12 Agro-economic Models

This section lays out the global output protocol for the agro-economic sector's contribution to ISIMIP. For further details, please contact Hermann Lotze-Campen (lotze-campen@pik-potsdam.de) and us (Info@isimip.org).

Note that the variable names are chosen to comply with AgMIP conventions, or are harmonized with the conventions used in the water sector (for irrigation water). They are given in lower-case letters only in order to prevent the use of mixed-case names in the file names (see section 0).

Specific settings still have to be discussed with the participating agro-economic modelling groups, also in connection with work in AgMIP GlobEcon and the SSP process. One important issue to be clarified is the timeline of the simulations, i.e. 2050 or 2100.

12.1 Sector-specific input

Most agro-economic models will need three types of inputs. Projections on GDP and Population per country are to be taken from the IIASA database on SSP scenarios. Furthermore, exogenous productivity trends for agriculture can be taken from IFPRI. In AgMIP, the IFPRI-IMPACT team has developed a procedure to adjust baseline productivity shifters to different GDP projections. However, until now this has only be done until 2050. In principle, this procedure could be applied to the ISIMIP scenarios as well.

This has to be further discussed with the participating agro-economic modelling groups.

12.2 Output

This section still has to be discussed with the participating agro-economic modelling groups, also in connection with work in AgMIP GlobEcon and the SSP process. One important issue to be clarified is the timeline of the simulations, i.e. 2050 or 2100.

Output to be reported (list of variables specified in **Table 35**) for:

1) the following crops: wheat, coarse grains (i.e. maize, millet, sorghum, barley, oats, and rye), rice, oilseeds (i.e. soy, groundnut, rapeseed, palm), sugar (cane and beet); aggregate of the five major groups (CR5)

and

2) if possible, the following other quantities: managed grass land, ruminant meat, non-ruminant meat

Table 35: Output variables for agro-economic models.

Variable	Variable name	Resolution (time, spatial)	Unit (NetCDF format)	Comments
Effective crop yields	yield_<crop>[13]	time steps (regional)	dry matter t/ha/yr (t ha-1 yr-1)	Crop-specific, all crops
Total production	prod_<crop>	time steps (regional)	kcal/capita (kcal capita-1)	Crops plus livestock
Applied irrigation water	irrww_<crop>	time steps (regional)	$kg/m^2/s$ (kg m-2 s-1)	Water supplied to the fields
Weighted average producer prices	xprp_<crop>	time steps (regional)	USD2005/t (2005US$)	For outputs listed above
Representative price on int'l markets	xprr_<crop>	time steps (regional)	USD2005/t (2005$)	For outputs listed above
Weighted average export price	xprx_<crop>	time steps (regional)	USD2005/t (2005$)	For outputs listed above
Resource prices for water and land	xprw, xprl	time steps (regional)	$USD2005/m^3$, USD2005/ha (2005$)	Or adequate land/water scarcity index

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[13]   output codes: whe, mai, ric, soy, mill, sor, sug, rum, nrm, alc, pas, pea, cas, sun, nut, mgr, pst and agt for wheat, maize, rice, soy, sorghum, millet, sugar/sugarcane, ruminant meat, nun-ruminant meat, all crops, pasture, peas, cassava, sunflower, groundnuts, managed grass, pasture and agricultural total , respectively.

Land use patterns, rainfed	lupat_noirr_<crop>	time steps (regional	% (%)	Crop fractions, rainfed For outputs listed above
Land use patterns, irrigated	lupat_firr_<crop>	time steps (regional	% (%)	Crop fractions, irrigated For outputs listed above
Total land use	Area	time steps (regional)	ha (ha)	For outputs listed above, multicropped land should be counted only once
Irrigation pattern	Irrpat	time steps (regional)	% (%)	Fraction of irrigated land
Exogenous rate of crop yield increase	Eryieldincr	time steps (regional)	%/yr (% yr-1)	
Effective Nitrogen application	effnit	annual (regional)	t/ha (t ha-1)	
Total per capita calorie consumption	Totcal	time steps (regional)	kcal/capita /day (kcal cap-1 day-1)	
Animal-based per capita calorie consumption	Anical	time steps (regional)	kcal/capita/day (kcal cap-1 day-1)	To calculate shares
Total domestic consumption	cons_<crop>	time steps (regional)	dry matter t/yr (t yr-1)	Crops plus livestock
Food use	food_<crop>	time steps (regional)	dry matter t/yr (t yr-1)	Crops plus livestock
Feed use (for livestock	feed_<crop>	time steps (regional)	dry matter t/yr	Crops plus livestock

consumption)			(t yr-1)	
Other use	othu_<crop>	time steps (regional)	dry matter t/yr (t yr-1)	Crops plus livestock
Net trade	nett_<crop>	time steps (regional)	dry matter t/yr (t yr-1)	Crop-specific (exports >0, imports <0) Excludes regional intra-trade
Exports	Expo	time steps (regional)	dry matter t/yr (t yr-1)	Excludes regional intra-trade
Imports	Impo	time steps (regional)	dry matter t/yr (t yr-1)	Excludes regional intra-trade

All results should be reported as averages or aggregates over the AgMIP GlobEcon standardized set of geographical regions listed in **Table 36**.

Table 36 Standardized geographical regions

Code	Region	Notes
WLD	World	
CAN	Canada	
USA	United States of America	
BRA	Brazil	
OSA	Other South & Central America	Incl. Caribbean and Mexico
FSU	Former Soviet Union	
EUR	Europe	Excl. Turkey
MEN	Middle-East and North Africa	Incl. Turkey
SSA	Sub-Saharan Africa	
CHN	China	Incl. Hong-Kong, Macao
IND	India	
SEA	South-East Asia	Incl. Japan, Taiwan
OAS	Other Asia	Other South Asia, other Oceania, Mongolia
ANZ	Australia and New Zealand	
NAM	North America	CAN & USA
OAM	South and Central America	BRA & OSA
AME	Africa and Middle East	MEN & SSA
SAS	Southern and Eastern Asia	CHN & IND & SEA & OAS

12.3 Experiments

12.3.1 Historic runs and validation experiment

The participating agro-economic models are currently not prepared to do evaluation runs for e.g. 20-30 years into the past. This is mostly due to data limitations on key parameters and socio-economic model inputs. However, all participating agro-economic models should provide illustrative examples on how they evaluate key model outputs against historic data, at least for some period where observed data and model outputs overlap (e.g. for agricultural prices, cropland and grassland areas).

12.3.2 Fast-Track simulations

10 agro-economic models have participated in the AgMIP GlobEcon Phase 1, in parallel to the ISIMIP fast track. Main results for the timeline until 2050 have been summarized in Nelson et al. (PNAS, 2013). The consolidated output of these model runs still needs to be uploaded to the ISIMIP database.