HOW TO IMPLEMENT REGIONALIZED LCI IN WFLDB (FOOD) AND/OR WALDB (FIBER)

GeoFootprint

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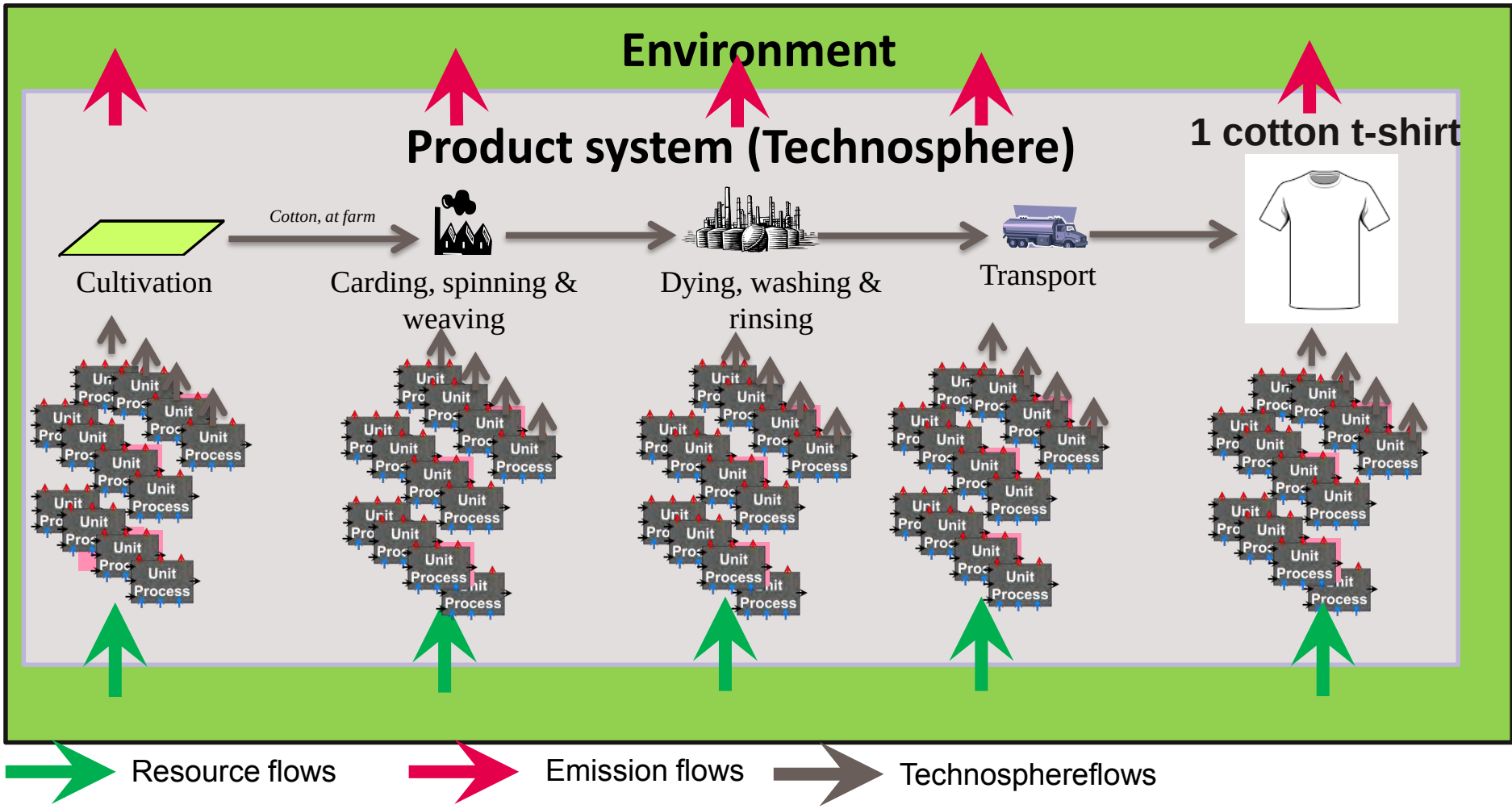
Stakeholder-demands increasingly lead to a need for companies to measure their environmental impact

Quantifying environmental impact with Life Cycle Assessment

A data intensive task



➔ **Data foundation is key ….but incomplete**

WFLDB and WALDB:
Improving decision-making in the realm of food / feed / fibre

YESTERDAY
INCOMPLETE DATA FOUNDATION

Capability to assess environmental impacts in the **food and apparel industry** is incomplete or limited

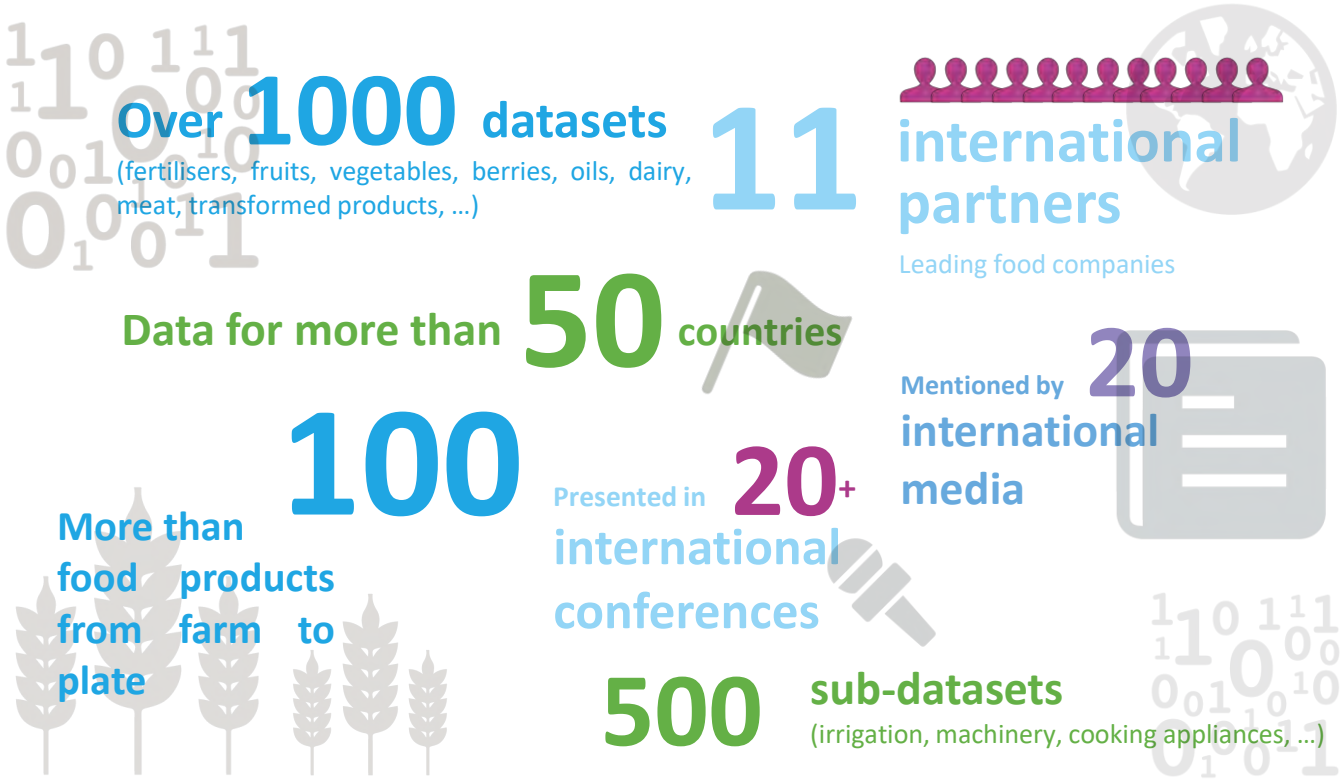
Background database

TODAY & TOMORROW
ROBUST DATA FOUNDATION

For environmental assessment in the food and apparel industry

Background database

World Food LCA Database (WFLDB) in a nutshell



The World Apparel & Footwear LCA Database (WALDB)

AIMS TO PROVIDE DATASETS FOR SINGLE PROCESSES OF ALL KEY APPAREL AND FOOTWEAR MATERIALS

RAW MATERIALS

- Cotton
- Organic Cotton
- Wool
- Viscose
- Silk
- Synthetics
- Leather

- Most relevant regions

APPAREL PRODUCTION

- **Cotton** Ginning, Spinning, Mercerizing
- **Wool** Scouring & top making, Spinning
- **Generic** Bleaching & dying, Weaving, Knitting, Assembly, finishing

FOOTWEAR PRODUCTION

- Tanning
- Last production
- Sole production
- Cut & link
- Insole production
- Assembly
- finishing

USE PHASE

- Washing
- Dry cleaning

END OF LIFE

- Re-use
- Shoe and apparel recycling

➔ **Cultivation step is key (food, feed, fibre) but characterized by large uncertainties**

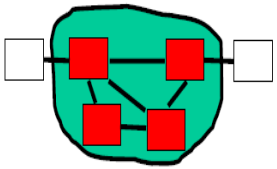
Compilation of cultivation datasets (CD)

The traditional way

Databases

Literature data

Company data / Questionnaire



Models

LCA dataset:

Cotton cultivation, CN

Resource flows (input)

…
Land requirement
…

Technosphere flows (input)

…
Tillage
Irrigation
Ammonium nitrate
Potassium chloride
…

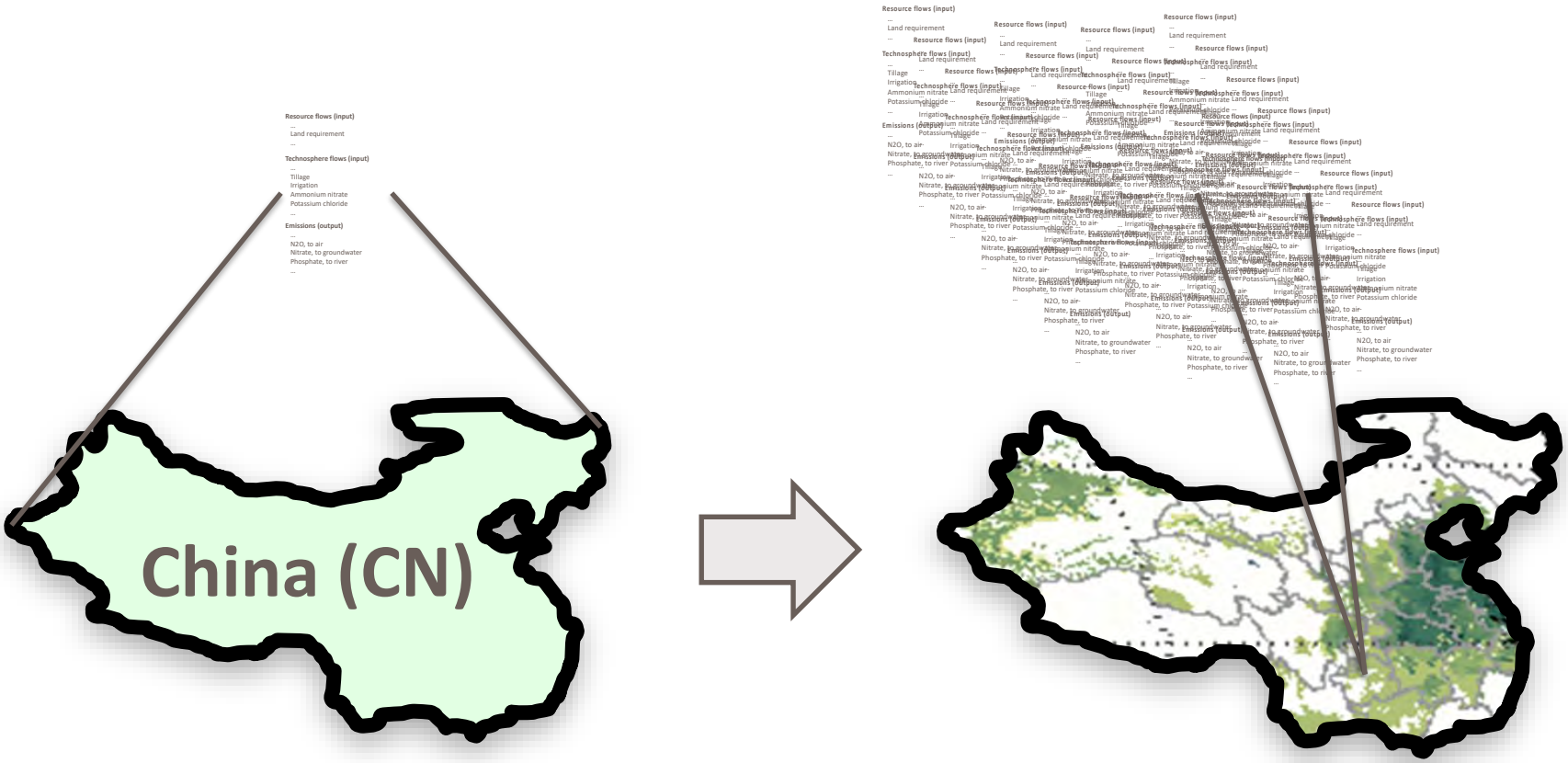
Emissions (output)

…
N2O, to air
Nitrate, to groundwater
Phosphate, to river
…

40-80 exchange flows

➔ **Large spatial uncertainty**

How can we achieve a more accurate representation of agricultural practices in LCA?



Today:

ONE dataset uniformly describes entire country

Tomorrow:

Datasets are **computed for every grid-cell (e.g. 10 x 10 km)**

REGIONALIZED LCI MODELING

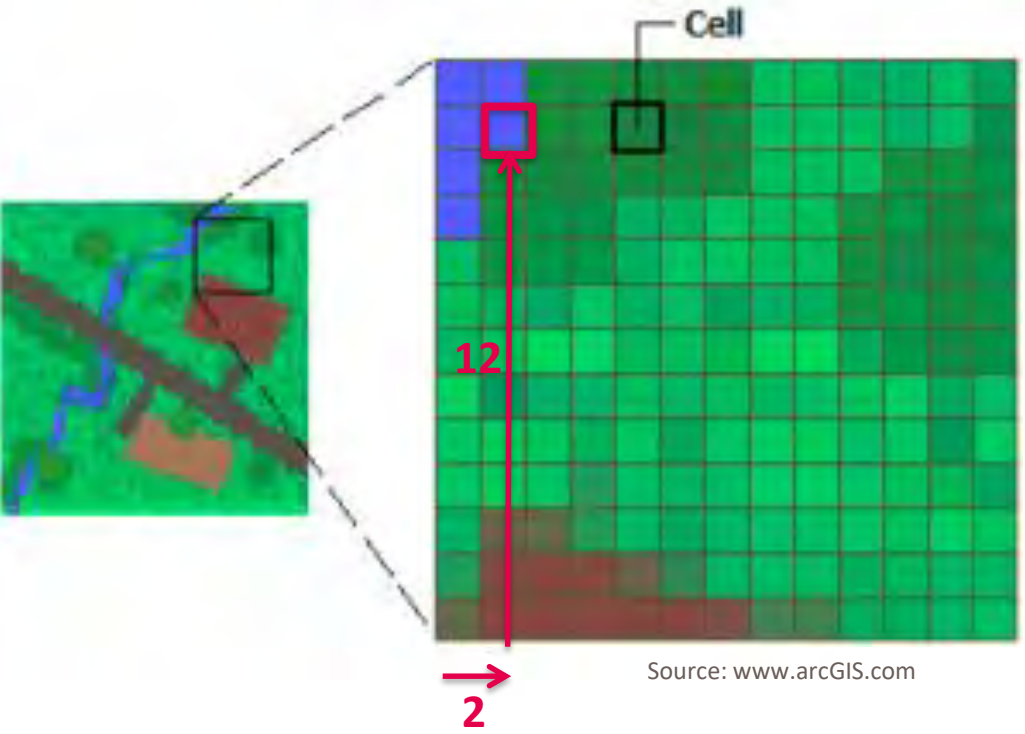
CONCEPT

By integration of spatial (raster) data into LCA
Explicit consideration of spatial features

Raster data:

- represent the world as a surface of regular grid cells
- each grid cell represents a value, e.g. land usage = 2 (Forest)

  ➔ can be queried, e.g. "What land usage at coordinates X2Y12?"

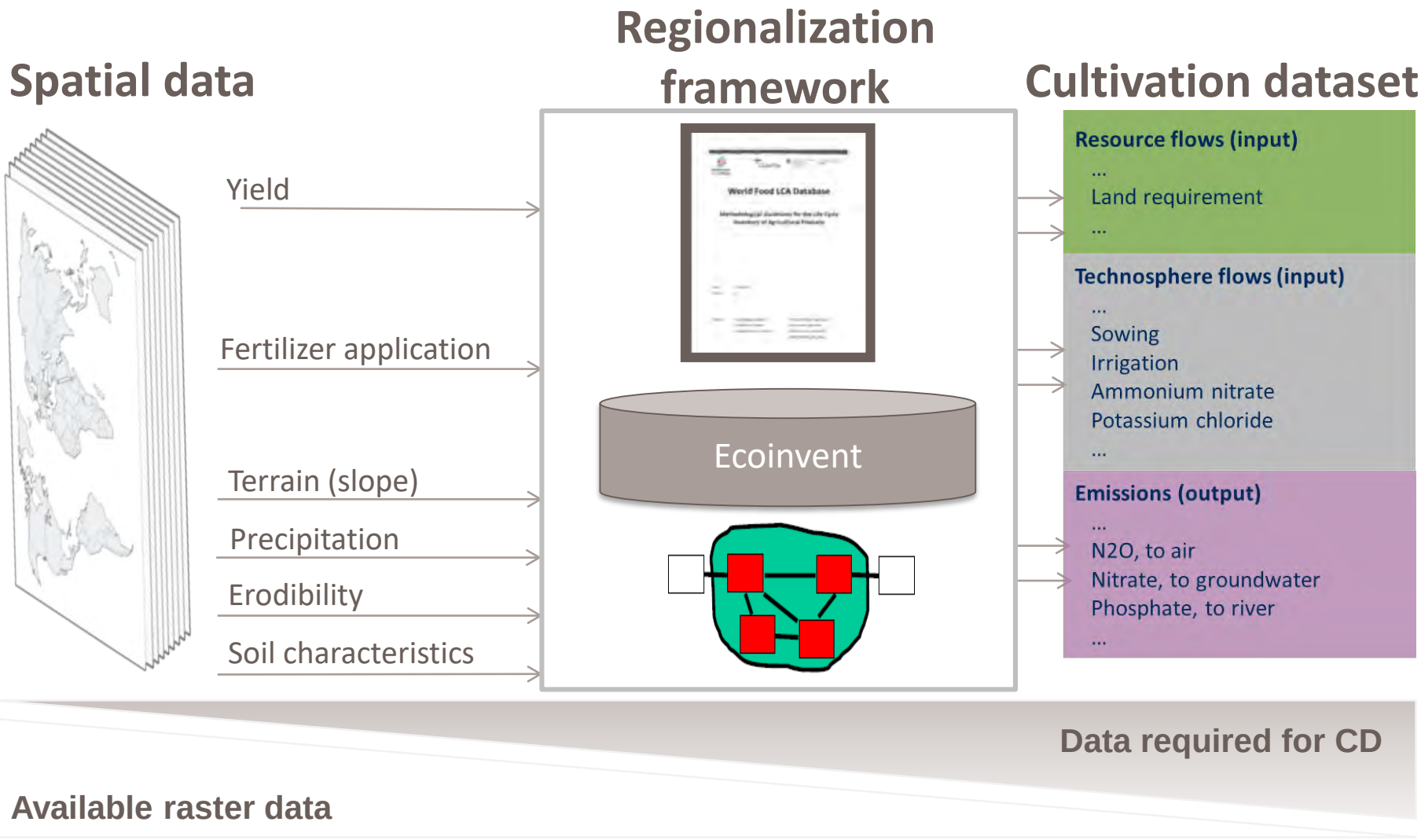


Source: www.arcGIS.com

Land usage layer		
Coordinates	Code	Land usage
X2 Y12	1	River
X5 Y11	2	Forest
X3 Y1	3	Arable
X9 X9	4	Grassland

Regionalized LCI modeling

Bridging the gap between raster and cultivation datasets



REGIONALIZED LCI MODELING

PROOF-OF-CONCEPT

RAPE SEED CULTIVATION IN GERMANY

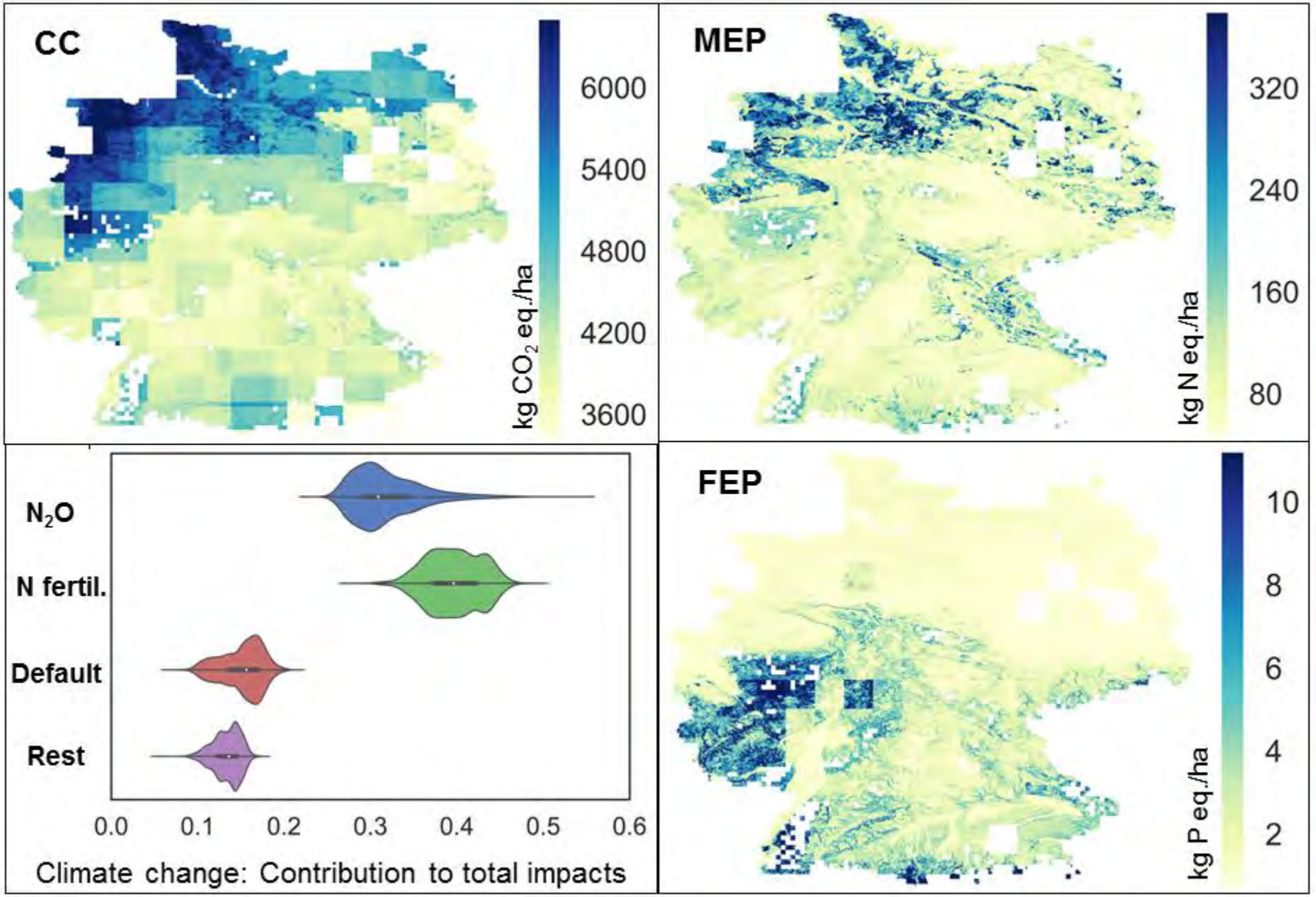
Proof-of-concept: Goal and Scope

- Test application of the regionalization framework
- Generate cultivation dataset (CD) for each grid cell where rapeseed cultivation takes place
  - resolution of ~1 x 1 km ➔ 580'000 regionalized CD

- Each regionalized CD lists the exchange flows related to the cultivation of **one hectare** of rapeseed in a **cradle-to-gate** perspective.
  - further usage (e.g. as feed or biofuel) is not considered

- 3 LCIA midpoint indicators to assess the environmental impacts:
  - climate change (**CC**, IPCC2013 GWP100a),
  - marine eutrophication (**MEP,** ReCiPe Midpoint (H)) and
  - freshwater eutrophication (**FEP**, ReCiPe Mipoint (H)).

Results: Rape seed cultivation in Germany



Regionalized LCIA modeling: insights from proof-of-concept

- Proof-of-concept
  - shows that the integration of spatial data into agricultural LCA calculation facilitates large-scale computation of cultivation datasets in “high resolution”
  - still many assumptions required to generate a comprehensive cultivation dataset (e.g. default data for pesticides and machine operations)

- Framework
  - allows consideration of micro-spatial variations otherwise overlooked in country-level LCA calculations ➔ improves representativeness
  - **scalable:** spatial repository for all major crops in the world
  - **flexible:** degree of regionalization can be adapted to data availability

GeoFootprint

THE MAP FOR SUSTAINABILITY CROP MANAGEMENT

GeoFootprint will allow companies, public authorities and farmers dealing with crops to instantly get the spatially-sensitive footprint of major agricultural products everywhere in the world in a web-based map.

QUANTIS-C-KIC PRESS RELEASE

Quantis

ABOUT | METRICS | TOOLS | STRATEGY

Press releases > Quantis and EIT Climate-KIC launch the GeoFootprint Project to develop a tool to measure and monitor environmental impacts of crops

Quantis and EIT Climate-KIC launch the GeoFootprint Project to develop a tool to measure and monitor environmental impacts of crops

24 | 08 | 2018

Lausanne, Switzerland, August 24, 2018 — Environmental sustainability consulting firm **Quantis** has been awarded a grant by **EIT Climate-KIC**, the EU's largest public-private partnership addressing climate change through innovation, to launch the **GeoFootprint Project**. The groundbreaking two-year project will deliver **comprehensive and site-specific data via a publicly available, web-based platform** to a diverse set of actors across crop-based value chains. **The goal of the project is to foster more effective measurement, monitoring and management of local sustainable agricultural practices**.

https://quantis-intl.com/quantis-and-eit-climate-kic-launch-the-geofootprint-project/

Project organization – 2 ½ years of GeoFootprint

Commissioner

Project partners

Preferred users group

Advisory board

eit Climate-KIC

1.4 million EUR

arx IT

IT/GIS developer

Quantis

LCA & Sustainability metrics consultancy

CFA COOL FARM ALLIANCE

Industry platform for sustainable agriculture metrics and tools

Target audience of the GeoFootprint platform: are being consulted to define the functional and non-functional specifications of the tool

Advises on strategic, political and scientific direction.

ADEME, FAO, IUCN, SAI, UNEP, WBCSD, WWF

Objectives of the project (=limitations of the proof-of-concept)

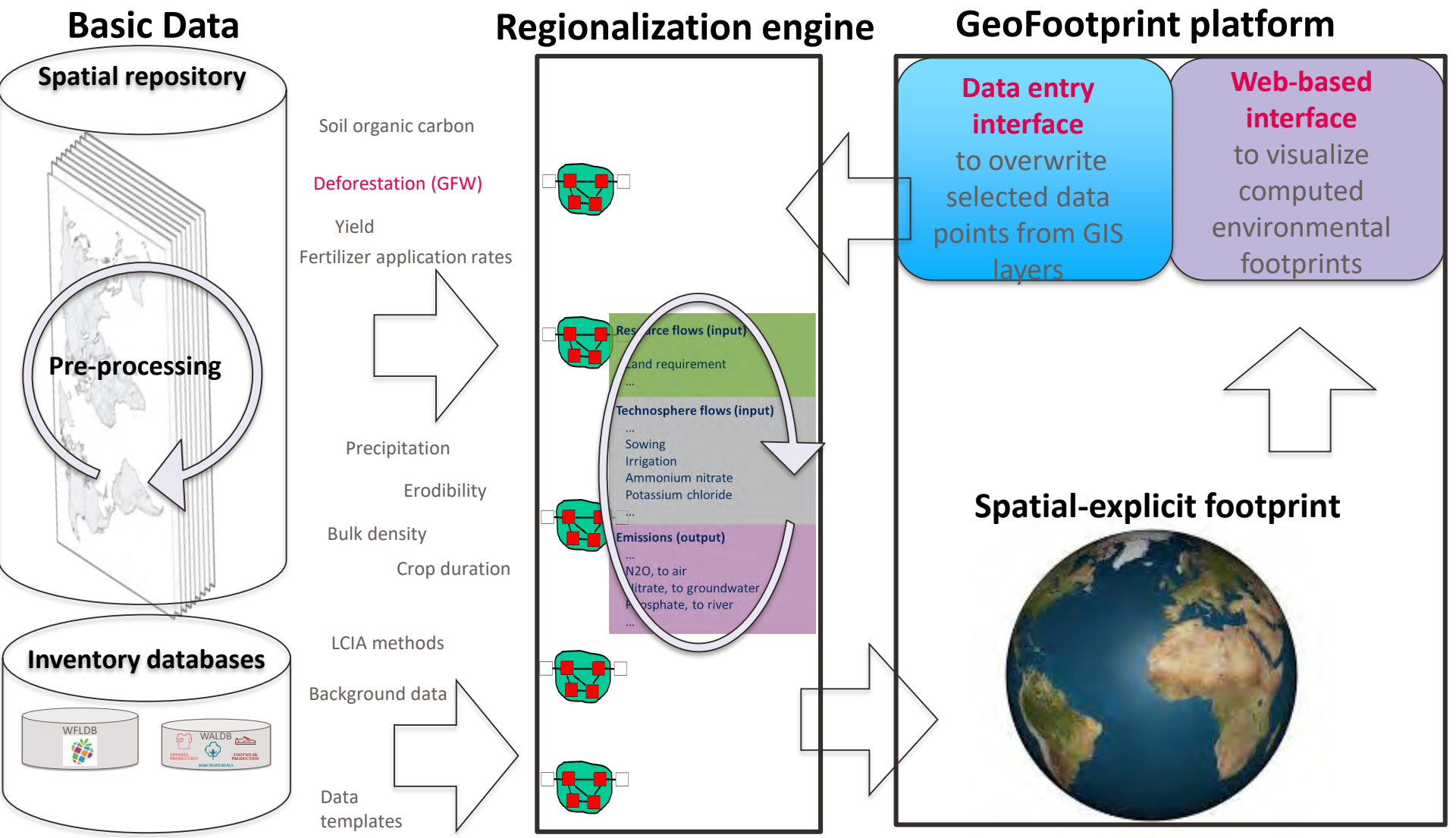
Development of a **computational regionalization engine** that facilitates a seamless integration of all relevant spatial data into environmental footprinting.

Development of a **business plan ensuring the platform deployment** using preferred users group and Advisory Board feedback.

Development of a **Land Use (LU) and Land Use Change (LUC) calculation modules**

Development of a **web-based platform with user-friendly interface automatizing the footprint assessment** with various access levels

Concept


Basic Data
Regionalization engine
GeoFootprint platform
Spatial repository
Pre-processing
Inventory databases
WFLDB
WALDB
Soil organic carbon
Deforestation (GFW)
Yield
Fertilizer application rates
Precipitation
Erodibility
Bulk density
Crop duration
LCIA methods
Background data
Data templates
Technosphere flows (input)
Sowing
Irrigation
Ammonium nitrate
Potassium chloride
Emissions (output)
N2O, to air
Data entry interface
to overwrite selected data points from GIS layers
Web-based interface
to visualize computed environmental footprints
Spatial-explicit footprint

USE CASE

COTTON CULTIVATION

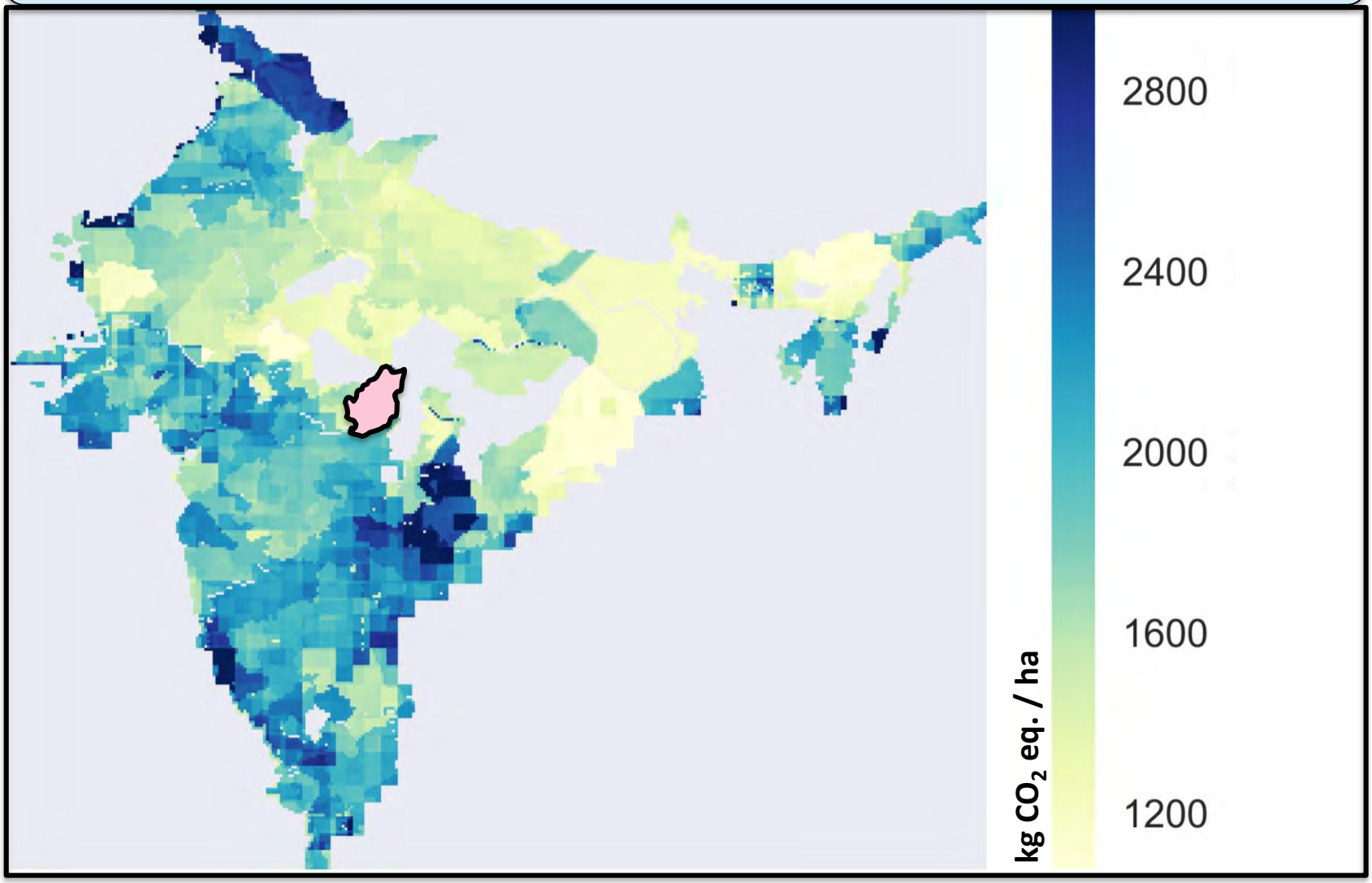
Mock-up – Map-browser

Select crop

Cotton

LCIA indicator

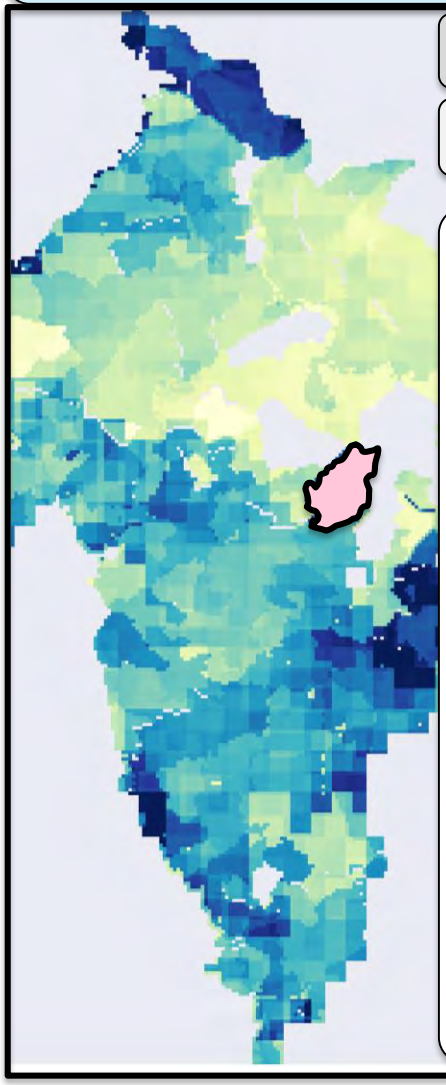
Carbon footprint



Mock-up: LCIA result breakdown for a selected **region**

Select crop: Cotton

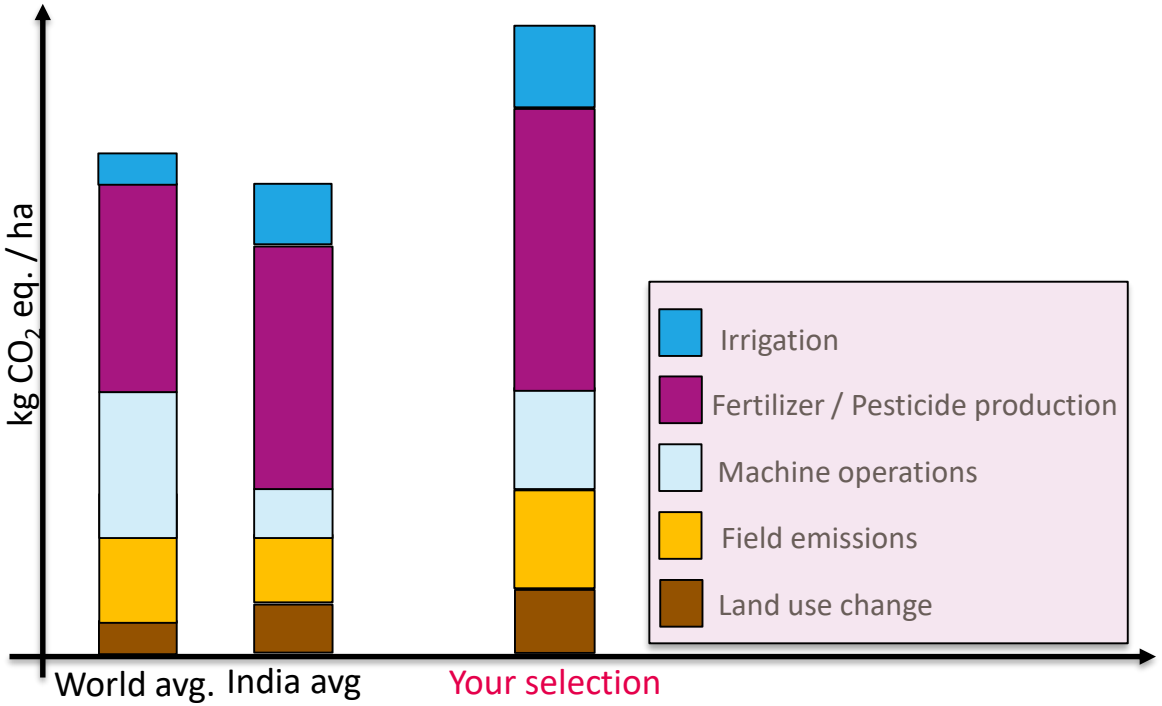
LCIA indicator: Carbon footprint



Contextual parameters

Input flows

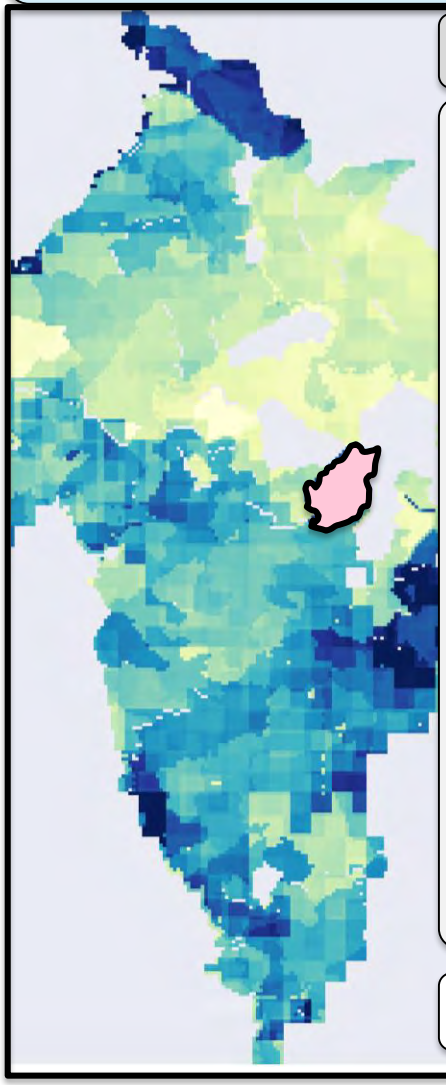
LCIA - by category



Mock-up: View input flows for a selected **region**

Select crop: Cotton

LCIA indicator: Carbon footprint



Contextual parameters

Input flows

Fertilizer

N-fertilizer	85	kg N / ha
P-fertilizer	35	kg P2O5 / ha
K-fertilizer	22	kg K2O / ha

Irrigation

Amount	3'250	m^3 / ha
Type	...	
.....		

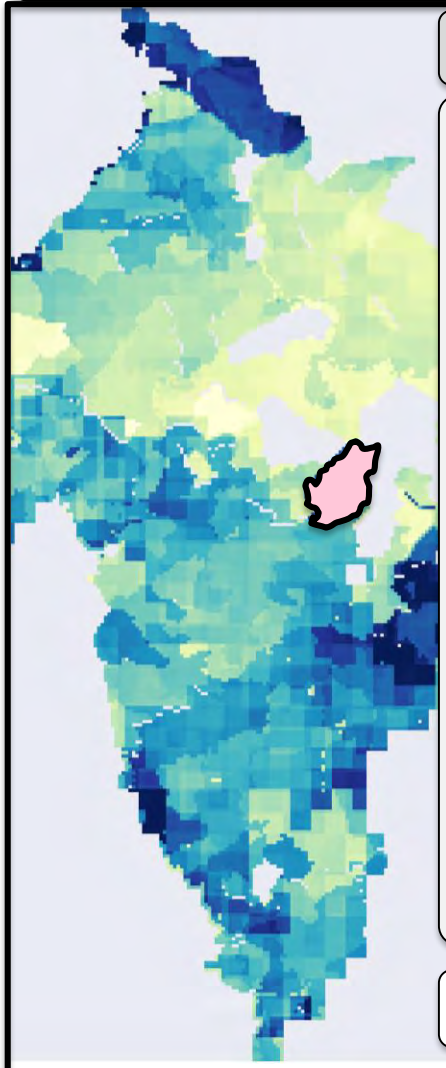
....

LCIA - by category

Mock-up: Manipulate input flows for a selected **region**

Select crop: Cotton

LCIA indicator: Carbon footprint



Contextual parameters

Input flows

Fertilizer

N-fertilizer	105	kg N / ha
P-fertilizer	45	kg P2O5 / ha
K-fertilizer	25	kg K2O / ha

Irrigation

Amount	2'250	m^3 / ha
Type	...	
.....		

....

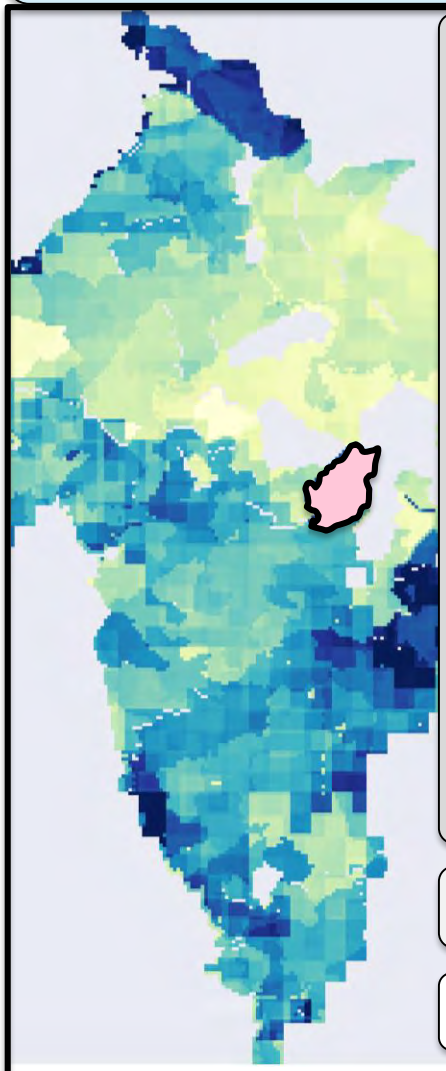
Recompute

LCIA - by category

Mock-up: View and manipulate parameters for a selected **region**

Select crop: Cotton

LCIA indicator: Carbon footprint



Contextual parameters

Soil characteristics

Soil organic carbon	80	ton C / ha
Bulk density	1'230	kg soil / m3
Coarse fragments	15	%
...	...	...

Land use

Tillage practice	No tillage
Input practice	High (without manure)
.....	

....

Recompute

Input flows ^

LCIA - by category ^

CONCLUSION

Conclusion

- WFLDB & WALDB
  - improves the (data) foundation of LCA-based decision-making in regard to food, feed and fibre
  - country-level datasets not always sufficient
  - powerful foundation for regionalized LCI modeling
    - provides the templates required for default data
- Regionalized LCI modeling
  - improves geographical representativeness and reproducibility of agricultural datasets
  - offers new possibilities for dataset aggregation and analysis
  - foundation for regionalized LCIA
- GeoFootprint will allow key decision-makers in the realm of food, feed and fiber to:
  - instantly get the spatially-sensitive footprint of major commodities everywhere in the world in a web-based user-friendly visual way (map),
  - consider micro-spatial variations otherwise overlooked in agricultural LCA
  - effectively understand and replicate the value added of sustainable practices

THANK YOU!

QUESTIONS??

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