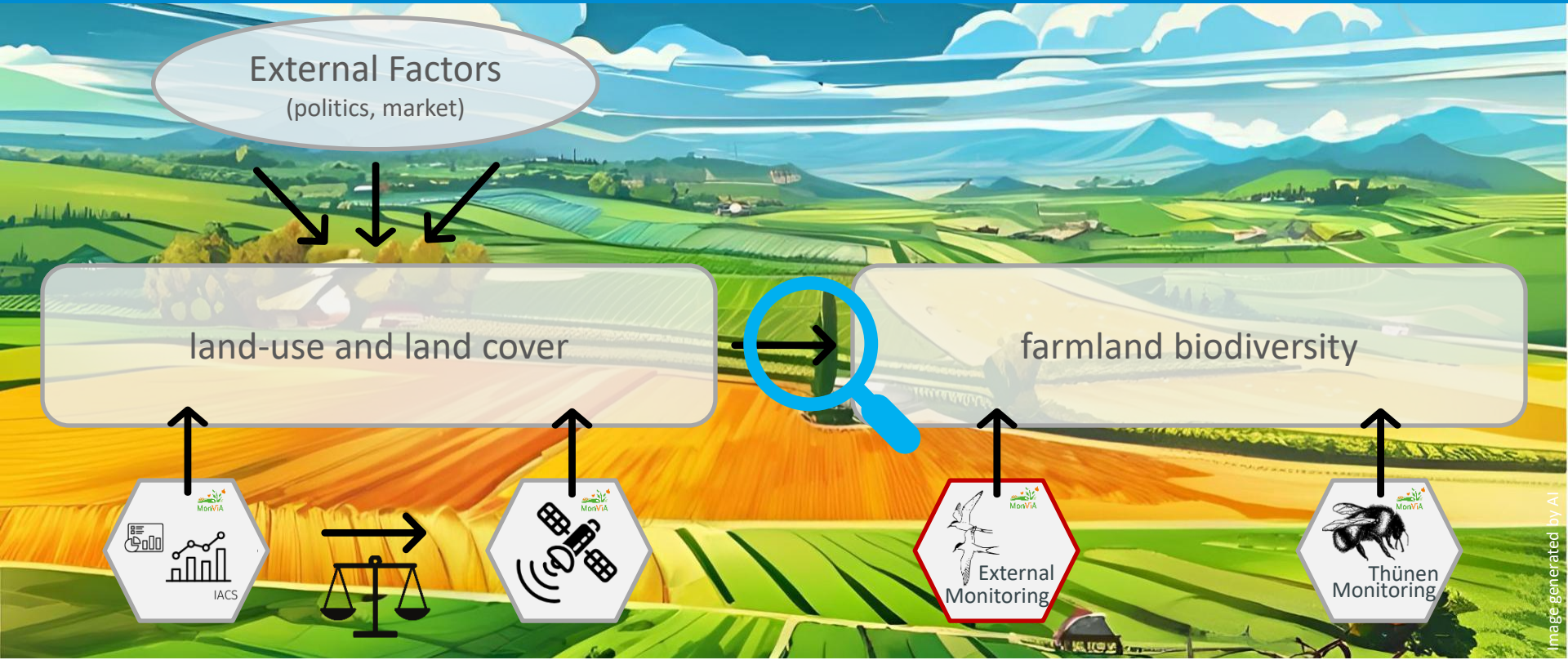


DOY 1st cut:

No. of cuts:

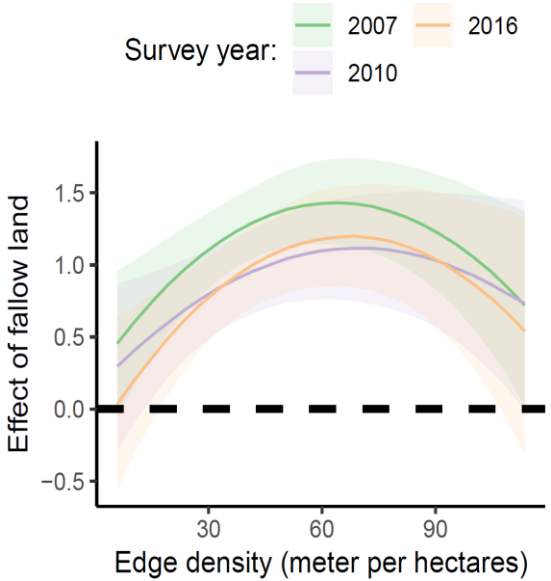


Understanding Status and Trends of Biodiversity under Land Use / Land Cover



MonViA-Cooperation-project

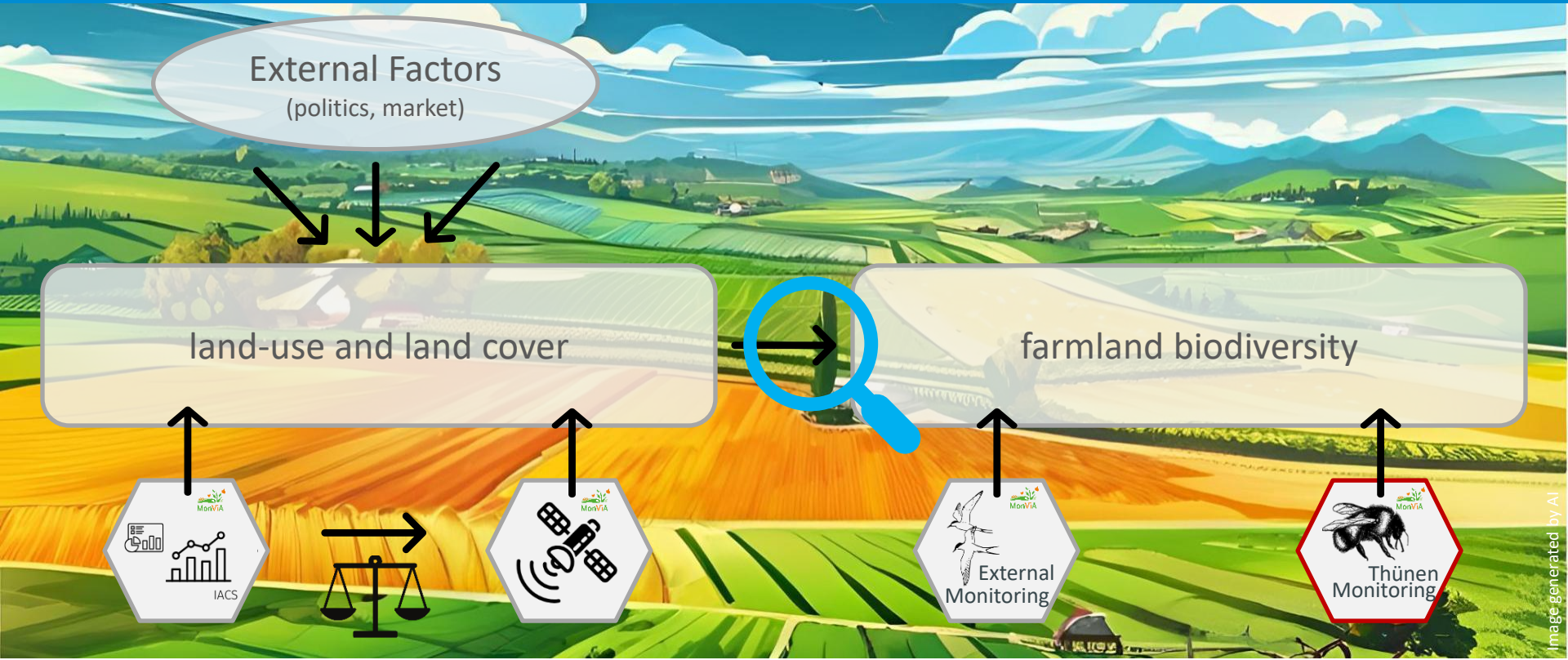
Do the benefits of fallow land for farmland birds depend on the complexity of the surrounding landscape?



Species richness and abundance **positively associated** with district-level fallow area

- Associations richness: fallow peaked at intermediate values of structural complexity (i.e., edge density)
- **Policy:** Promote fallow land, esp. in landscapes of medium structural complexity

Understanding Status and Trends of Biodiversity under Land Use / Land Cover

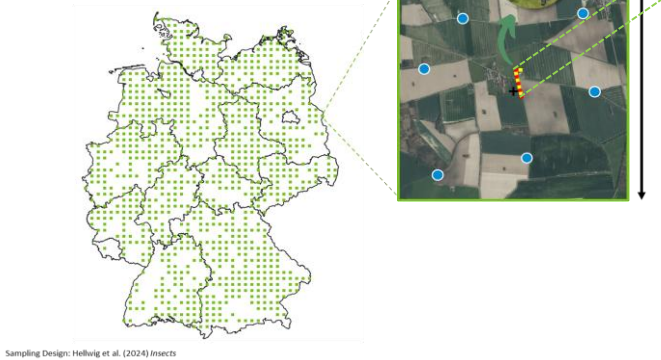


MonViA-Wildbee-Monitoring

What is Citizen Science?

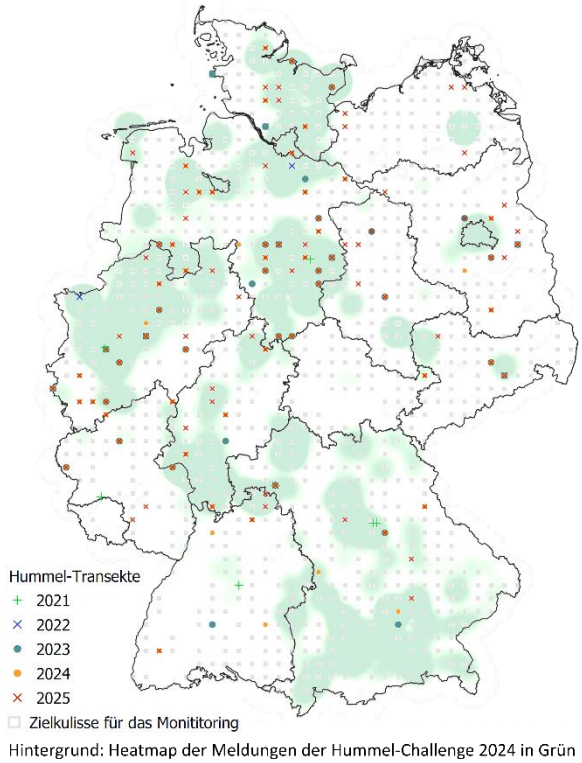
- **Public participation** in scientific research. Involves **non-professional volunteers** (citizens) working with scientists.
- Supports **data collection, analysis, and reporting**.
- Can contribute to **policy-making** and environmental monitoring.

Goal Wild bee-Monitoring: is to create a robust data foundation together with citizens on the status and trends of wild bees in agricultural landscapes.



https://wildbienen.thuenen.de
@wildbienen.thuenen

MonViA-Wildbee-Monitoring



Hintergrund: Heatmap der Meldungen der Hummel-Challenge 2024 in Grün

Wild bee monitoring
IN AGRICULTURAL LANDSCAPES

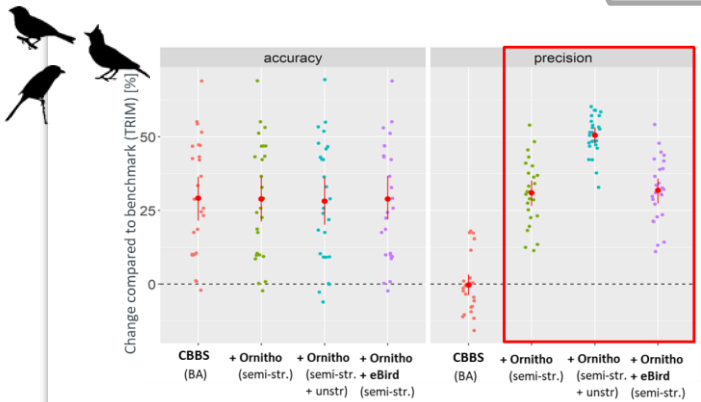
Structured data

+

Unstructured data

GBIF
Global Biodiversity Information Facility

Observation INTERNATIONAL



Data integration improved precision of farmland bird population trends

Policy: New opportunities for earlier identification of declining populations, esp. for not well-monitored species

Summary

Future Challenges

1. **Methodological Challenges**
   - Isolation of diver and time delay.
2. **IACS:** Availability of IACS Data for future analysis.
3. **EO:** Temporal, spatial consistency; limitation of the Sentinel resolution.
4. **Organismic Monitoring:** Spatial/ temporal coverage & building up data series and capacity.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Take-Home Messages

1. Agriculture is a highly complex system, and understanding the diverse drivers of biodiversity is essential to reverse current negative trends.

2. IACS and EO data offer (complementary) strengths and limitations in describing land use and land cover in space and time.

3. Data on how farmland organisms respond to agricultural practices remain limited. Citizen science (and smart technologies) hold great potential to fill these knowledge gaps.

Thank you!

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THÜNEN

Federal Office for Agriculture and Food

JKI Julius Kühn-Institut

MonViA - Consortium

Appendix
MonViA – Thünen Team

Agricultural Statistic


Earth Observation

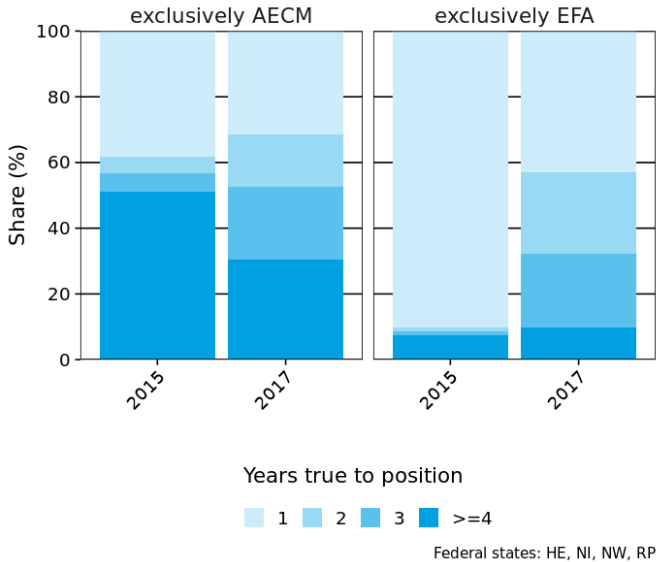

Cooperation Project Farmland Birds


Wild bee Monitoring

Appendix
MonViA- IACS / Agricultural statistics

Implementation of fallows on arable land: a result of political decisions

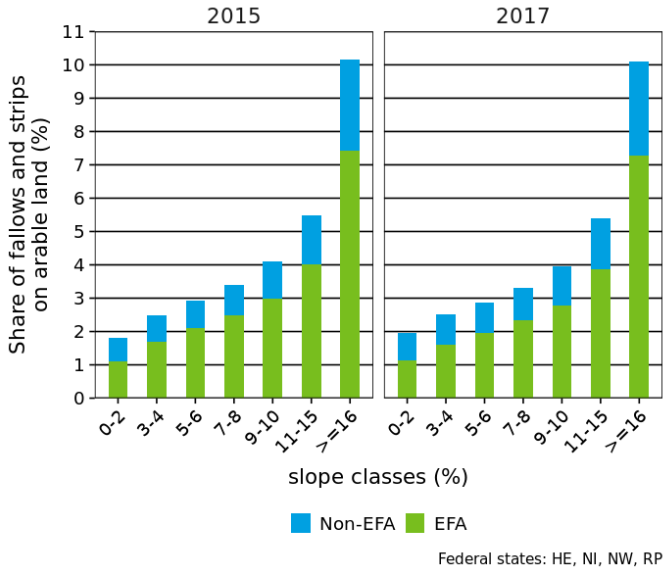
- **How?**
  After initial implementation, several years on the same spot (even if not obliged)



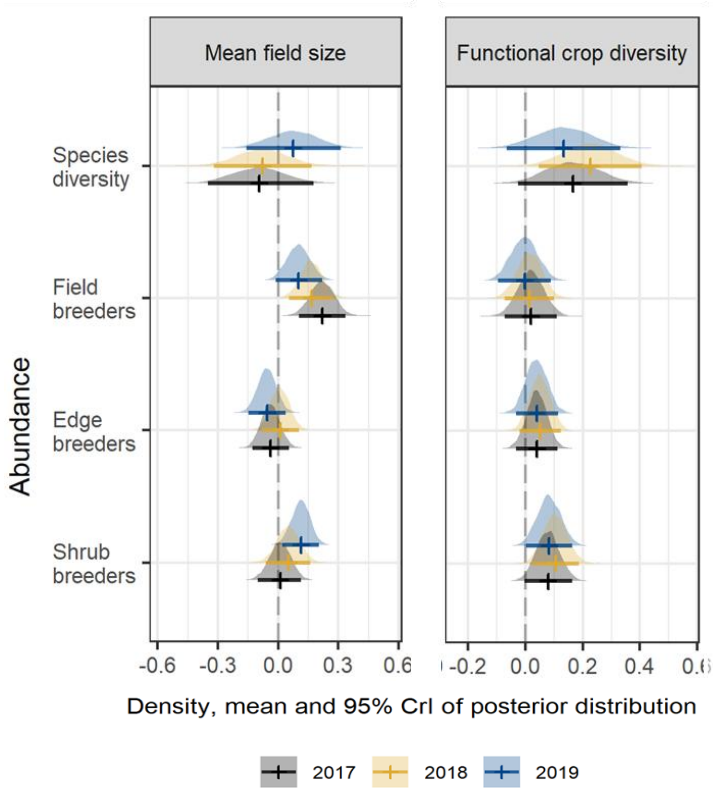
Appendix
MonViA- IACS / Agricultural statistics

Implementation of fallows on arable land: a result of political decisions

- **Where?**
  on steeper slopes



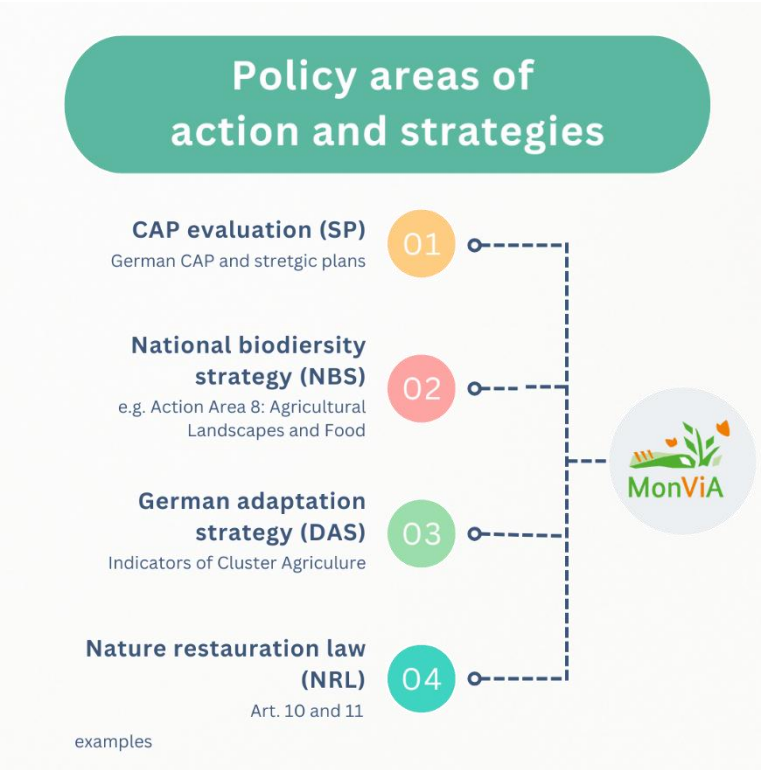
Appendix
MonViA-Cooperation-project



How do field size and functional crop diversity affect farmland birds?

- No general positive effect of smaller field size
- Positive effect of crop diversity on species diversity and shrub breeders
- **Policy**: Promote smaller field sizes in less structured landscapes

Appendix


Policy areas of action and strategies
CAP evaluation (SP)
German CAP and stretgic plans
01
National biodiersity strategy (NBS)
e.g. Action Area 8: Agricultural Landscapes and Food
02
German adaptation strategy (DAS)
Indicators of Cluster Agriculure
03
Nature restauration law (NRL)
Art. 10 and 11
04
MonViA
examples