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FOOD SECURITY, SUSTAINABLE INTENSIFICATION AND ORGANIC AGRICULTURE

Nadia El-Hage Scialabba, Senior Officer
Food and Agriculture Organization of the United Nations
Rome, Italy

Definitions

Mind the paradigm

Sustainable Intensification (SI): "the optimization of crop production per unit area through the management of biodiversity and ecosystem services" (FAO) – practiced through conservation tillage, integrated pest management and precision agriculture

=> a production approach covering primarily crop commodities

Organic Agriculture (OA): "organic production systems based on specific and precise standards of production which aim at achieving optimal agroecosystems which are socially, ecologically and economically sustainable" (IFOAM)

=> a food supply system' approach to plant and animal products

Food security: "when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life" (World Food Summit, 1996)

=> a policy objective covering food availability, access, utilization, stability

SI and OA paradigms

Sustainable intensification	Organic agriculture
• Aim: advancing the productivity frontier, or "closing the yield gap" • Research: primarily technological innovations • Approach: unilateral, such as, climate-smart, water-smart, etc. • Nutrition: more calories/area (US crops over the last 60 years have a decreased Nutrient Index by ~1/3; lack of micronutrients affects 2 billion people/year)	• Aim: enhancing natural processes for more goods and services • Research: by default, people-driven trial and error • Approach: holistic and multi-scale, from field to fork • Nutrition: also more nutrients/area (necessity of more diversity and resilient varieties and breeds)

Sustainability of SI

Efficiency (productivity under normal conditions): substantially increases crop yields with reduced water, energy and labour inputs

Resilience (productivity under disturbed conditions): improved resilience to climatic extremes and vulnerability to macro-economic risks (dependence on inputs suppliers and price increases)

Connectedness (transboundary impacts and participation): improves watershed and groundwater recharge and soil organic carbon

Coherence (ecological balance and economic integration): positively impacts soil habitat and benefits labour-scarce areas

Diversity (biological, income and knowledge): safeguards soil biodiversity but may use GMOs (cross-pollination) and glyphosates (weed resistance)

Sustainability of OA

Efficiency (productivity under normal conditions): lower productivity than HEIA but more efficient nutrient/yield ratio and longer-term soil fertility; economically more profitable, even without price premium

Resilience (productivity under disturbed conditions): more resilience to climate variability and market price fluctuations

Connectedness (transboundary impacts and participation): habitat enhancement practices reduce landscape fragmentation, no pesticide drifts, social action groups and vibrant communities

Coherence (ecological balance and economic integration): almost closed nutrient and energy cycles optimize agro-ecosystem balance (except where specialization relies heavily on organic input imports); more on-farm jobs and enhanced socio-economic integration

Diversity (biological, income and knowledge): enhanced floral and faunal diversity, value-added income and blended traditional/scientific knowledge

Delivery of SI and OA

Sustainable intensification

- Area: 125 Mha (no till) in 2010
- World food supply: not defined
- Labour: less
- Ecosystem services: provisioning (P) and regulating (R) for soils
- Relatively well-endowed areas, large holdings
- Trade-oriented systems

Organic agriculture

(ecofunctional intensification and extensification)

- Area: 37 Mha (certified in 2010)
- World food supply: ~2% retails
- Labour: more (~ 30%)
- Ecosystem services: P, R (for soil, water, climate, biodiversity) and cultural services
- Ecological intensification works also in poorly endowed areas
- Can re-localize food systems where hunger resides

Why sustainable intensification?

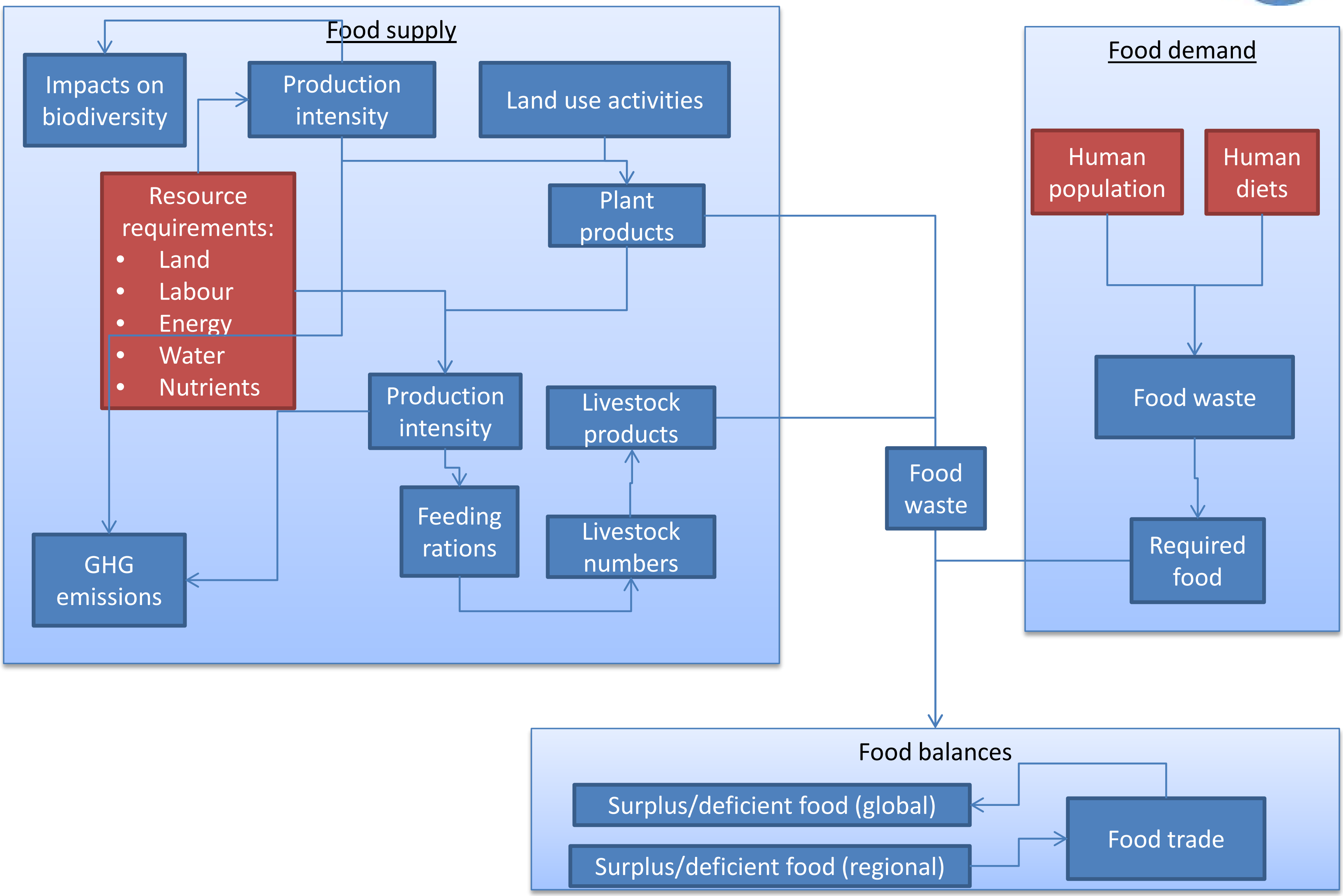
- Natural resources scarcity and climate change constraint the ability to meet the food demand of the expected 9 billion
- FAO AT2030/2050: estimates 65% of increased global food demand between 2000 and 2050
- Producing more with less is a major challenge => SI policies

CAUTION

- FAO projections do not indicate how much production is needed but how much production is expected, based on optimistic GDP prospects (i.e. does not account for crisis)
- Global image does not account for food wastage, regional imbalances, malnourishment, nor food import dependency
- Word food demand projections are based on 2 products: meat (+85%) and crops (+66%)

Sustainability and Organic Livestock modelling (SOL-m)

A General Algebraic Modeling System (GAMS) developed by FiBL for FAO with FAOSTAT data



SOL-m scenarios

1. **Baseline "today".** Current situation in the world, based on land use (arable crops, permanent crops, grassland), livestock numbers/herd structures, feeding rations, commodity trade, prices, utilization of commodities (food, feed, seed, waste, other), population numbers, and nutritional requirements.
2. **Baseline scenario 2050**. Official FAO projections on population numbers and nutritional requirements, as well as technical progress (yield potential) and intensification trends in the agricultural sector.
3. **Reduction of concentrate use by 50% in 2050.**
4. **Reduction of concentrate use by 100% in 2050.**
5. **Full conversion to organic livestock production in 2050.** This includes: i) management of grassland according to organic standards; ii) production of cropland for concentrates according to organic standards; and iii) an increased share of other organic cropland (assuming specialized concentrate-producing farms will mostly do a conversion of their entire farm).
6. **Full conversion to low-input organic livestock production in 2050.** This scenario combines elements of the Scenario 4 and Scenario 5.

Sustainability and Organic Livestock modelling (SOL-m)

Preliminary results of SOL-m global land use and food sector sustainability in 2050

Indicator	Unit	SCENARIO_1	SCENARIO_2	SCENARIO_3	SCENARIO_4	SCENARIO_5	SCENARIO_6
Agricultural land	% compared to base year	→ 100.0%	↗ 101.2%	↘ 98.3%	↘ 98.4%	↑ 105.6%	↘ 98.4%
Human population	% compared to base year	→ 100.0%	↑ 136.5%	↑ 136.5%	↑ 136.5%	↑ 136.5%	↑ 136.5%
Available food energy for human consumption	% compared to base year	→ 100.0%	↑ 106.5%	↑ 118.0%	↑ 136.6%	↑ 116.6%	↑ 132.8%
Available food protein for human consumption	% compared to base year	→ 100.0%	↑ 108.8%	↑ 108.1%	↑ 154.6%	↑ 108.0%	↑ 146.0%
Share of livestock products	% compared to base year	→ 100.0%	↑ 106.6%	↓ 57.2%	↓ 30.5%	↓ 51.5%	↓ 31.4%
Share of plant products	% compared to base year	→ 100.0%	↘ 99.3%	↑ 107.6%	↑ 112.2%	↑ 108.6%	↑ 112.0%
Nitrogen surplus	% compared to base year	→ 100.0%	↑ 118.2%	↗ 102.3%	↓ 90.6%	↓ 53.0%	↓ 41.2%
Phosphorus surplus	% compared to base year	→ 100.0%	↓ 85.7%	↑ 106.7%	↗ 104.9%	↓ 38.2%	↓ 57.0%
Energy use	% compared to base year	→ 100.0%	↑ 110.2%	↘ 98.4%	↓ 94.1%	↗ 104.0%	↓ 86.8%
Global Warming Potential (GWP)	% compared to base year	→ 100.0%	↑ 124.8%	↑ 107.4%	↓ 92.9%	↓ 80.5%	↓ 66.2%
Land degradation potential	% compared to base year	→ 100.0%	↑ 116.8%	↘ 96.0%	↘ 96.8%	↑ 131.7%	↘ 95.0%
Deforestation pressure	% compared to base year	→ 100.0%	↑ > 200.0%	↓ < -200.0%	↓ < -200.0%	↑ > 200.0%	↓ < -200.0%
Toxicity potential	% compared to base year	→ 100.0%	↑ 109.2%	↘ 96.5%	↘ 98.2%	↓ 93.2%	↘ 95.6%
Grassland overexploitation	% compared to base year	→ 100.0%	↑ 133.6%	↑ 120.9%	↗ 101.0%	↑ 120.1%	↗ 100.7%
Biodiversity	qualitative trend	→	↓	↗	↑	↗	↑

SI and OA in practice

Sustainable intensification

- No cultivation of more land
- More output from the same area
- No adverse environmental impact

BUT

- Yield successes often followed by failure to market increased outputs
- In practice, biotech (GM-based) research getting more **funding** (1/3 of US Feed the Future ag. research funds go to climate-resistant cereals)

Organic agriculture

- No cultivation of more land
- More/less output from same **area**
- Enhanced environmental impact

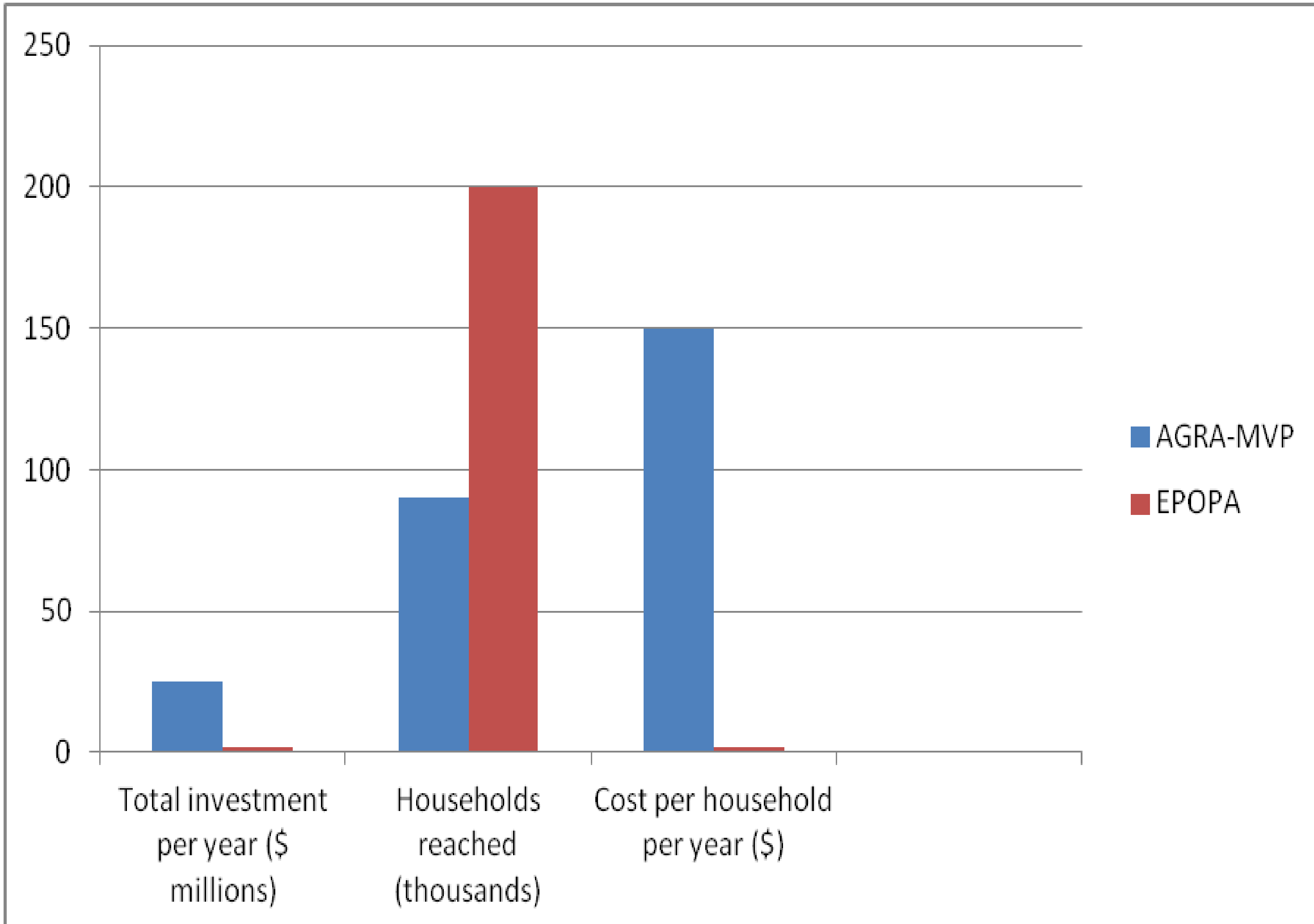
BUT

- Increased markets (access + prices)
- In practice, self-learning of natural processes, virtually no support
- More benefits per unit of labour, investment and natural resources

SI and OA in Africa

Gates Foundation Millennium Villages Project (AGRA-MVP)

***versus* Export Programme for Organic Products from Africa (EPOPA)**



Towards food security

A productivist approach alone will exacerbate food insecurity

Ecological intensification must be accompanied by different diets

Food security projections made for all conventional systems – SI and others - to 2050 will indeed raise yields globally *(FS – availability*) **on average!**

Without improving:

- access to the hungry *(FS - access)*
- malnutrition *(FS - utilization)*
- food systems' stability to chocks *(FS – stability)*

- OA conserves the food production base by lowering GHG emissions, energy use, N-P surpluses and toxicity potential
- Without improvements (i.e. low concentrate feed to livestock), OA would need 334 million ha of land (instead of the 70 of non-organic) to sustain 2050 livestock demand
- With livestock products' consumption reduced to 1/3-1/4, OA without concentrate feed could produce sufficient calories per capita, while using less land (than baseline)

Thank you for your attention

www.fao.org/nr/sustainability

www.fao.org/organicag