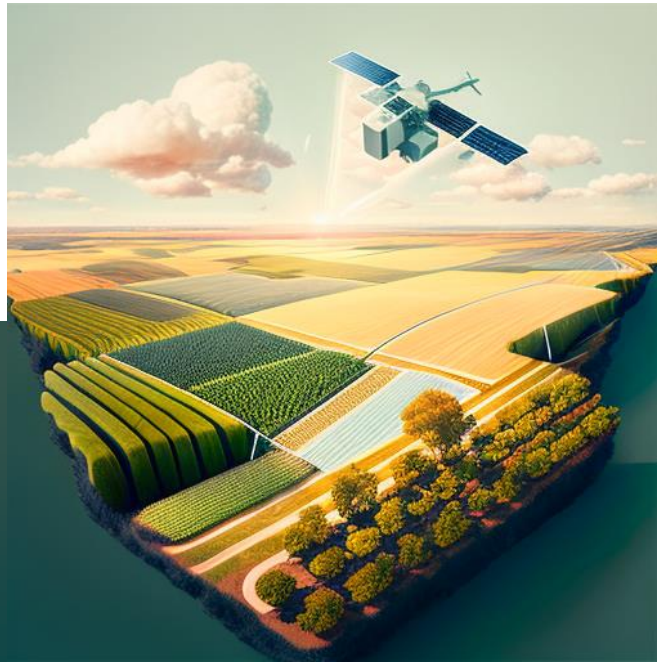
Halle, 22.05.2023

FAIRagro

MonViA

Julius Kühn-Institut
Bundesforschungsinstitut für Kulturpflanzen
Federal Research Centre for Cultivated Plants

Anwendung von **(Geo)datenqualitätsmetriken:** Ableitung von **Biodiversitätsmetriken** aus fernerkundungsbasierten **Landnutzungsdaten** in **landwirtschaftlichen** Regionen Deutschlands



Jannes Uhlott, Markus Möller

Julius Kühn-Institut
AG Geodatenmanagement
Institut für Pflanzenbau und Bodenkunde, Braunschweig

Mein Weg ans JKI

Universität Bremen

2013 – 2017
Bachelor Geowissenschaften

2017 – 2018
Master International Geophysics

Universität Bremen

2018 – 2021
Master Geowissenschaften

seit 2021
JKI Braunschweig

Monitoring der biologischen Vielfalt in Agrarlandschaften

monitoring of biodiversity in agricultural landscapes

Julius Kühn-Institut

THÜNEN

INFORMATIONS- UND KOORDINATIONSZENTRUM BIOLOGISCHE VIELFALT

Bundesministerium für Ernährung und Landwirtschaft

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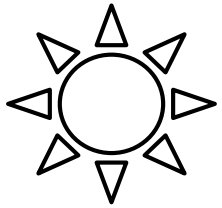
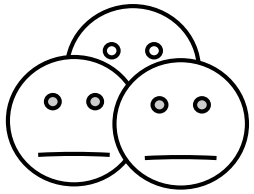
Arable regions



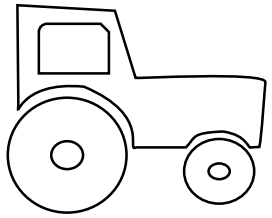
climate change



population growth

changing dietary habits

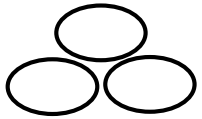
monocultivation



intensification + mechanisation

plant protection products

decline in biodiversity:



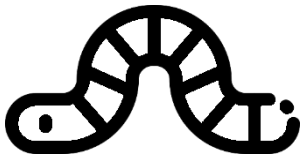
soil quality

species richness

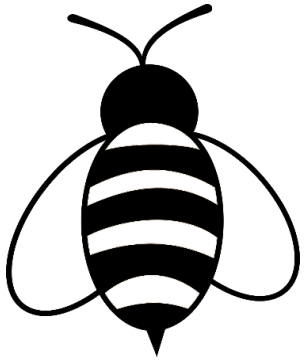
crop yield

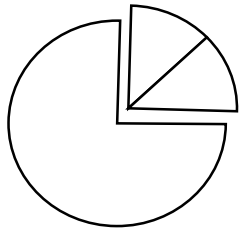
Measure Biodiversity

MonViA


earthworms

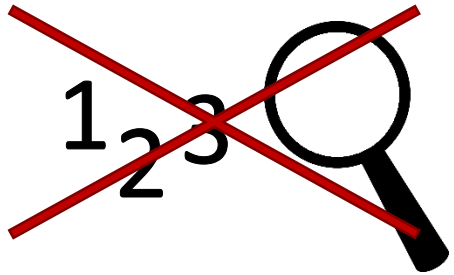

beneficial insects


bees


agrarstatistics


remote sensing

Biodiversity:



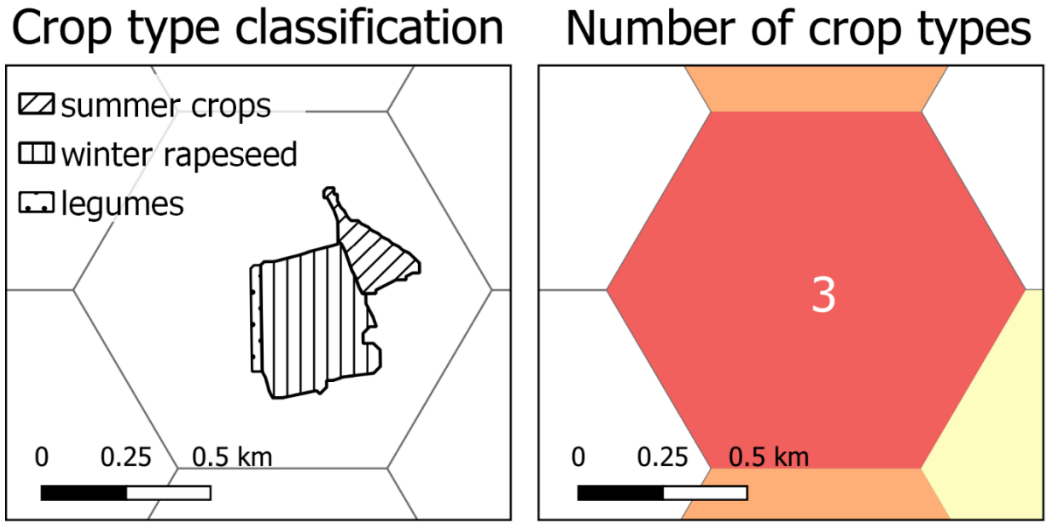
Not measurable as a specific number

Biodiversity metrics

Biodiversity Metrics

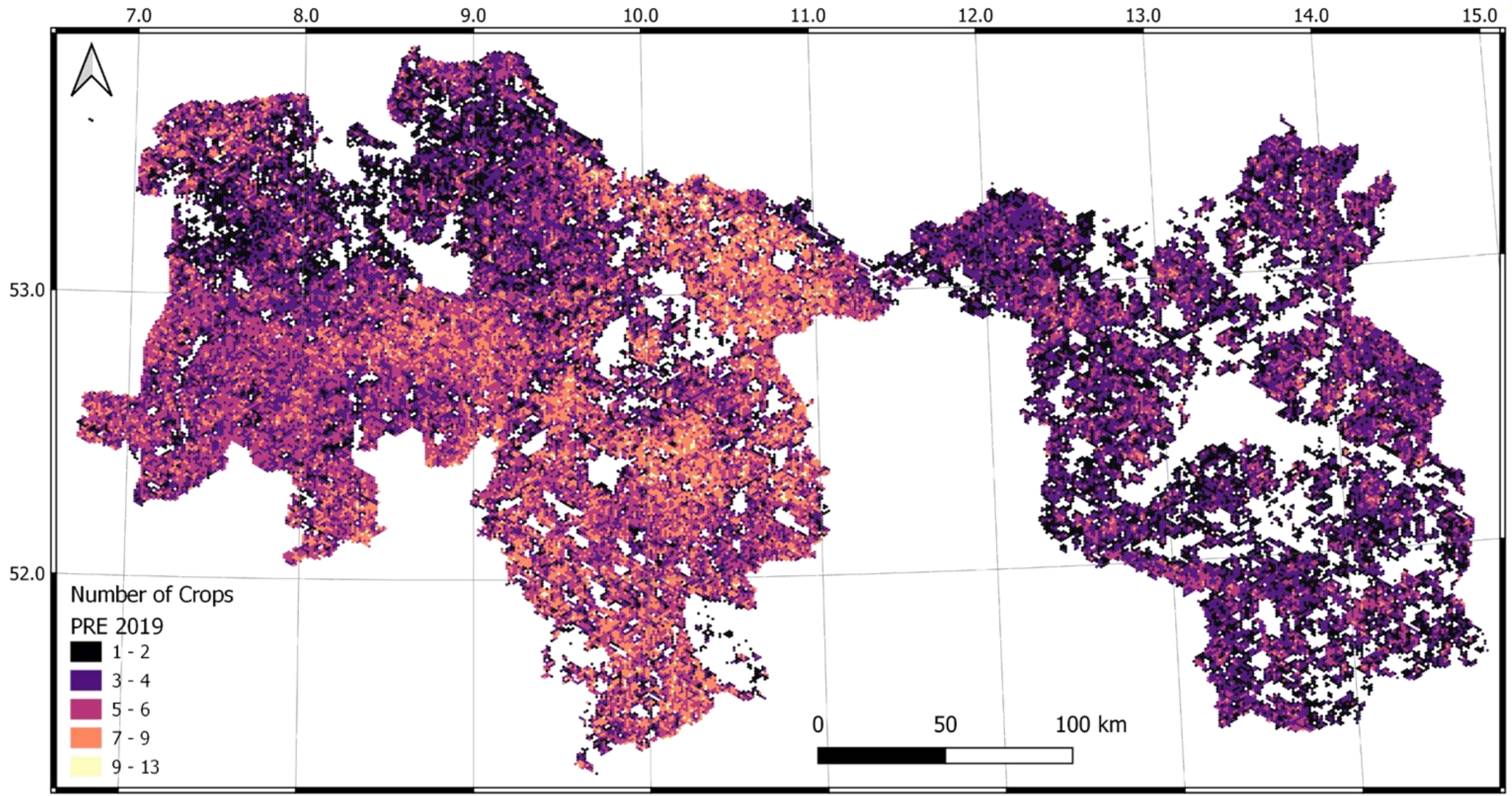
Metrics	Calculation	Range
Fieldsize	Area-weighted mean of the polygon areas per hexagon	0 – 1 km²
Number of crops	Number of different crops per hexagon	0 – 17*
Shannon Index	Shannon Index (number and share) per hexagon	0 – 2.43*

* Based on results of Blickensdörfer Lower Saxony 2019 (Level 3)



References: Wolf et al. (2021), Uthes et al. (2020), Fahrig et al. (2015), Schindler et al. (2008)

Example: Number of Crops



Wir wissen

- Biodiversität in Agrarlandschaften ist wichtig.
- Mit Fernerkundung können flächendeckende Daten erzeugt werden.
- Biodiversität kann nicht anhand einer Zahl/Messung bestimmt werden.
- Stattdessen werden sog. Biodiversitätsmetriken abgeleitet.

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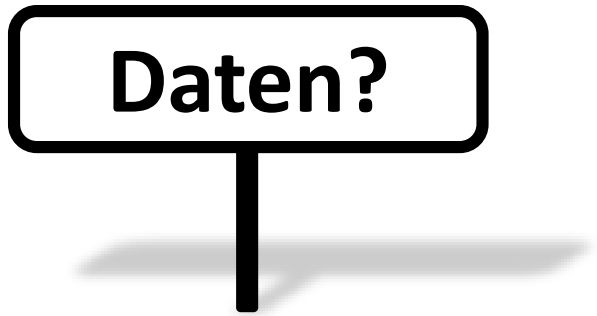


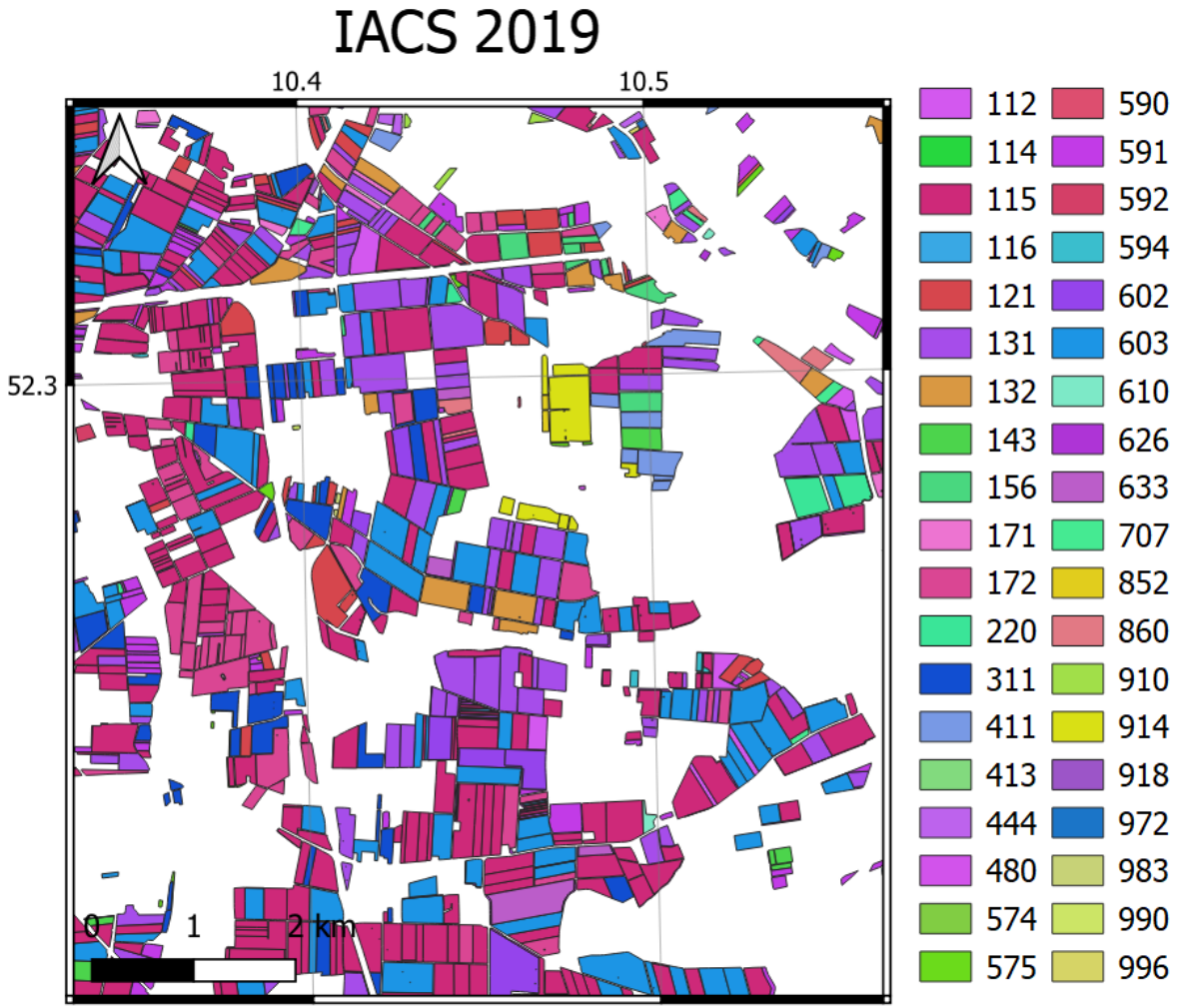
Daten

Anwendung von **(Geo)datenqualitätsmetriken:**
Ableitung von **Biodiversitätsmetriken** aus fernerkundungsbasierten **Landnutzungsdaten** in **landwirtschaftlichen** Regionen Deutschlands

Landnutzungsdaten!

Einführung IACS (InVeKoS)

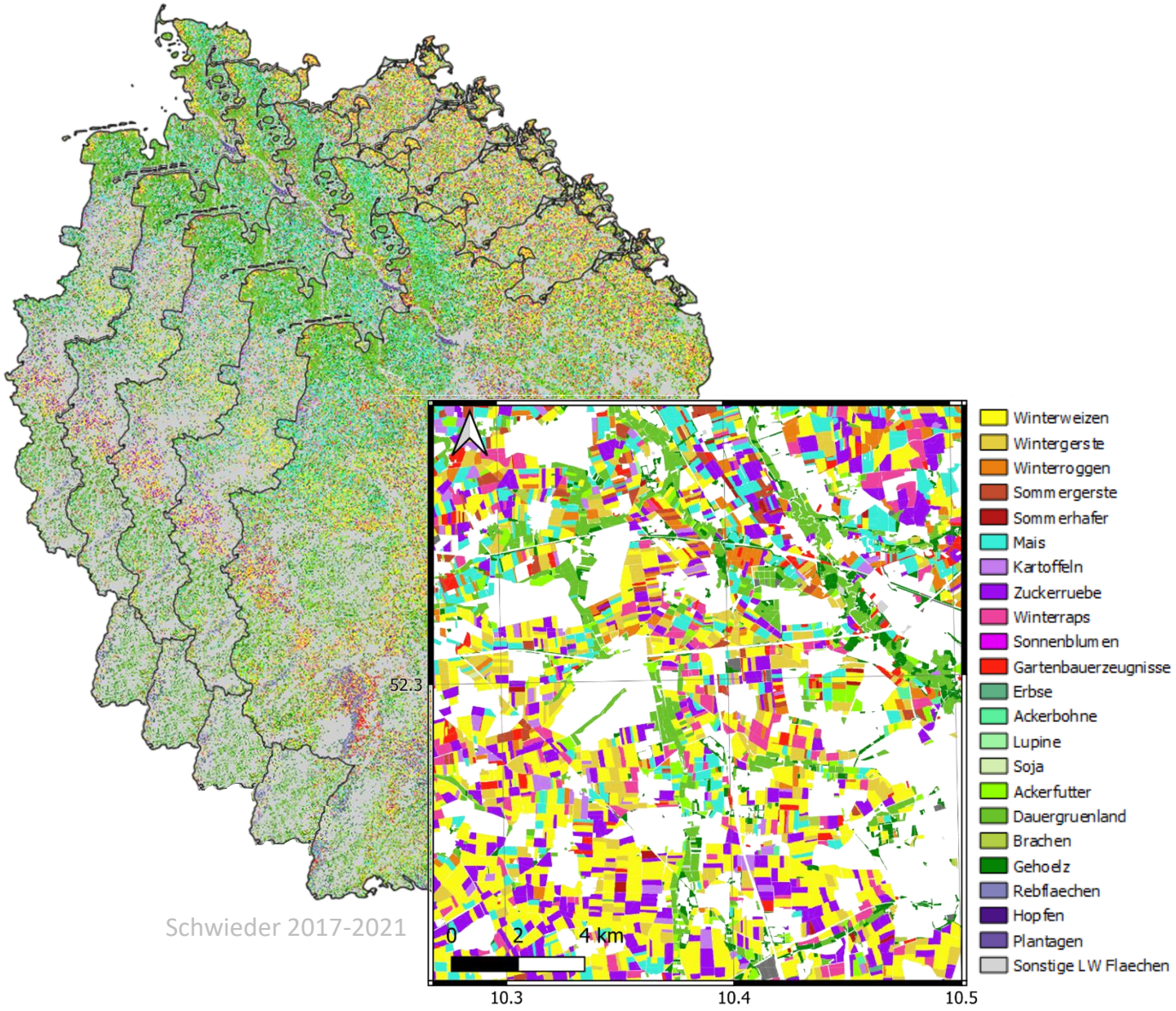
Database created by EU common agricultural policy (CAP)



+ Detailed information on crop types
+ Information on land use (grassland, landscape elements)
+ High spatial and thematic resolution (NI 2019: 226 classes)
+ Regularly (annually)

- Limited availability

Remote sensing based Crop Type Classifications



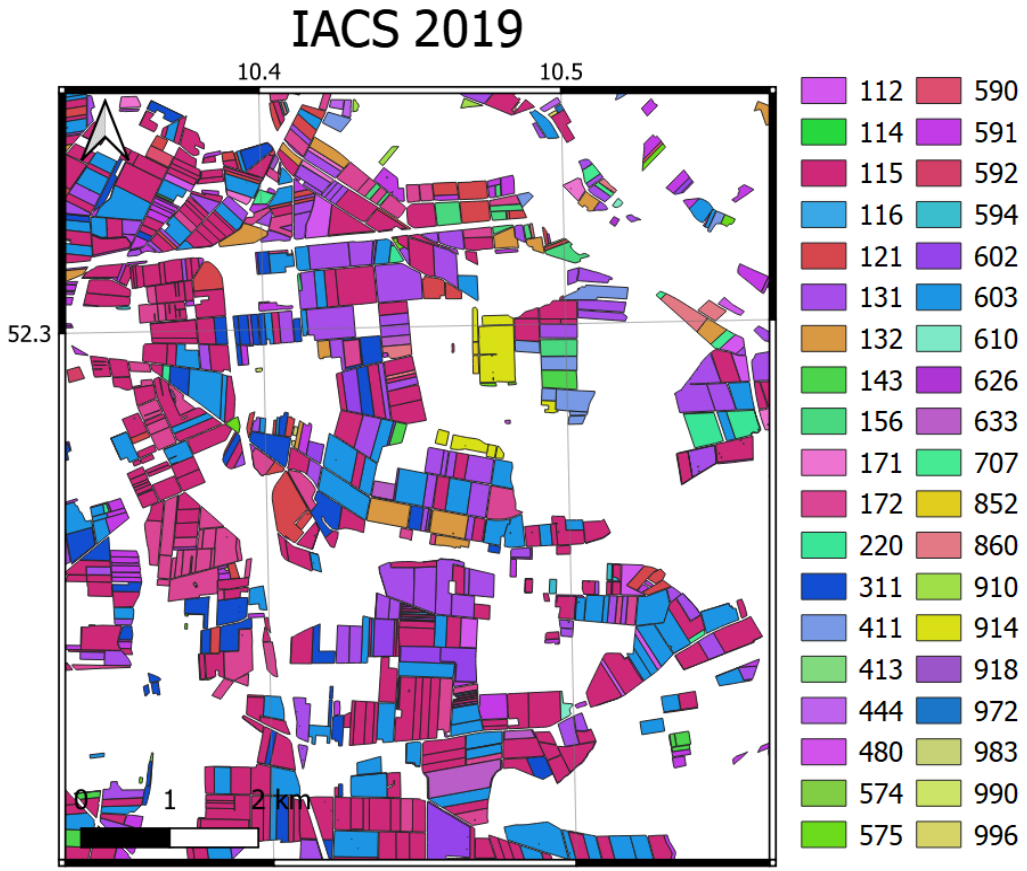
Schwieder 2017-2021

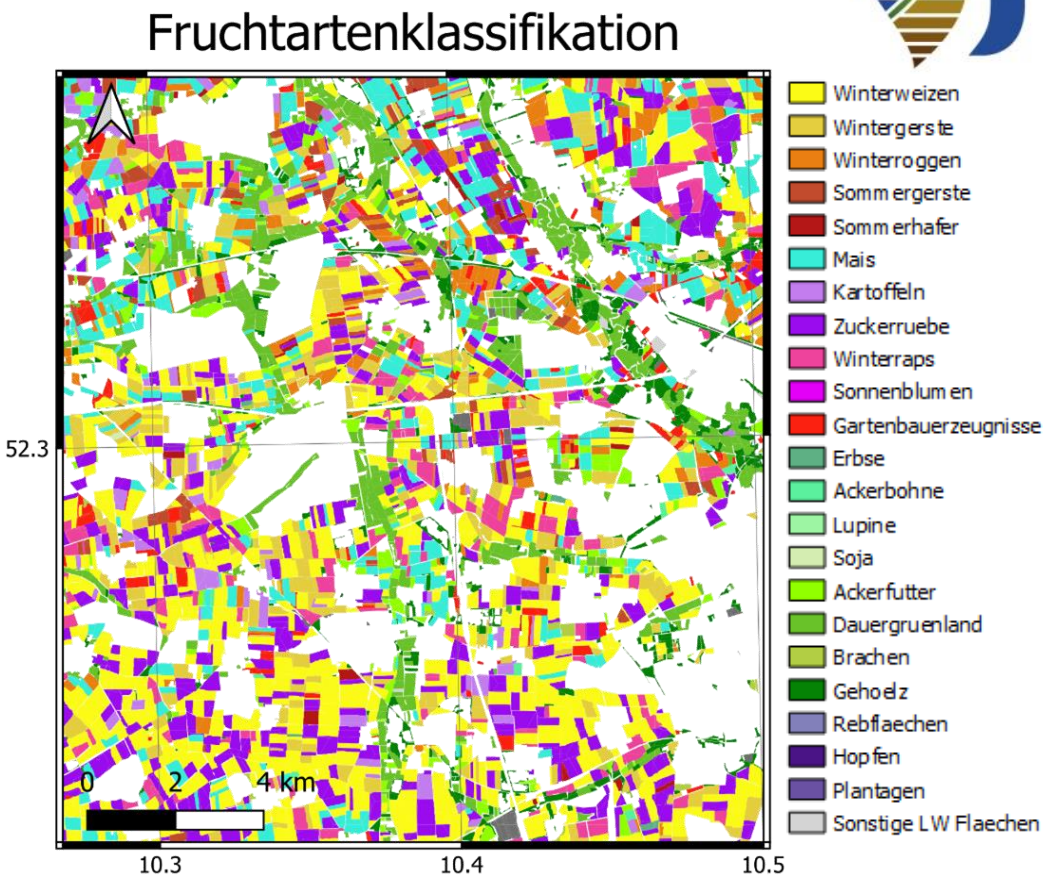
Schwieder 2021, Bundesallee BS

- Preidl (2020)
- Blickensdörfer/Schwieder (2022, 2023)
- Asam (2022)
- Griffiths (2019)

Germanwide data

Remote sensing based Crop Type Classifications

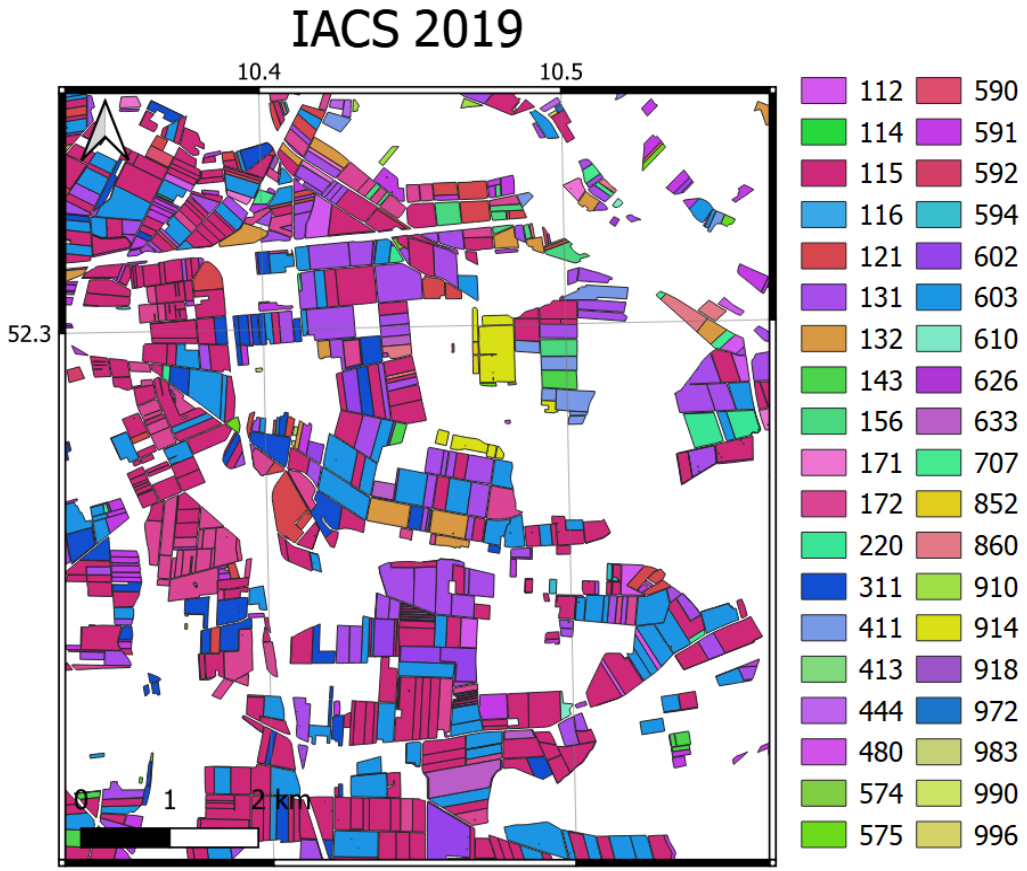


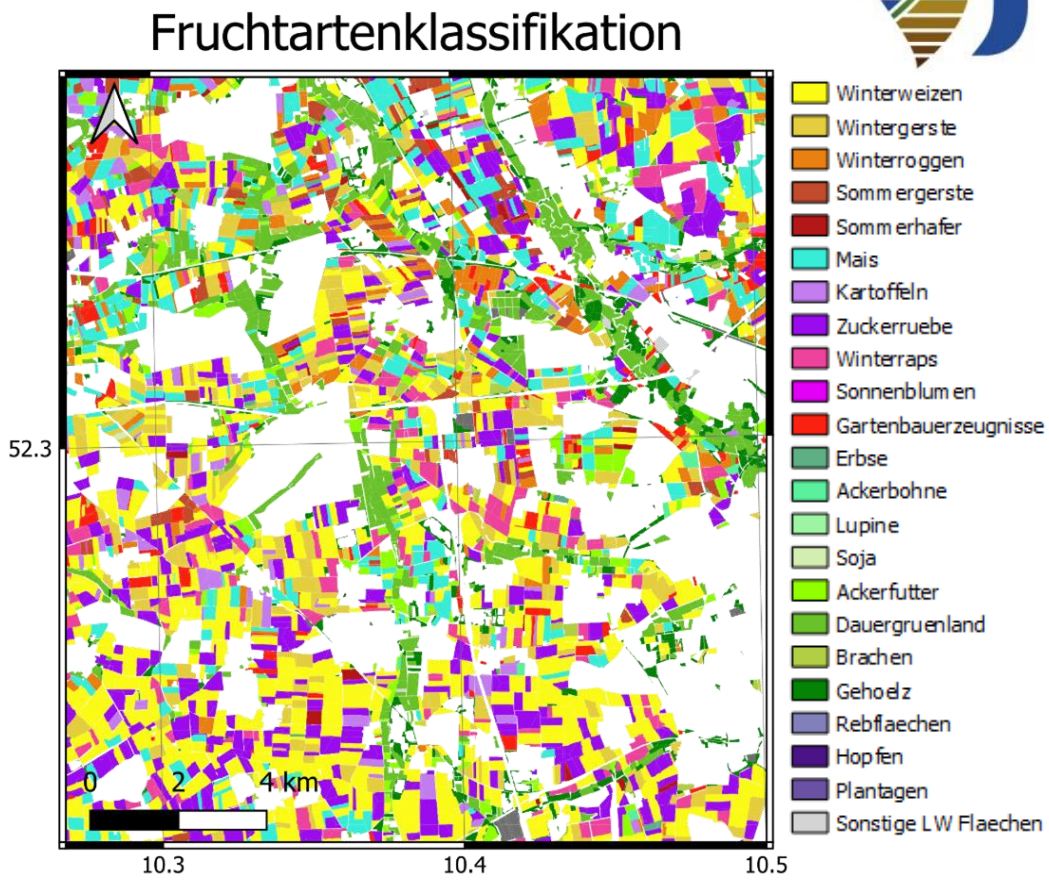


+ Higher spatial and thematic resolution
- Only data for Lower Saxony and Brandenburg

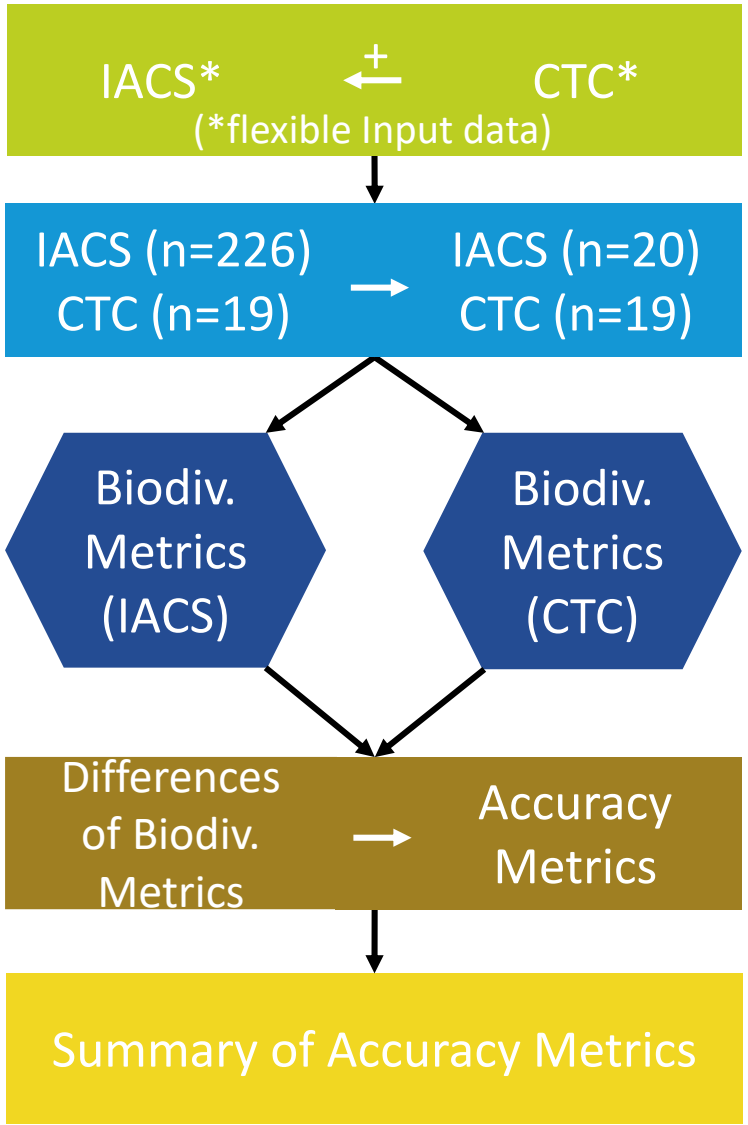
+ Germanwide data available
- Lower spatial and thematic resolution

Remote sensing based Crop Type Classifications





Wie ähnlich sind sich die abgeleitete Biodiversitätsmetriken auf Basis der unterschiedlichen Eingangsdaten (IACS vs. CTC)?



Zonal Statistics:
Majority voting of CTC on IACS geometry

Aggregation:
Assignment of IACS classes to CTC classes

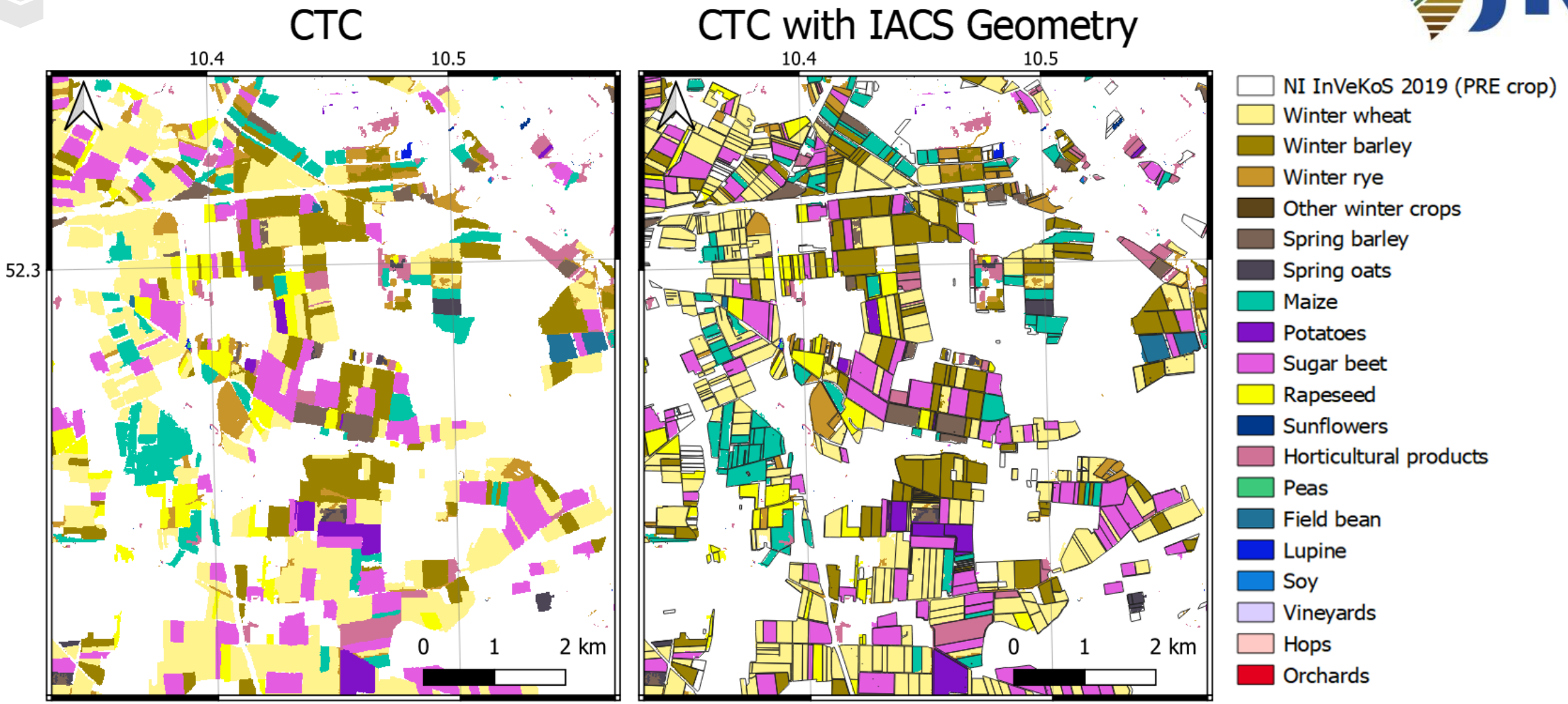
Calculation of Biodiversity Metrics:
Number of Crops and Shannon Evenness Index for IACS and CTC per hexagon as reference unit

Calculation of Accuracy Metrics:
R^2, RMSE of the differences of biodiversity metrics for IACS and CTC

Application Matrix:
Summary of accuracy metrics in tables and figures

Zonal Statistics

IACS* ± CTC*
(*flexible Input data)



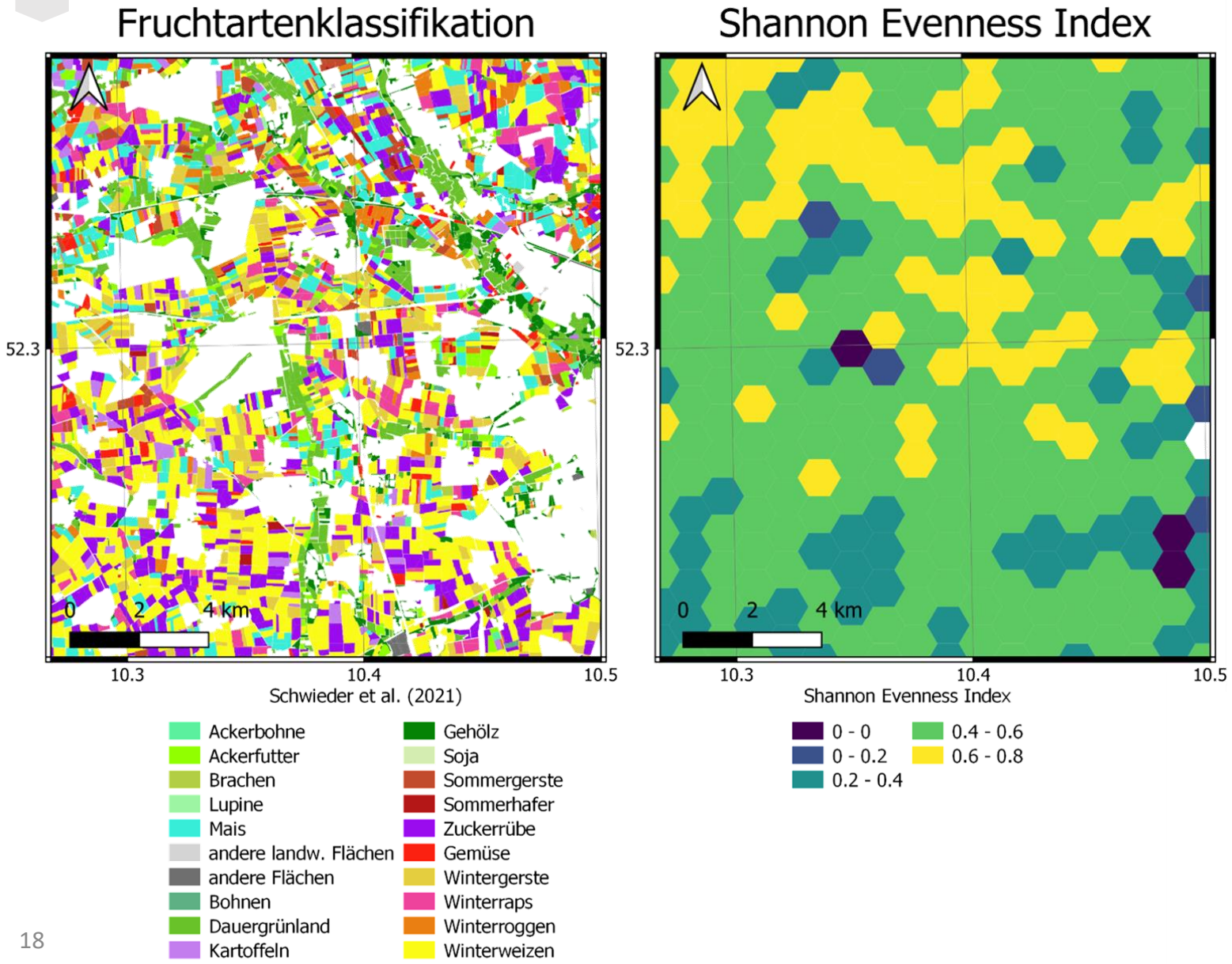
Aggregation

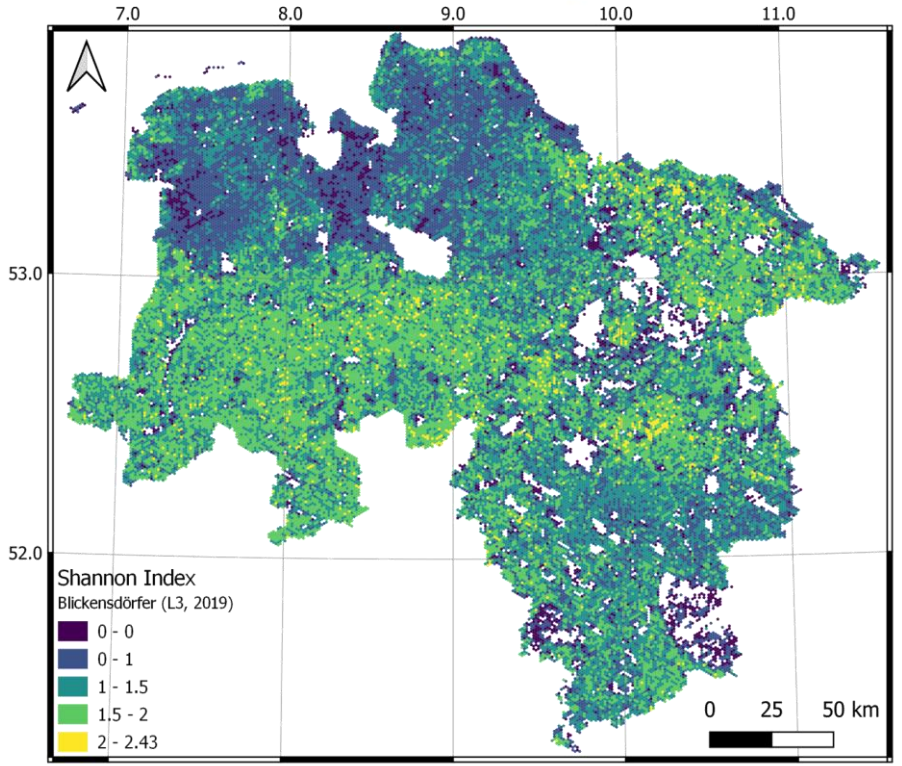
IACS (n=226) CTC (n=19)	IACS (n=20) CTC (n=19)

Schwieder

Code	Bezeichnung	InVeKoS
200	Permanent grassland	441, 443, 451, 452, 453, 455, 459
1602	Arable fodder	221, 250, 421, 422, 423, 424, 425, 433
1101	Winter wheat	112, 115
1103	Winter rye	121
1102	Winter barley	131
1104	Other Winter crops	114, 156
1201	Spring barley	132
1202	Spring oats	116, 122, 143, 157
1300	Maize	171, 177, 410, 411, 412
1401	Potatoes	601, 602, 606
1402	Sugar beet	603
1501	Rape	311
1502	Sunflowers	320
1611	Peas	210, 240
1612	Field bean	220
1613	Lupine	230
1614	Soya	330
1603	Horticultural products	610, 613, 630, 632, 633, 634, 635, 637, 638, 707, 860
4003	Plantations	821, 824, 825, 826, 983
4001	Vineyards	843, 844, 847
4002	Hops	856

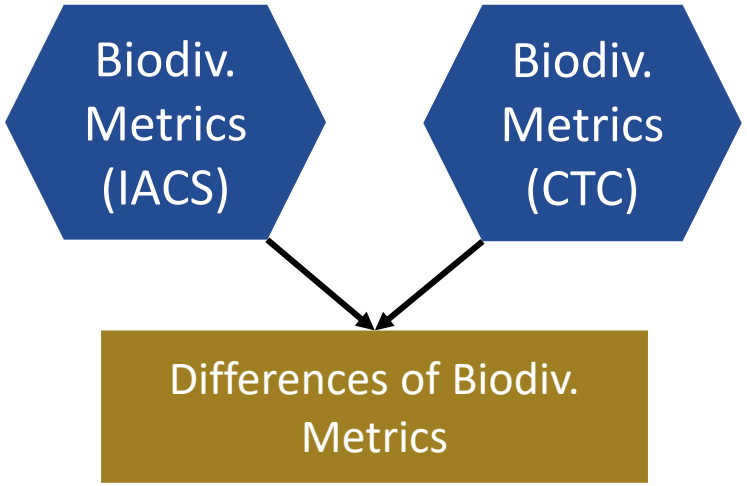
Calculation of Biodiversity Metrics



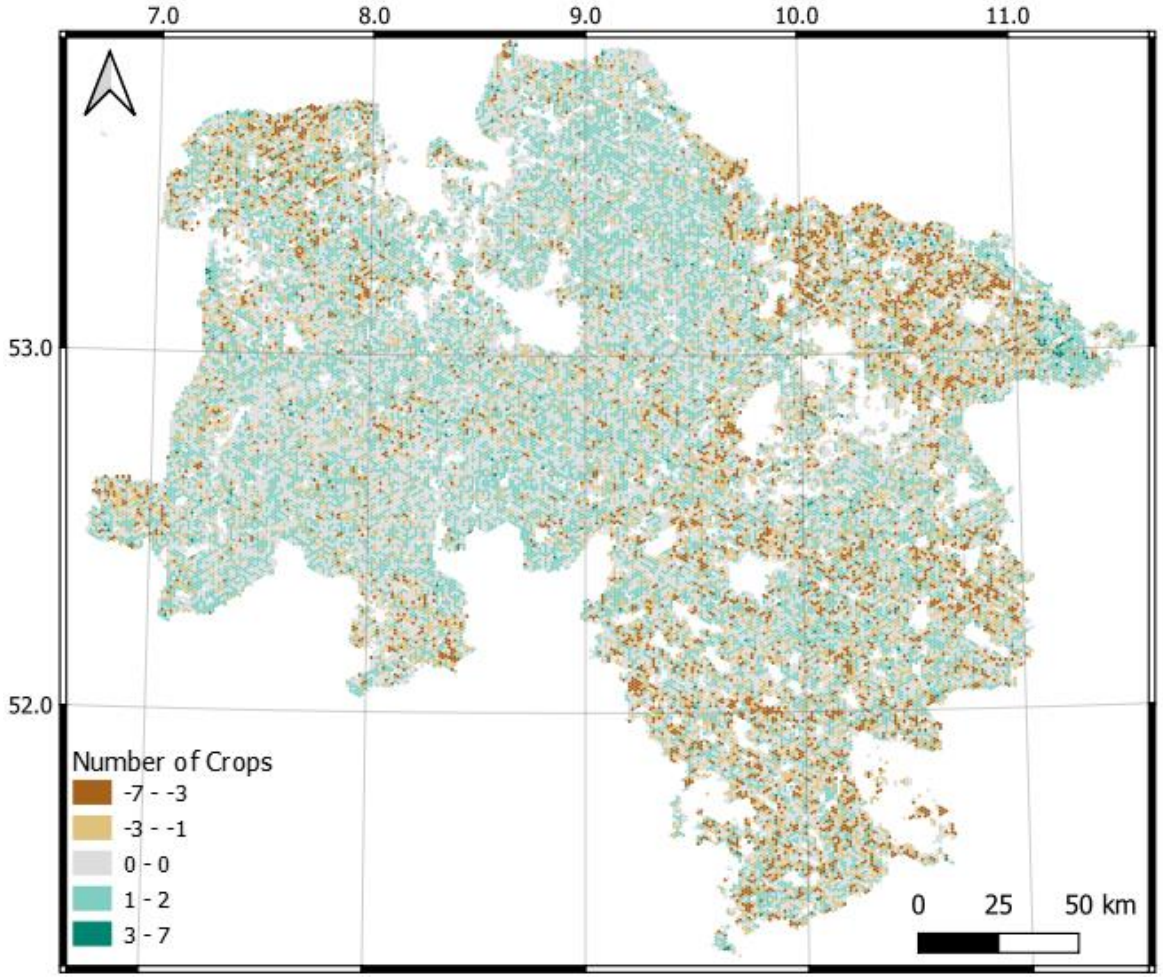


Shannon Index für Niedersachsen 2019 auf Basis der Fruchtartenklassifikation nach Blickensdörfer et al. (2022).

Difference

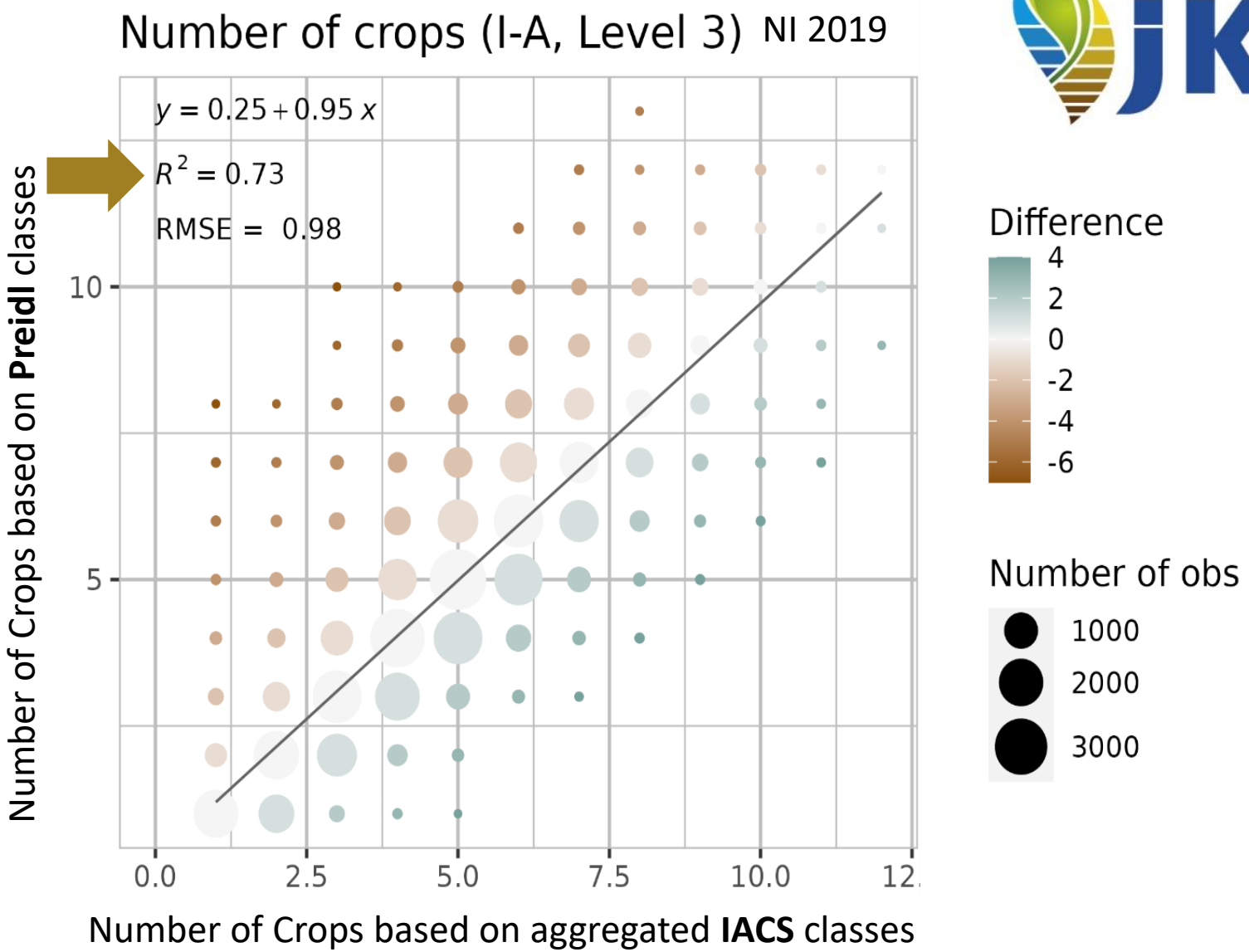


Number of Crops (IACS-PRE) Lower Saxony 2019



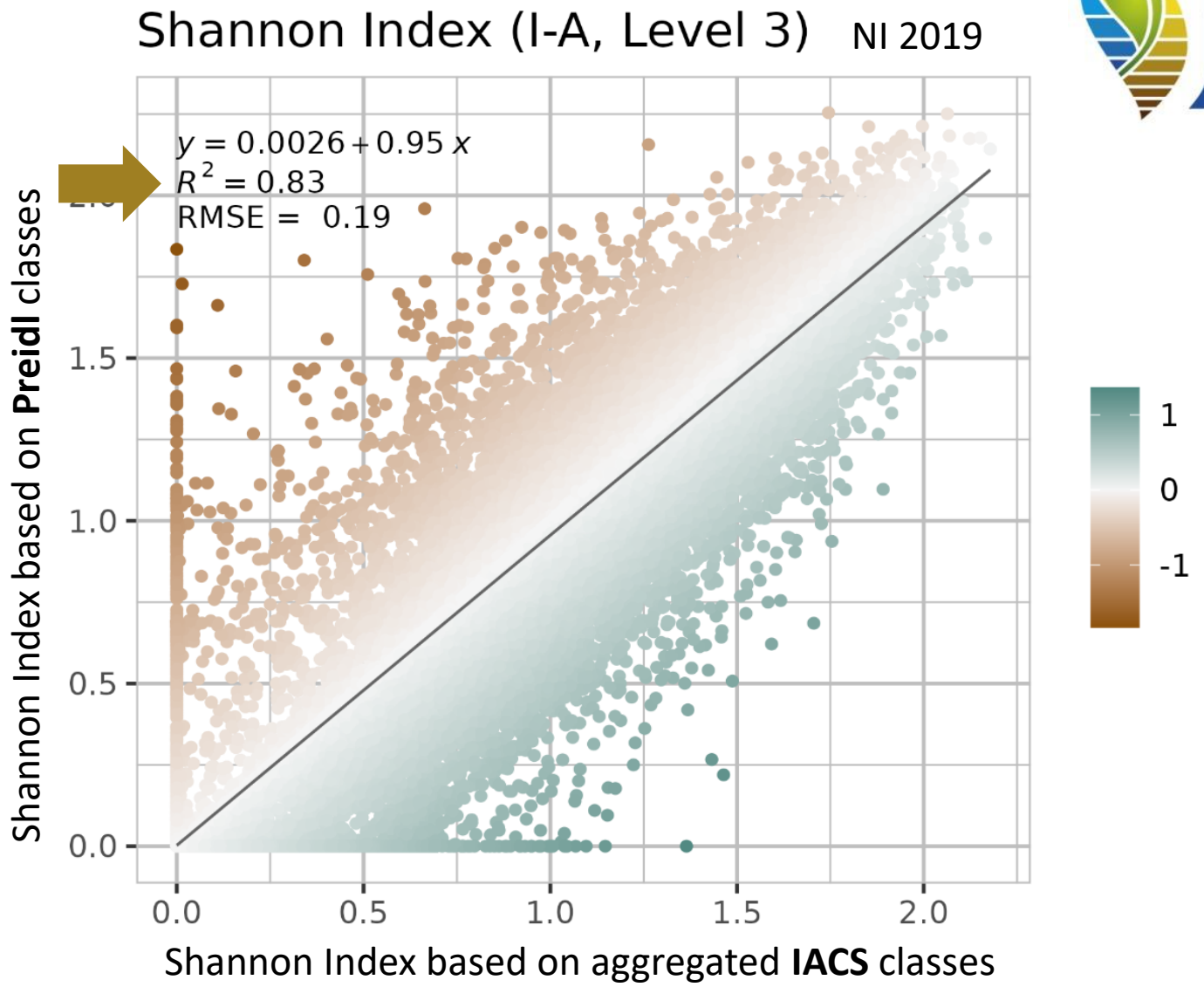
Accuracy Metrics

Differences of Biodiv. Metrics | Accuracy Metrics

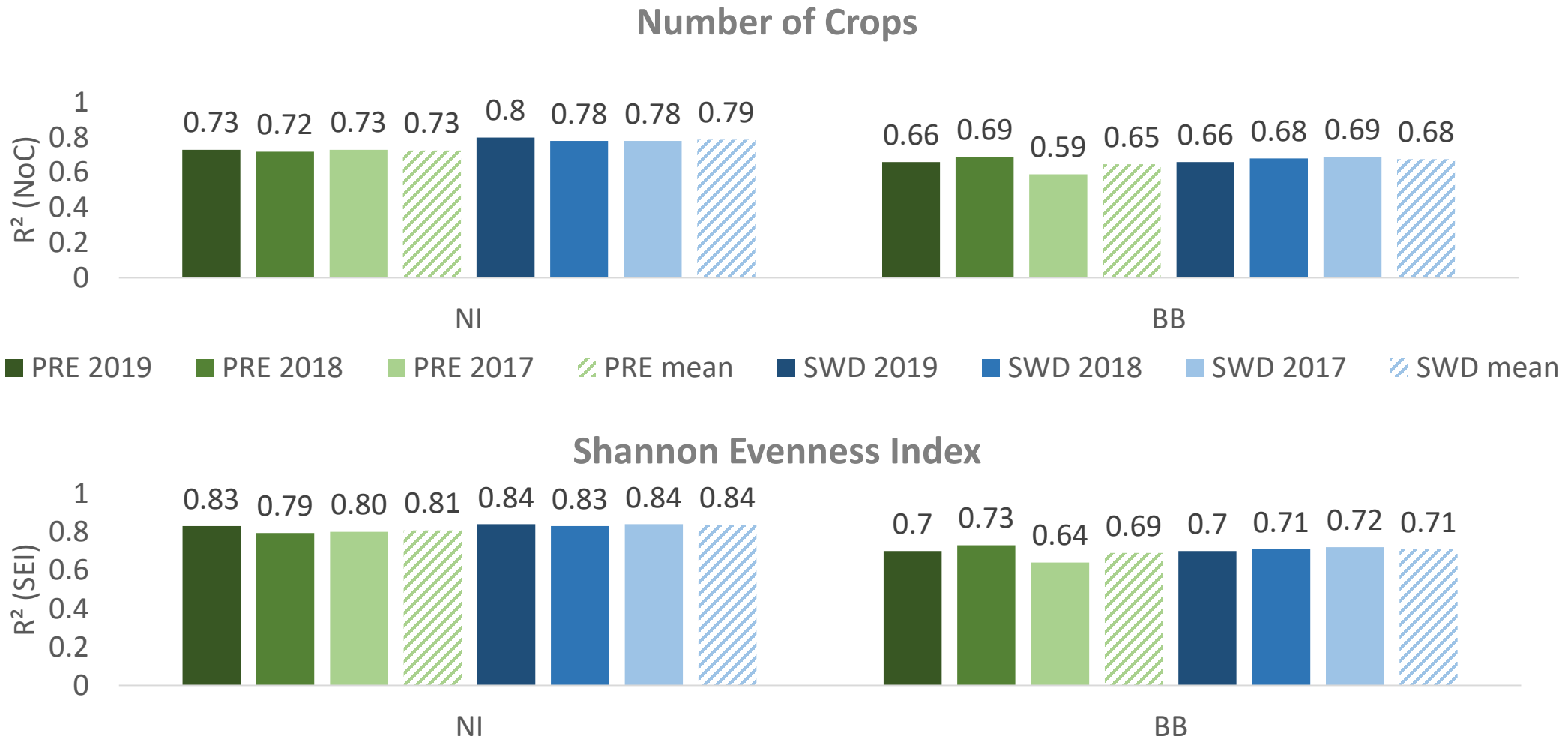


Accuracy Metrics

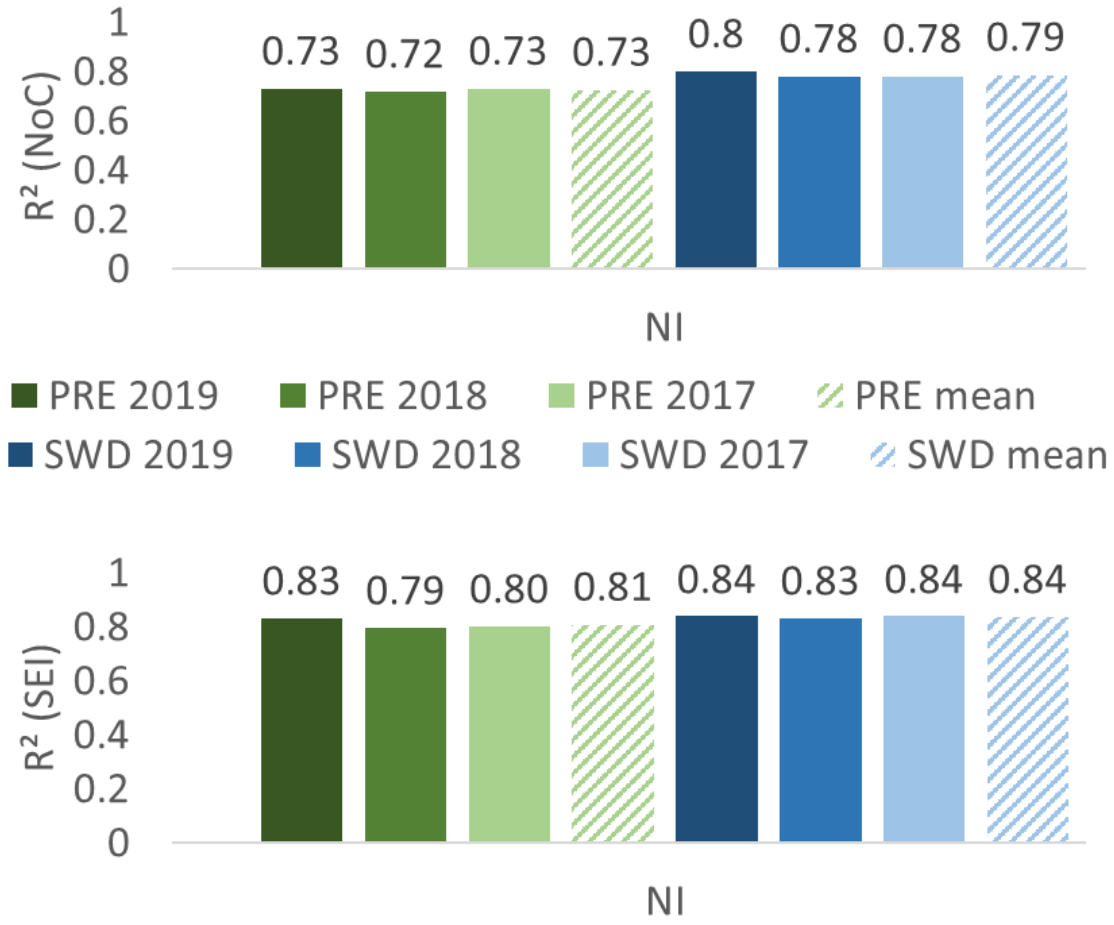
Differences of Biodiv. Metrics → Accuracy Metrics



Summary of Accuracy Metrics



Summary of Accuracy Metrics

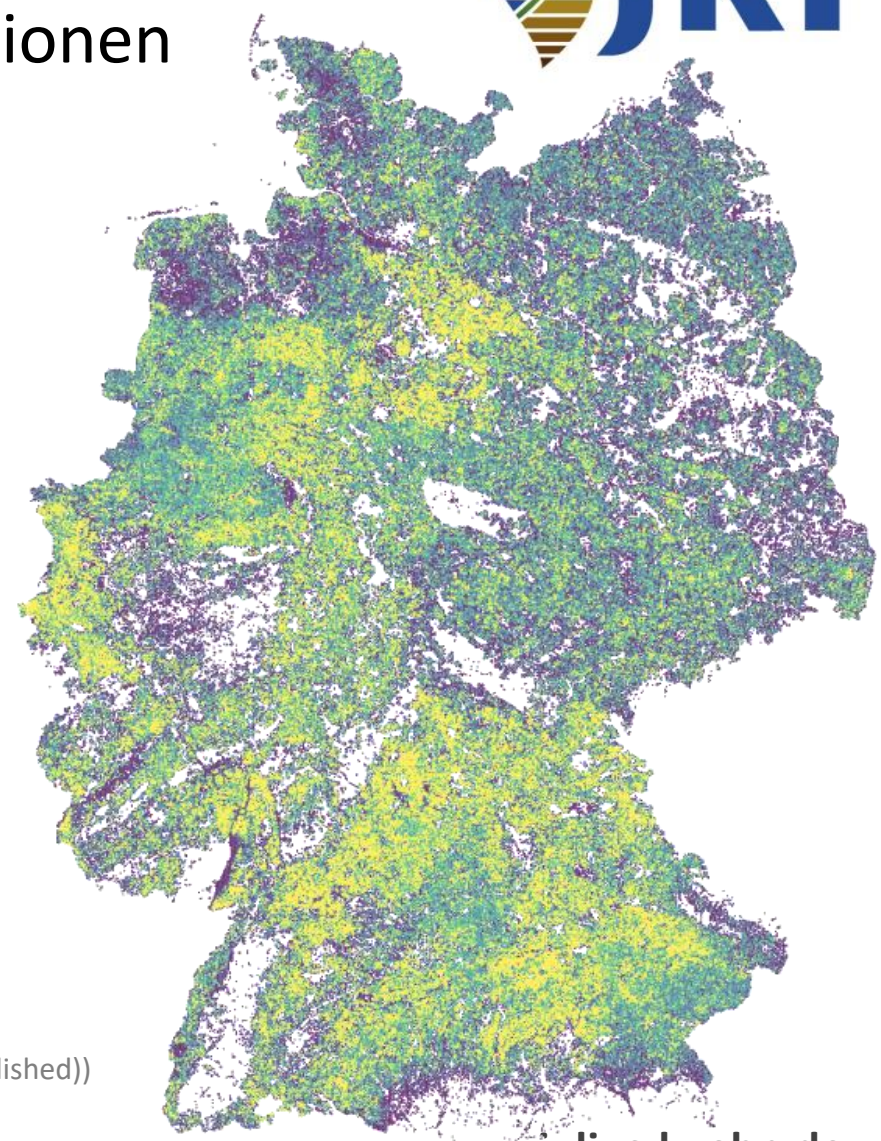


- Hohe R^2-Werte für
  - beide Bundesländer
  - 3 Jahre
  - 2 Fruchtartenklassifikationen

→ starke Ähnlichkeiten zwischen den Metriken auf Basis der verschiedenen Inputdaten

Conclusion

→ Fernerkundungsbasierte Fruchtartenklassifikationen können fehlende InVeKoS-Daten ersetzen



Shannon Evenness Index 2017 (nach Schwieder et al. 2023 und Tetteh et al. 2023 (not published))

Ausblick

- Anwendung von verschiedenen Inputdaten
- Veröffentlichung von nachvollziehbaren und reproduzierbaren Methoden
- Veröffentlichung von Ergebnissen basierend auf mehreren Eingangsdaten
- Eingangs- und Ergebnisdaten mit Datenqualitätsmetriken versehen (Metadaten)

FAIRagro

Findable, **A**ccessible, **I**nteroperable, and **R**e-usable

References: Höck et al. (2020), Rat für Informationsinfrastrukturen (2009)

Take home message

- Abnehmender Trend der Biodiversität in der Landwirtschaft
- „Messung“ der Biodiversität nur indirekt möglich

  → Indikatoren werden im Rahmen von MonViA entwickelt
- Datengrundlagen sollten sorgfältig gewählt werden
- Eingangsdaten, Ergebnisse und Methoden sollten FAIR sein

Findable, **A**ccessible, **I**nteroperable, and **R**e-usable

Vielen Dank für das Interesse

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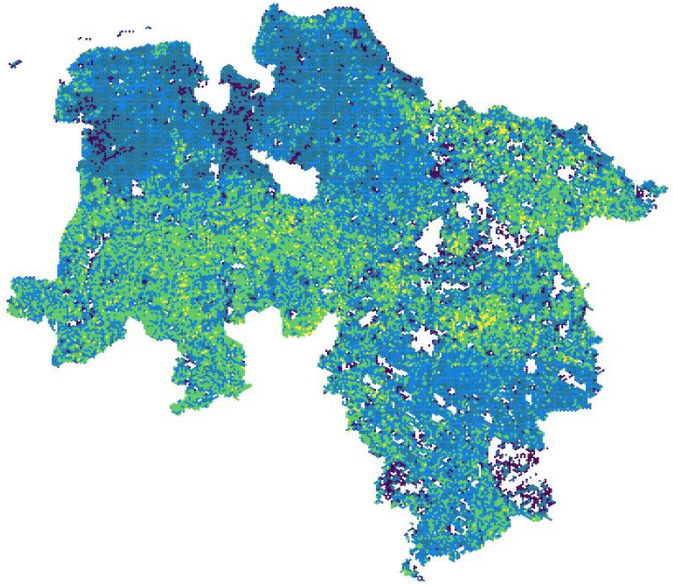

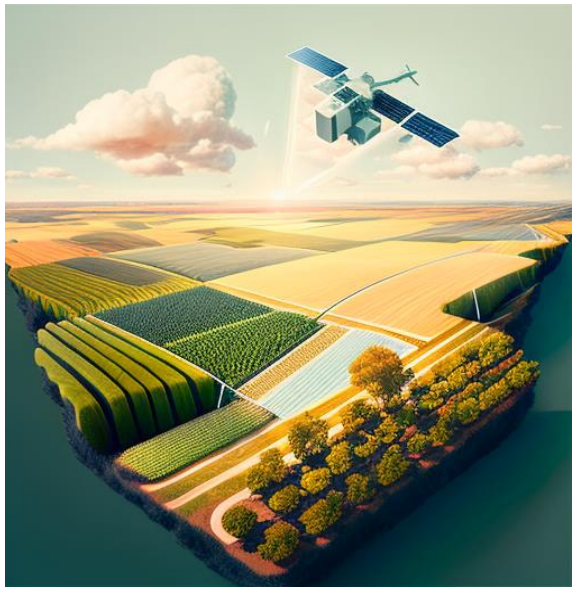

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