Global Agricultural Costing and Investment framework

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Introduction and summary of work

Agricultural activity and the continuous croplands expansion at global scales exert a wide range of **pressures on natural ecosystems** and is expected to continue with **increasing world population** and **upscale demand.**

The debate of **land sharing** versus **land sparing** has emerged as a strategy to assess balances between **biodiversity conservation and high-yield agriculture.**

We develop an **agricultural costing and investment framework** to understand cost functions and test the hypothesis that **agricultural production in land sharing and sparing scenarios is less costly than in current practices at global scales.**

Through a bottom-up approach we gather **physical and financial information** for agricultural systems from inventory data, scientific literature as well as data surveys and calculate costs of production across **three distinct scenarios, business as usual (BAU), land sparing (MLS) and land sharing (TCS)**.

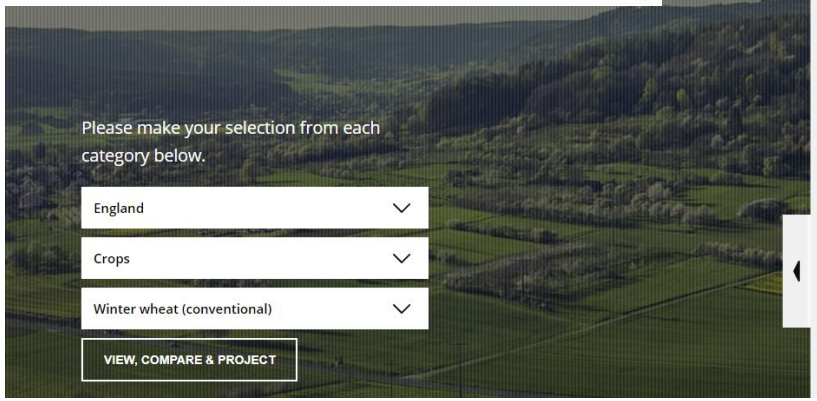
Preliminary findings demonstrate that it would **cost approximately 40% less in MLS and TCS in comparison to BAU** to produce the same amount of food at a global scale.

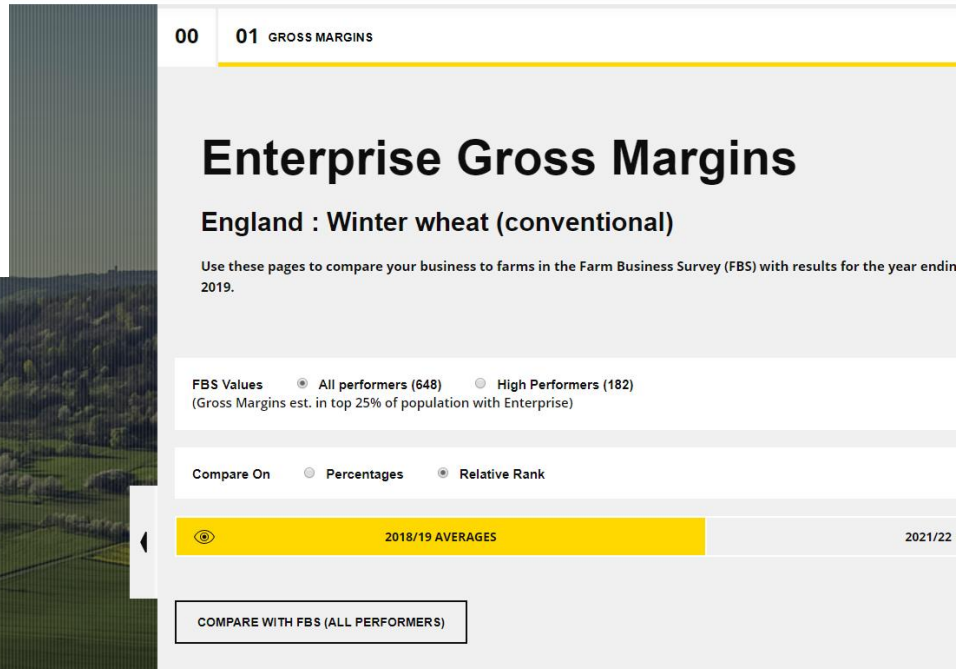
Touch screen discussion part

Methodological approach

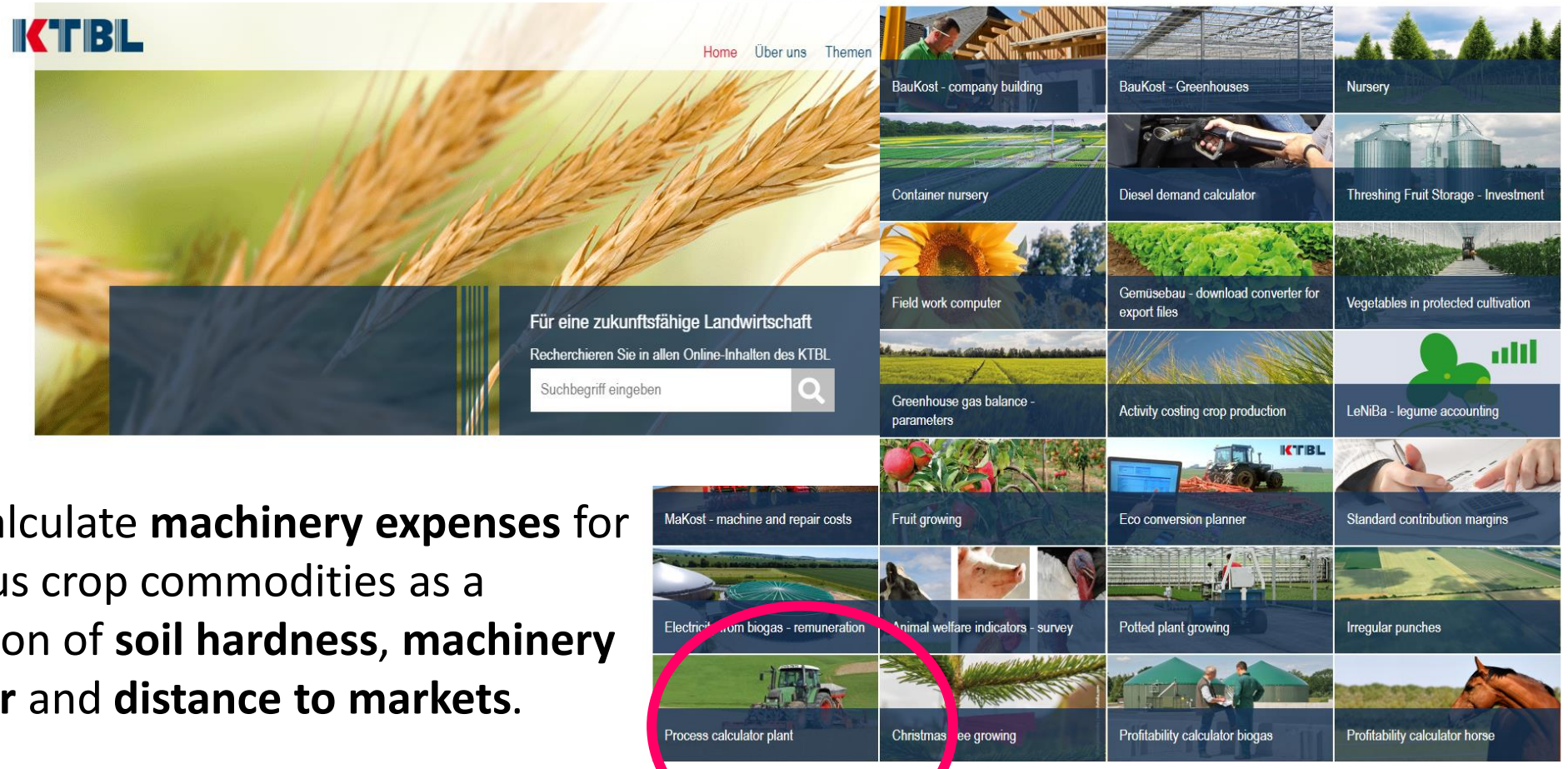
- We construct a cost engineering framework in line with the **Farm Accountancy Data Network** (FADN) and the **Farm Business Survey** (FBS) accounting methods.
- Cost functions are disaggregated in **seven cost elements** and are distinguished between **variable** and **fixed** costs:
  - Seeds
  - Fertiliser
  - Plant protection
  - Labour
  - Fuel and energy
  - Financing
  - Infrastructure

Data tools – Farm Business Survey





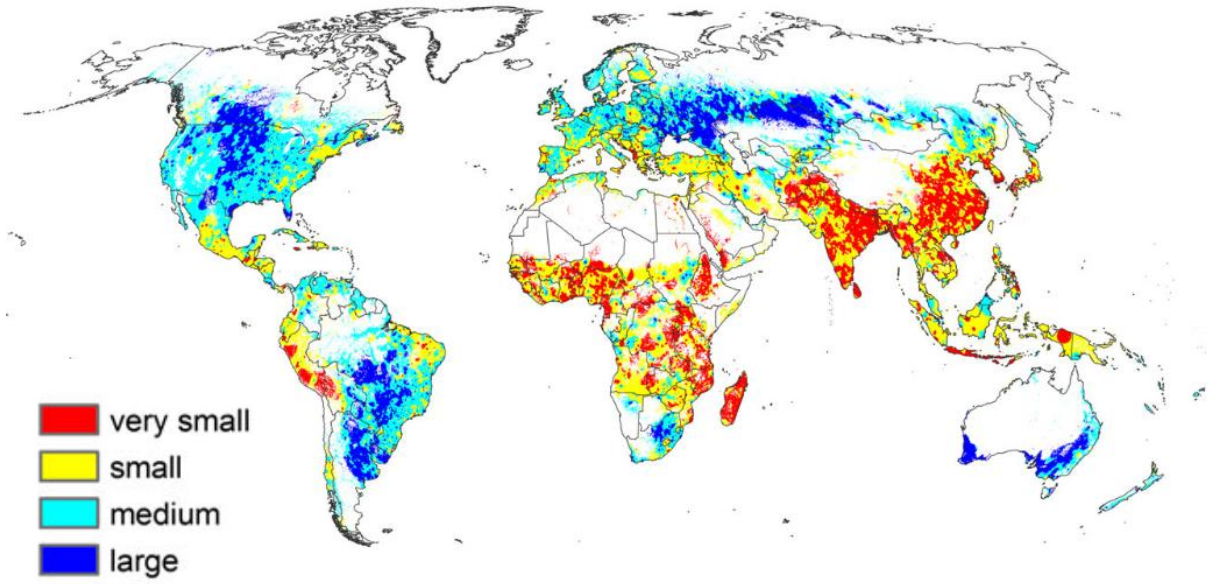
Data tools – KTBL

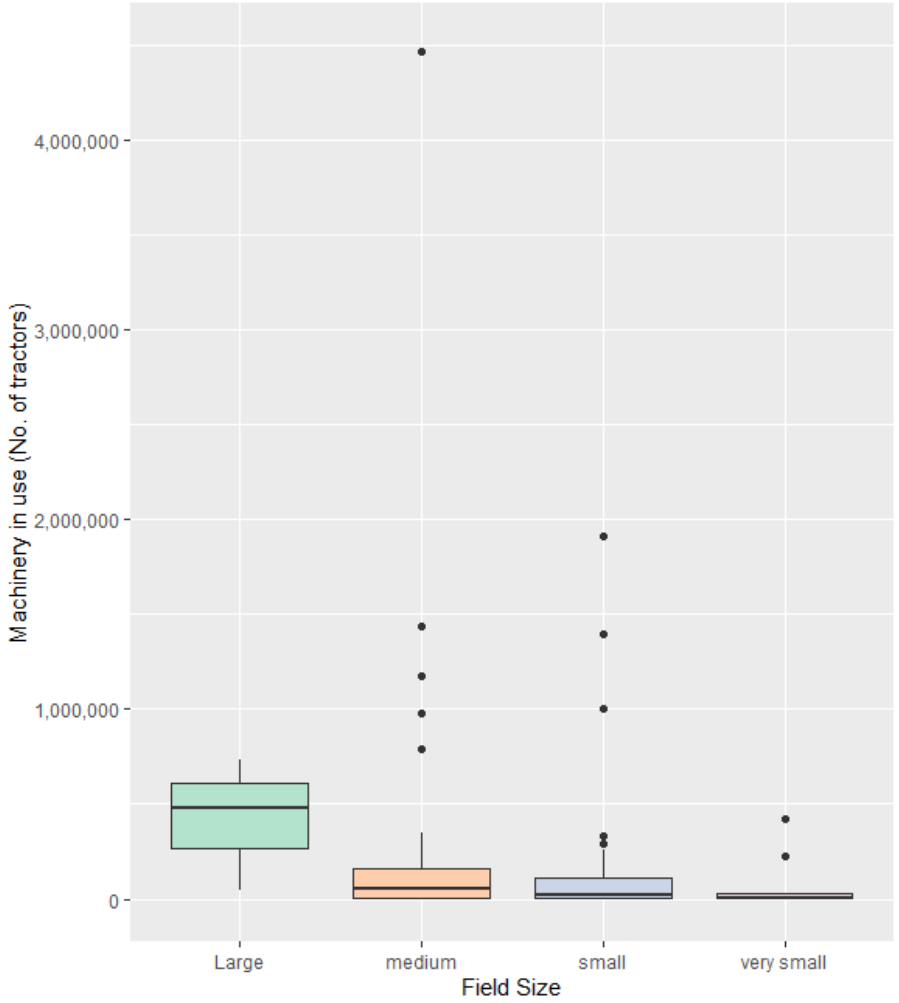


We calculate **machinery expenses** for various crop commodities as a function of **soil hardness**, **machinery power** and **distance to markets**.

Assumptions

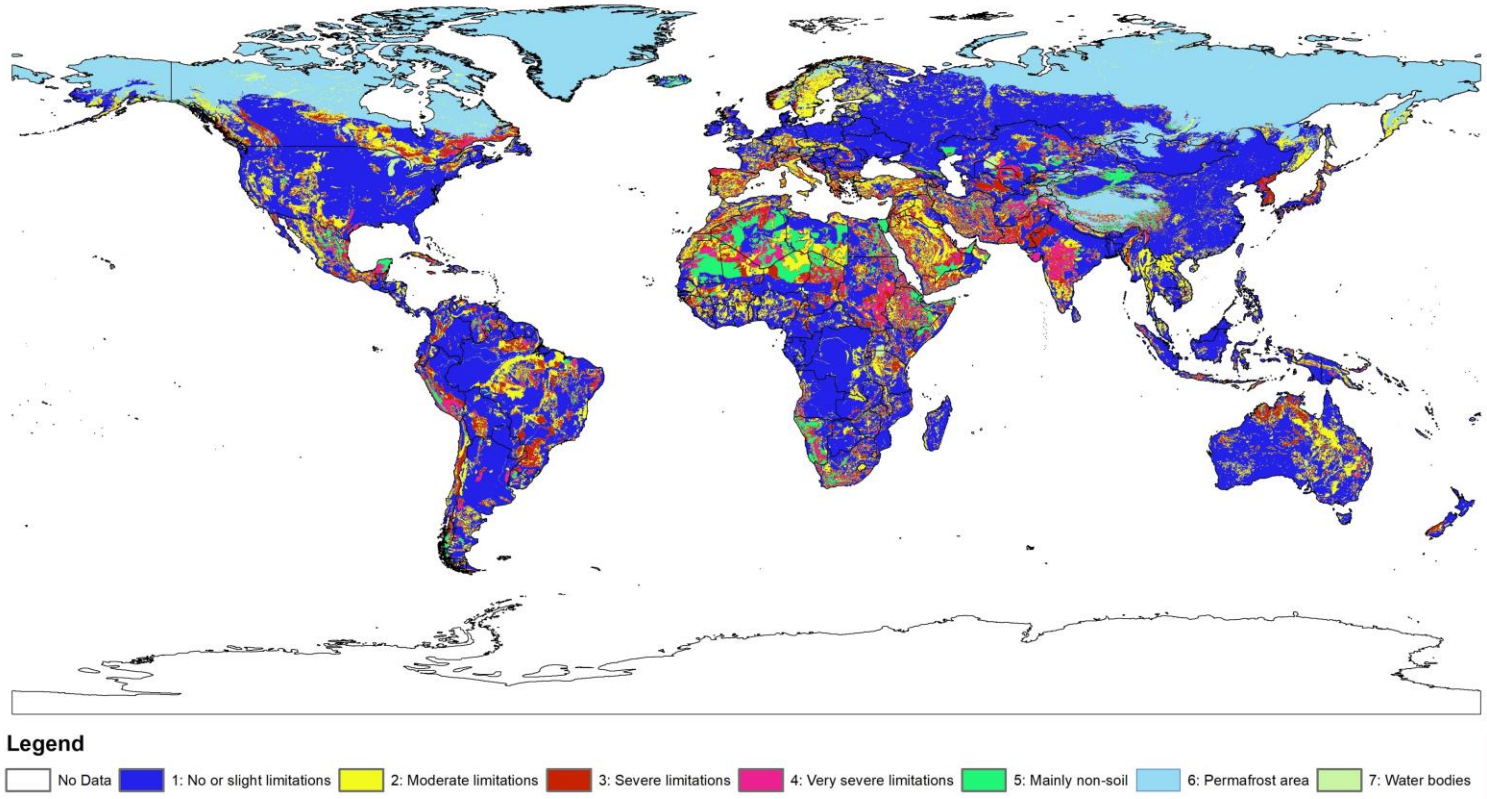
Average **field size** (per country) is related to production practices such as **technology adoption.**





Fritz et. al 2015. Mapping global cropland and field size. *Glob. Change Biol*. 21, 1980–1992.

Assumptions



Fischer, G., F. Nachtergaele, S. Prieler, H.T. van Velthuizen, L. Verelst, D. Wiberg, 2008. *Global Agro-ecological Zones Assessment for Agriculture (GAEZ 2008)*. IIASA, Laxenburg, Austria and FAO, Rome, Italy

Soil workability indicates **tillage resistance** and thus, relates to differentiation of **machinery costs**.

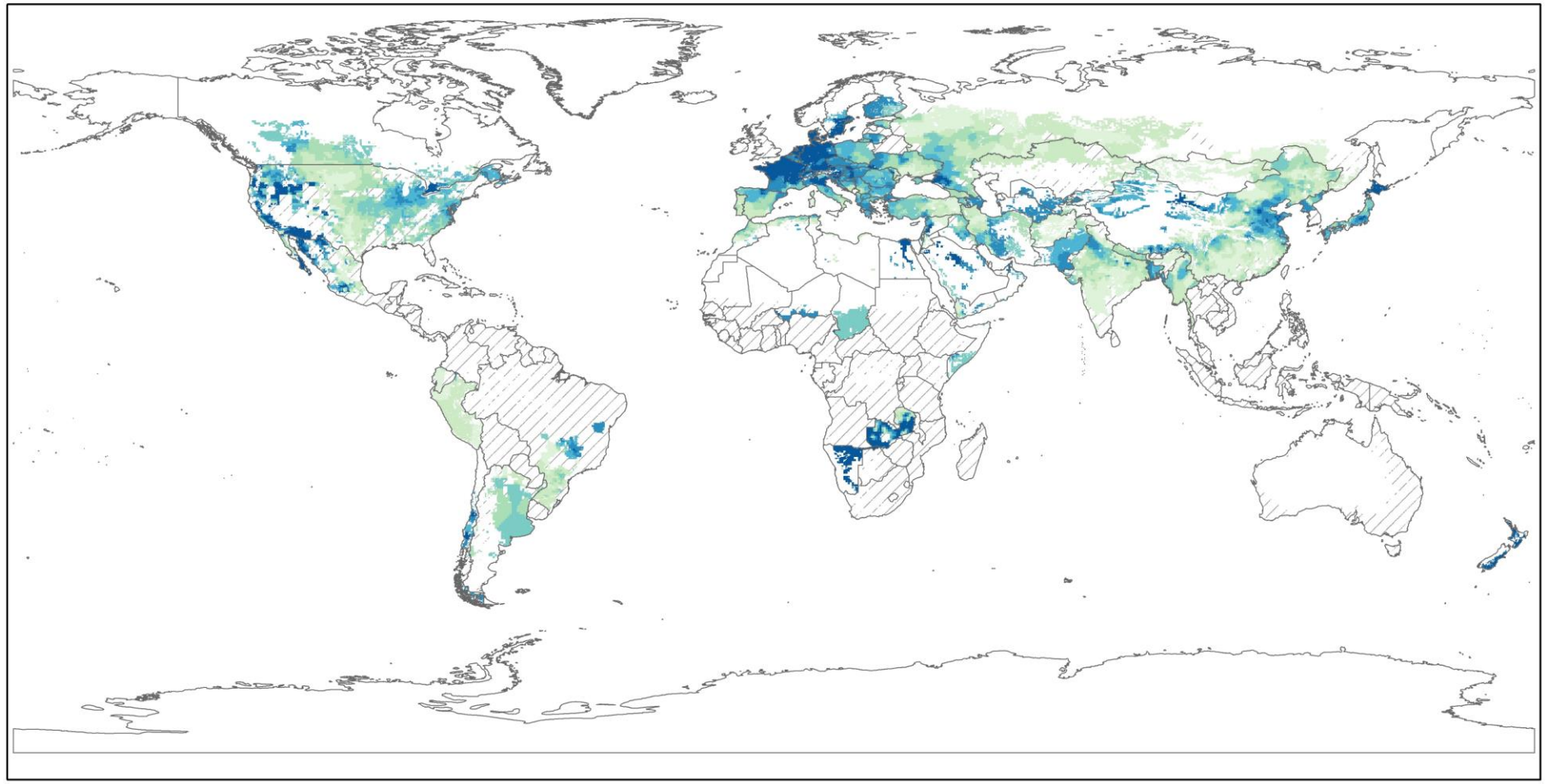
Field size \ Soil workability	Light	Medium	Hard
Very small	1	4	0
Small	31	33	4
Medium	43	28	8
Large	18	10	6

Downscaling national financial data

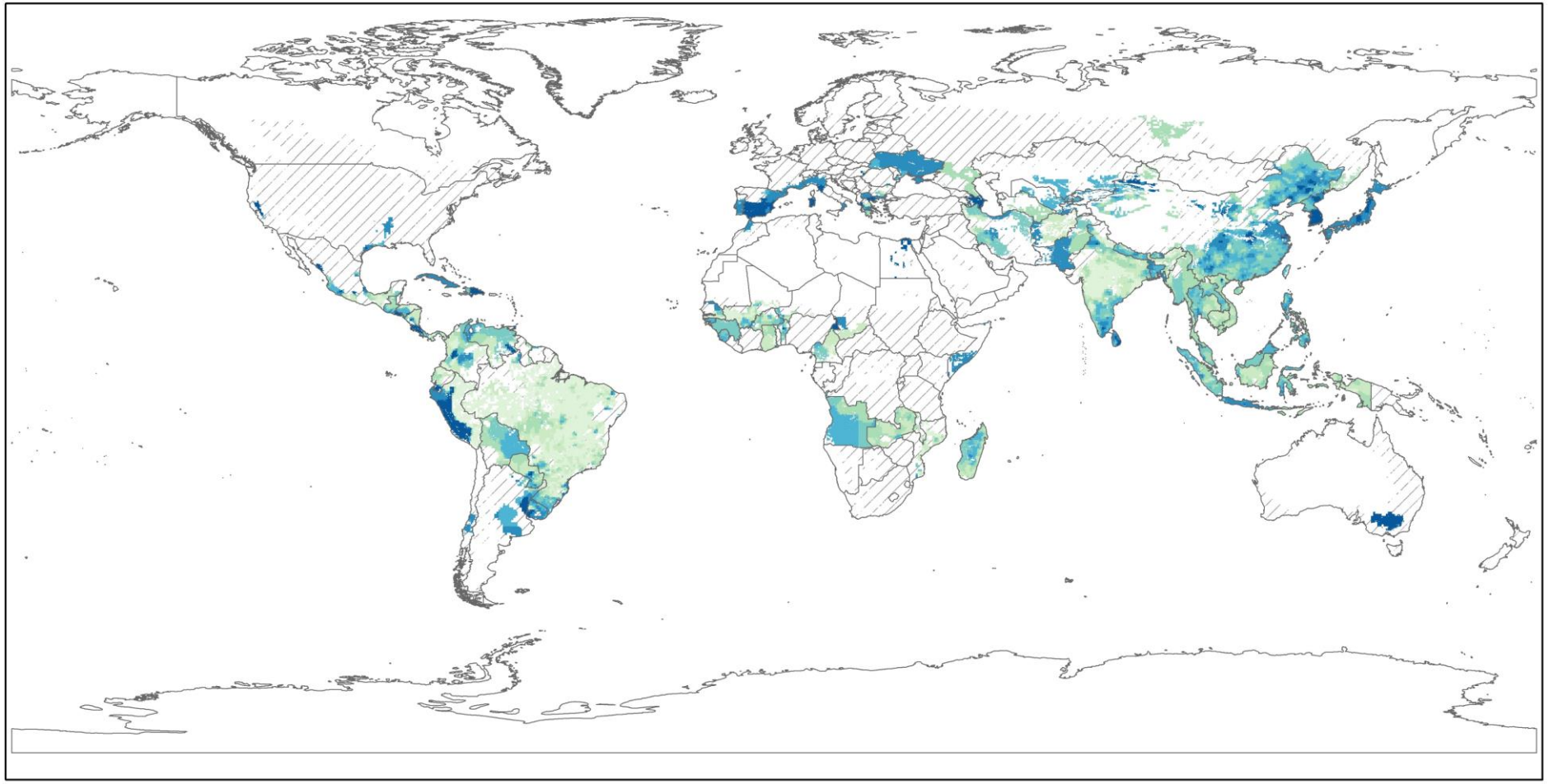
We use physical data to estimate production intensity (Intensification factor - *IF*) through input-output functions.

$$IF = \ 0.25 * \left(\frac{YLDG}{YLDG_{MAX_{CNTRY}}} + \frac{YLDG}{YLDG_{ATT_{MAX_{CNTRY}}}} + \frac{FTN}{FTN_{MAX}} + \frac{FTP}{FTP_{MAX}} \right)$$

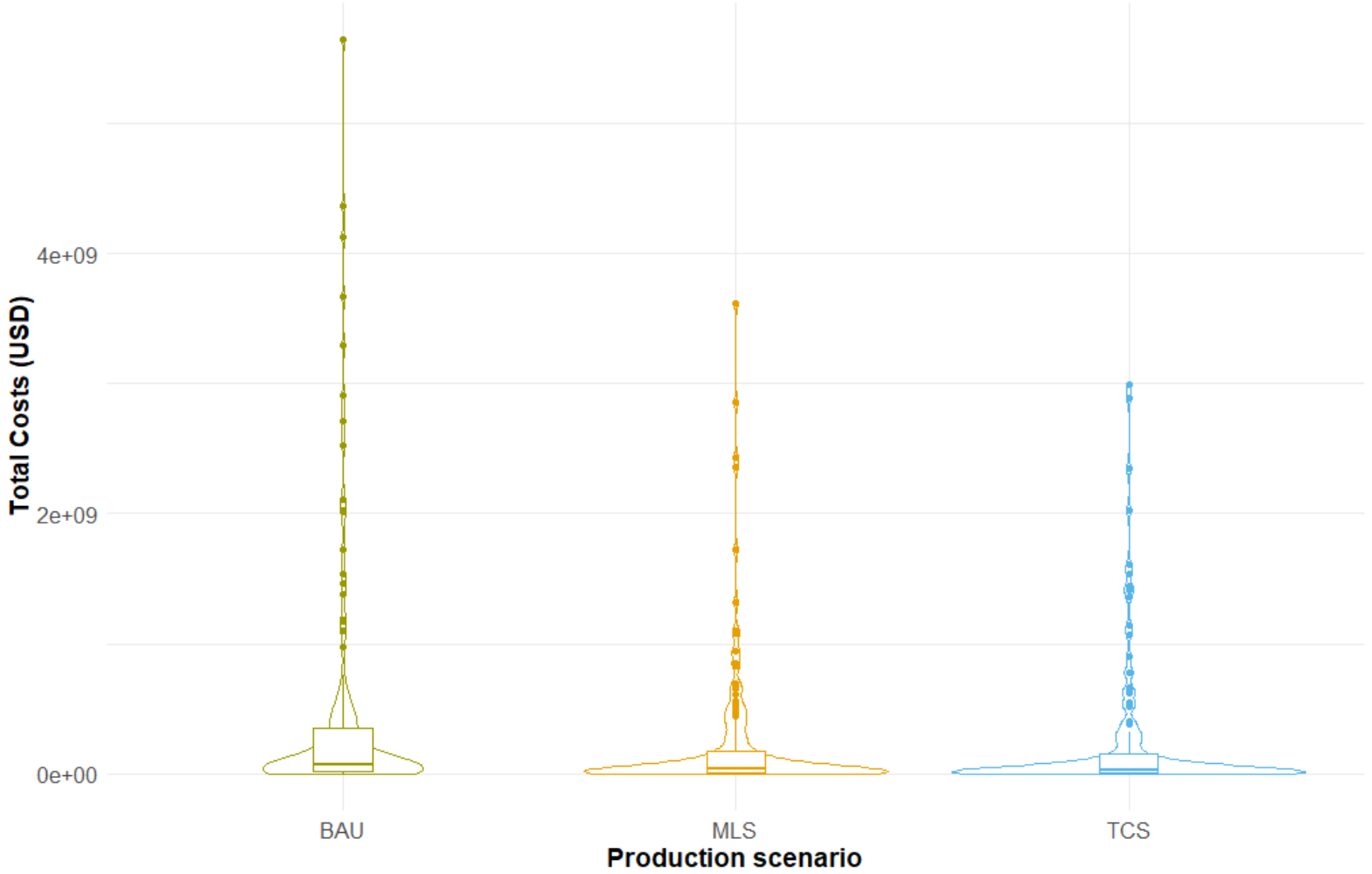
Downscaling national data - IF



Downscaling national data - IF



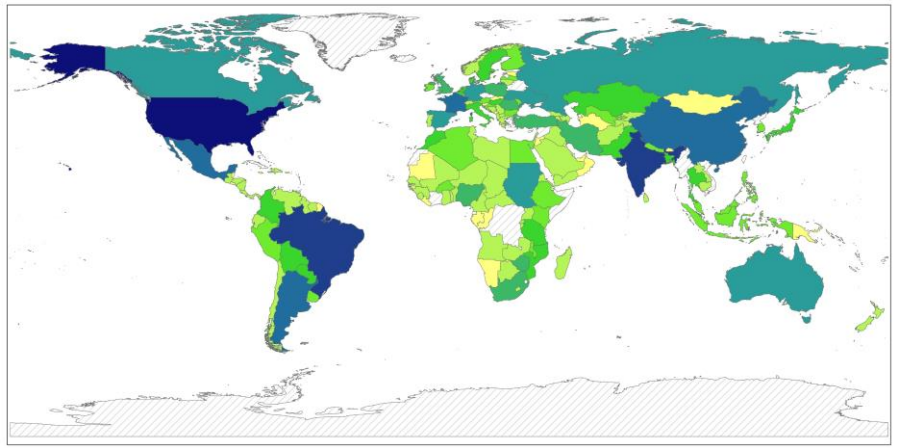
Preliminary findings – Global Costs of production



Preliminary findings – Global Costs of production mapped

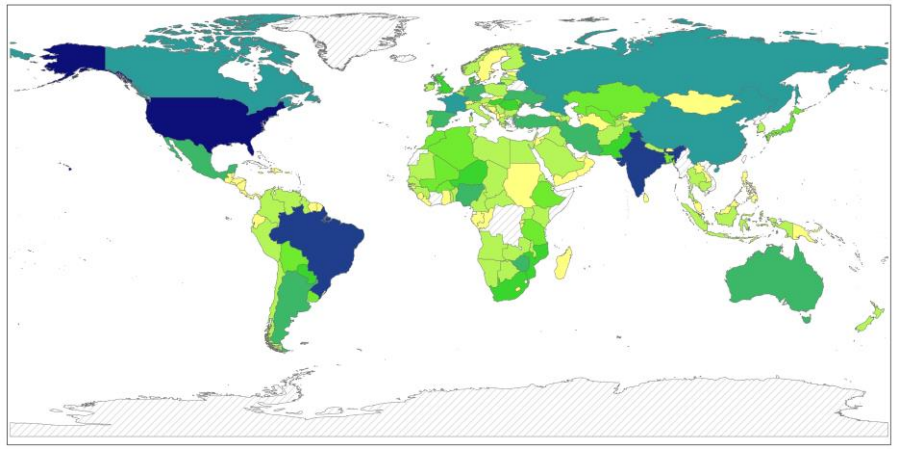
BAU Total Costs in million USD

< 10 | 118 | 334 | 754 | 1,729 | 3,297 | 5,645 | 10,254 | 47,038



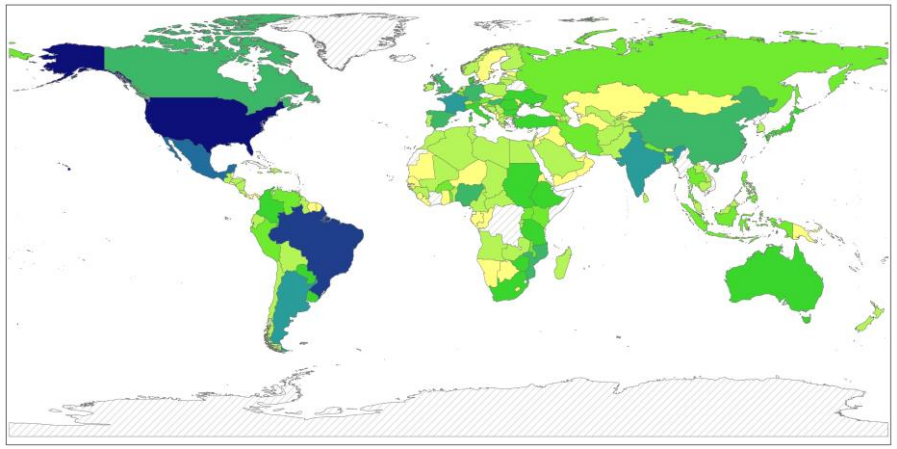
TCS Total Costs in million USD

< 10 | 118 | 334 | 754 | 1,729 | 3,297 | 5,645 | 10,254 | 42,719

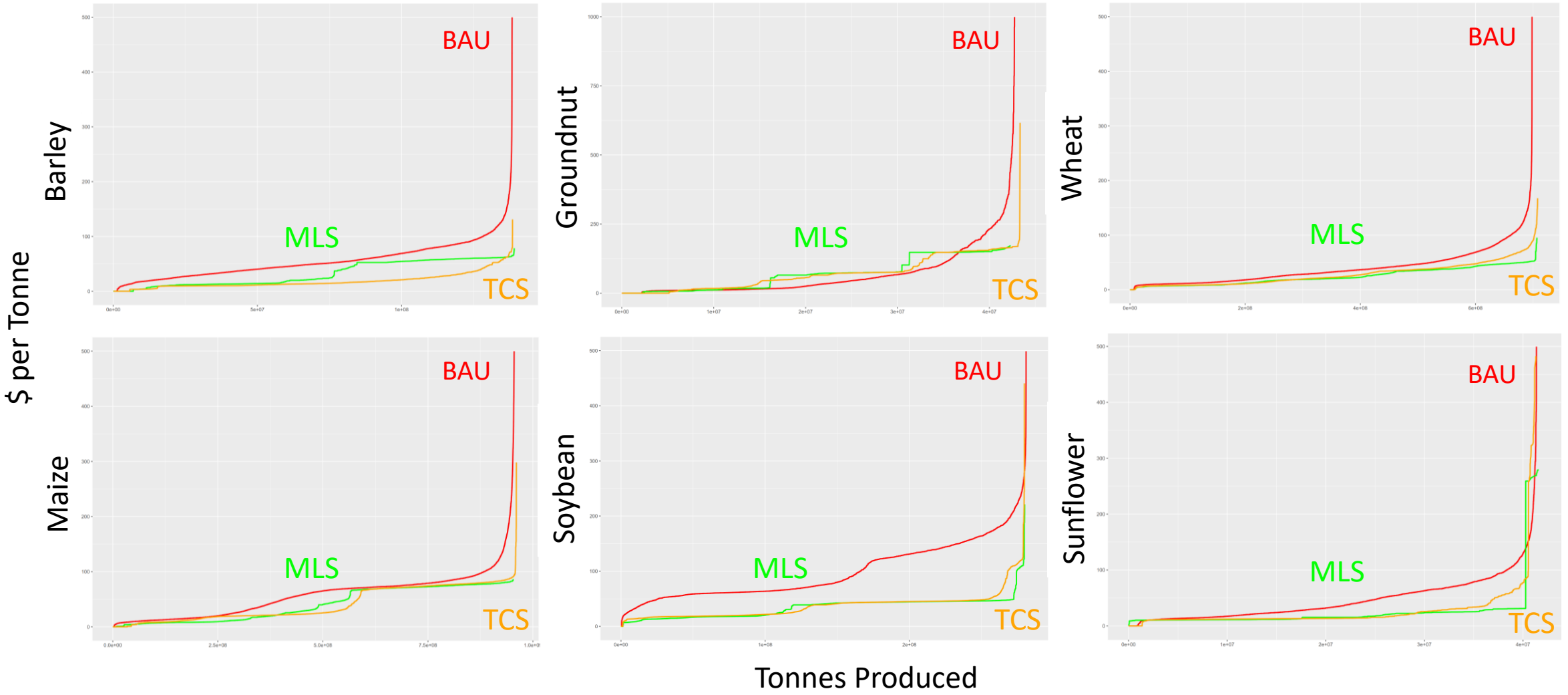


MLS Total Costs in million USD

< 10 | 118 | 334 | 754 | 1,729 | 3,297 | 5,645 | 10,666 | 43,864

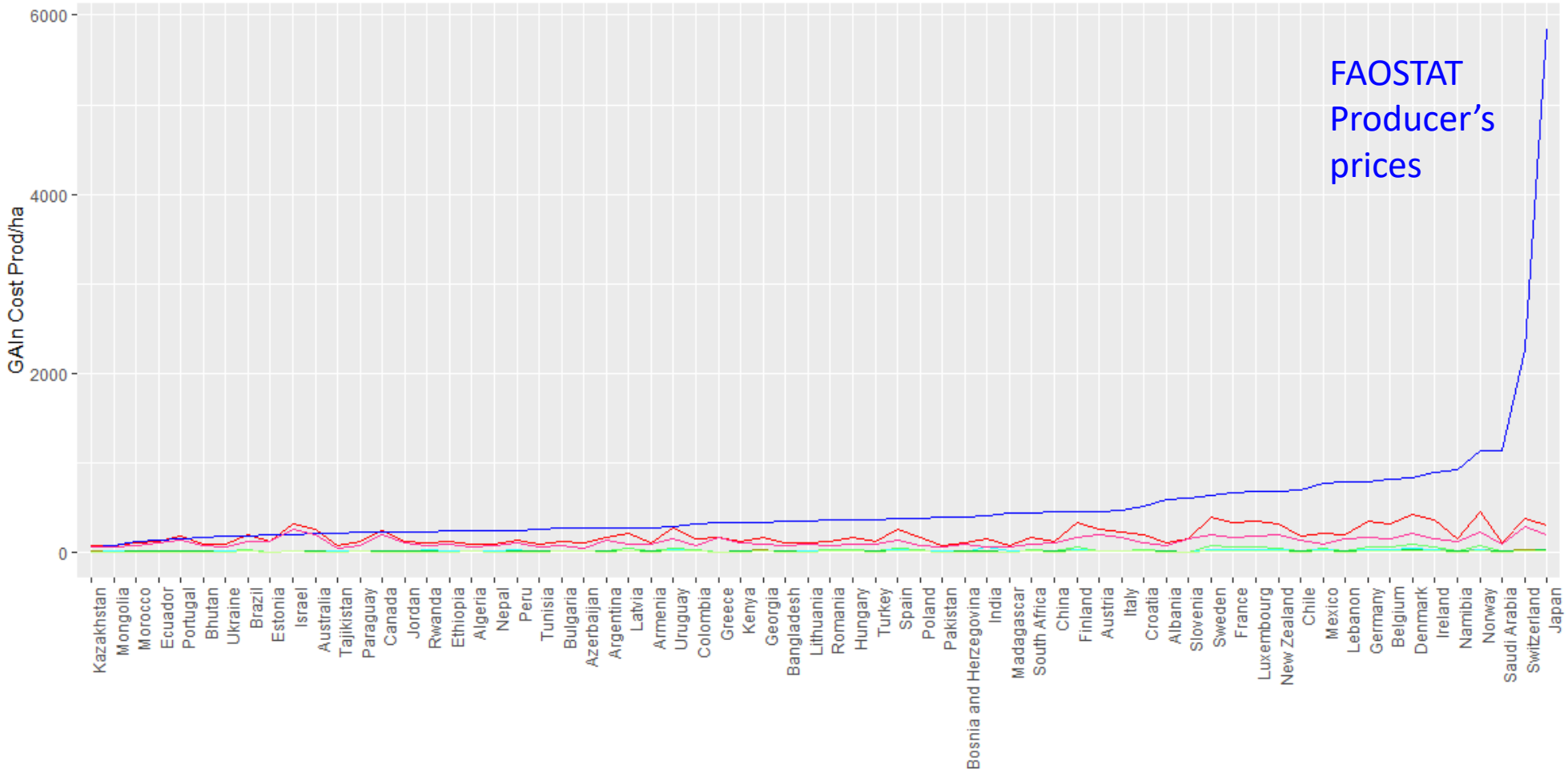


Preliminary findings – Supply Curves



Preliminary cross validation – FAOSTAT

Wheat cost of production and Producers' prices per country



Preliminary cross validation – FAOSTAT

Potatoes cost of production and Producers' prices per country