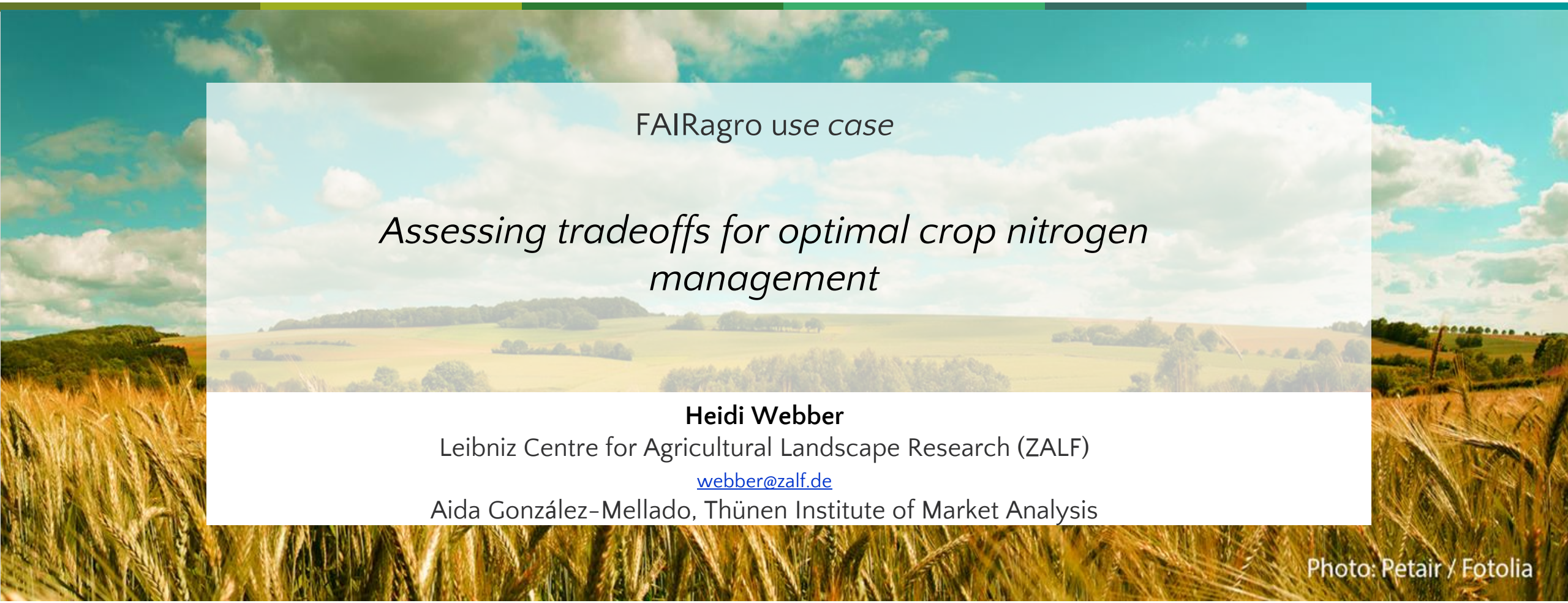


FAIRagro *use case*

Assessing tradeoffs for optimal crop nitrogen management

Heidi Webber
Leibniz Centre for Agricultural Landscape Research (ZALF)
webber@zalf.de
Aida González-Mellado, Thünen Institute of Market Analysis

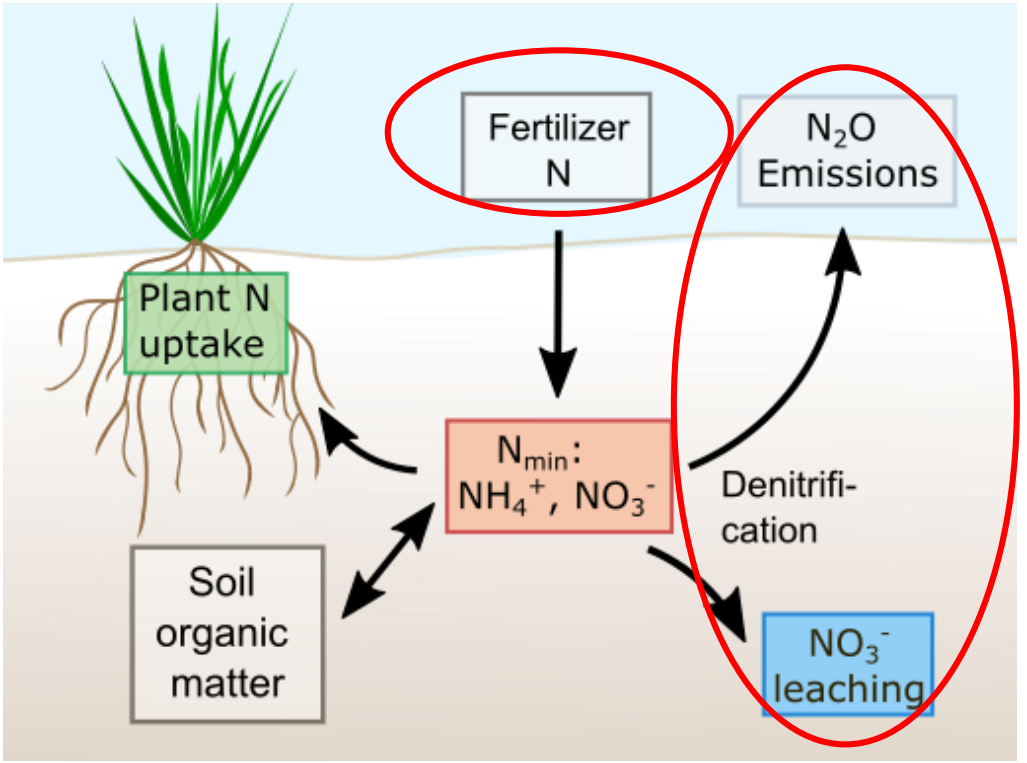
Hintergrund und wissenschaftliche Fragestellung

FAIRagro

- Nitrogen (N) losses are severe environmental problem though N often limits crop yields
- Improving N management challenging
  - interplay of crop N uptake and soil N transformations
  - soil heterogeneity
  - weather uncertainty

- Research question: How can crop rotations and N fertilization be designed to optimize tradeoffs between crop yield and N losses?

- Hypothesis: improved data availability & infrastructure for integrated soil & crop model parameterization, applications & scaling can improve N tradeoff assessments



(Figure from Maire Holz, 2021)

Heidi Webber (ZALF)
webber@zalf.de

Wissenschaftliche Disziplinen und Skalen

FAIRagro

- **Soil scientists**
- **Crop scientists**
- **Agronomists**
- **Agroecosystems**
- **Agricultural economists**
- Hydrologists (water quality)
- Biodiversity

- **Sub-field (process knowledge)**
- **Field & farm (management decisions)**
- **Landscape (environmental problems)**
- Market (influences management decisions)
- National (regulations)
- Global (climate system)

Heidi Webber (ZALF)
webber@zalf.de

Use Case Ziele

FAIRagro

1. **Improve data access and standardization** to various existing geo-referenced datasets
2. **Improve access to legacy data for model parametrization** through digitalization, standardization, making findable and geo-referencing of experimental datasets on soil and crop nitrogen processes
3. **Support more transparent and reproducible data scaling and aggregation** of both model input and simulation data with aim to reduce and better quantify uncertainties

Heidi Webber (ZALF)
webber@zalf.de

FAIRagro

What exists already?

- International AgMIP modelling community model data standards: ICASA standards (https://agmip.org/agdig-data-interoperability-group/)
- Much data…,
  - Weather & climate scenarios: DWD weather, JRC weather, ZALF EU climate scenarios
  - Soil data: BÜK200, *European Soil Databases* (*ESDB*)
  - Topsoil Soil Organic Carbon: EU, LUCAS
  - Phenology data: DWD
  - Crop production areas & land use maps: CORINA, MIRCA
  - Crop yield statistics: NUTS3 level for Germany
  - Crop yield climate impacts simulations: EU and global scale
  - Crop and input prices, farm data

Heidi Webber (ZALF)
webber@zalf.de

Was wird im Use Case realisiert (outcomes)?

1. **Searchable data base for common model input data**
   - weather, soil, crop phenology and management
   - ICASA standards
2. **System to create standardized model datasets from legacy experimental studies**
   - use existing data extraction methods
   - ICASA standards
3. **Platform for data aggregation of model input and simulation data**
   - collate and standardize existing landuse & production area datasets needed for aggregation
   - allow user specification of target resolution and aggregation methods
   - provision data at desired resolution with documentation
   - offer uncertainty quantification

Heidi Webber (ZALF)
webber@zalf.de

Involvierte Partner

FAIRagro

- **Modellers and experimentalists**: ZALF (crop system modeling, soil science, farm system analysis), Thünen Institute (economic market modelling)

Heidi Webber (ZALF)
webber@zalf.de

Lücken und Defizite

FAIRagro

- Need to refine the scope of second objective – digitalization of legacy experimental data
  - Expertise in data extraction
- Data providers – what is possible, particularly for the farm data (privacy issues)
- Scoping to prioritize most important data
  - -> other world regions

Heidi Webber (ZALF)
webber@zalf.de