



Considerations and challenges when choosing a Partial Equilibrium modelling (PE) and Computal General Equilibrium modelling (CGE) for global long-term analysis of food and agriculture

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GPS: work and outputs

Global perspective studies (GPS) have a long tradition at FAO. Outputs include:

Corporate reports on key issues

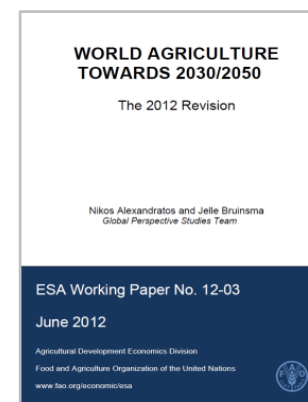
- E.g. report on “*The future of food and agriculture – Trends and challenges*” (2017)

World Agriculture towards 20XX

- long-term projections of agriculture, food security and natural resource use. Last baseline projection until 2050 (**AT2050**, Alexandratos and Bruinsma, 2012)

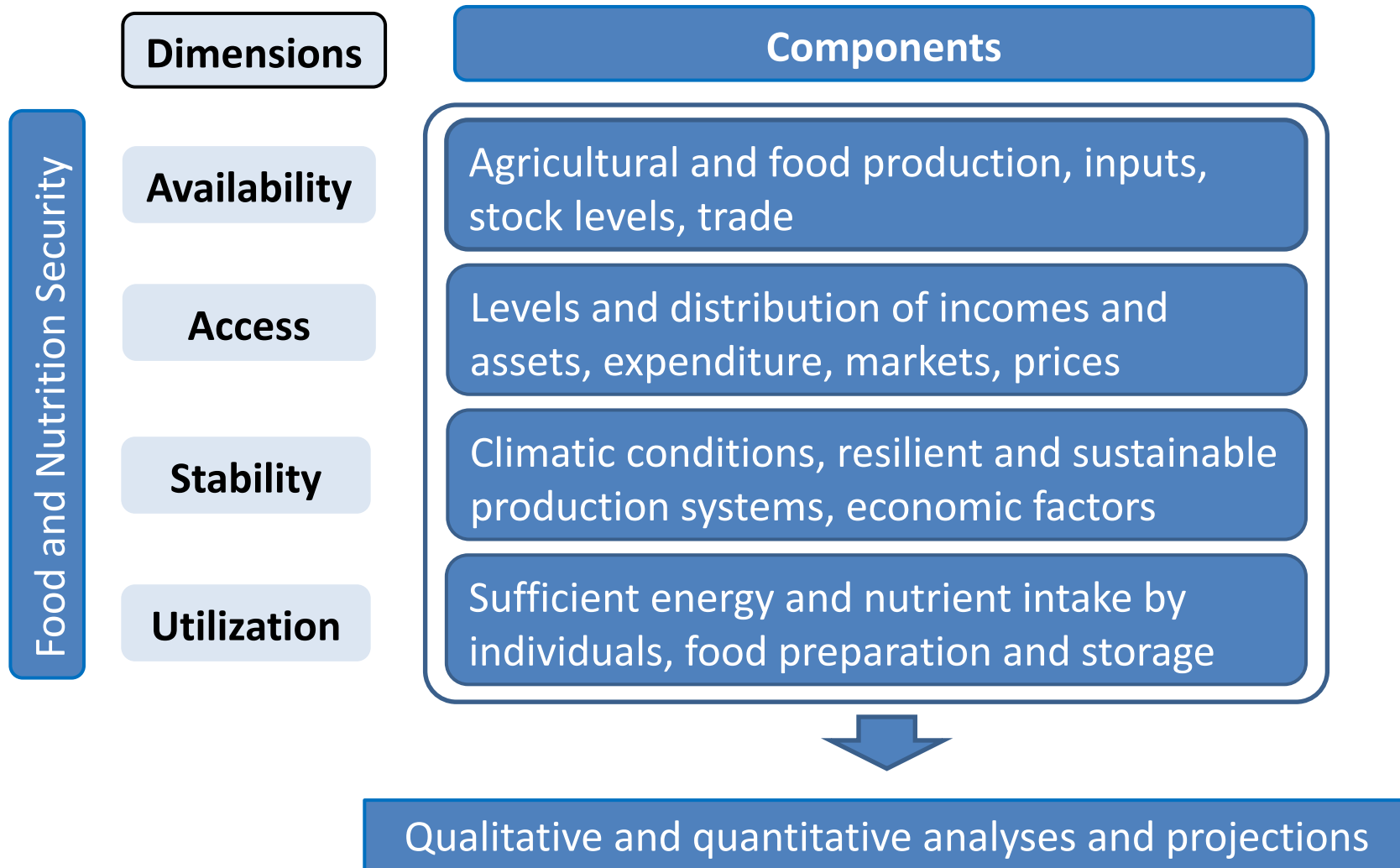
Frequent requests for selected findings from GPS reports by colleagues at HQ and decentralized offices, national and international organizations, and member states

Upcoming report: *The future of food and agriculture – Alternative pathways to 2050*



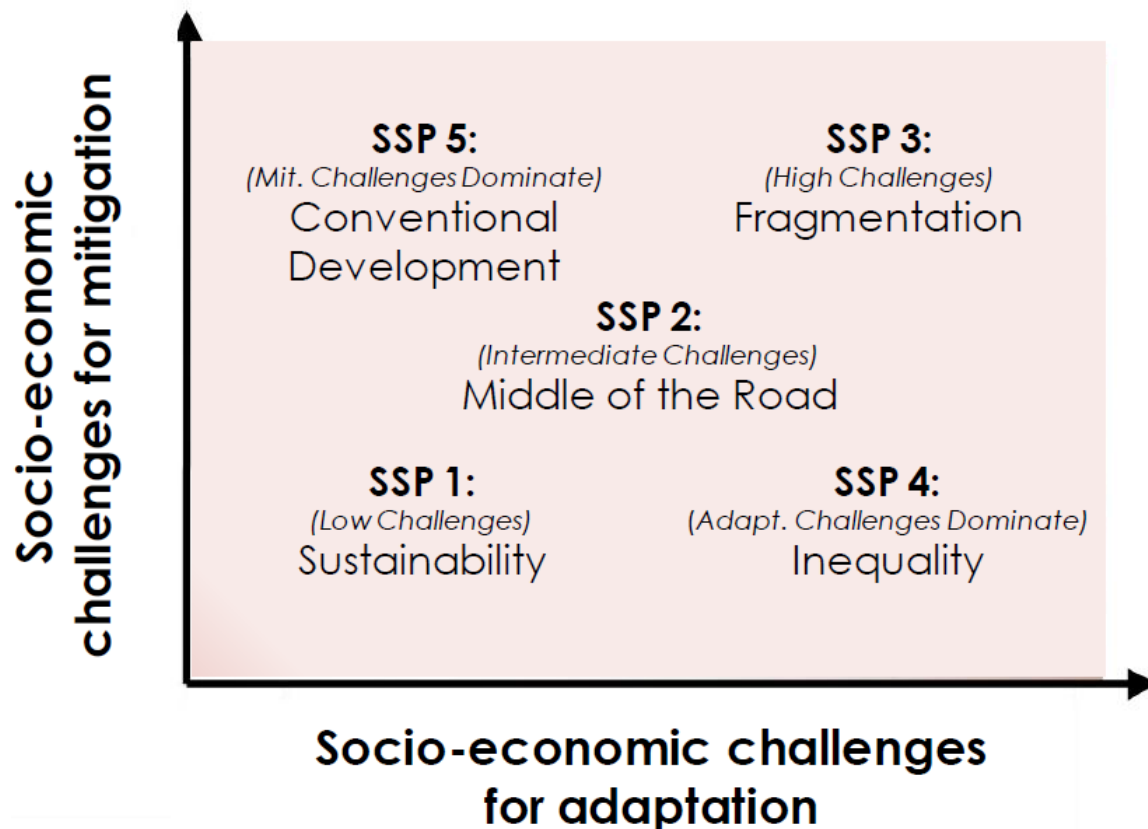


Major topic: FNS in the long term



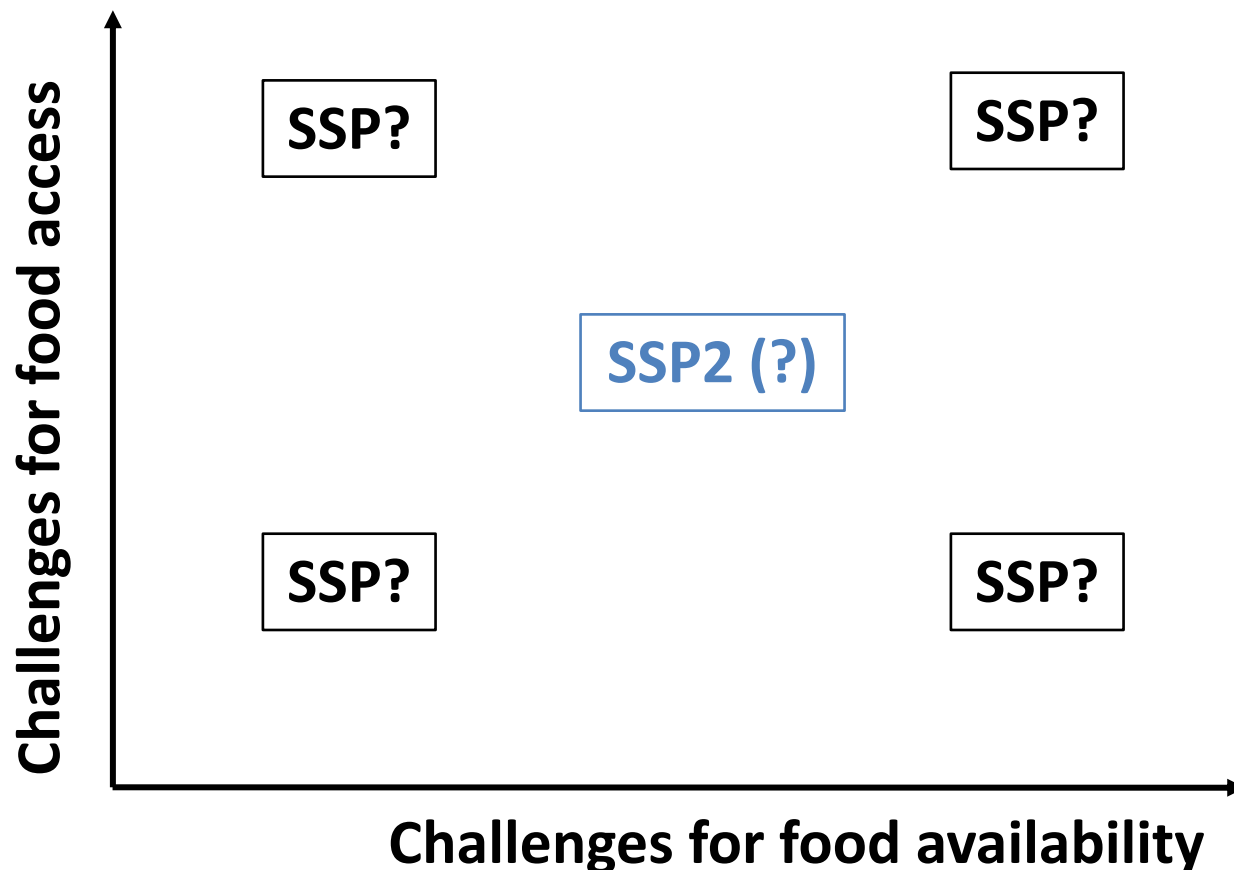


Long-term scenarios: Shared Socio-Economic Pathways (SSP)





Shared Socio-Economic Pathways and FNS: Comparable challenges space?





Global Agriculture Perspectives System (GAPS)

GAPS v1

- Partial equilibrium model for agricultural commodities
- Replicates the AT2050 projections for 110 countries and 34 commodities
- Base year 2005/07
- Implemented in GAMS

For upcoming report: Extension and Upgrade to GAPS v2

- Build around 2011-2013 FAOSTAT Food Balance Sheets and Productions Statistics
- GAEZ* v4 for climate change impacts on land and water resources and crop yields
- FAO GLEAM* for feed requirements, herd dynamics, and proportions of animal production systems
- UN DESA World Population Prospects 2015
- OECD Shared Socioeconomic Pathways for income projections
- Covers 154 countries and 68 commodities



Additional/complementary requirements

Analyses related to FNS in the long run require also information on:

- Population dynamics, migration, and limits to natural resources
- Income distribution
- Investment and finance
- Structural change and global value chains
- Climate change and the energy-agriculture-climate change nexus

Question: What can/should be done in-house?

- Expert consultation in February 2016
- Factors considered: GPS team size, available expertise in-house, existing models

Conclusion: Use an existing CGE model to complement the partial model regarding

- Investment in agriculture
- Structural change and global value chains
- Climate change and the energy-agriculture-climate change nexus

=> Collaboration with Purdue University to adopt the ENVISAGE model



GAPS2ENVISAGE: Database challenges

Comparability of database

- ENVISAGE is build on the GTAP v9 database
 - Agric. and food commodity groups follow CPC
 - Other commodity groups based on ISIC
 - Symmetric IOT, one activity per commodity
 - GAPS is built on FAOSTAT food balance sheets and production statistics
 - Market balances expressed in primary equivalents (except oilseeds)
 - Existence of multi-output technologies (raw cotton gives seeds and fibres)
 - These differences can be overcome on the production side
 - These differences create challenges for the comparability of the demand- and trade side between both models
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GAPS2ENVISAGE: Activity mappings

Many-to-one correspondence for most agricultural activities:

GTAP Nr	GTAP Code	GAPS Code	GAPS Name
1	pdr	A_PARI	Growing of paddy rice
2	wht	A_WHEA	Growing of wheat
3	gro	A_BARL	Growing of barley
3	gro	A_MAIZ	Growing of grain maize
3	gro	A_MILL	Growing of millet
3	gro	A_SORG	Growing of sorghum
3	gro	A_XCER	Growing of other cereals
4	v_f	A_BANA	Growing of bananas
4	v_f	A_CASS	Growing of cassava
4	v_f	A_CCNT	Growing of coconuts
4	v_f	A_CITR	Growing of citrus fruits
4	v_f	A_OLIV	Growing of olives
4	v_f	A_PLAN	Growing of plantains
4	v_f	A_POTA	Growing of potatoes
4	v_f	A_PULS	Growing of dried pulses
4	v_f	A_SWPY	Growing of sweet potato and yams
4	v_f	A_XCRO	Growing of other crops
4	v_f	A_XFRU	Growing of other fruits
4	v_f	A_XRNT	Growing of other roots and tubers
4	v_f	A_XVEG	Growing of other vegetables



GAPS2ENVISAGE: Commodity mappings

Many-to-many correspondence for most agricultural commodities on the demand side (example: cereals)

GTAP Nr	GTAP Code	GAPS Code	GAPS Name
26	b_t	C_BARL	Barley
3	gro	C_BARL	Barley
25	ofd	C_BARL	Barley
3	gro	C_MAIZ	Grain maize
3	gro	C_MILL	Millet
25	ofd	C_MILL	Millet
25	ofd	C_MIRI	Milled rice
23	pcr	C_MIRI	Milled rice
1	pdr	C_MIRI	Milled rice
1	pdr	C_PARI	Paddy rice
3	gro	C_SORG	Sorghum
25	ofd	C_SORG	Sorghum
25	ofd	C_WHEA	Wheat
2	wht	C_WHEA	Wheat
3	gro	C_XCER	Other cereals
25	ofd	C_XCER	Other cereals



Aligning GAPS and ENVISAGE baselines

Baselines are constructed using common drivers (income, climate, population)

Iterative process to create similar baseline projections for the agricultural sector

- Harvested area, gross production value, ...
- Productivity gains for crops and livestock

No explicit alignment of trade and final consumption (by now)



Considerations for future work

Consistency between traded commodity groups in principle possible through FAOSTAT trade statistics

- Time-demanding data work
- Done by whom? In-house or collaboration with other organisations with similar interests?

Consistency between consumed commodity groups by deriving share of primary equivalent expenditure in total food expenditure

- Same questions as above

Wide-spread interest in such topics possible as this applies to all GTAP-based CGE models and FAOSTAT-based partial models



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Thank you

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