World food supply and water resources: an agricultural-hydrological perspective (AgroHyd)

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Agriculture is and will remain the major worldwide user of water resources. The objective of the working group AgroHyd is to increase water productivity (e.g. farm water productivity - the ratio of farm output to water input) in agriculture. The web-based AgroHyd Farmmodel can be used to calculate water flows and water-based indicators for different kinds of farm systems in plant and livestock production. The developed AgroHyd Farmmodel is flexible and adaptable to different regions and farming systems. The tool enables farmers and decision-makers to evaluate the water consumption in plant production on different regional levels and in livestock systems.

Modeling the water demand at the farm scale

In order to calculate the water demand in different farm systems, an extensive set of physical models and input data are needed to take the variety of agricultural management options into consideration. The model takes into account direct and indirect water flows crossing the spatial boundaries of the farm system, which are set from an institutional perspective, in the sense that any physical feature that belongs to the farm also belongs to the system. The modeling and investigation is done within the three subsystems-soil, crops and livestock - and within the two production branches: plant production and livestock production.

Calculating Indicators

The input data range from large datasets on local climate and soils, to specific operating data on farm practices used in the farm systems investigated. Using the calculated water flows and data on the farm output, water related indicators are calculated for the farm system. The farm data is generated through interviews with farmers, while the other data stems from local, federal, and international services.

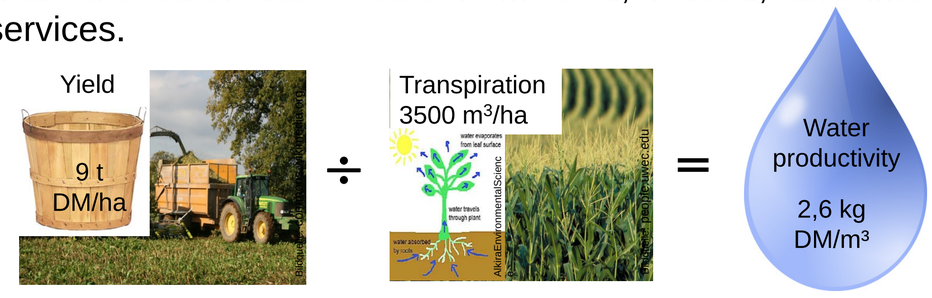

Fig 1: How much biomass can be produced from 1 m³ of water?

Results

For the first time the **indirect water** demand for farm buildings in milk production was assessed. The indirect water demand for livestock houses ranges from 1.4 to 1.9 m³ animal per place and year and varies marginally between barn variants.

The effects of fattening systems for chickens on the water productivity in **broiler production** were quantified for conditions in Germany and Brazil. For all fattening systems, the water productivity was 0.3 kg carcass weight per m³ water input, 2.8 MJ food-energy per m³ water input and 57 g food-protein per m³ water input. The shorter fattening period and lower feed demand in the more intensive fattening systems were compensated by the higher carcass weight and higher water productivity of the feed components in the more extensive systems.

Four feeding strategies in German **dairy farming** were analyzed based on the maximization of grass silage, maize silage, pasture or concentrate. Water productivity of feed components varies widely with a dry mass output per m³ water input of 1.5 kg for grass silage and 2.6 kg for maize silage, 0.8 to 1.8 kg for grain and 0.4 kg for soybeans from Brazil.

Method

The project divides into five work packages, which build on and complement one another:

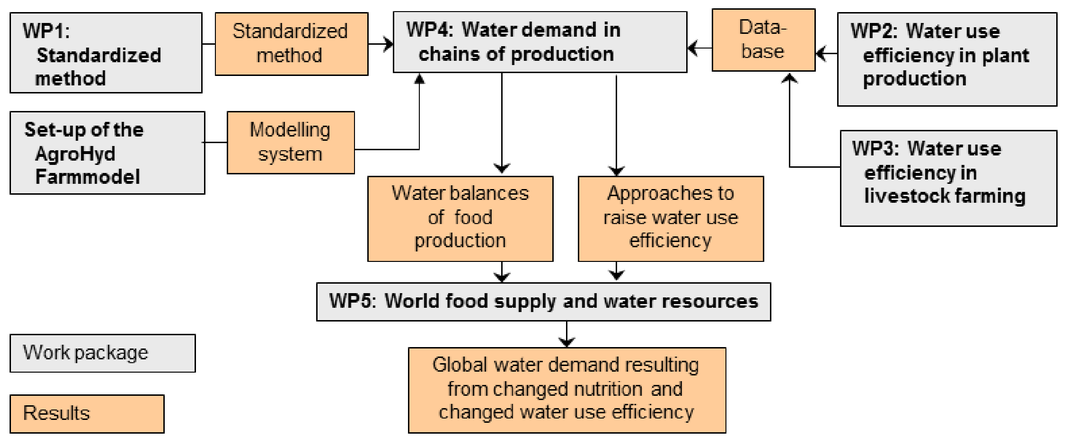

Fig. 2: Workpackages (WP) Project AgroHyd

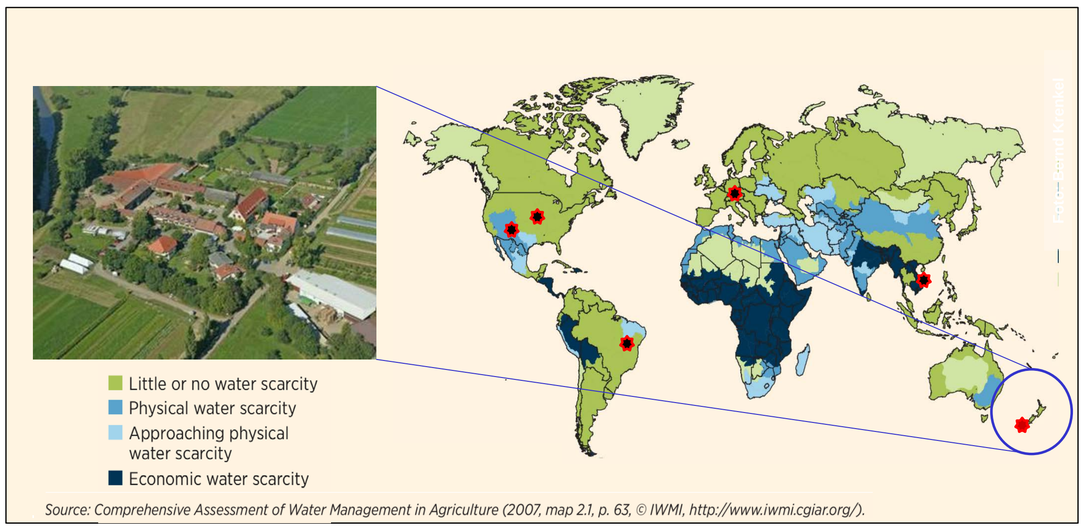

Fig. 3: Investigation regions AgroHyd: Farms in Vietnam, Brazil, USA and Uruguay have been innvstigated.

In summary, a farm-scale modeling tool to evaluate the farm and crop water use in current farming methods has been developed that is applicable for many regions of the world. The parallel work on the international level (e.g. farms in Brazil, New Zealand, Vietnam, USA, and Uruguay) and the local project allowed the development of the AgroHyd Farmmodel to incorporate enough flexibility in input and interfaces to adapt the model to very different plant production systems, climates and locations.

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Die Auswirkungen von vier verschiedenen Ernährungsweisen auf die jeweilige benötigte Wassermenge wird analysiert. Als Basis für die Zusammenstellungen der Ernährungsweisen, dient die Datenbank der European Food Safety Agency (EFSA). Durch die Nutzung der standardisierten EFSA-Gruppierungen und der europaweiten Verzehrdaten können die Analysen auf weitere Regionen ausgeweitert werden.

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