

Mapping mixed crop-livestock and multiple cropping systems for climate change impact research

Katharina Waha (CSIRO), Stefan Siebert (Univ. Bonn), Mark van Wijk (ILRI), Jan Philipp Dietrich (PIK)

AGRICULTURE AND FOOD – GLOBAL FOOD AND NUTRITION SECURITY GROUP
www.csiro.au



Currently global impact assessments assume that climate change will impact crop and livestock production similarly in different farming systems. However the diversified and integrated nature of some farming systems might increase their resilience to adverse climatic conditions but testing this hypothesis is not possible due to lack of data.

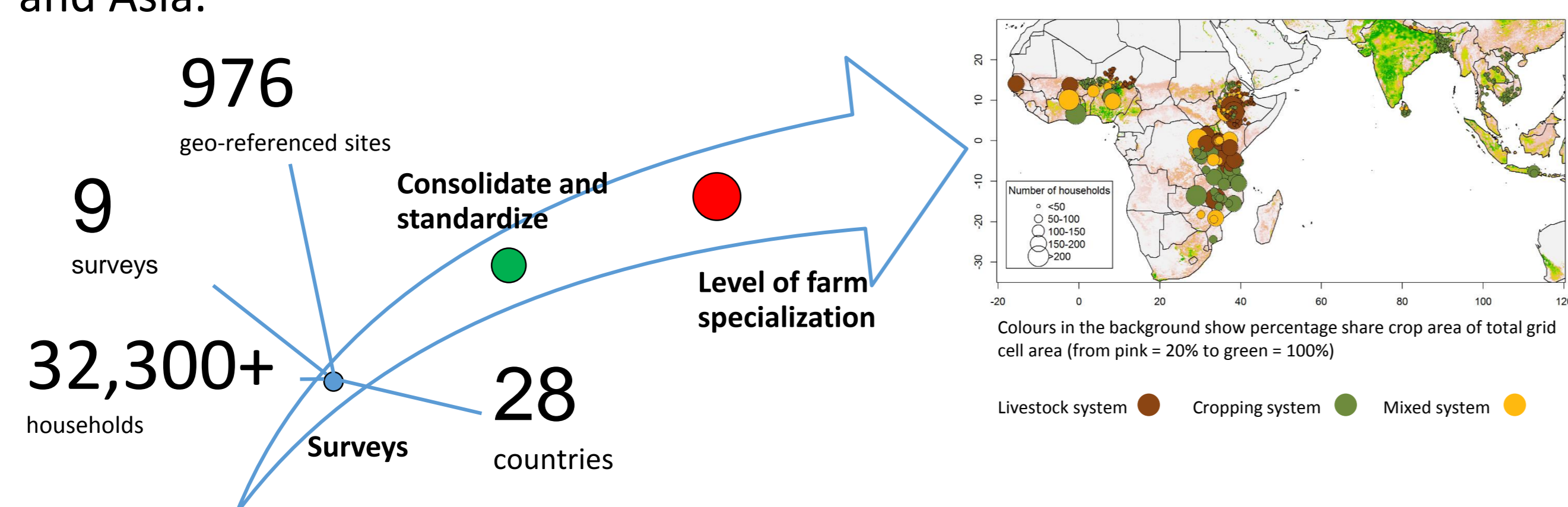
The new multiple cropping and mixed systems maps presented below improve climate impact assessments through better (1) temporal differentiation of the presence of different crops for linking with climate variability throughout the year and (2) spatial differentiation of the presence of mixed smallholder farming for analysing vulnerabilities of farmers.

Mixed Crop-Livestock Systems

Why study them? Crop-livestock systems play a major role in the dynamics of many agricultural systems in smallholder farming systems (1.2-2.5 billion people¹). Their diversified and integrated nature might support resilience on the farm level to adverse climatic conditions and allow more efficient use of resources and spreading of risks than in specialized systems.

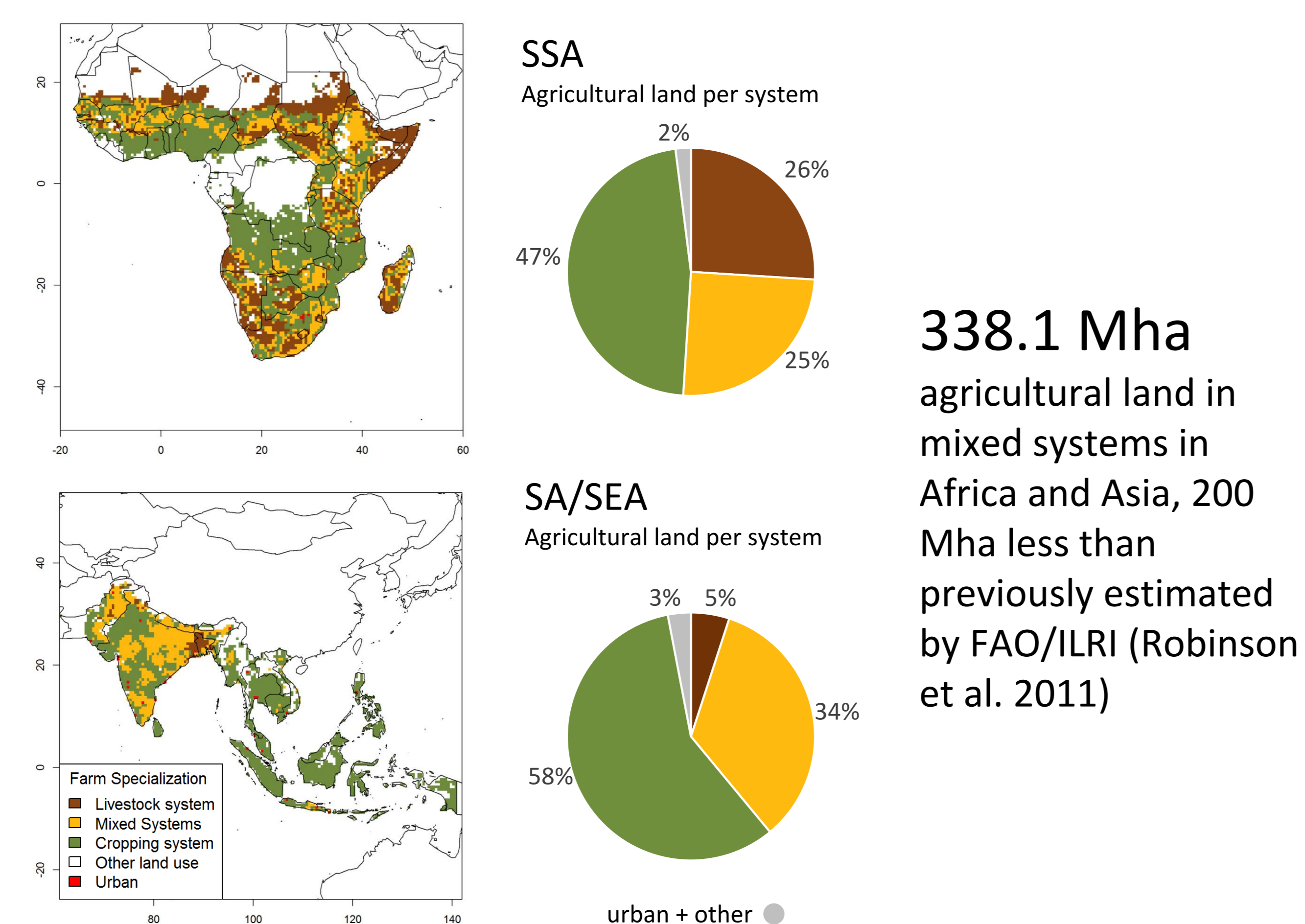
Methods

Farming systems are classified as mixed crop-livestock systems if crop and livestock production contribute more than 10% but less than 90% to the total value of production (Sere & Steinfeld 1996). We use agricultural household surveys to describe the spatial distribution of mixed and specialized farming systems in low- and middle income countries in Africa and Asia.



Ownership of cropland and livestock relates to farm production: For extrapolating to unsurveyed sites, the cropland-to-livestock ratio (ha-to-TLU) was calculated for all surveyed farming households. Most of the farming households engaged in mixed farming own cropland that is at least half but not more than 1.5 times the number of livestock owned.

Results



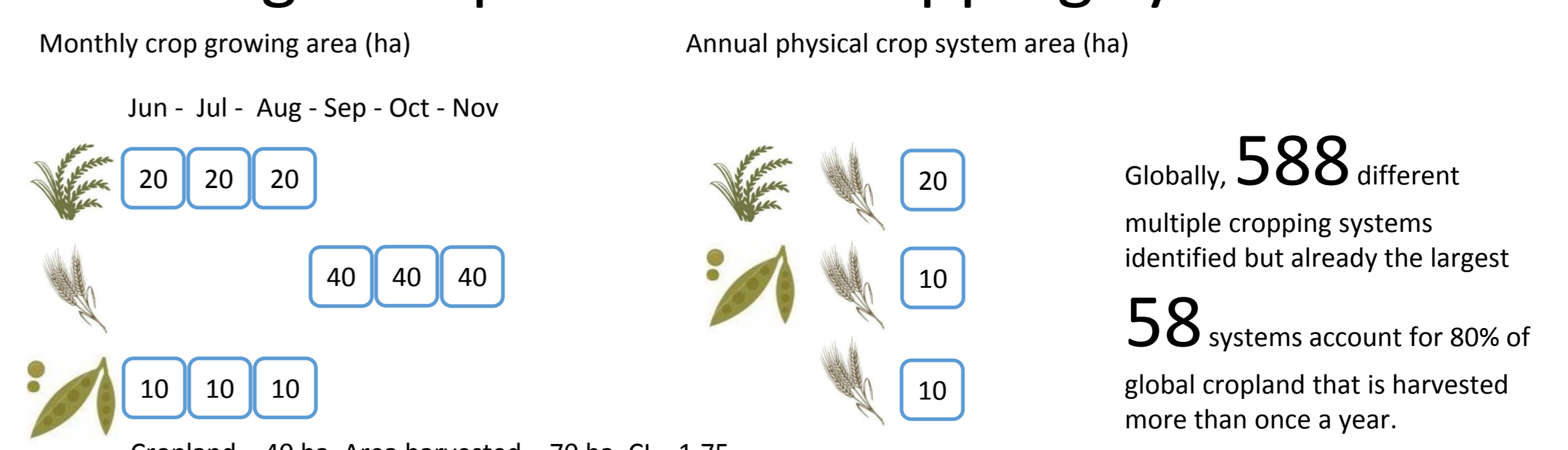
Multiple Cropping Systems

Why study them? Multiple cropping is a common and widespread management strategy in tropical and subtropical agriculture. It allows risk-spreading to different growing seasons and crops if farmers have access to seeds, fertilizer, water and labour. Their occurrence also influences ground coverage, water fluxes, soil chemical properties and pest infestation.

Methods

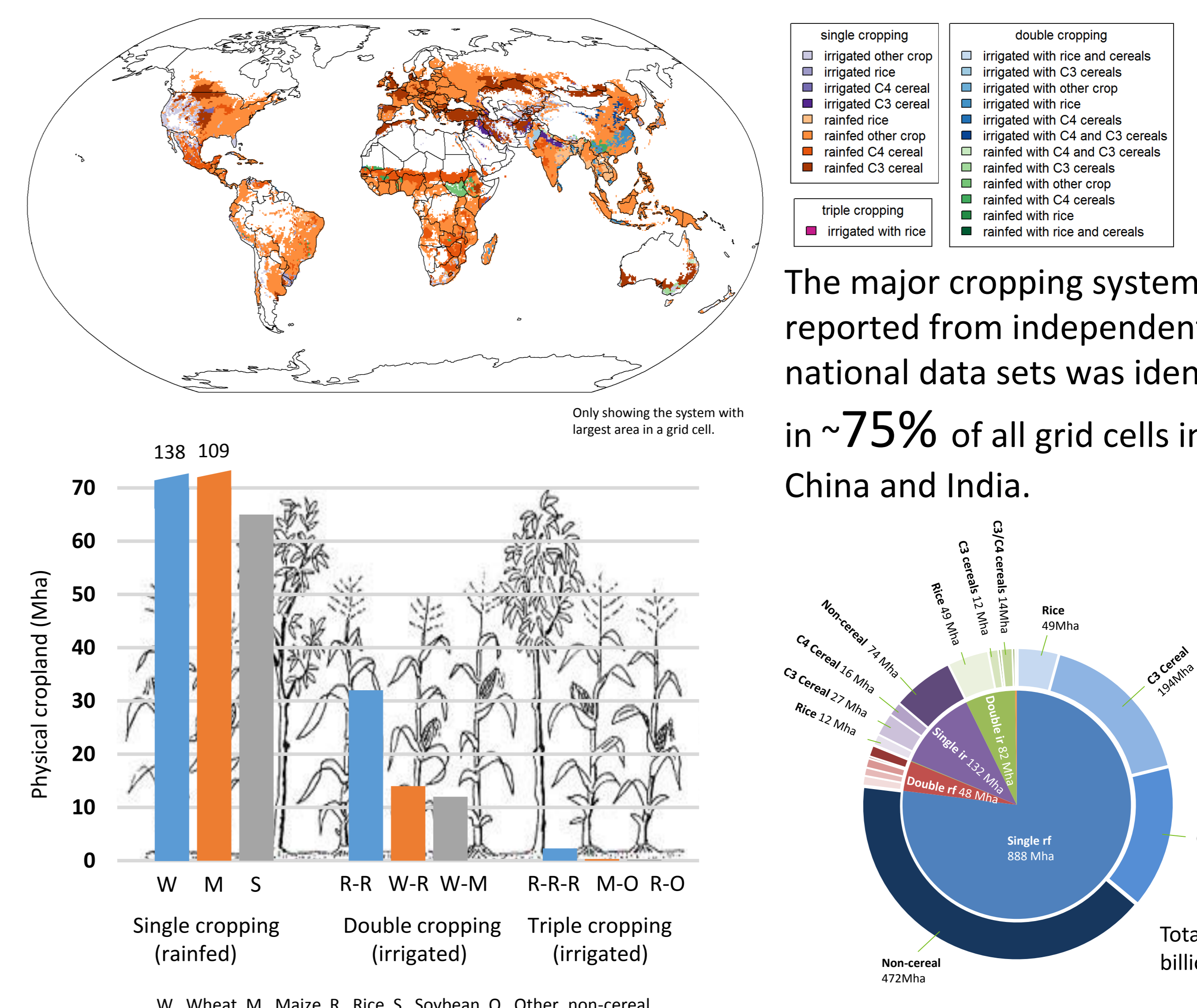
We define multiple cropping systems as being composed of two or three crops grown in a sequence during a 12-month period on the same piece of land. We use a global crop calendar for 26 rainfed and irrigated crops (Portmann et al. 2010) to identify physical cropland and growing periods of currently existing single and multiple cropping systems.

From single crops... ..to cropping systems



The monthly cropping calendar above indicates five possible cropping systems: rice, wheat, pulses as single crops, and two double cropping systems rice-wheat and pulses-wheat. However, for a given total cropland and cropping intensity there is only one possible combination of cropping systems: rice-wheat, pulses-wheat and wheat.

Results



The major cropping systems as reported from independent national data sets was identified in ~75% of all grid cells in China and India.

FOR FURTHER INFORMATION

Katharina Waha
e katharina.waha@csiro.au

<https://research.csiro.au/foodglobalsecurity/>

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Seré & Steinfeld (1996) *World livestock production systems: Current status, issues and trends*. Rome, Italy: Food and Agriculture Organization of the United Nations.
Portmann et al. (2010) MIRCA2000 - Global monthly irrigated and rainfed crop areas around the year 2000: A new high-resolution data set for agricultural and hydrological modeling. *Global Biogeochemical Cycles*, 24(GB1011), 1–24.

FOOTNOTES

¹ As reported in IFAD/UNEP report 'Smallholders, food security and the environment' and by the human rights organization FIAN International.