Impact of the transition to a healthy diet on food security, agriculture and the environment in Ethiopia

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Current diet in Ethiopia

- Prevalence of Undernourishment is 20% in 2016-2018 (FAO).
- Current diet diversity is low and needs to be improved (Gebru et al., 2018)
- Dominance of staple foods (mainly cereals) and low consumption of fruits and vegetables
- Insufficient intake of certain nutrients
    - Vitamin C and Calcium (Baye et al., 2019);
    - Vitamin A, Zinc and Iron (Gebru et al., 2018);
    - Vitamin A, Calcium, Folate, Zinc, Iodine, Folate and Vitamin B_{12} (Bekele et al., 2019))

Measure of self-sufficiency in food supply

- Data from 2019 (FAO)
- High import dependency for sugar and vegetable oils
- Modest import of cereals and vegetables (9% and 7%)
- Low import of other food groups < 5%

Main food groups	Production (1000 t)	Import (% of production)	Export (% of production)
Cereals	29673	9%	0%
Starchy Roots	8087	0%	0%
Sugar Crops	1499	0%	0%
Sugar & Sweeteners	555	**131%**	0%
Pulses	2880	2%	**10%**
Oilcrops	1073	0%	**39%**
Vegetable Oils	134	**234%**	0%
Vegetables	1596	7%	3%
Fruits	1028	3%	0%
Meat	794	0%	4%
Eggs	54	0%	0%
Milk	3644	0%	0%
Fish, Seafood	56	4%	2%
Sum (93% of Total)	51073	7%	2%

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Healthy and Zero Hunger diets in BioSpacs

- 'EAT-Lancet healthy reference diet' defined for total intake of 2500 kcal/cap/day (Willett et al., 2019)
- The Average Dietary Energy Requirement has been estimated at 2306 kcal/cap/day for the population in Ethiopia (FAO)
- Taking uneven food distribution into account, suggests an average intake of 2835 kcal/cap/day for attaining PoU = 0%.

➢ Healthy Diet : EAT-L reference food intake * 2306/2500

➢ Zero Hunger : EAT-L reference food intake * 2835/2500

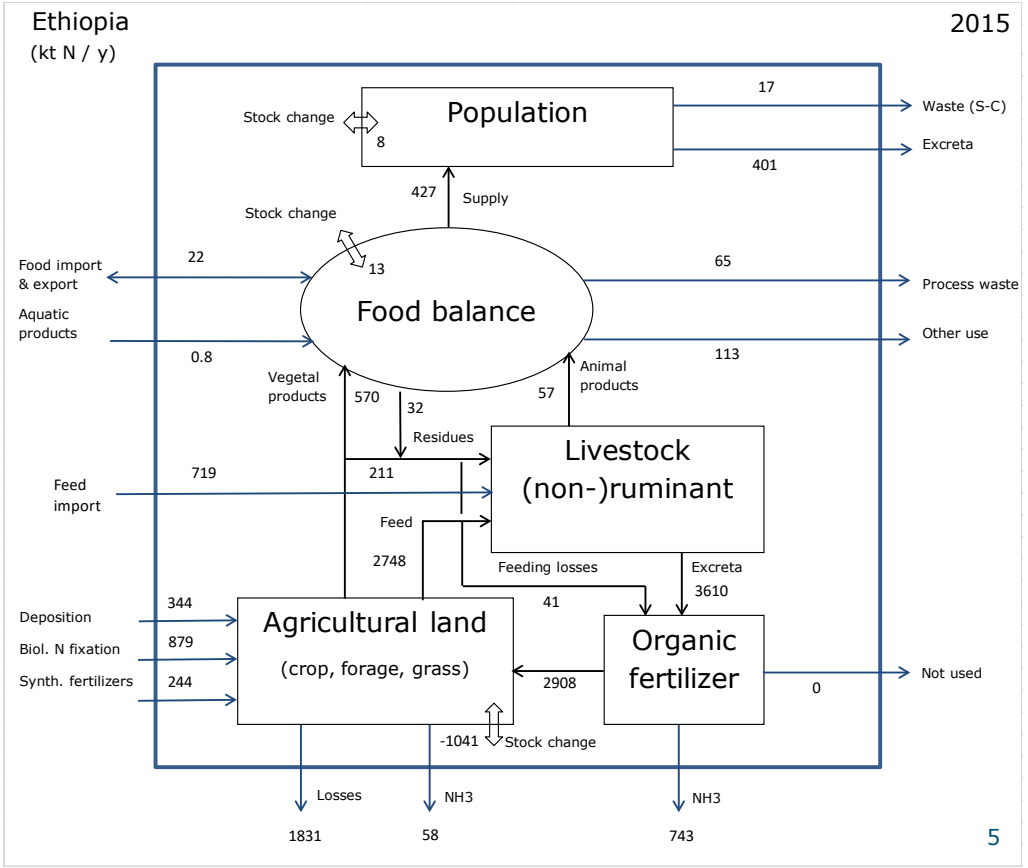
Results of BioSpacs for 2015 (current diet)

- Nutrient flows in the food production and consumption system of Ethiopia
- Main characteristics N balance:

➢ Very low net food N import relative to food N supply (5%)

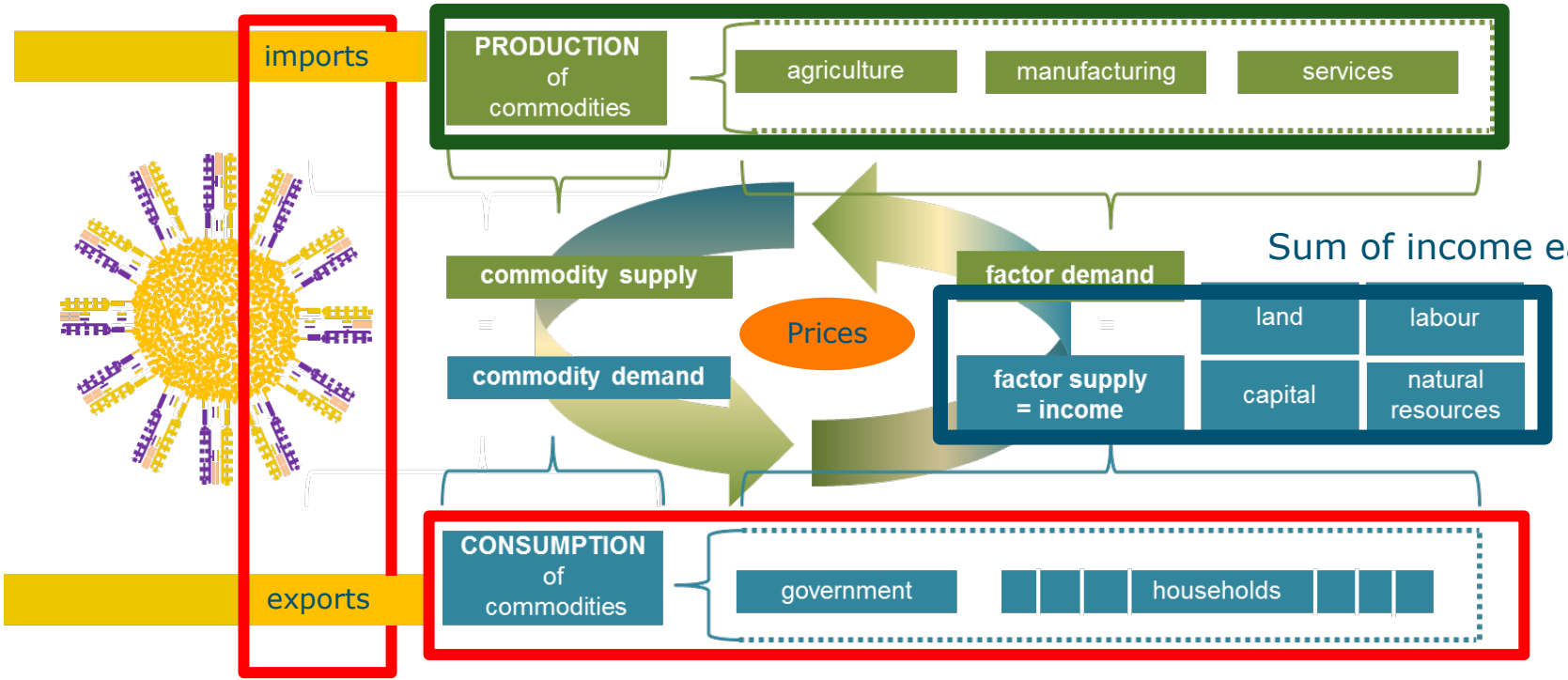
➢ Large uncertainty with livestock excretion and feed resources (a.o. grass)

➢ Declining soil N fertility on ca. 37 million ha agricultural land (on average: -28 kg N/ha,y)



MAGNET – an economic model of nations in the global economy

Sum of value added

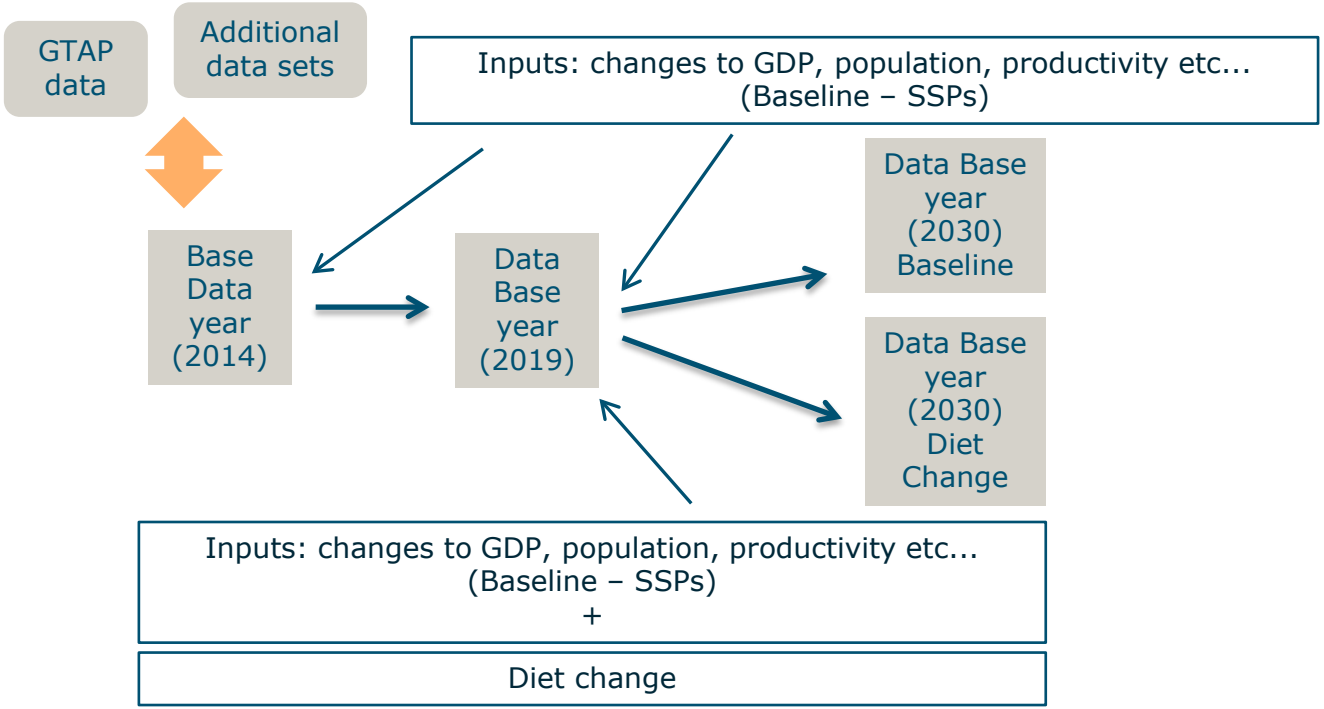


Sum of income earned

Expenditure side

GDP = C+ I + G + X - M

MAGNET: Global CGE macro-economic model- GTAP Core



Diet and Diet change

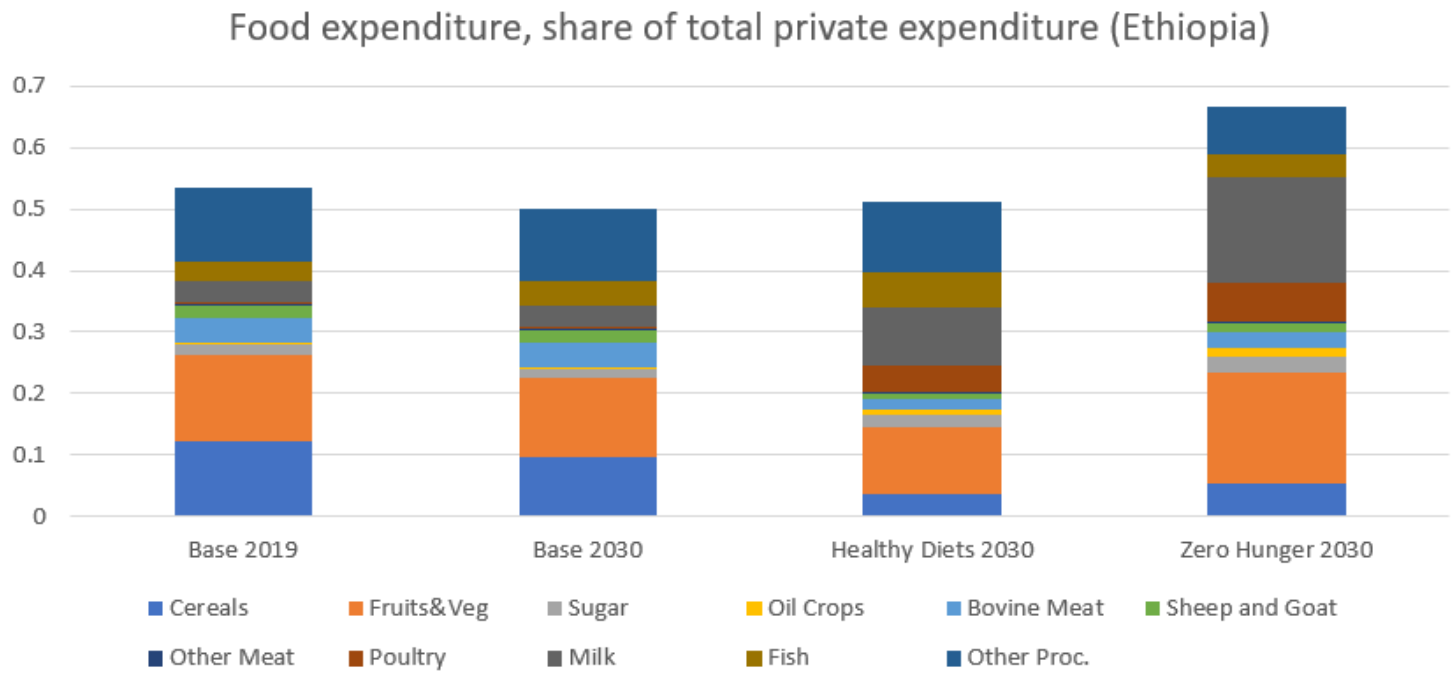
	2019	Healthy Diets	Zero Hunger	Healthy Diets 2030	Zero Hunger 2030
Food Catagory	kcal/capita/day			% Change from 2019	
Cereals	1648	748	919	-55	-44
Fruits&Veg	501	519	638	4	28
Sugar	72	111	136	54	90
Oil Crops	159	649	798	308	402
Bovine Meat	30	18	22	-41	-27
Sheep and Goat	12	7	9	-41	-27
Other Meat	5	3	3	-42	-28
Poultry	5	75	92	1544	1922
Milk	55	141	173	156	215
Fish	1	36	45	2820	3491
Total	2487	2306	2835		

Macro Effects

	2014	2019	Base 2030	Healthy Diets 2030	Zero Hunger 2030
GDP/CAP	573	766	1218	1225	1191
Income Share from Ag.	0.35	0.31	0.27	0.27	0.44

- Large GDP (300%) and Population (40%) increase assumed from SSP2 from 2014-2030
- Baseline shift out of agriculture as incomes increase.
- Healthy diet shift consumption to domestic sources slightly increasing GDP
- Zero Hunger diet shift consumption significantly which reduces overall GDP and significantly increases agricultural incomes.

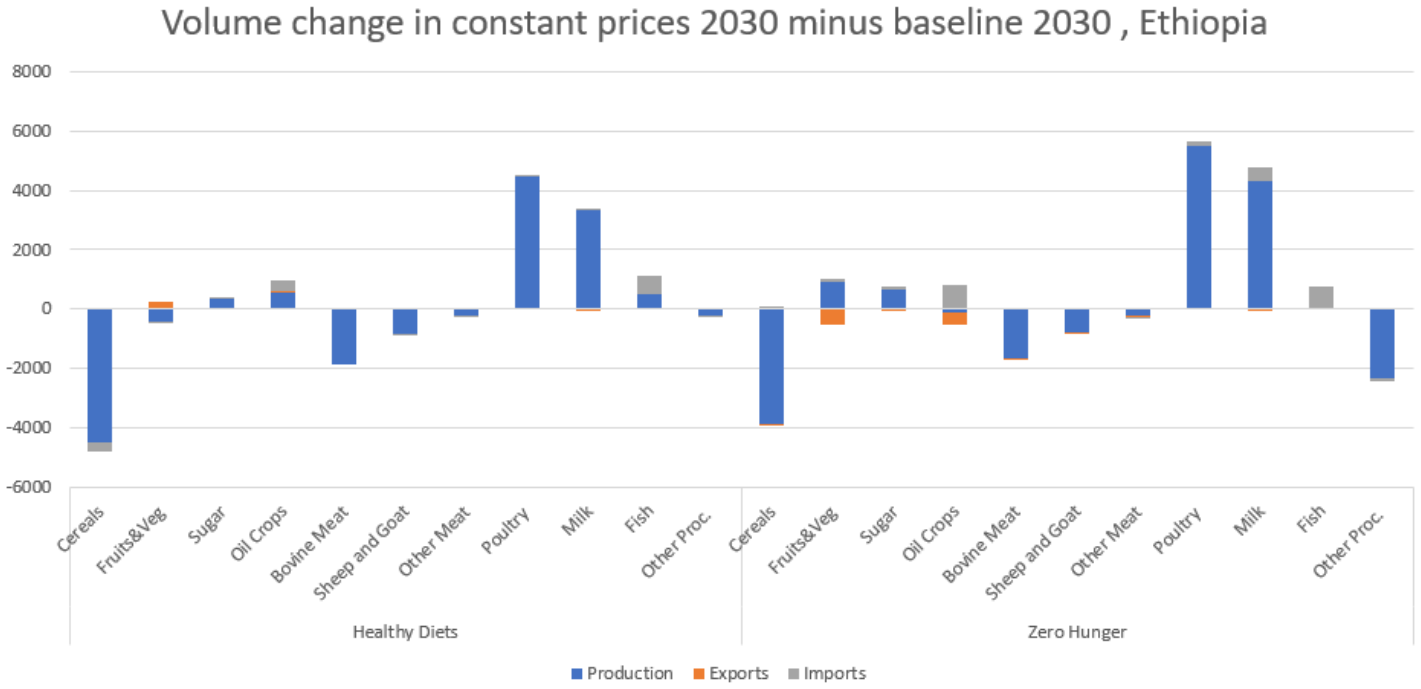
Food Expenditure



Conclusion

- Healthy diet scenario re-allocates existing agricultural resources without large effects on income and food costs.
- Zero Hunger scenario exceeds current productive capacity, pulls additional resources back into agriculture and significantly increases prices.
- Additional trade policies could be explored as well as policies increasing agricultural productivity.
- Affordability for urban poor should be considered as they won’t receive benefit from high agricultural prices.

MAGNET results



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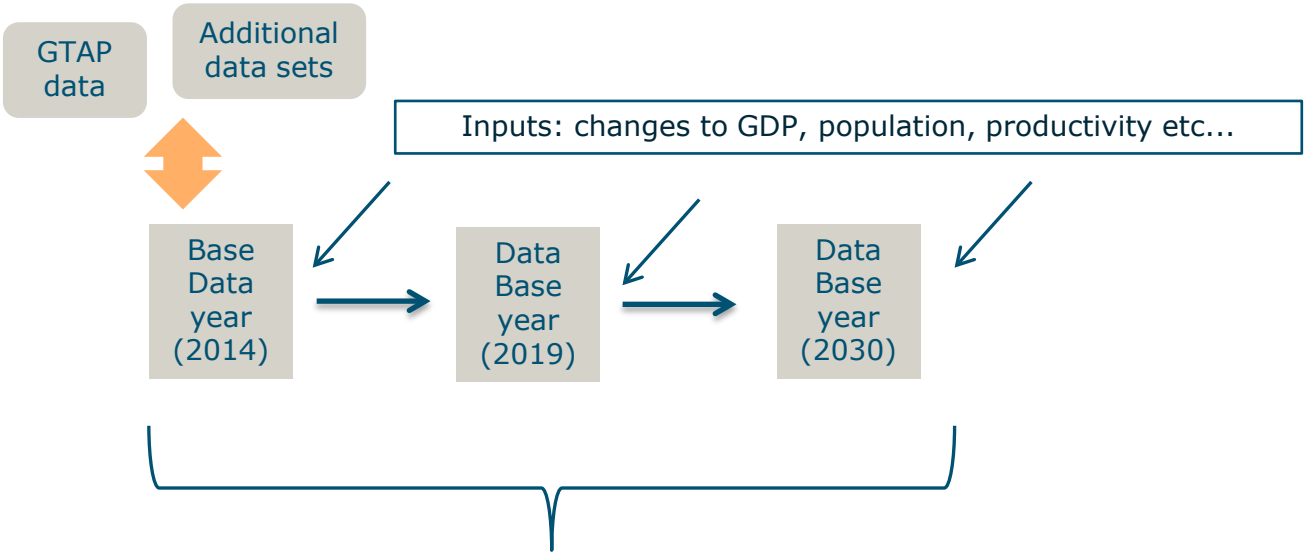

BIOSPACS

- A biophysical model to calculate food production, required inputs and associated emissions as a function of diet, population and trade.

Inputs:

- Diet (food groups as defined in the Food Balance Sheets of the FAO)
- Population size
- Import and export of food groups (across national boundaries)

Outputs:

- Land and synthetic Nitrogen and Phosphorus fertilizer requirements
- N and P flows within and across the borders of a country
- Emissions of N2O, CH4, NH3 and soil N losses (leaching + N2)

MAGNET – modular extension of GTAP

MAGNET database:

- Builds on GTAP v10.1 (reference year 2014)
- Added food & biomass detail (122 activities, 141 commodities)
- Added natural resource detail (15 endowments)

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For more info visit **www.magnet-model.eu**