BioSpace25 - Biodiversity insight from Space
10 - 14 February 2025 | ESA-ESRIN | Frascati - Italy

Development of an OECD farmland habitat biodiversity indicator with remote sensing
- A pilot study for Germany -

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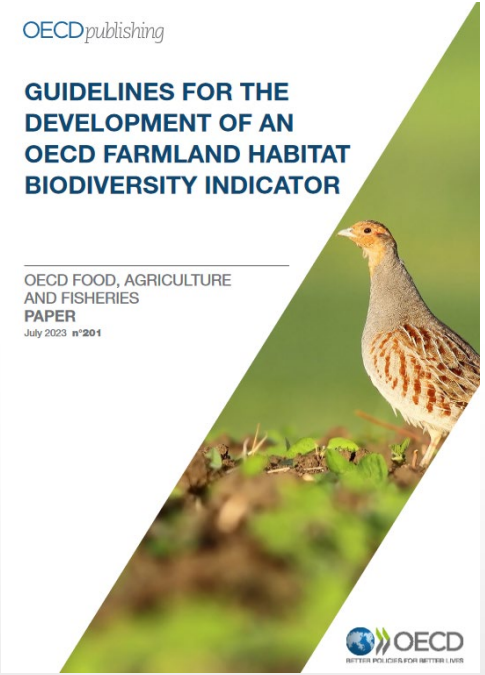
Background and Motivation

- Critical to understand relationship between agricultural land use and biodiversity
  → nature conservation strategies and policy advisory
- Monitoring needed
  → track changes and identify trends within countries
- Pragmactic Farmland Habitat Biodiversity Indicator (FHBI) proposed in OECD white paper in 2023



Bayr, U., Cobourn, K., Dieker, P., Fjellstad, W.J., Herzog, F., & Lankoski, J. (2023). Guidelines for the development of an OECD farmland habitat biodiversity indicator

FHBI workflow

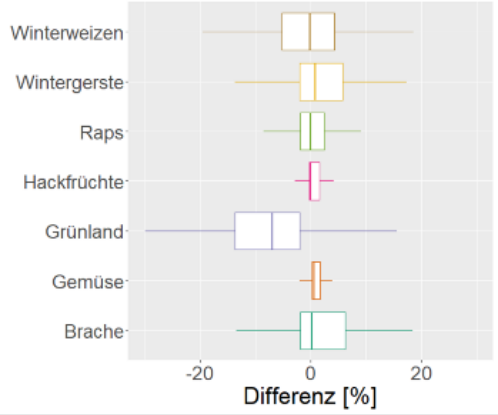
1. Define the **farmland habitats** to be monitored
2. Gather **land use data** that are available on a national scale
3. Assign **habitat quality value** according to its biodiversity value:
   very low (1), low (2), moderate (3), high (4), very high (5)
4. Combine habitat values for various land-use layers
5. Calculate weighted index for defined spatial unit:
   *habitat proportions * habitat quality values*

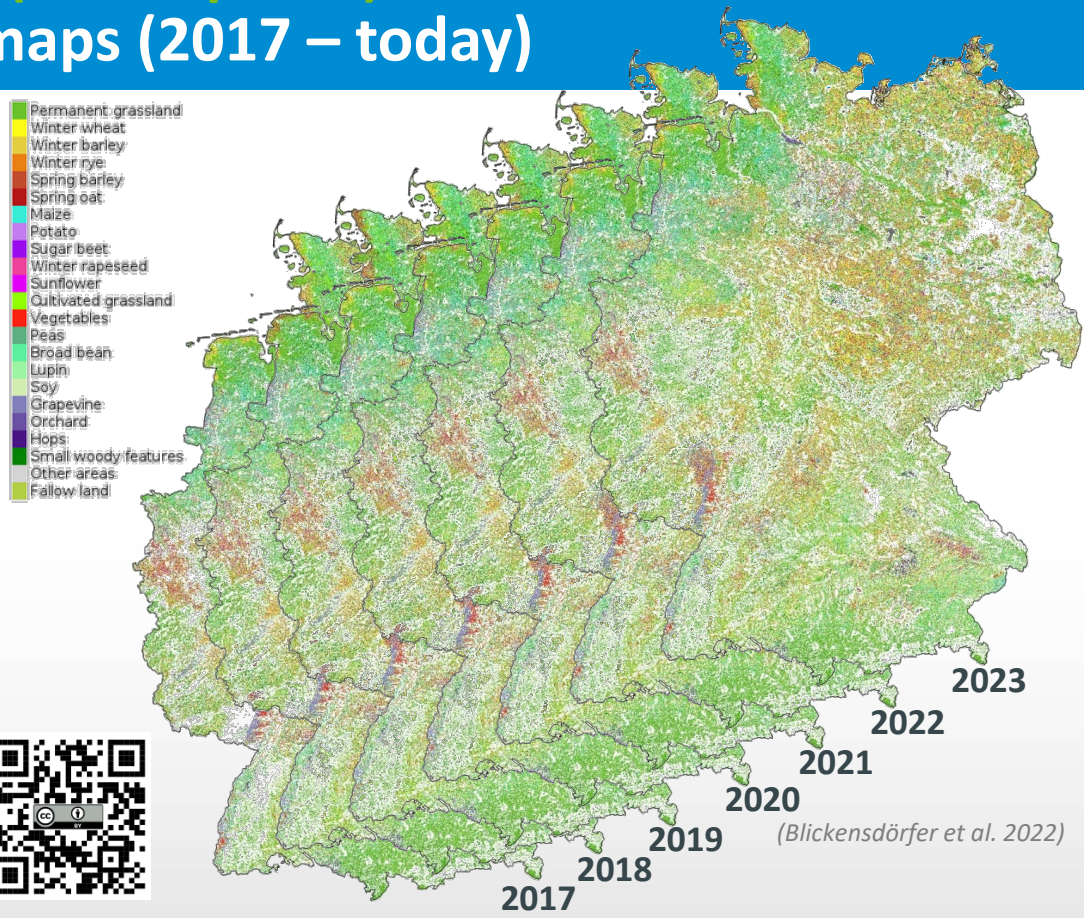
FHBI = (% Very low x 0) + (% Low x 0.25) + (% Moderate x 0.5) + (% High x 0.75) + (% Very high x 1)

Land-use data – agriculture (or: cropland)
National annual crop type maps (2017 – today)

Raster maps

- Wall-to-wall classification of agr. land
- 10 m spatial resolution
- High thematic detail (20+ classes)
- High consistency with agric. statistics



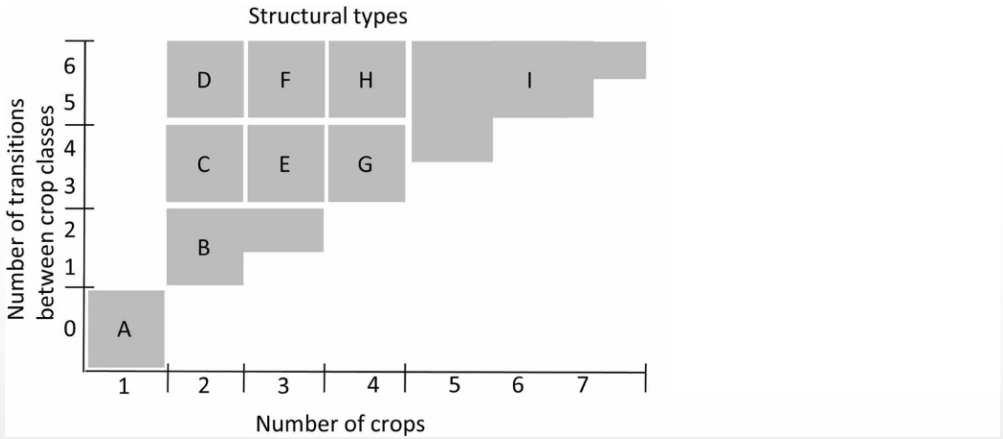


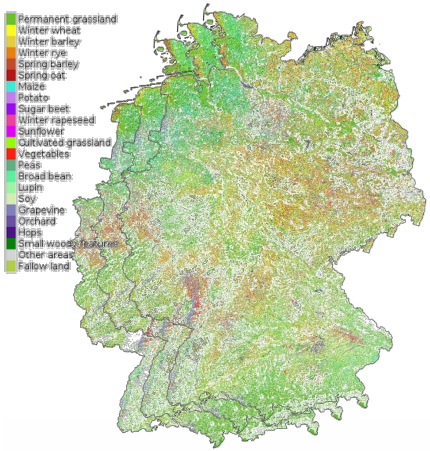
(Blickensdörfer et al. 2022)

Habitat quality – cropland
Structural and functional diversity → FHBI

Cropland use

- Translation of seven year (2017-2023) crop sequences following Jaenicke et al. (2022)
- Structural types
  - Number of crops
  - Number of transitions
- Functional types
  - Share of leaf crops
  - Share of spring crops

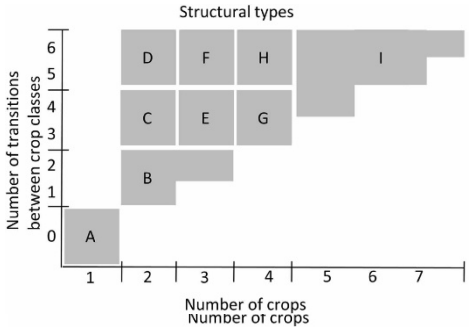


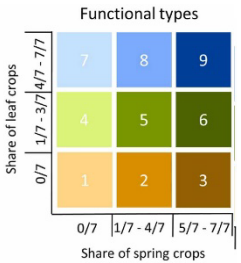


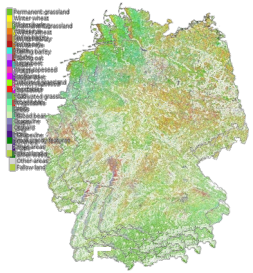
Jänicke, Clemens, et al. "Field-level land-use data reveal heterogeneous crop sequences with distinct regional differences in Germany." *European Journal of Agronomy* 141 (2022): 126632.

Habitat quality – cropland

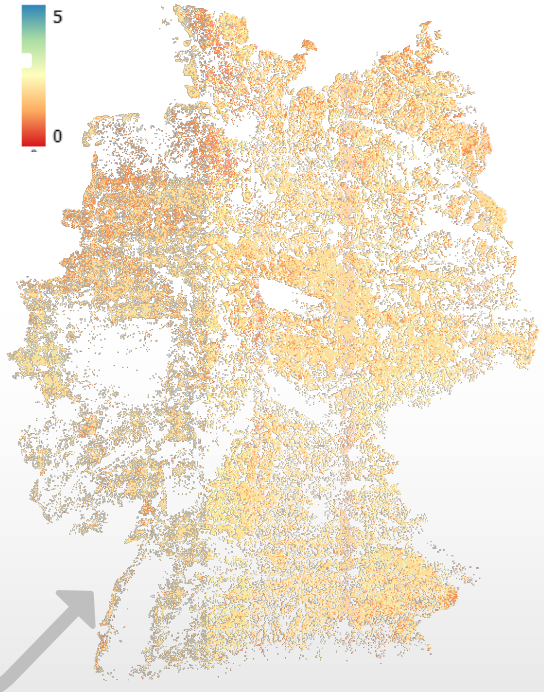
Structural and functional diversity → FHBI







HQV map cropland



FHBI classification scheme	
1	very low
2	low
3	moderate
4	high
5	very high

Jänicke, et al. (2022)

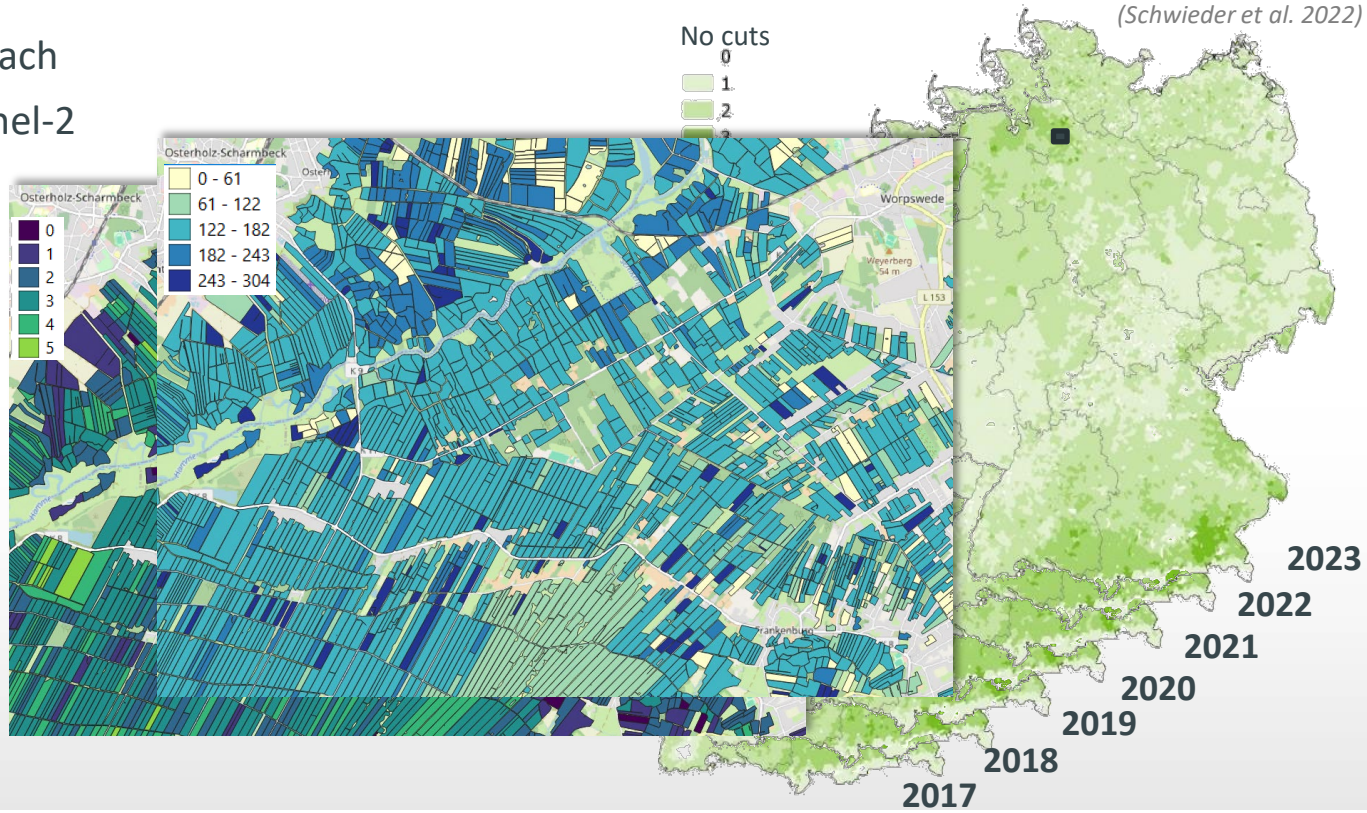
Habitat Quality Values (HQV)

Structural type	HQV
A	1
B	1
C	1
D	1
E	2
F	2
G	3
H	3
I	3

Functional type	HQV
1	1
2	2
3	1
4	2
5	3
6	2
7	1
8	2
9	1

Land-use data – grassland
Annual maps of grassland use intensity (2017 - 2023)

- Adaptive rule-based approach
- Dense time series of Sentinel-2 / Landsat-data
- Mowing frequency & date of cutting



Habitat quality – grassland
Grassland use intensity (GLUI) → FHBI

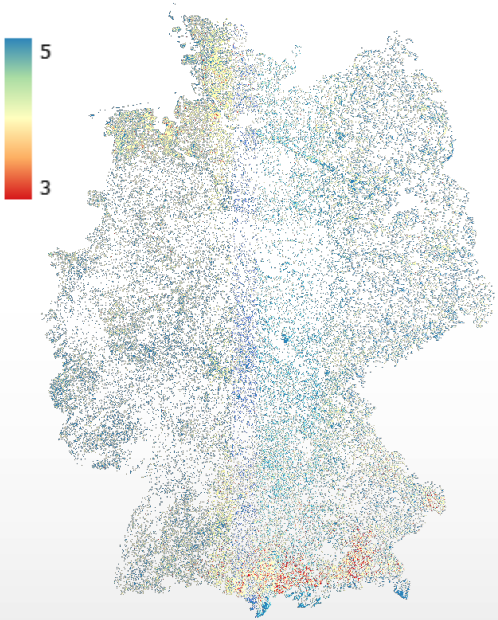
Grassland use intensity

- Combine time series of GLUI maps
- Median number of mowing events per pixel
- Assign FHBI value to each GLUI class

Other land use types

- Assign FHBI value to permanent land-use classes

HQV map combined



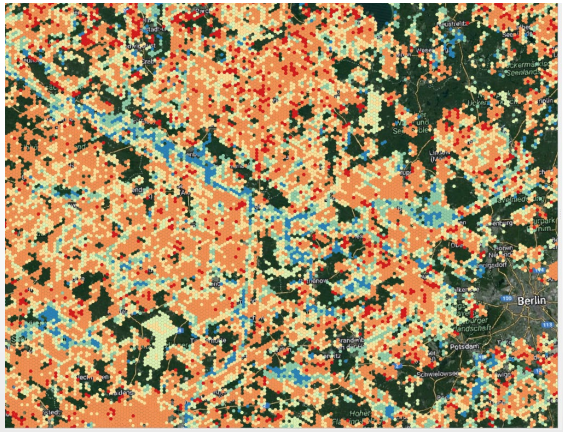
FHBI classification scheme	
1	very low
2	low
3	moderate
4	high
5	very high

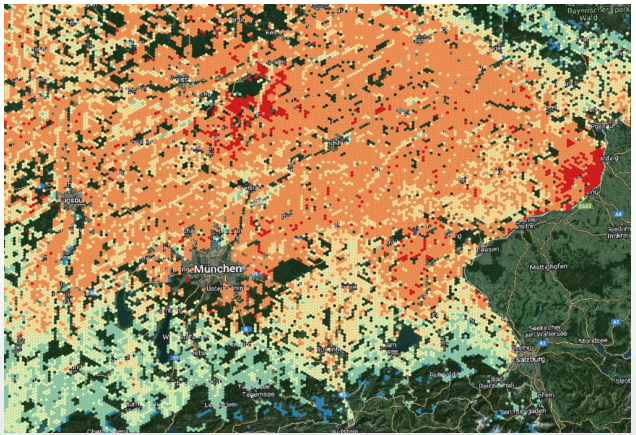
Mowing frequency	HQV
0 -1	5
2- 3	4
4 +	3

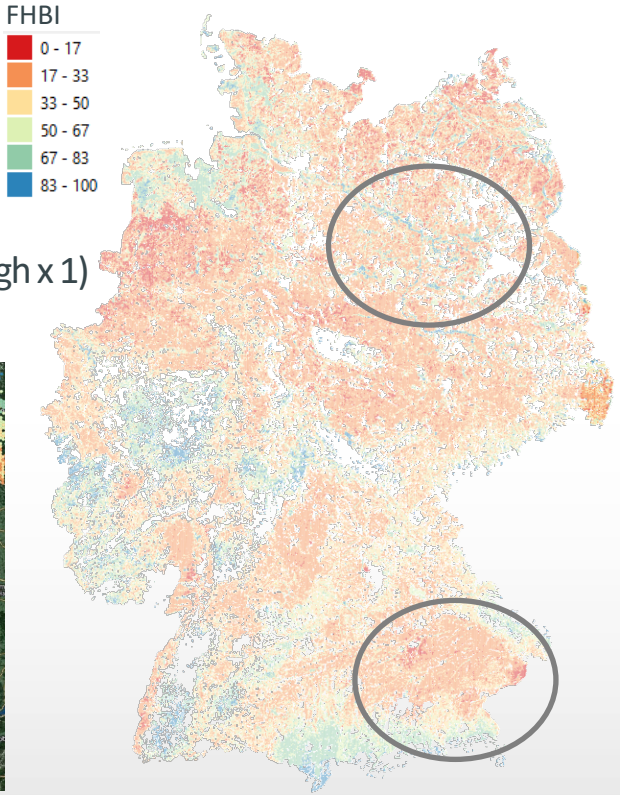
Other classes	HQV
Small woody features	4
Grapevine	2
Hops	1
Orchards	2
Other areas	3

Farmland Habitat Biodiversity Indicator
First FHBI map for Germany

- Aggregation to spatial unit: 100 ha hexagons
- Cutoff: share of agricultural area >= 20%
- FHBI Calculation:
  (% Very low x 0) + (% Low x 0.25) + (% Moderate x 0.5) + (% High x 0.75) + (% Very high x 1)

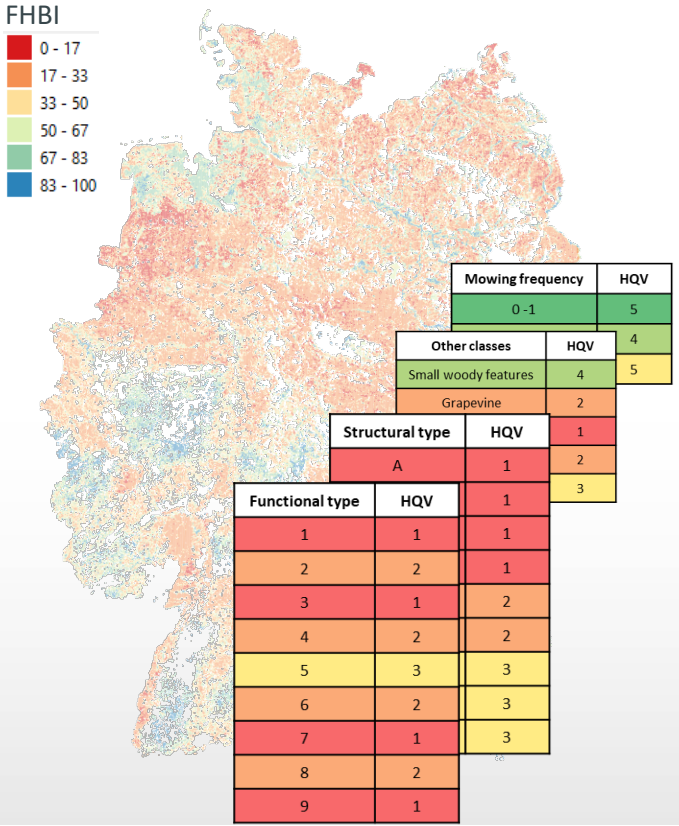






Farmland Habitat Biodiversity Indicator
Summary and Outlook

- **Comprehensive** and straight forward **area wide indicator** based on **remote sensing** data
- Can be **frequently** derived and in general be **transferred** to other regions
- Open questions:
  - How to decide for **optimal habitat quality values**?
  - Specific for: species, taxa, communities?
  - Where/how to get **reliable data**?
  - How to account for **regional differences** in land use?
  - Include a**dditional data**: SWF, catch crops, landscape metrics…



Invitation: Workshop on Farmland Habitat Biodiversity

When: Today 15:00 – 16:30 / 17:00 – 18:30

Where: B15 Room A

What: World Cafe and discussion of the FHBI

- General concept
- Transferability in space and time (initial results using VLCC products)
- Inclusion of additional data
- Link to biodiversity data

Thank you for your attention!

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Refernces

Blickensdörfer, L., Schwieder, M., Pflugmacher, D., Nendel, C., Erasmi, S., & Hostert, P. (2022). Mapping of crop types and crop sequences with combined time series of Sentinel-1, Sentinel-2 and Landsat 8 data for Germany. *Remote Sensing of Environment, 269*, 112831.

Jänicke, C., Goddard, A., Stein, S., Steinmann, H.-H., Lakes, T., Nendel, C., & Müller, D. (2022). Field-level land-use data reveal heterogeneous crop sequences with distinct regional differences in Germany. *European Journal of Agronomy, 141*, 126632.

Schwieder, M., Wesemeyer, M., Frantz, D., Pfoch, K., Erasmi, S., Pickert, J., Nendel, C., & Hostert, P. (2022). Mapping grassland mowing events across Germany based on combined Sentinel-2 and Landsat 8 time series. *Remote Sensing of Environment, 269*, 112795.

Stein, S., & Steinmann, H.-H. (2018). Identifying crop rotation practice by the typification of crop sequence patterns for arable farming systems – A case study from Central Europe. *European Journal of Agronomy, 92*, 30-40.

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