Solutions for Sustainable Intensification through Agro-biodiversity (SUSINTAB)

We will develop an online information service targeted at agricultural workers in dryland areas to provide information on the nutritional value and water use efficiency of locally viable crops.

SUSINTAB online service will bring a new perspective to food production systems by combining two currently disconnected datasets: plant species water use efficiency (WUE) and their nutritional value (NV). Ensuring Ministries of Agriculture and their extension officers have ready access to crop WUE and NV information through access to raw data, graphical representations, and crop drought, soil and nutritional health suitability maps, will better guide agricultural policies and farmer advisory services driving crop selection. Combining these two datasets is of particular importance for drylands, which represent 41% of the global terrestrial area that 2 billion people use for grazing and cropping (Stroosnijder, 2012) and where water is becoming scarcer and food and nutrition remain insecure. Any increase in WUE achieved by eliminating or reducing non-productive water use leads to an increase in yield where water is the major factor limiting plant growth (G. Stanhill, 1986). More water-efficient plants assure more "crop per drop" helping to stay within global freshwater limits and food consumption demands (Brauman et al 2013). Likewise, assuring more "human nutritional contribution per plant" offers a better approach towards food and nutrition security since just increasing yields and calories is failing to secure human health (Remans et al., 2015; Herforth & Ahmed, 2015; Anderman et al., 2014). SUSINTAB users will retrieve location-specific information on WUE and NV for selected plant species by identifying a plant and geographic region of interest. The online service will be co-designed with extension officers and members of the Ministry of Agriculture.

Hypothesis & basis for success. Ready access to information about plants combining high NV with high WUE will speed up sustainable intensification uptake. With policy-makers' and extension workers' support, this information can be used by farmers for certifying on the market that food production was respectful of natural resources and is of high nutritional quality.

How will you pilot it? We will develop a prototype of the SUSINTAB online service on combined WUE and NV values for an initial set of 38 plant species[1]. We will work directly in countries where this first phase will focus on combining species-level data on agrobiodiversity from Bioversity projects with crop NV and WUE data sourced from global and regional databases tentatively in Ghana, Ethiopia, Uganda and Zambia. Through FAO's in-country presence, we will engage representatives of Ministries of Agriculture at national, regional and local levels to co-design the SUSINTAB online service and test the clarity and utility of the data it generates. We expect to create a network of extension workers and ministries of agriculture offices in the four countries to foster cross-country knowledge exchange.

[1] Crops included in the CGIAR mandate crops, Crop Ontology or crops assessed by Brauman et al. 2013: Barley, Brachiaria, Brassica, Cassava, Castor bean, Chickpea, Citrus, Cocoa, Coffee, Pulses (common bean), Cotton, Cowpea, Date palm, Forages, Grape, Groundnut, Lentil, Maize, Millet, Mungbean, Musa, Oat, Oil palm, Pearl millet, Pigeon pea, Potato, Rapeseed, Rice, Rye, Sorghum, Soybeans, Sweet potato, Sugar beets, Sugar cane, Sunflower, Vitis, Wheat, Yam

Those who actively engage and interact along the 12-month period will be champions for expanding the uptake of SUSINTAB in other regions to other extension officers, thus reaching more farmers.

We will generate or compile spatially-explicit crop production, performance and requirements for at least 20 crops present in each country[2]. Data sources and methods will be selected based on geospatial cover, consistency, completeness and acquisition date. Food composition tables (WHO, USDA or country base) will be compiled to estimate the nutritional value of each food item and crop[3]. WUE values will be extracted from Brauman et al., (2013) and calculated when missing. Data extraction from existing sources will be speeded up with Named Entity Recognition (NER) tools. All data will be cleaned, formatted, harmonized and well documented (with metadata) in SUSINTAB.

Timeline and budget. Bioversity (Elizabeth Arnaud, Marie-Angelique Laporte, Sarah Jones, Natalia Estrada-Carmona) and FAO (Imma Subirats) will combine their expertise in data extraction, standardization, visualization and metrics selection ($30,000). Teams will aggregate data into SUSINTAB open knowledge base with ontologically consistent variables and metrics, and develop an online graphical interface for data exploration and visualization ($50,000). FAO focal points will engage with the ministries of agriculture and extension officers ($12,000). Active and constant participation will be incentivized through small but meaningful prizes such as internet credit and tablets ($4,000). Some champions will be supported to attend a key global, national or regional meeting and share their experience using SUSINTAB ($4,000).

Essential data generated. We will generate and combine two basic, yet critical, data sets (water use efficiency, and nutritional value) for at least 38 plant species in dryland areas across four countries. We will create a new, organized and cleaned data set for NV with meaningful nutritional indicators that pull information from different sources, and will collate information on WUE already calculated for 16 crops with estimations we make (using a consistent methodology) for the other listed crops.

Use of existing data. We will integrate data from open databases on plant water requirements (CropWAT), nutrition (WHO, USDA, country-based food composition tables), climate (e.g. WorldClim).

Successful pilot - next steps. SUSINTAB will be extended to include more plants (e.g. wild crop relatives, other nutritious crops, and trees) and regions with desertification; variety-level information from seed systems; to information on crop yield, resilience (droughts, floods, frost, poor soils) and plant / food real time market price; be open for linking with existing decision-support tools or mobile apps as our ambition is to provide the service through a mobile text or application for farmers and extension workers. Future ambitions include translating the tool with national partners into priority languages to increase uptake in the field. We will explore options for two-way information exchange so farmers or extension workers can provide SUSINTAB with knowledge on crop WUE, NV and their management practices.

[2] For example, IFPRI- IIASA. 2016. Global Spatially-Disaggregated Crop Production Statistics Data for 2005 Version 3; Cropland and field size - geowiki; harvest plus; Monfreda, Ramankutty, Foley. 2008.

[3] For example, Food item food group contribution (Kennedy et al. 2011); Nutritional yield (DeFries et al. 2015); High contribution to iron, zinc, iodine, vitamin A (based on codex alimentarious), Nutrient density - Nutrient functional diversity, length production season, storability.