ATB
Leibniz-Institut für Agrartechnik
Potsdam-Bornim e.V.

AgroHyd

AgroHyd
World food consumption and water resources: an agro-hydrological perspective

- Introduction to ATB
- Overview of AgroHyd Project
- Business Plan

Judy Libra, Simone Kraatz, Katrin Drastig, Annette Prochnow, et al.

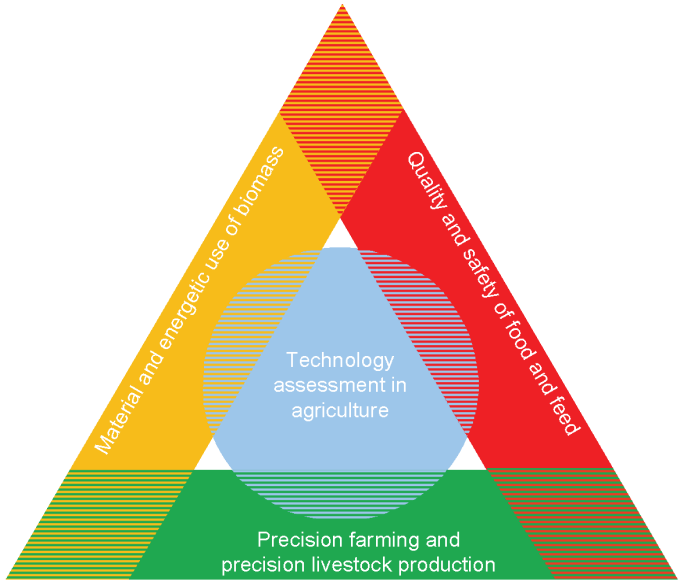
runlevel3

Leibniz
Leibniz-Gemeinschaft

ATB
Leibniz-Institut für Agrartechnik
Potsdam-Bornim e.V.

Goal: Improve resource efficiency in agriculture

- 280 employees
- 3 ha of raw material/ energy plantation
- 40 ha of experimental lots
- 4 research programs:



Leibniz
Leibniz-Gemeinschaft

1: Technology and Processes in Crop and Livestock Production
2: Quality and Safety of Food and Feed
3: Material and Energetic Use of Biomass

Areas of Work

Processing

fruit,vegetables,
meat, milk

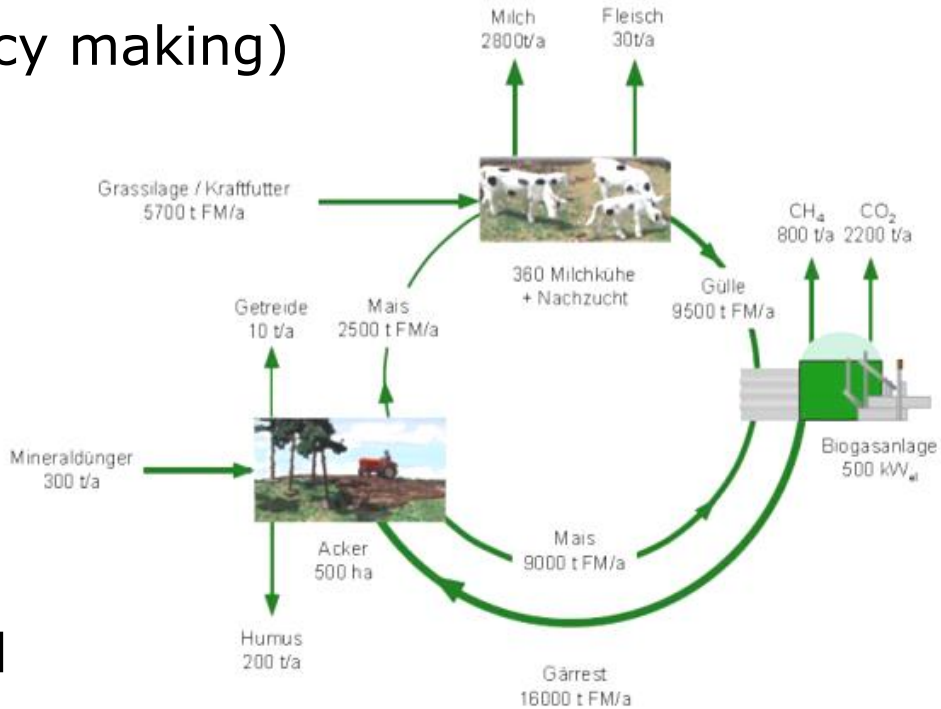
feed grain, silage,
fiber, energy plants

Supply chain
Food / feed / materials

Primary production

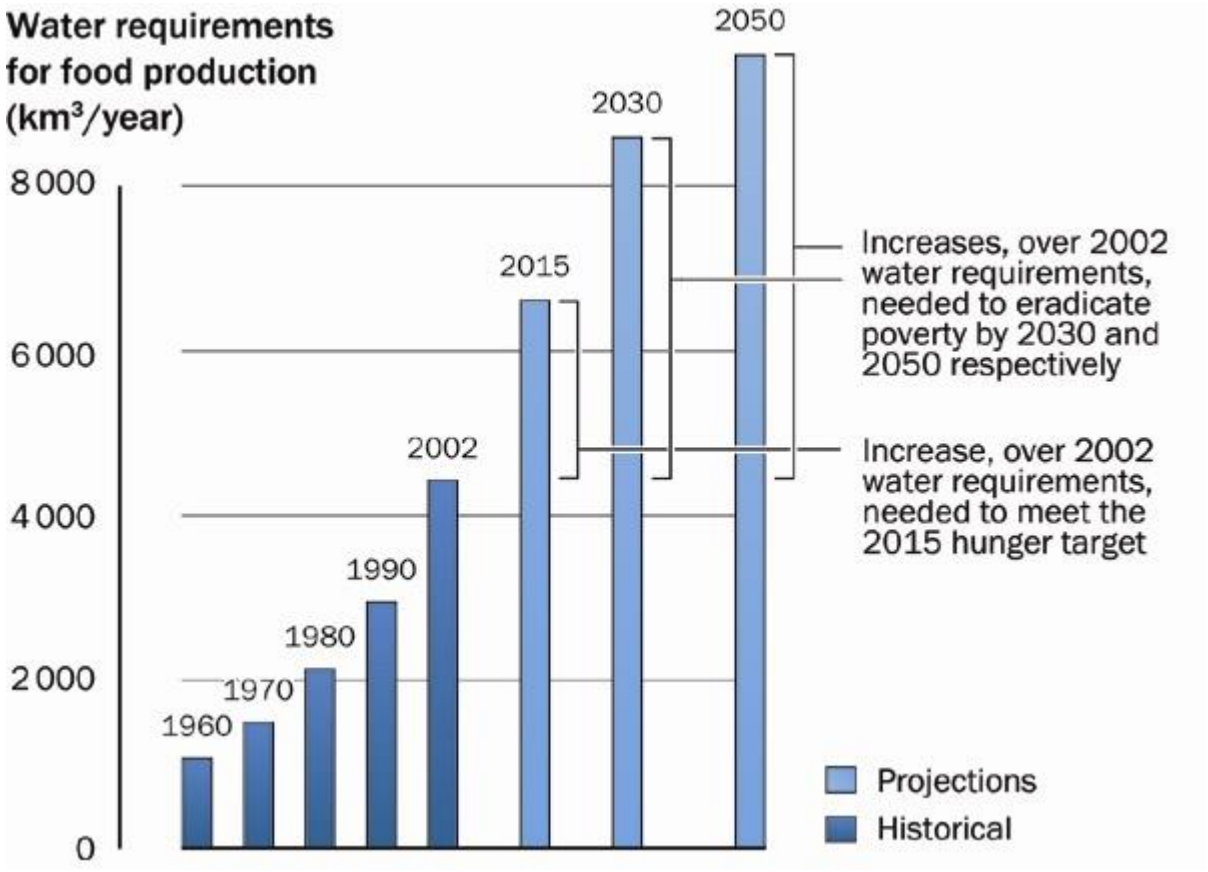
4: Technology Assessment in Agriculture
Focus - Modeling of agrosystems

- Modeling energy, water, carbon and nutrient fluxes
- Method development (LCA, economy, logistics)
- Decision support (e.g. policy making)



- Current Project: AgroHyd
  World food supply and water resources –
  an agricultural hydrological perspective

Challenge: increase in water requirements to meet future food demands



http://www.globalagriculture.org/fileadmin/pics/weltagrarbericht/unep.water_for_food_production_1960_2050.jpg

http://www.waterfootprint.org/

Determine options to reduce water demand

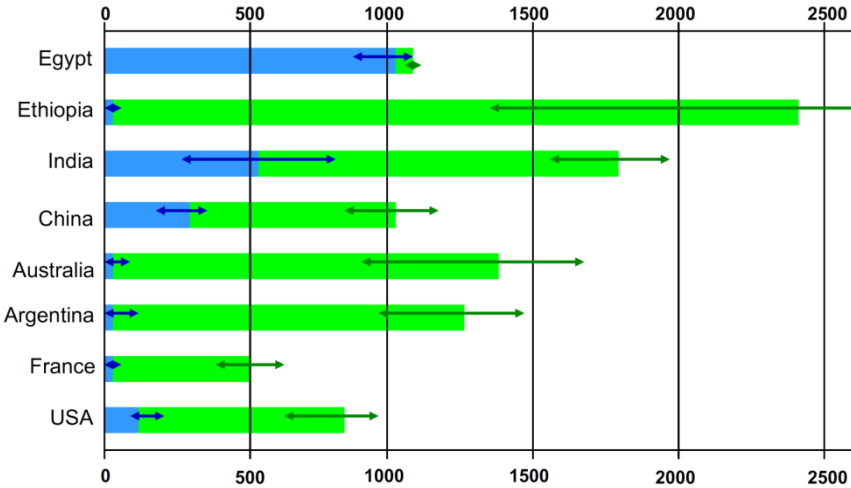
Green water and blue water in farm management

- 80% of agricultural land worldwide relies on rainfed production systems,
- providing 62% of the world's food.

à 80% of agro-evapotranspiration comes directly from rain
(when crops turn water into vapor)

Comprehensive Assessment of Water Management in Agriculture. (2007)

Hoff et al. (2010)



water use (m^3/ton of yield) of cereals

Strategy: influence partitioning of rainfall (or irrigation) between evaporation □ transpiration and infiltration □ runoff

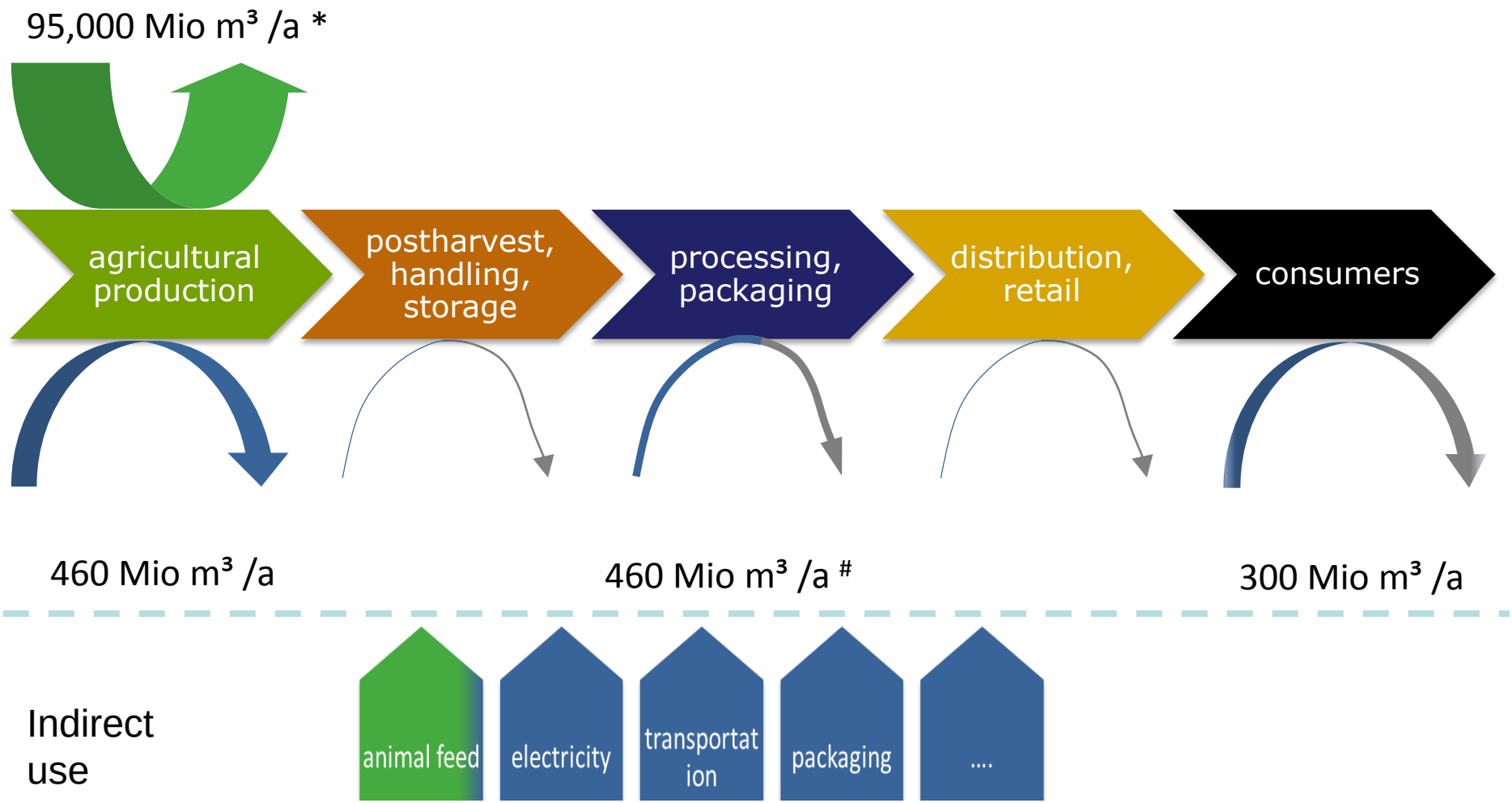
http://www.waterfootprint.org

Rain and soil water

http://www.waterfootprint.org

Ground and surface water

Water use for food production in Germany



Schematic representation of water use in the food supply industries for Germany (proportions not correct)
Data source: *ET – calculated from long-term water budget (BGR 2008); SBA (2012) Umweltnutzung und Wirtschaft,#Nahrungsmittel und Getränkeindustrie

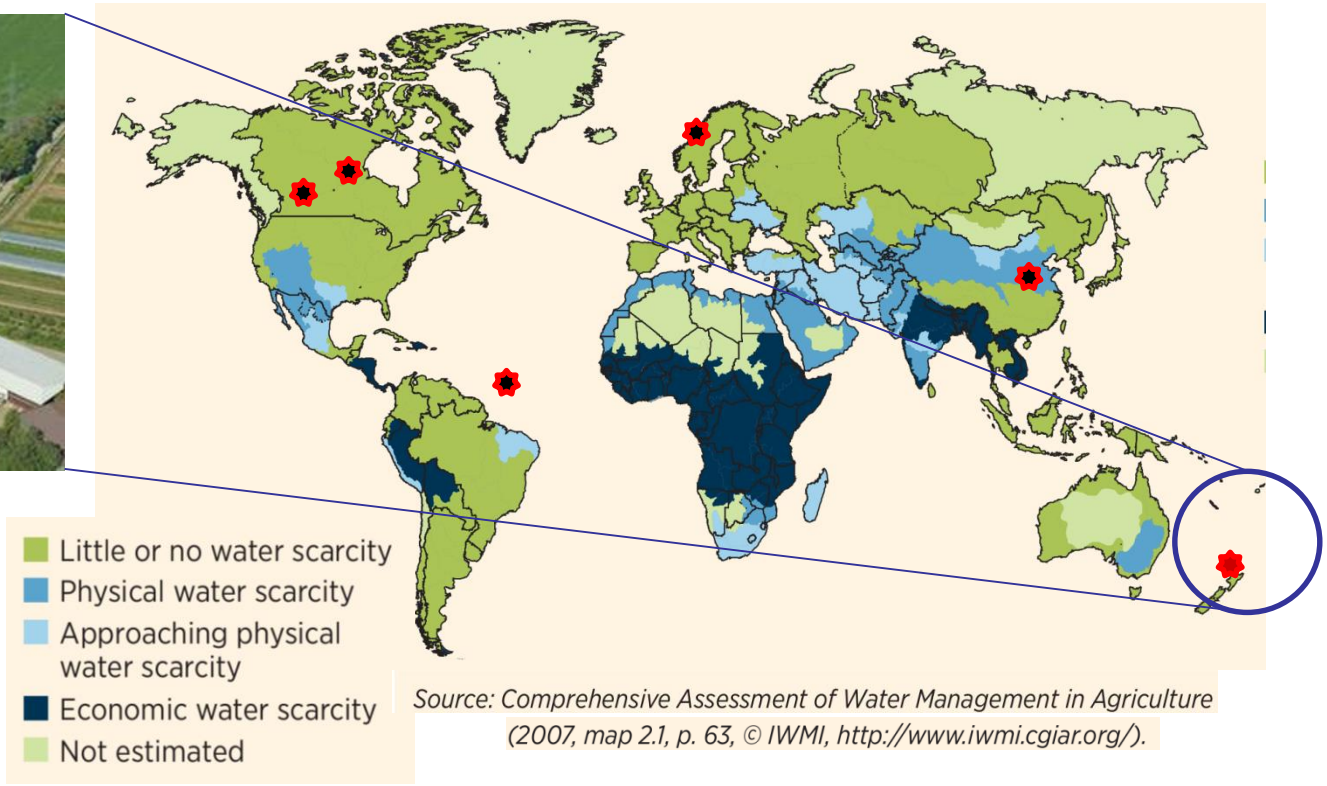
Objectives in „AgroHyd“

Evaluate hydrological processes and agricultural management options to increase farm water productivity

Improve water use in farm management

- calculate the water demand at farm scale
- recommend most suitable options for individual farms worldwide

Target groups – farmers and regional policy makers

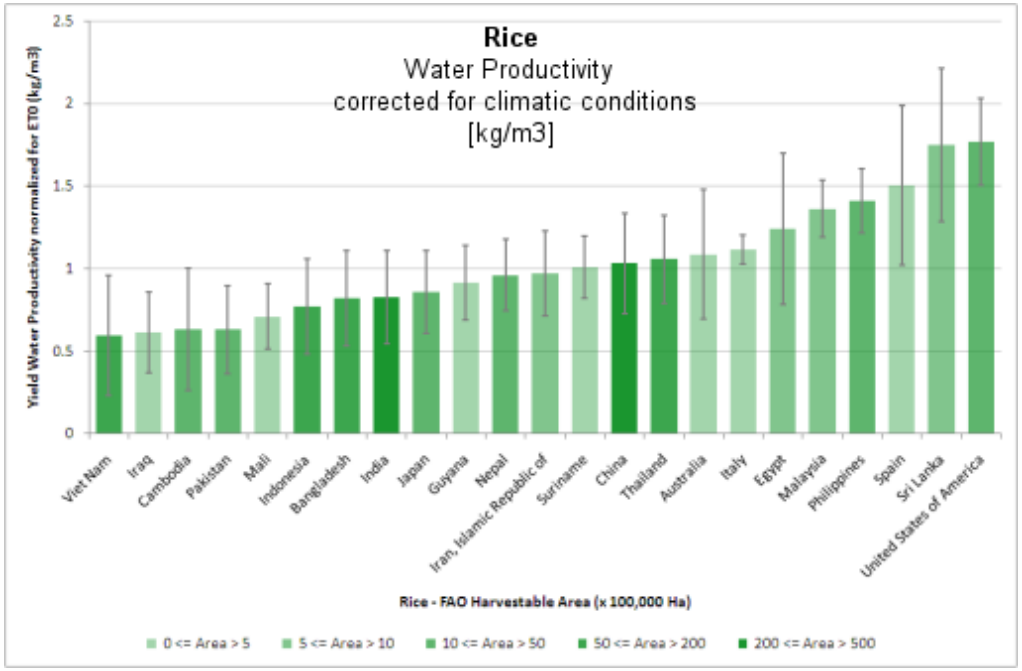


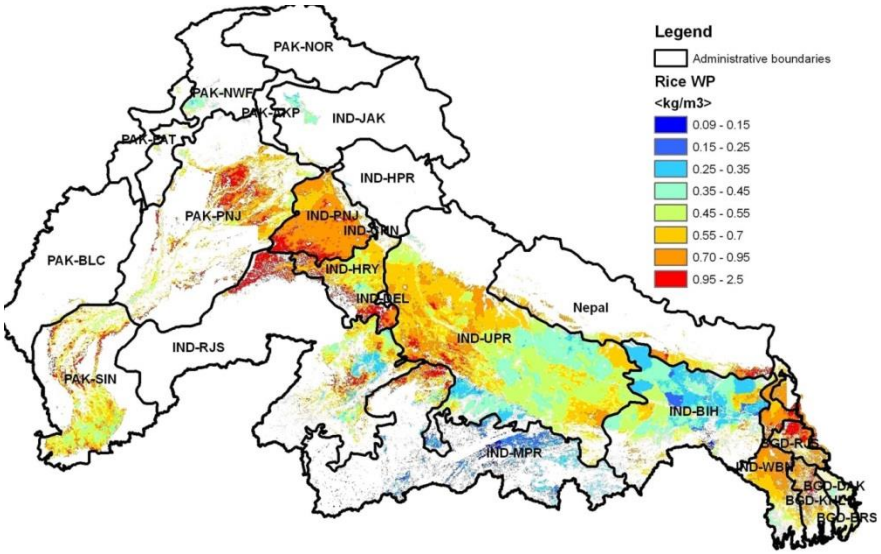
Source: Comprehensive Assessment of Water Management in Agriculture (2007, map 2.1, p. 63, © IWMI, http://www.iwmi.cgiar.org/).

Calculate water use in crop and livestock production
Develop database of farm water indicators

- Indicator – water productivity: mass of output per m^3 water input
  - depends on many factors
  - can vary between regions

and within one region

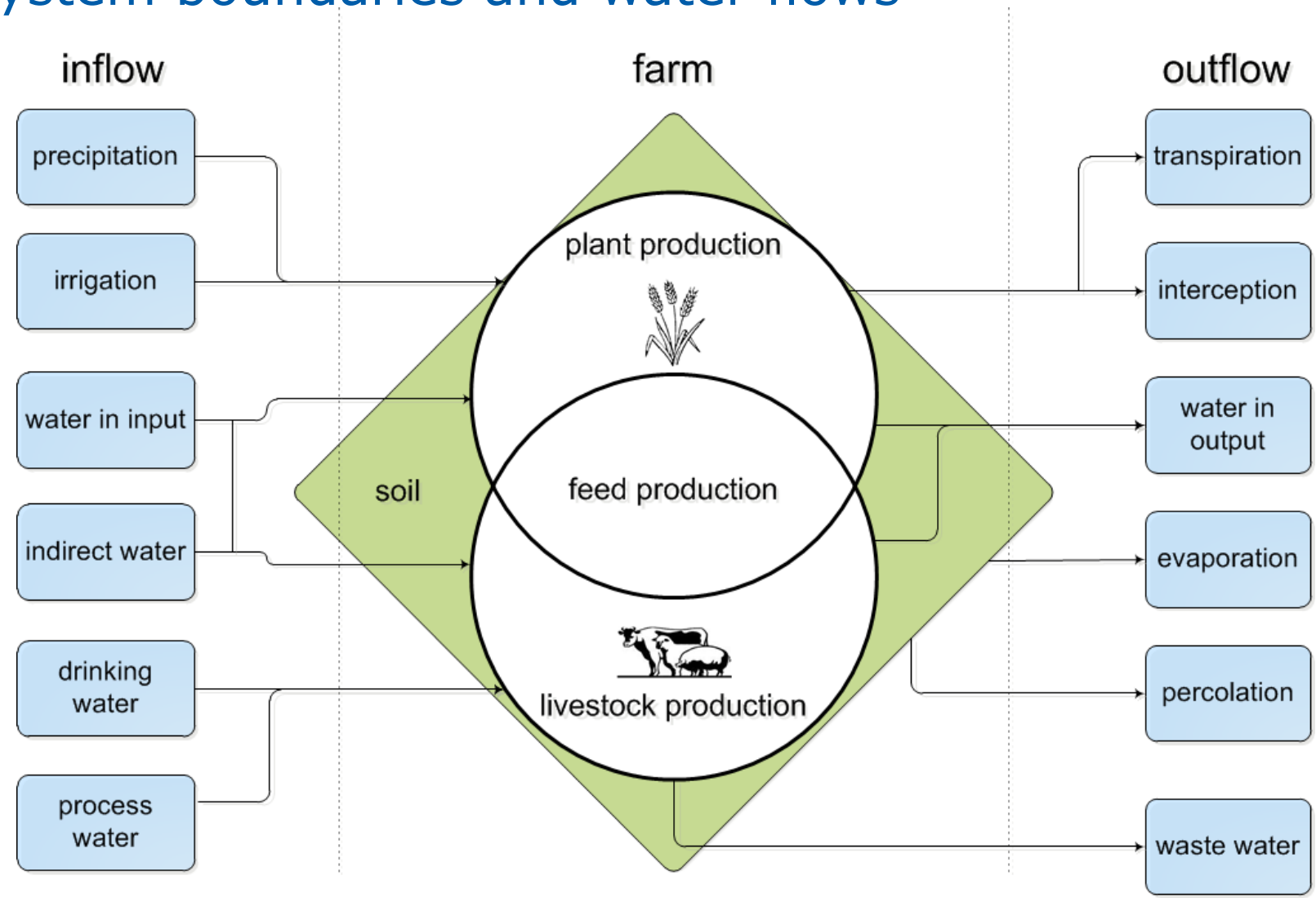




- Analysis of water productivity
  requires consistent data at the farm scale

http://www.globalagriculture.org/fileadmin/pics/weltagrarbericht/unep.water_for_food_production_1960_2050.jpg

System boundaries and water flows



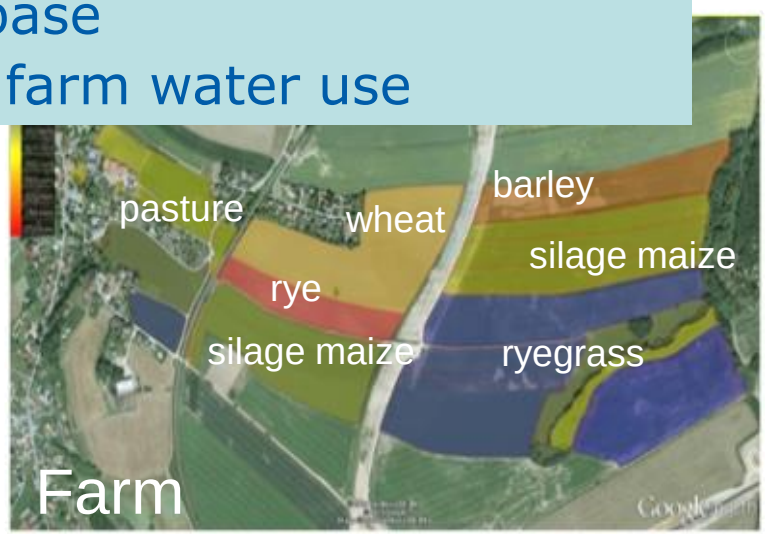
Water productivity in dairy production
Management options

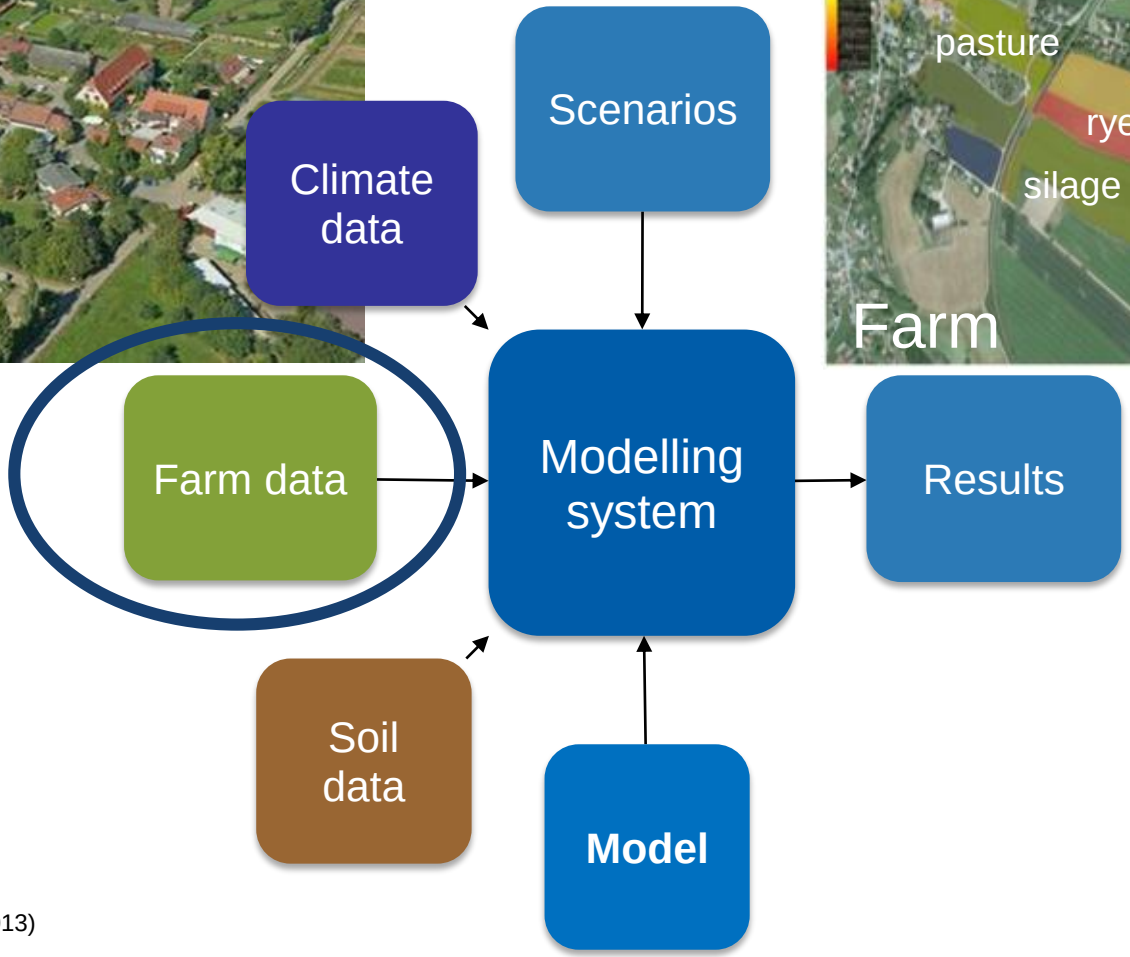
- Feeding strategies with varied diet comp
  - silages, pasture, concentrate
- Intensity of production
  - milk yield, replacement, life span
- Breeds
- Barn specific strategies
  - milking systems
  - cleaning processes
  - cooling processes

AgroHyd Farm Model: water demand on farms

Goal

- consistent and accessible farm data base
- reference sustainability indicators on farm water use

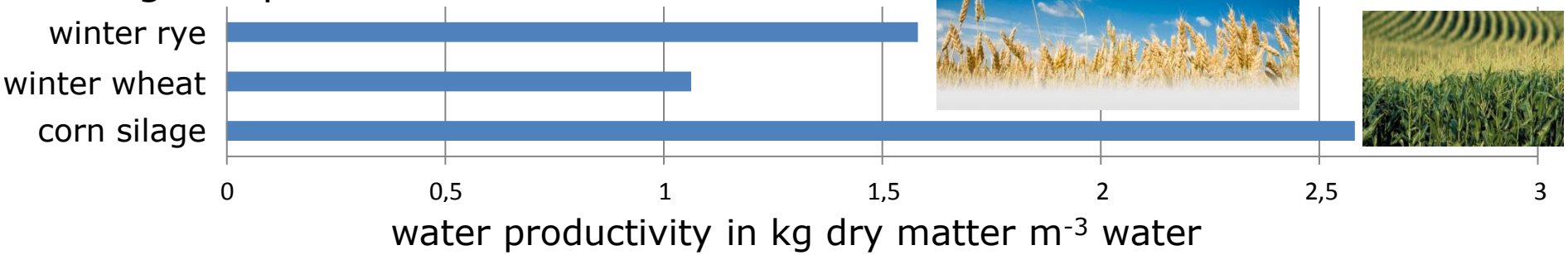




Info: Drastig et al., (2013)

Water Productivity of Farm Products

Forage crop



Milk

4.000 kg
8.000 kg
12.000 kg[1]

grass silage[2]
corn silage[2]
concentrate[2]

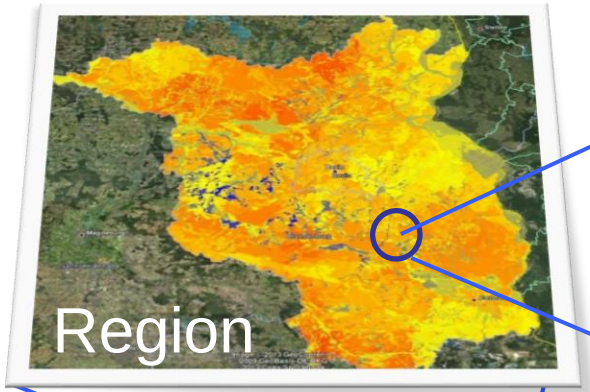
[1] balanced diet with half day grazing in summer

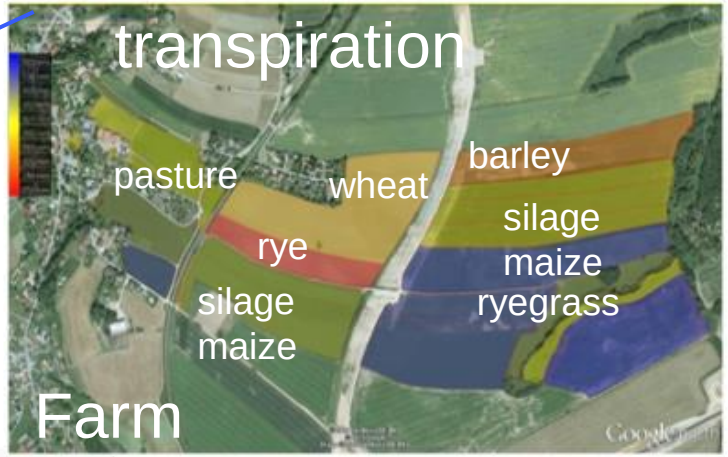
[2] 8000 kg milk with half day grazing in summer

Application of the AgroHyd Farm Model:

- Build database of indicators
- Calculate scenarios for improved water efficiency – farm management options, effect of diet, aggregation to regional level

=> What can farmers do to meet the water demand for food production in the future?





Outlook

- More regions (Brazil, Vietnam,…)
- More farm management options

Choice of indicators and their range of values

- Farm Water Productivity FWP
  [output per m_{Winput}^{-3}: on mass, energy or monetary basis]
- Degree of water utilization DWU [-]
- Specific techical water inflow STWI [m³/ha]
- Future model development – GHG emissions

Determination of indicators of water consumption at farm scale - Farm water productivity

$$FWP_{mass} = \frac{Mass_{output}}{W_{input}}$$

$$FWP_{energy} = \frac{Energy_{output}}{W_{input}}$$

$$FWP_{mon} = \frac{Revenues}{W_{input}}$$

Indicator values depend on:

- regional variations
- farm size
- management options
- annual deviations

Goal: reference sustainability guideline values for indicators

Prochnow, A., Drastig, K., Klauss, H.& Berg, W., 2012. Water use indicators at farm scale: Methodology and case study. *Food and Energy Security 1, 29-46*.

Water productivity improvement in farm systems
FA1 - pilot project

What problems / opportunities does the component solve / respond to?

- Changes in water availability for food production in farm systems (climate change)
- Increase water productivity in crop and livestock production

What are the components proposed solutions to the problems / opportunities?

- Quantify current water use on farms
- Estimate potential for increasing water productivity

Who are the component's clients, and how will the component market / 'sell' its services/products to them?

- Farmers interested in improving their water efficiency
- Governments and regional planning agencies: develop overview of current practices, estimate potential

What is the component's added-value?

- Proof of concept: provide basis for comparison of water productivity within and between regions
- Support to farmers with planning improvements
- Link with stakeholders in other regions

What are the component's key activities?

- Project preparation: methodology and software development, baseline assessment of various regions and management options for farm systems
- Project implementation: contact with farmers, gathering basis regional data, estimating farm water options for plant and livestock production

What are the component's estimated capital and resource requirements?

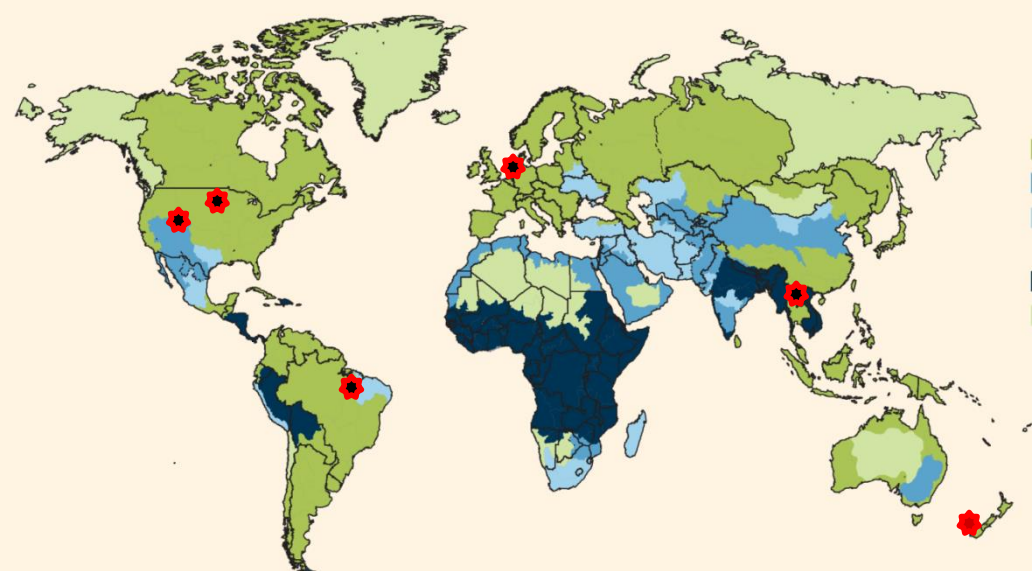
- ?USD for the finalization of project preparation
- ?USD during implementation: gathering data and evaluation

Full concept note available from the support group

Thank you for your attention!

- AgroHyd Project

Simone Kraatz
sikraatz@atb-potsdam.de
Judy Libra
jlibra@atb-potsdam.de

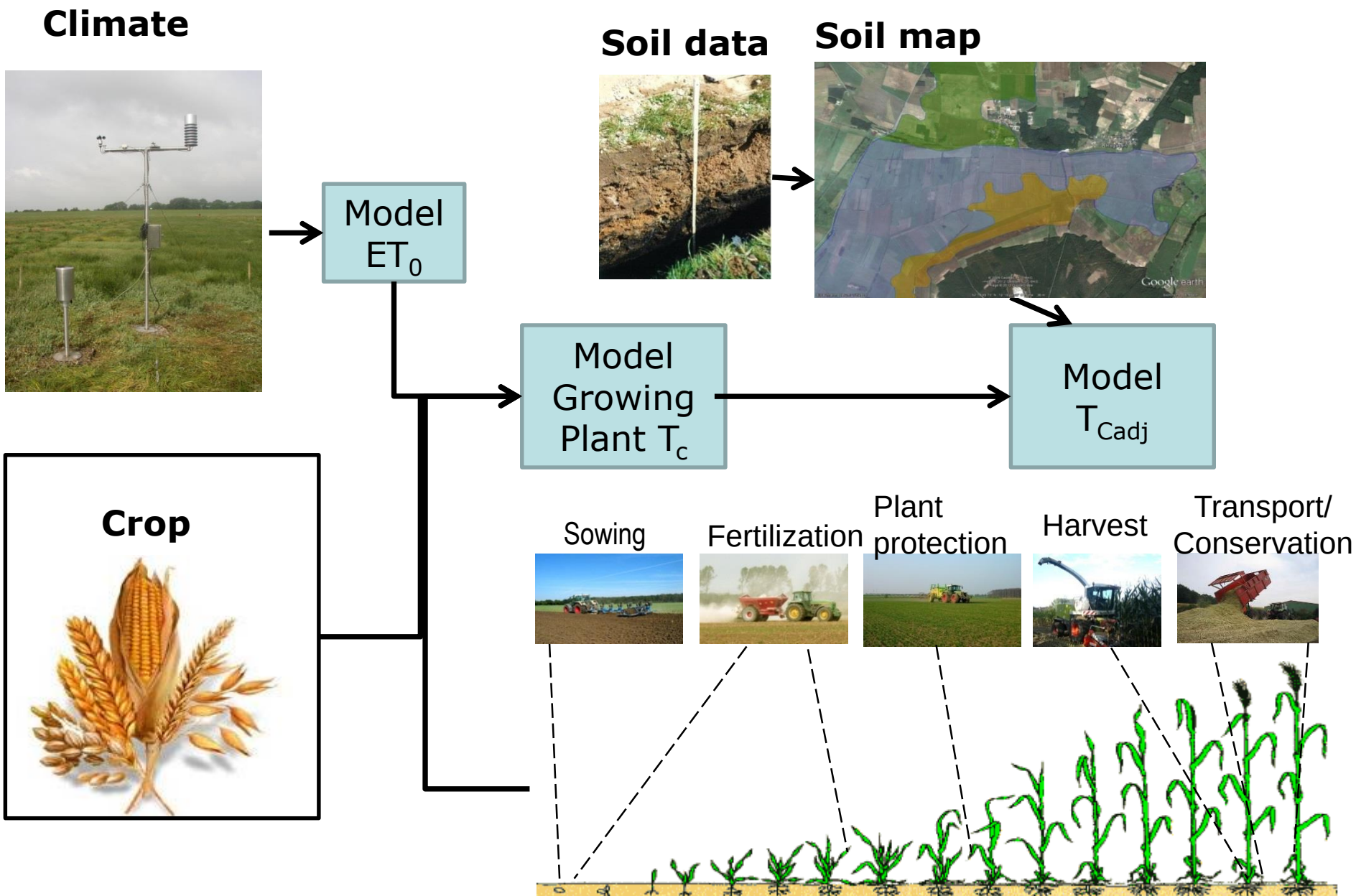


ATB

- **Short description of the project**, where target groups, objectives, actions, activities and expected results can be visualized.
-
- 2. **A clear explanation of how this project is related to improving efficiency** (Closing the efficiency gap) and its implications on natural resource use.
-
- 3. Finally a **short description of a business plan associated to this project** in terms of target groups, problems to solve, solutions to these problems, added value, key activities, resources requirements. For this element, **please find enclosed a P. Point presentation of an example** using two projects (presented in the last Guiding Group meeting).

ATB

AgroHyd Farm Model



Management strategies

Plant production

Soil tillage and humus conservation
- application of organic matter
- mulching
- turning under of crop residues

Cultivation under different regional characteristics
- `usual´ plant varieties
- drought-tolerant plant varieties
- plant varieties with low transpiration coefficient

Seeding
- high crop density

Fertilization
- sufficient potassium supply
- support of root formation

Optimizing of crop rotation and use of intermediate crop

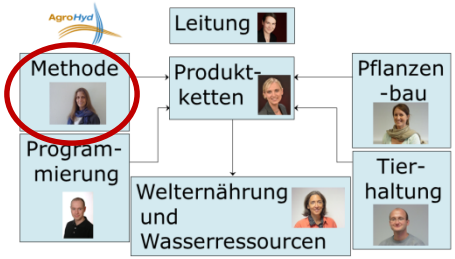
Livestock production

Feeding strategies with varied diet ingredients

Dairy and Beef/Meat production
- intensity of production (e.g. yield, replacement, life span)
- breeds (cattle and pig)
- site specific characteristics

Barn specific strategies
- milking systems
- cleaning processes
- cooling processes

Range of indicators



- Indicator values depend on:
  - regional variations
  - farm size
  - management options
  - annual deviations

→ to be considered when sustainability guideline values for indicators are defined




ATB