Food and Agriculture Organization of the United Nations

Regional Knowledge Sharing Consultation on Sustainable Agrifood Systems for Food Security and Sustainable Development in the ASEAN Region

International and Regional Perspectives of Sustainable Agriculture and Food Systems

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Outline

I. Definition:
II. Status and Features: Food Security and Agrifood Systems
III. Global Trends and Challenges: Implication on Agrifood Systems
IV. Solutions: Towards Sustainable Agrifood Systems
V. Enabling Environment for Sustainable Agrifood Systems

I. Definition: Sustainable Agriculture and Food Systems?

Sustainable Food Systems

- **Definition of Food Systems:**

"**Food systems encompass all the people, institutions and processes by which agricultural products are produced, processed and brought to consumers**. They also include the public officials, civil society organizations, researchers and development practitioners who design the policies, regulations, programmes and projects that shape food and agriculture" (FAO)

- **Definition of sustainable food system:**

"A **sustainable food system** is a food system that ensures food nutrition and nutrition for all in such a way that the economic, social and environmental bases to generate food security and nutrition for future generations are not compromised." (HLPE, 2014**)**

Sustainable Food Systems

- **Key elements:**

- **Supply side** policies and measures to strengthen accountability, resilience, and equity within the food system

- **Demand side** policies and measures for increasing access and empowering consumers to choose healthy diets.

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Zero Hunger

SDG2: “End hunger, achieve food security and improved nutrition, and promote sustainable agriculture” by 2030

SDG 2.1: End hunger

SDG 2.2: End all forms of malnutrition

SDG 2.3: Double agricultural productivity and incomes of small-scale food producers

SDG 2.4: Ensure sustainable food systems

SDG 2.5: Maintain genetic diversity

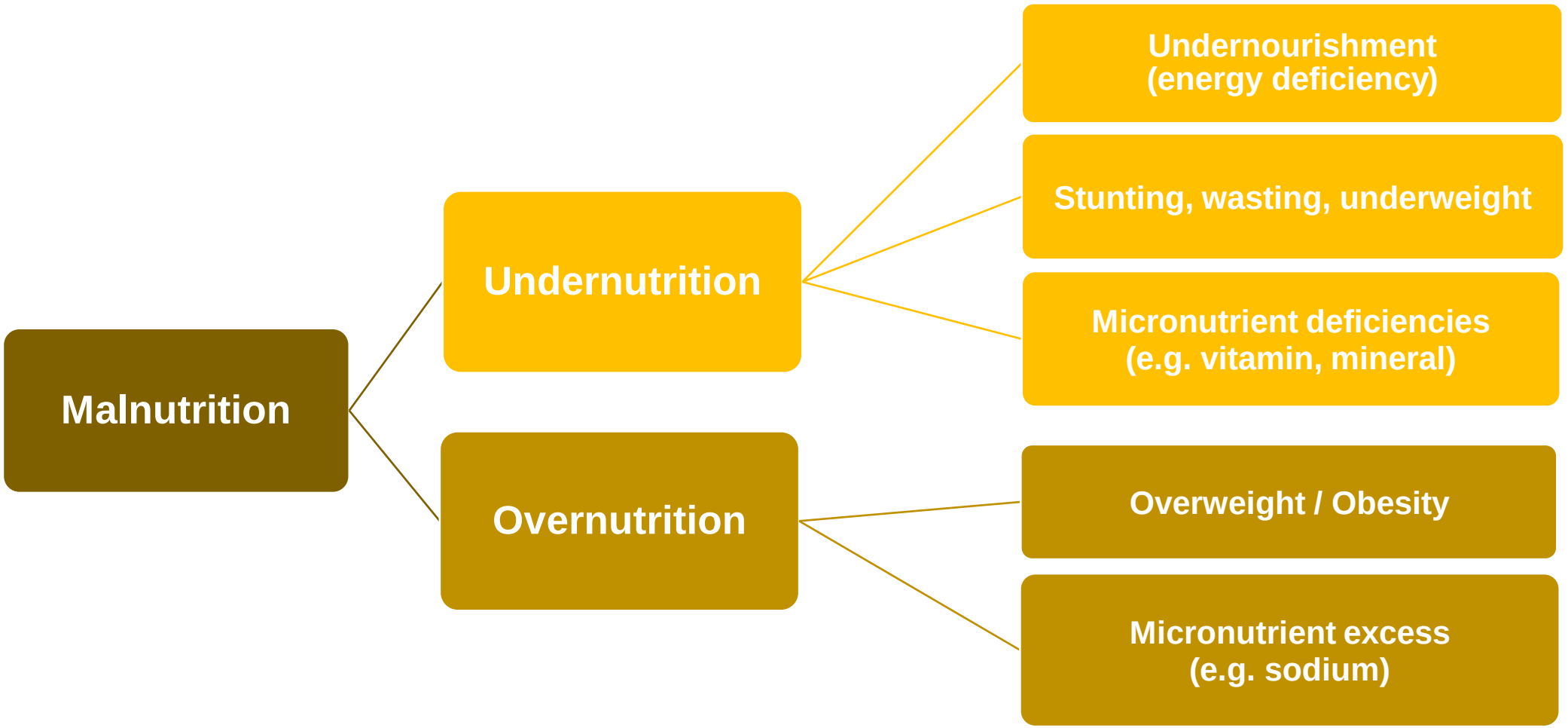
II. Status and Feature: Food Security and Agrifood System

2.1 Status: Food Security

2.2 Features: Agrifood system

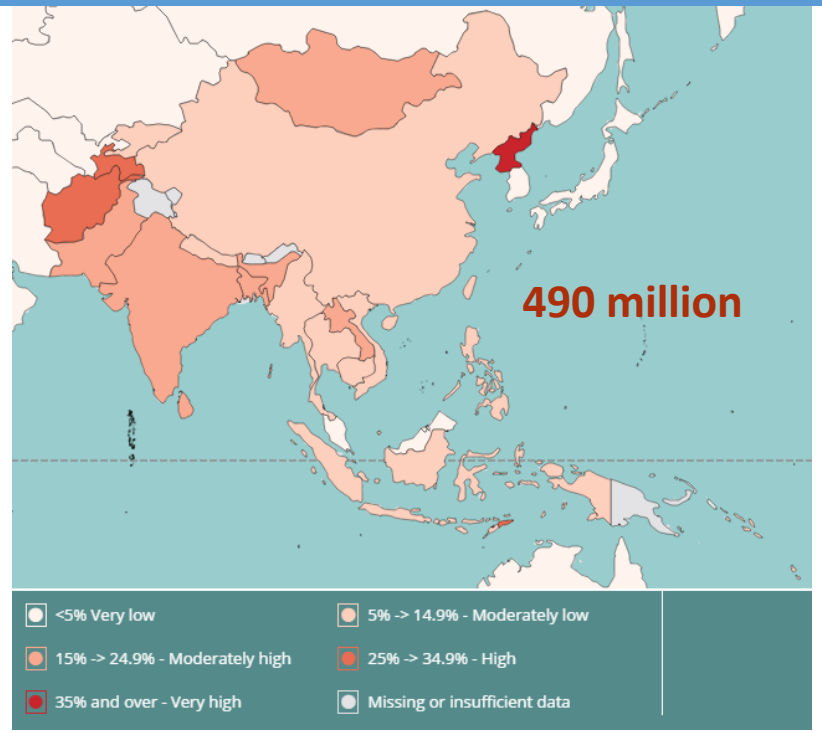
2.1 Food Security

Hunger and Malnutrition

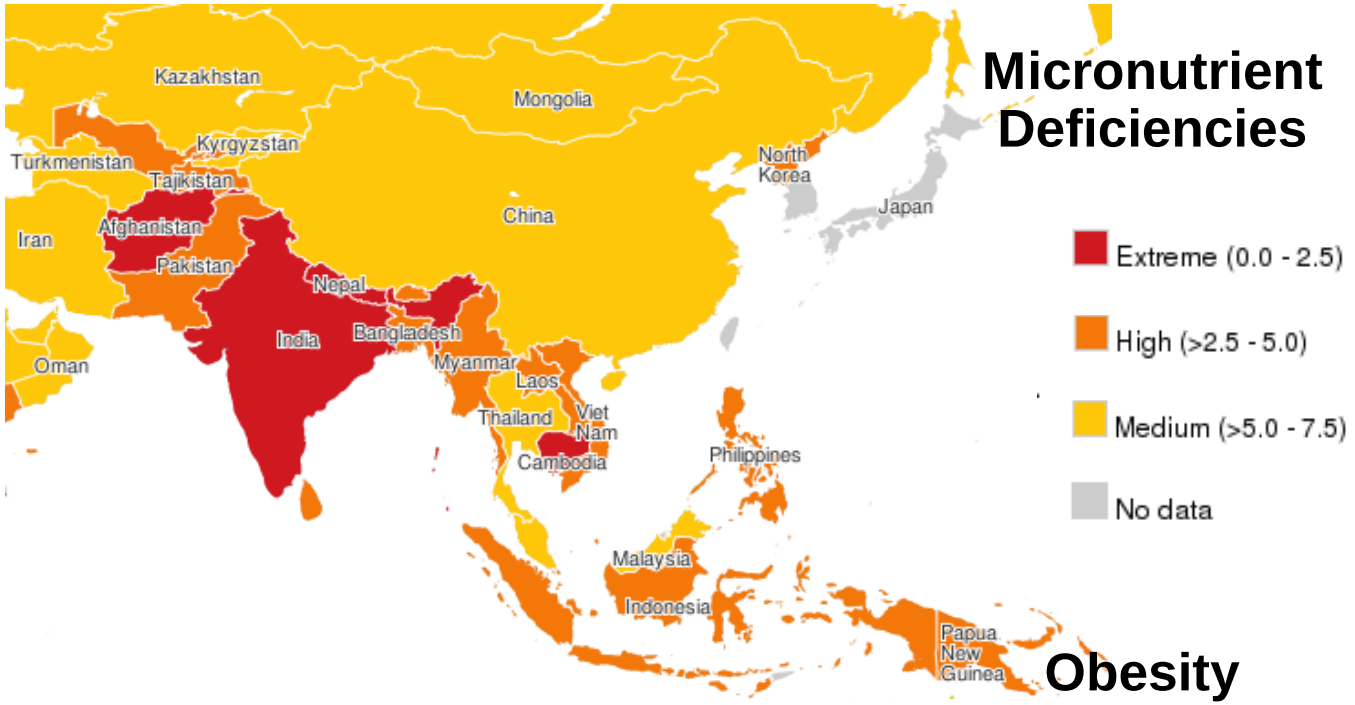


Hunger and Malnutrition in Asia & Pacific

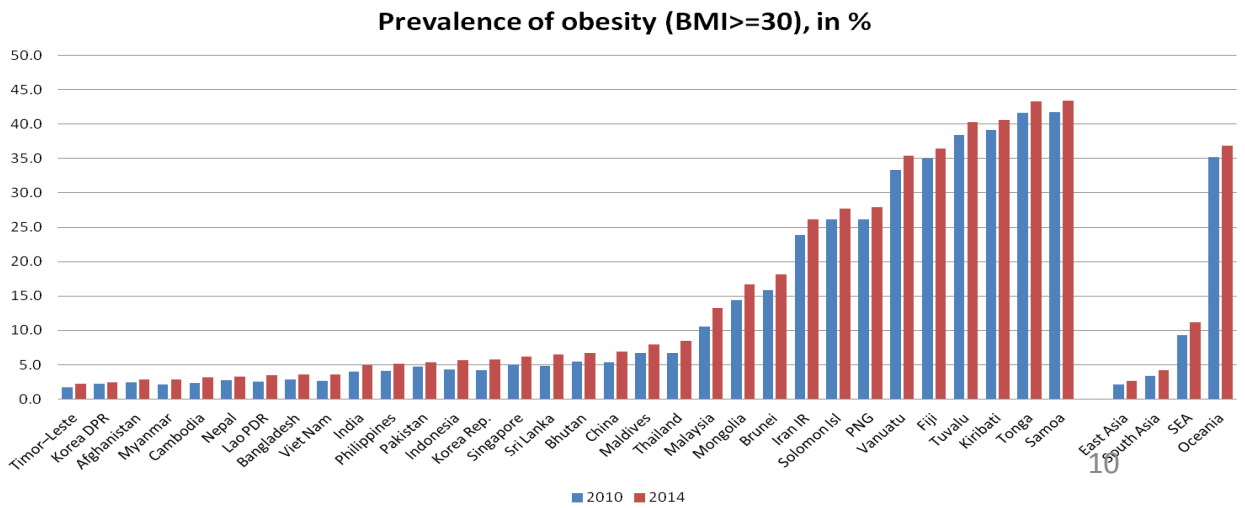
Hunger



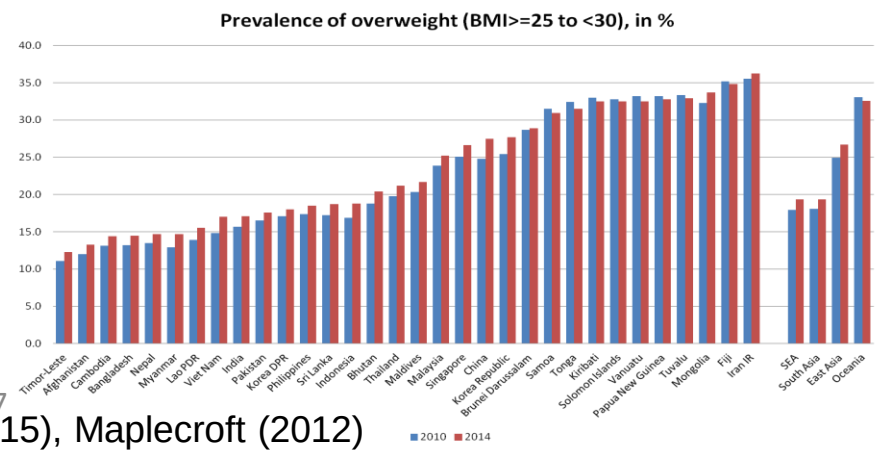
Micronutrient Deficiencies



Obesity



Overweight



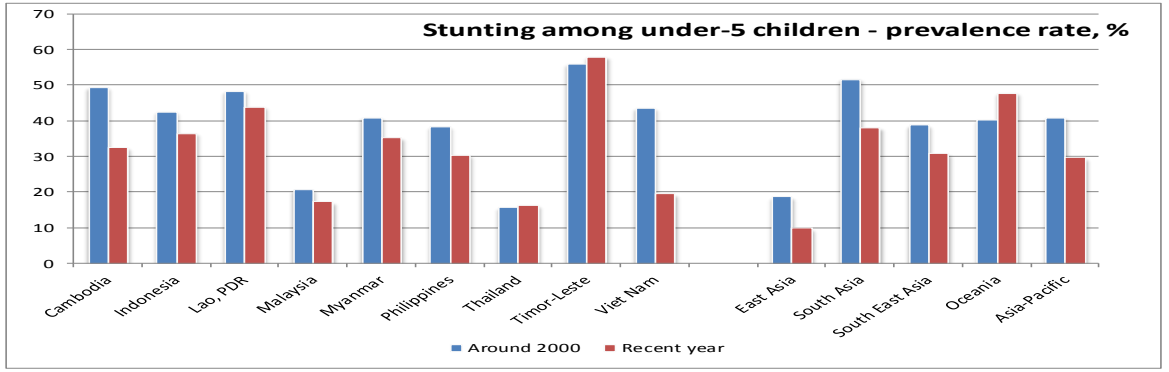
Sources: WHO (2015), Maplecroft (2012)

Prevalence of Stunting, Wasting and Underweight in the Region

Among under-5 children (in % as proportion of total under-5 children)

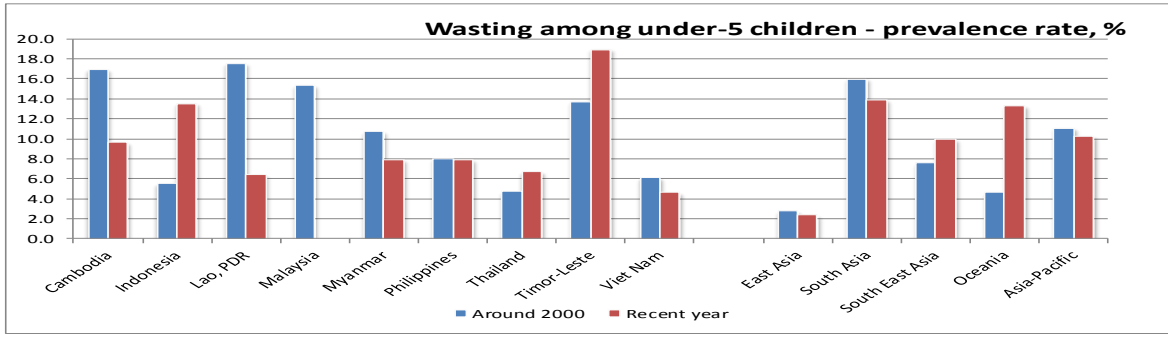
Stunting prevalence among under-5 children, %

	Around 2000	Recent year	Reduction rate % p.a.
Cambodia	49	32	3.0
Indonesia	42	36	1.2
Lao, PDR	48	44	0.9
Malaysia	21	17	2.7
Myanmar	41	35	1.7
Philippines	38	30	1.6
Thailand	16	16	-0.6
Timor-Leste	56	58	-0.5
Viet Nam	43	19	6.4
East Asia	19	10	
South Asia	52	38	
South East A	39	31	
Oceania	40	48	
Asia-Pacific	41	30	



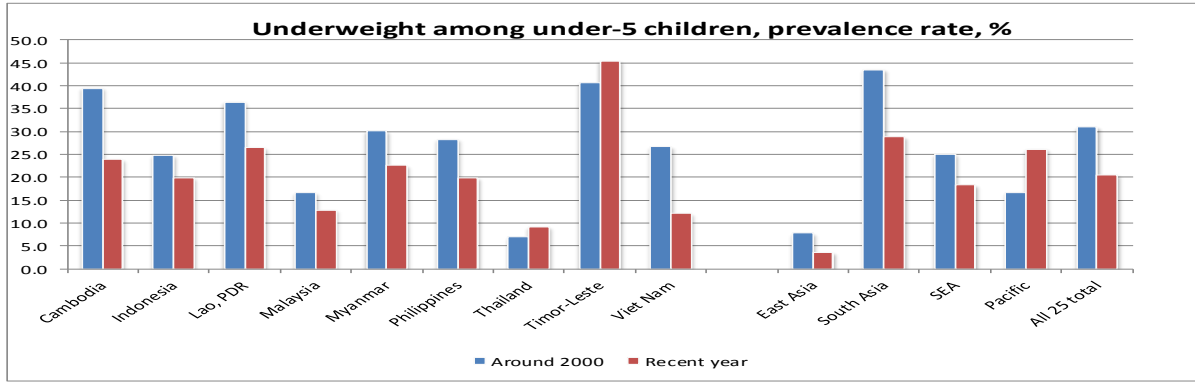
Wasting prevalence among under-5 children, %

	Around 2000	Recent year	Reduction rate % p.a.
Cambodia	16.9	9.6	4.1
Indonesia	**5.5**	13.5	-6.7
Lao, PDR	17.5	6.4	9.6
Malaysia	15.3		
Myanmar	10.7	7.9	3.4
Philippines	8.0	7.9	0.1
Thailand	4.7	6.7	-5.7
Timor-Leste	13.7	18.9	-4.5
Viet Nam	6.1	4.6	2.2
East Asia	2.7	2.3	
South Asia	16.0	13.9	
South East A	7.5	9.9	
Oceania	4.6	13.3	
Asia-Pacific	11.0	10.2	



Underweight prevalence among under-5 children, %

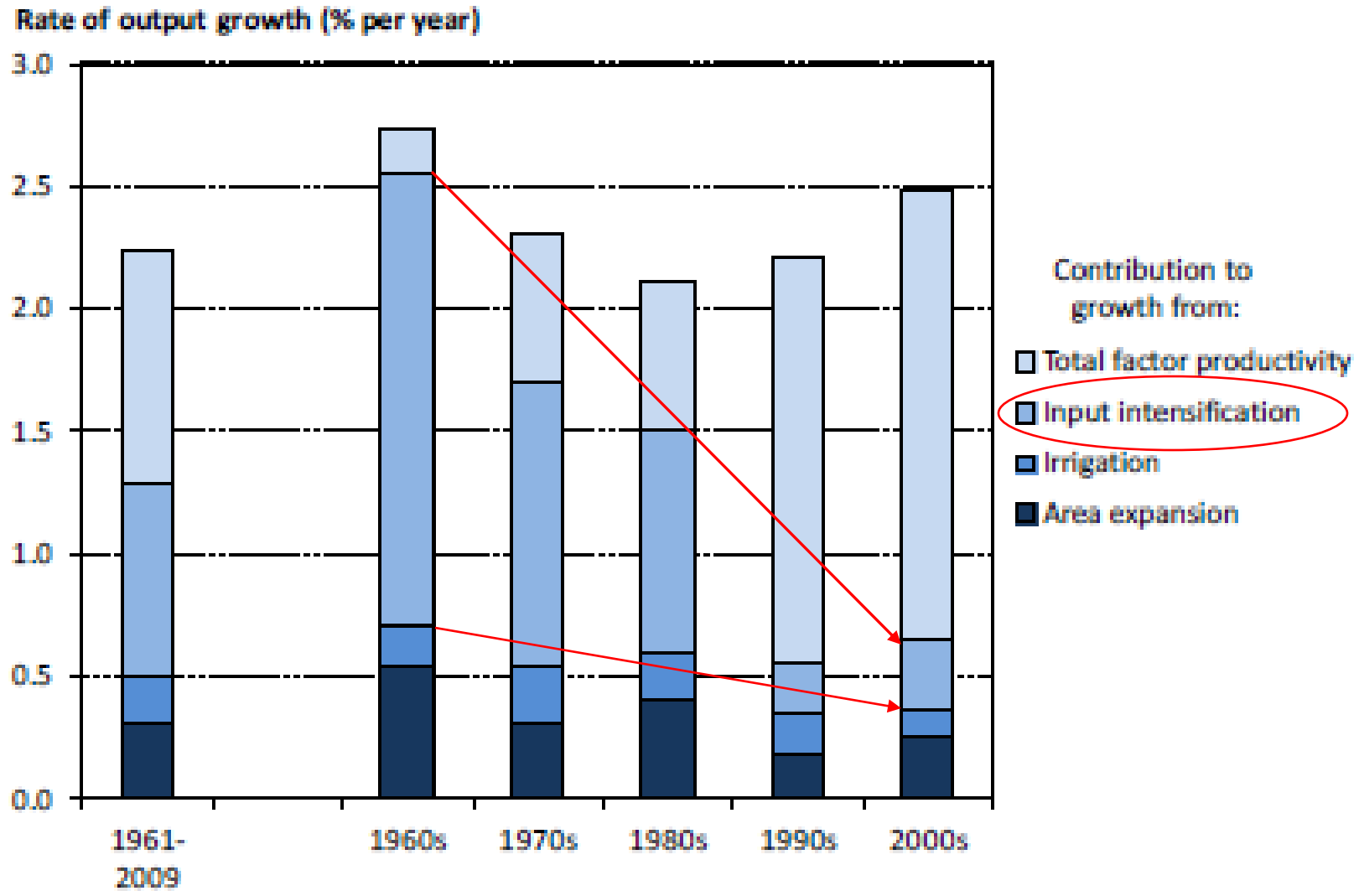
	Around 2000	Recent year	Reduction rate % p.a.
Cambodia	39.5	23.9	3.7
Indonesia	24.8	19.9	1.7
Lao, PDR	36.4	26.5	2.9
Malaysia	16.7	12.9	3.8
Myanmar	30.1	22.6	3.2
Philippines	28.3	19.9	2.4
Thailand	7.0	9.2	-4.5
Timor-Leste	40.6	45.3	-1.6
Viet Nam	26.7	12.1	6.3
East Asia	7.8	3.6	
South Asia	43.5	28.8	
SEA	25.1	18.3	
Pacific	16.8	26.2	
All 25 total	31.0	20.6	



Data source: UNICEF-WHO-World Bank joint database

2.2 Agrifood System

2.2.1. Agriculture Growth Sources

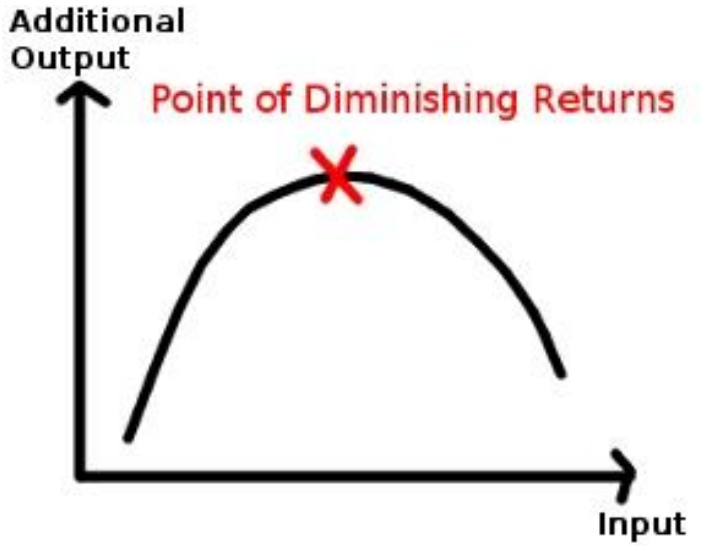


Source: Fuglie et al. (2012)

Inputs-Intensive Crop Production

High input-intensity Crop production

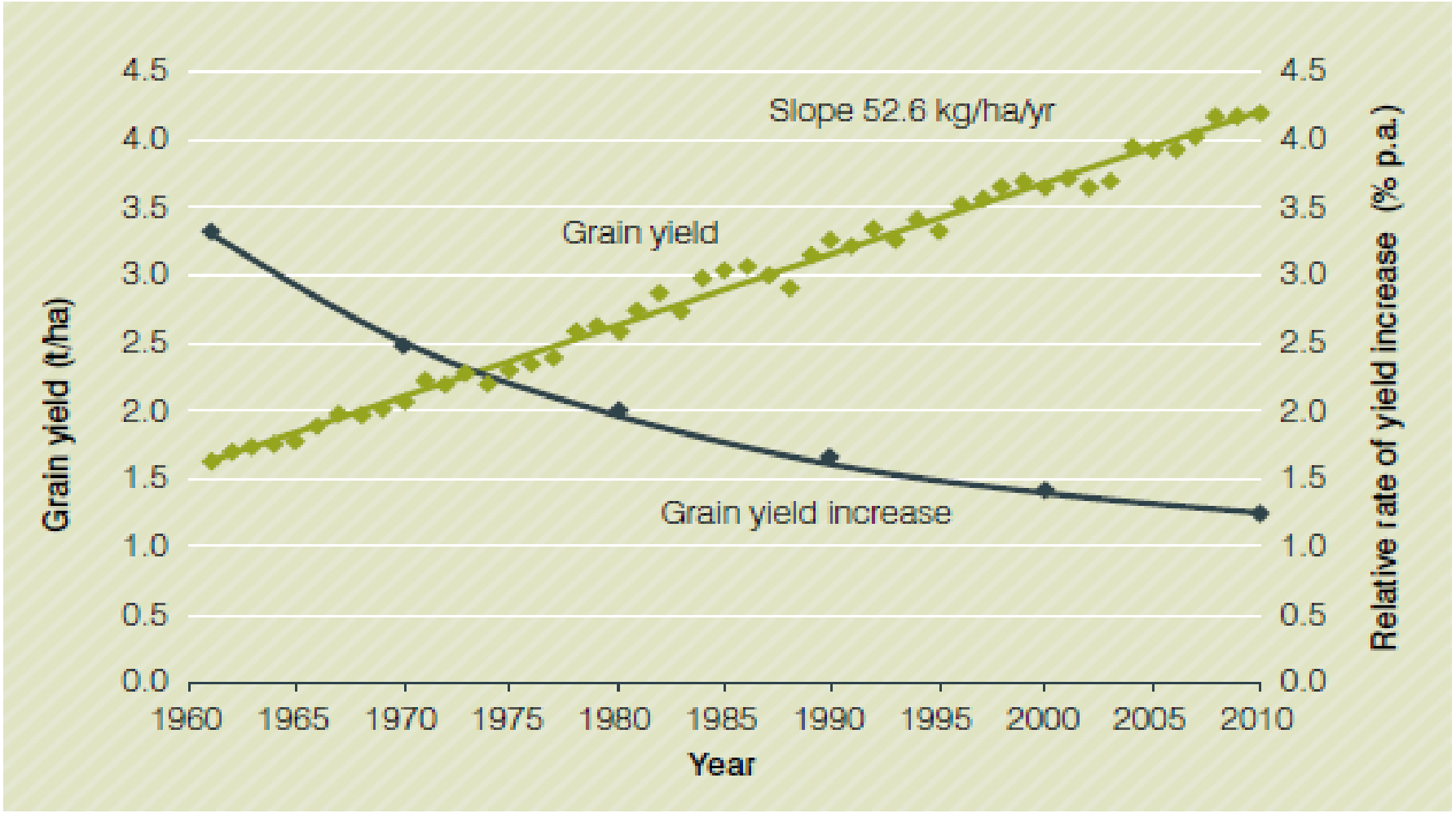
Green Revolution



- Negative impact on the environment: pollution, deforestation, degradation, desertification, soil erosion and salinsation, antibiotic resistance etc
- Monoculture depletes the land of its nutrients.

- Farm yields are approaching their economic upper limits in highly productive areas.
- In major irrigated wheat, rice, and maize systems, yields appear to be near 80% of the yield potential.

World Yield of Wheat, Rice and Maize and Annual Relative Rate of Yield Increase (1960 – 2010)



Source: FAOSTAT (2013)

Negative Impact of Inputs-Intensive Crop Production

Many systems of food production are unsustainable:

- Overuse of **chemicals and technology** inherent in the **high use of fossil fuel-derived energy** for synthesis of nitrogen fertilisers and pesticides
- Environmental pollution and human health issues
- **Excess use of fertilisers** with their run-off of nitrogen and phosphates damages water resources
- **Substantial quantities of greenhouse gases** and other pollutants contributing to climate change
- **Soil degradation** of intensive farming eroding the overall base of agriculture – history of earth abuse and soil erosion.
- Cropped areas increasingly advancing into marginal lands prone to erosion.
- Poorly designed and implemented irrigation systems that **cause water-logging, salinisation and alkalisation of soils**.
- Depleted commercial fisheries, endangered bird species and extinct insects that preyed on pests; and an **increase in insect-resistant pest species.**

Source: www.unep.org/geo/geo4/report/03_land.pdf

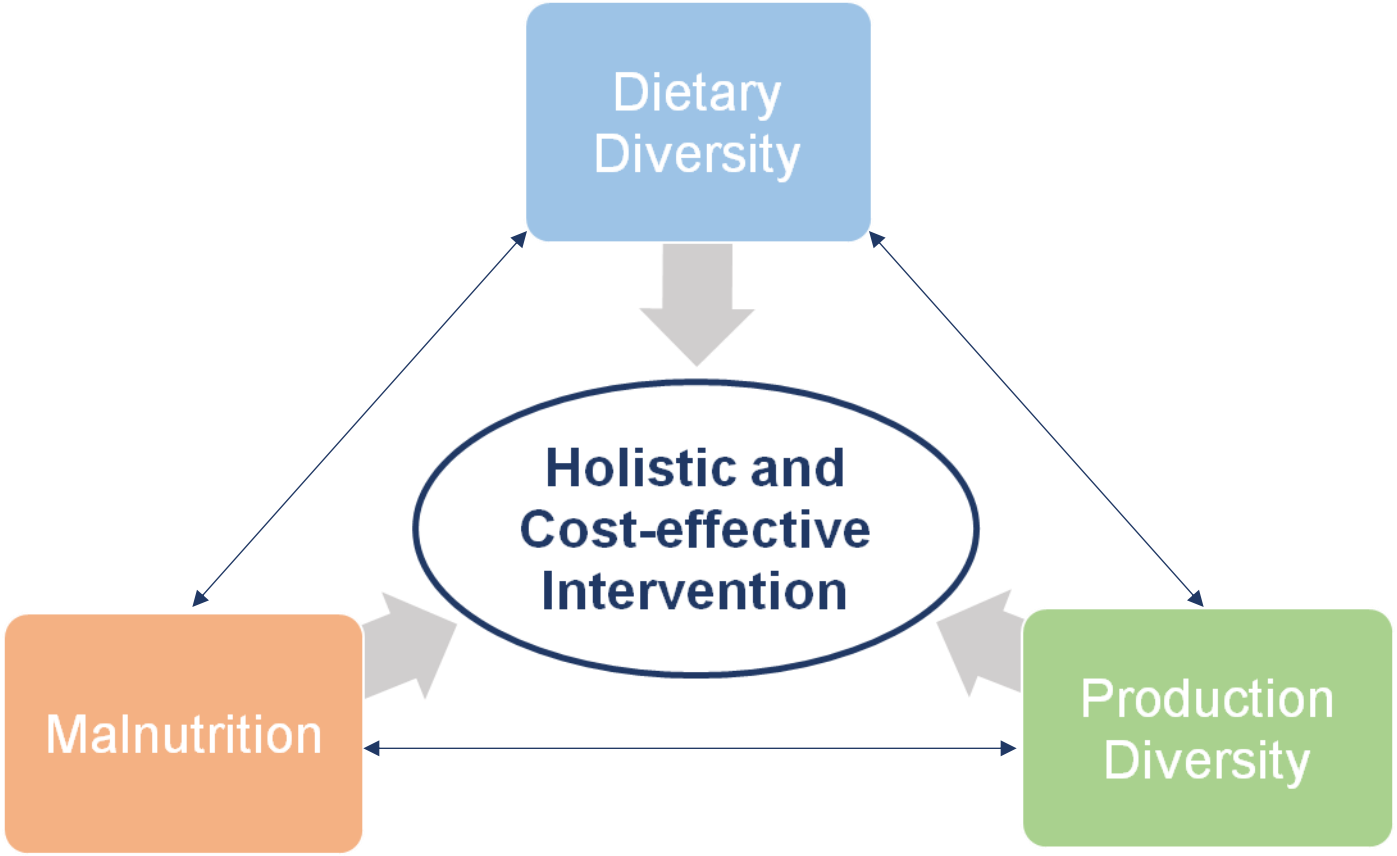
Potential Availability of Uncultivated Land Around 2010 in Different World Regions with Suitability to Crop Production

World region	Current cropland area (Mha)	Uncultivated area suited to crop production (Mha)[a]
Sub-Saharan Africa	221	201
Latin America and Caribbean	164	123
Eastern Europe and Central Asia	254	52
East and South Asia	454	15
Middle East and northern Africa	97	3
Rest of world	360	52
(of which, Australia)	(46)[b]	(26)[b]
World total	**1,550**	**446**

Source: Deininger and Byerlee (2011)

2.2.2 Disconnect in Food System

Gaps: Disconnect between malnutrition, dietary diversity and production diversity



A leading cause of persistent malnutrition is poor dietary diversity (poor quality and variety of food in the diet).

Low Dietary Diversity

Food supply in g per capita per day for a standard person of 70 kg body weight (2,000 kcal)

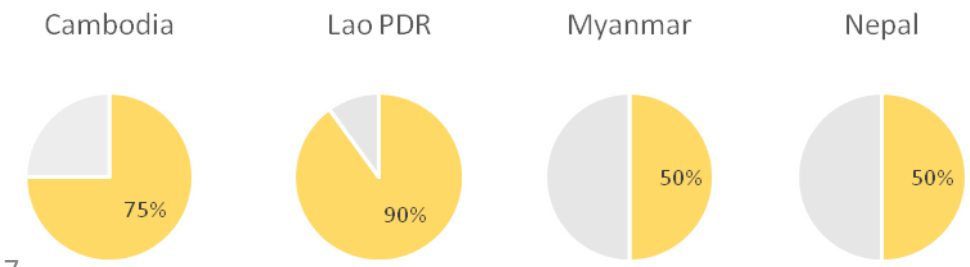
Commodities	Cambodia 2011	Lao PDR 2011	Myanmar 2013	Nepal 2013	*Recommended daily intake [g]*	
Cereals	475	489	397	529	300-500	overreliance on very few cereals (mainly rice)
Roots and tubers	88	122	59	234		
Pulses and legumes	14	8	38	35	50-150	
Animal source foods (meat, fish, eggs)	146	110	278	49		
Dairy	7	8	86	143	250-350	
Fats and oils	27	19	59	34	15-30	
Vegetables	106	367	223	313	>400	consumption of vegetables and fruits remains low
Fruits	70	187	108	168		

Source: FAOSTAT (DGE 2004; FAO 1997; USDA/USDHHS)

Low Production Diversity

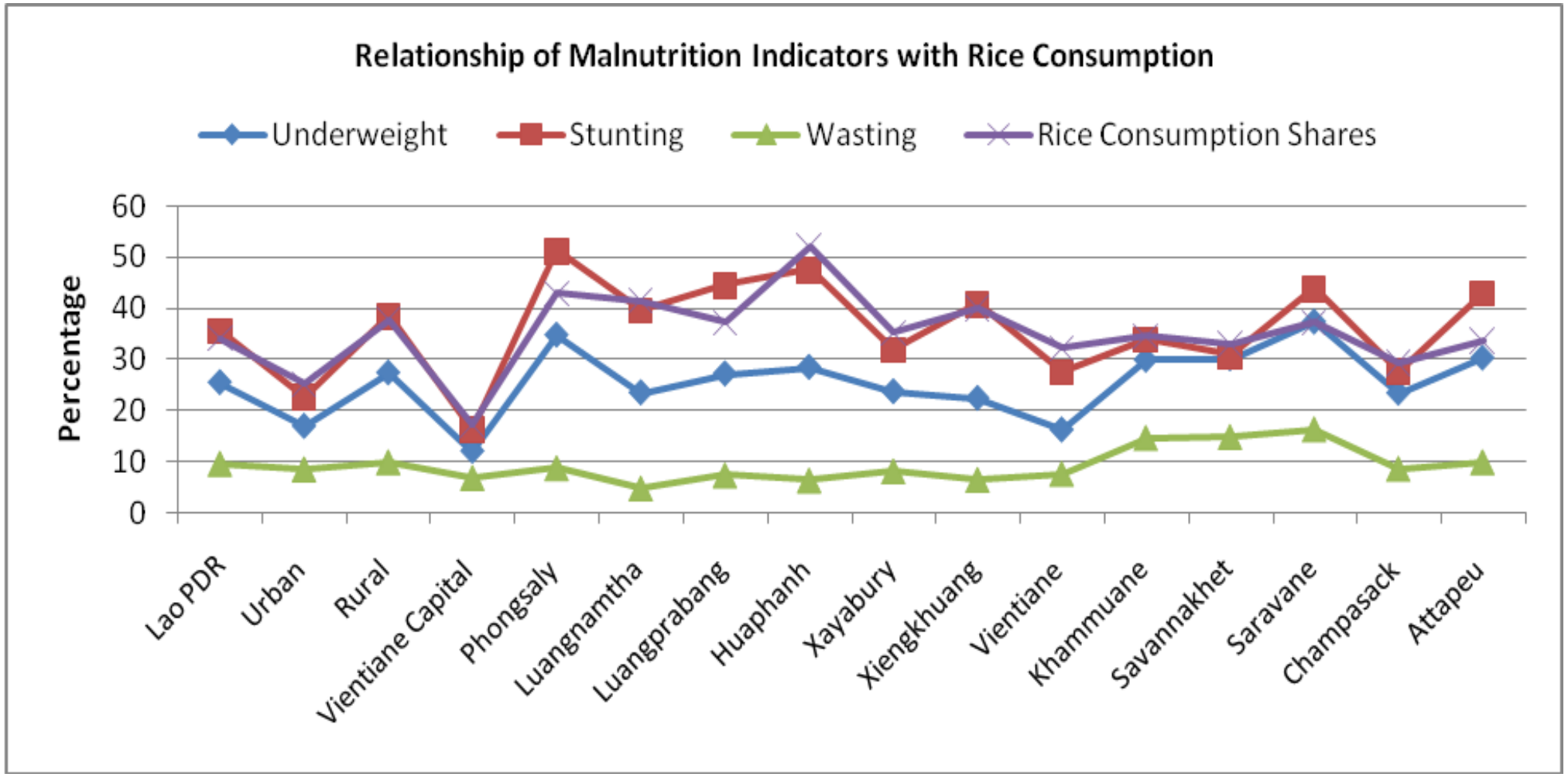
Myanmar 2012		Nepal 2012		Lao PDR 2012		Cambodia 2012	
Commodities	*Production (MT)*	*Commodities*	*Production (MT)*	*Commodities*	*Production (MT)*	*Commodities*	*Production (MT)*
Rice, paddy	28 080 000	**Rice, paddy**	5 072 248	**Rice, paddy**	3 489 210	**Rice, paddy**	9 290 940
Sugar cane	10 000 000	**Vegetables**	3 298 816	**Maize**	1 125 485	**Cassava**	7 613 697
Vegetables	4 000 000	**Sugar cane**	2 930 047	**Cassava**	1 060 880	**Maize**	950 909
Beans, dry	3 900 000	**Potatoes**	2 584 301	**Sugar cane**	1 055 675	**Vegetables**	628 000
Maize	1 500 000	**Maize**	2 179 414	**Vegetables**	910 085	**Sugar cane**	573 771

Total of agricultural households growing rice [%]



Monoculture

Correlation: Malnutrition and Rice Consumption in Lao PDR



Source: FAOSTAT

Features in Current Agrifood System

- Input-intensive production mode unsustainable
- Disconnect of malnutrition, dietary and production diversity

III. Global Trends and Challenges: Implication on Agrifood Systems

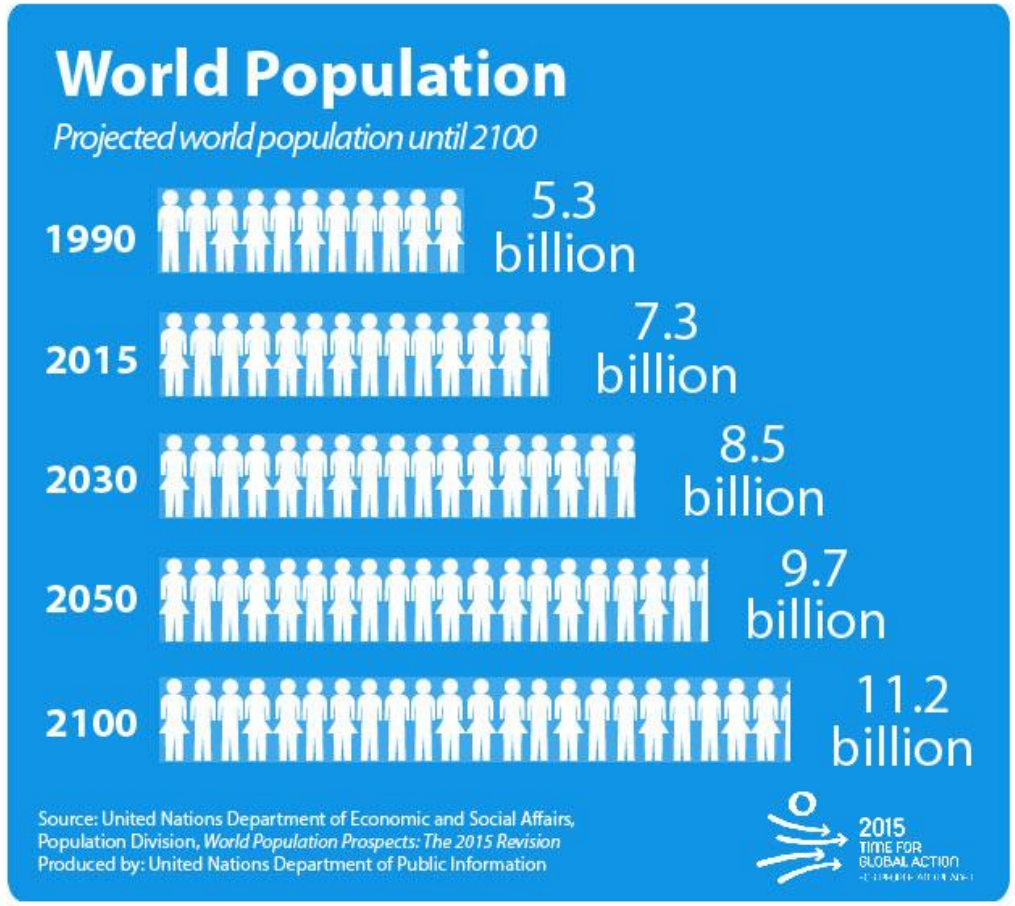
3.1 Global Trends: Growing Demand

3.2 Global Challenges: Supply Constrains

3.3. Implications

3.1 Global Trends: Growing Demand

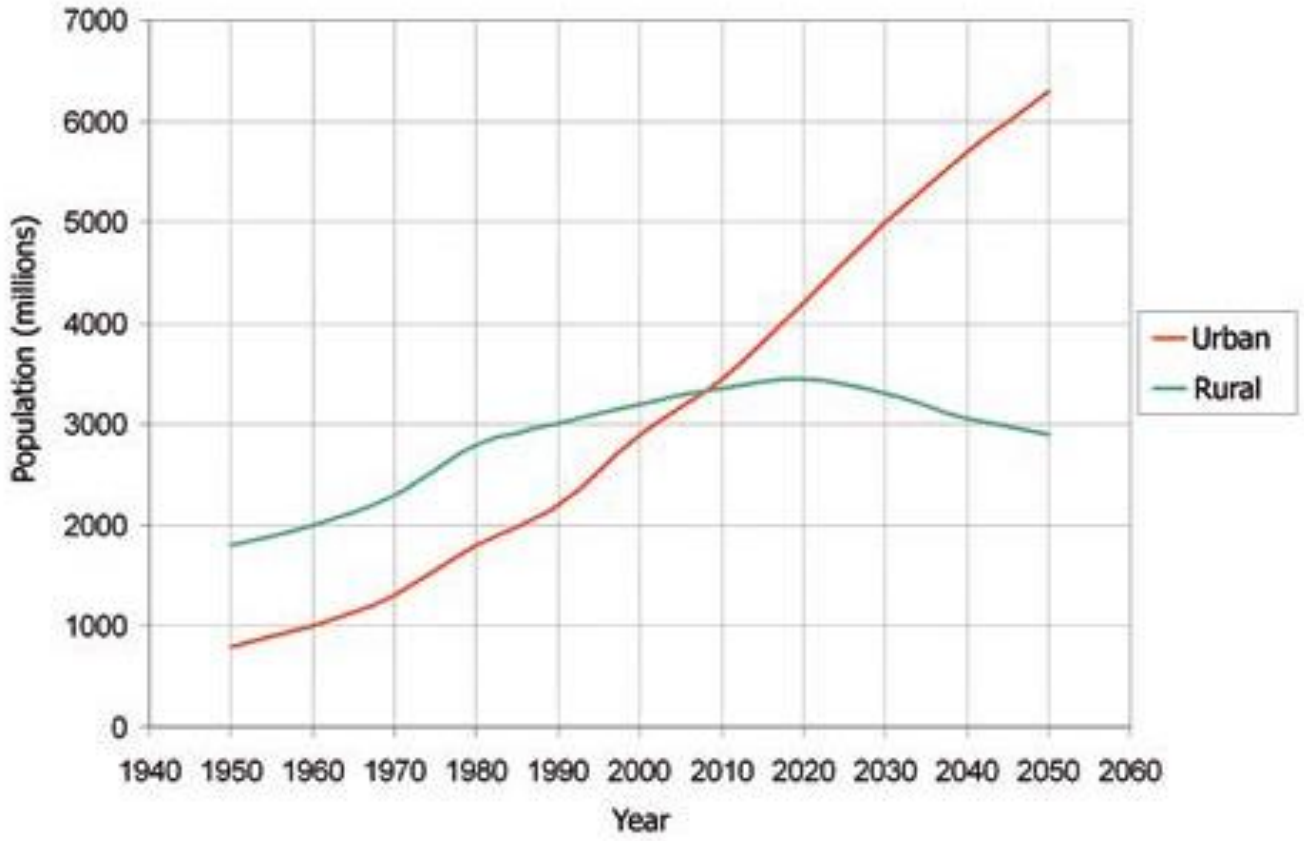
Population Growth



Implication:

- A 30% increase in global population would require a 60-70% increase in production to feed a projected 9.7 billion in 2050.
- Competition for increasingly scarce land, water and energy resources will intensify.

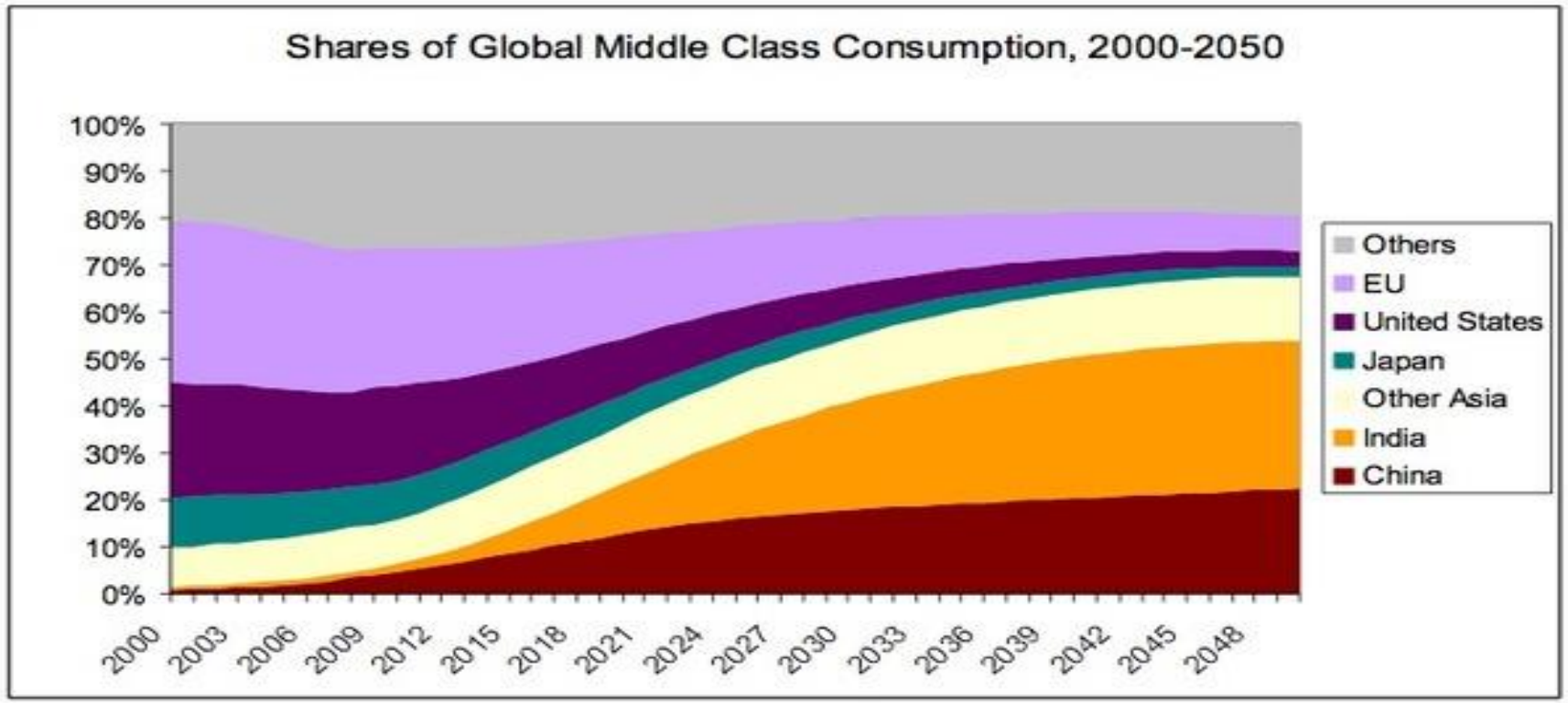
Urbanisation



Source: Oxfam (2014)

Rising Income

- Rising income leads to changing dietary patterns towards other cereals than rice, more meat and dairy products



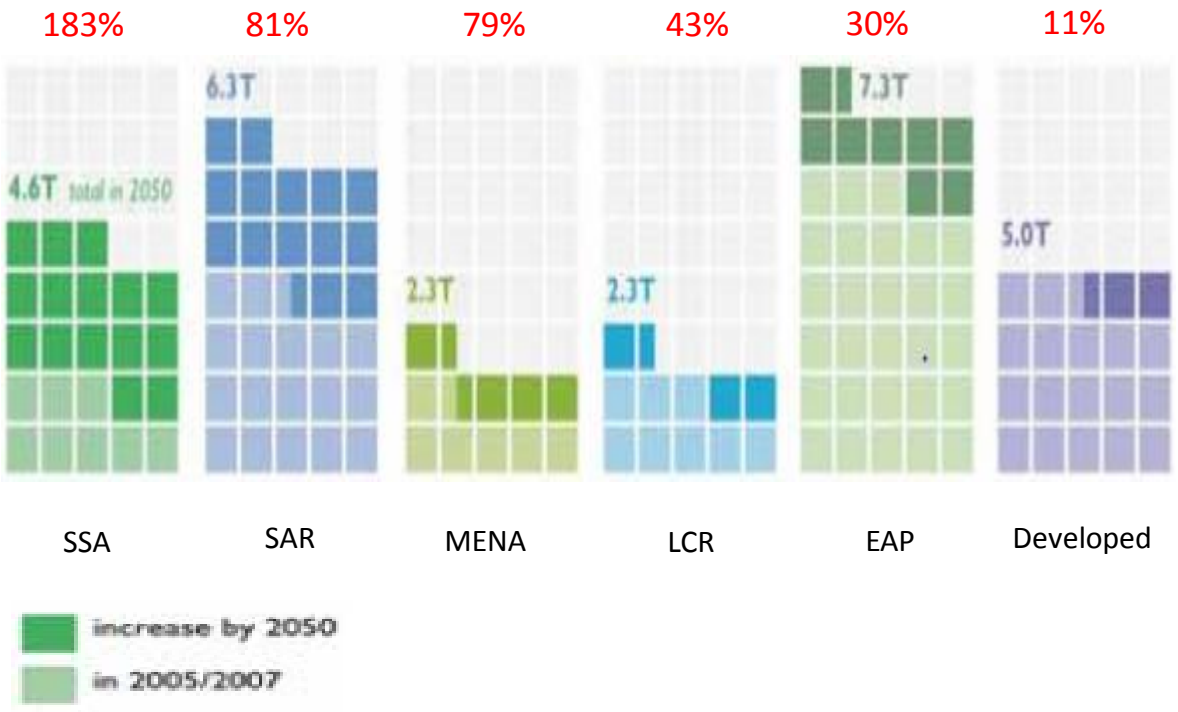
Growth in AG commodity demand toward 2050…

How to Feed 9 Billion People in 2050

Changing Consumption

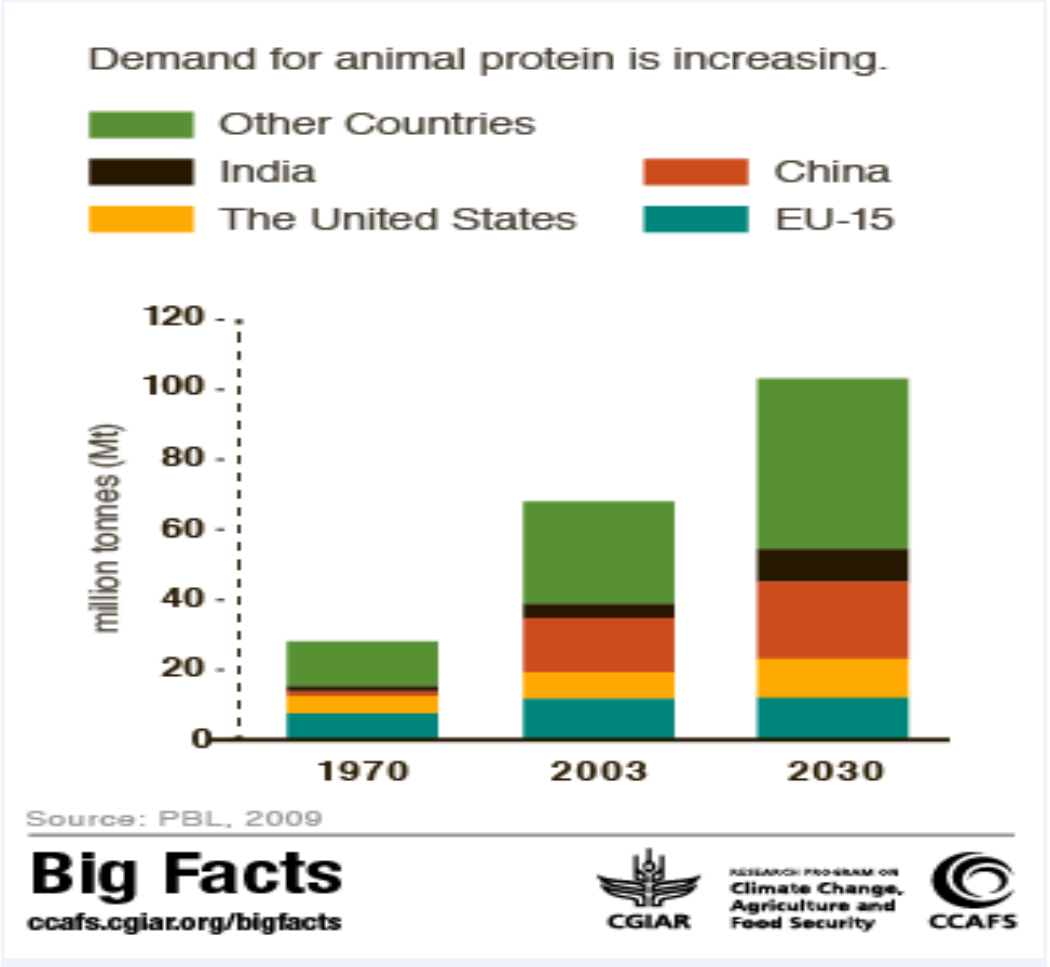
Food Consumption by Region 2005/07 vs 2050

Percentage Increase 05/07 – 2050



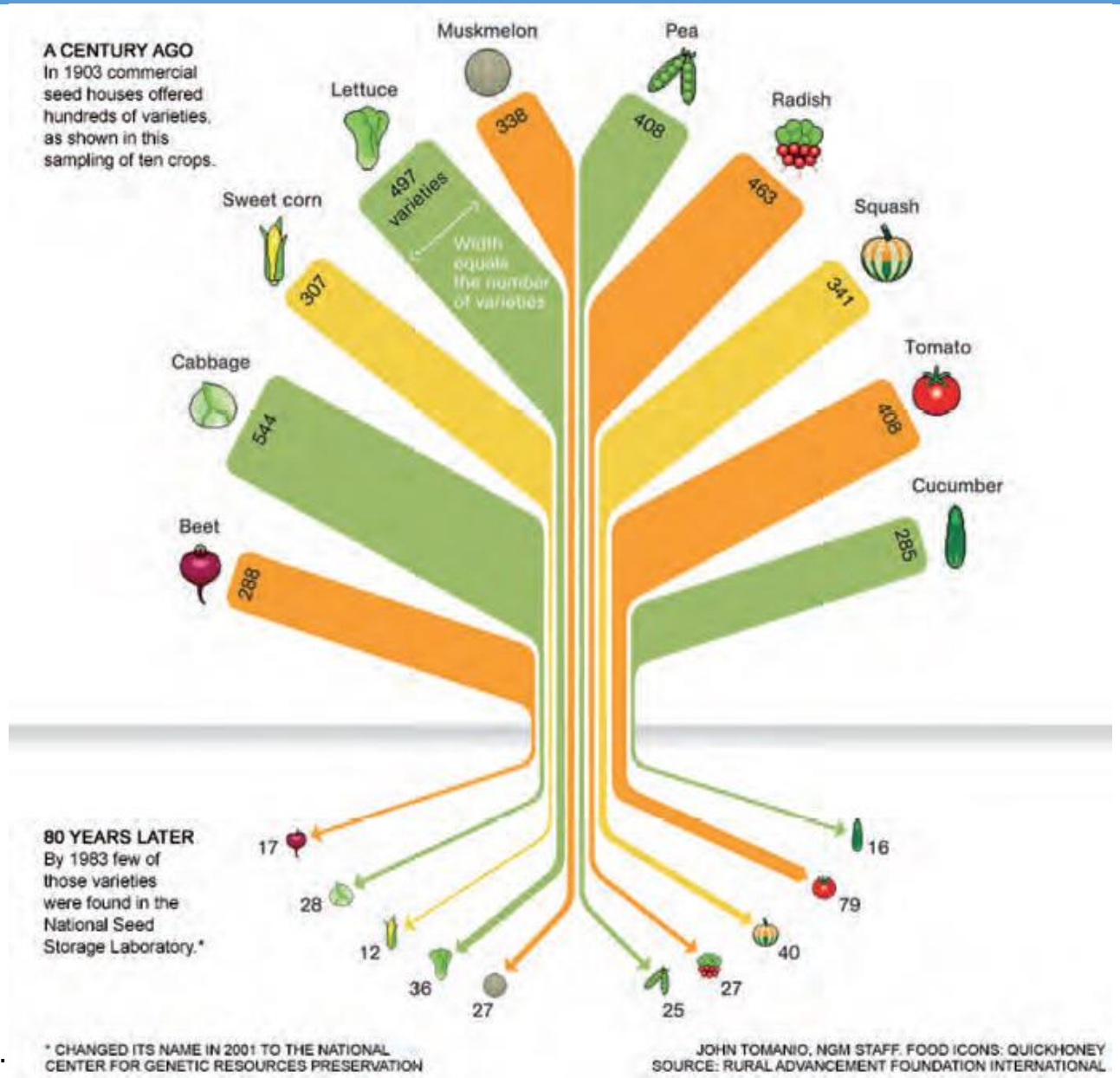
CEA 2013 based on FAO 2012, CCAFS 2015

Changing Diets



3.2 Global Challenges: Supply Constrains

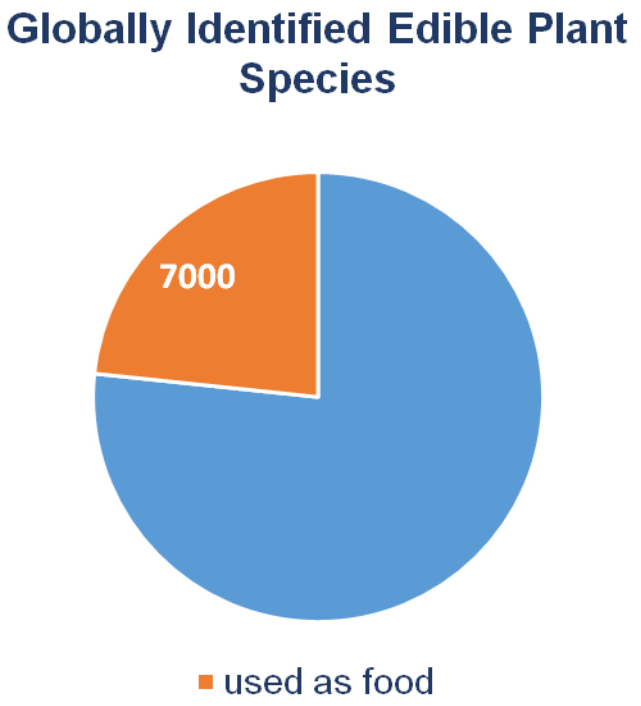
3.2.1. Declining Agricultural Diversity

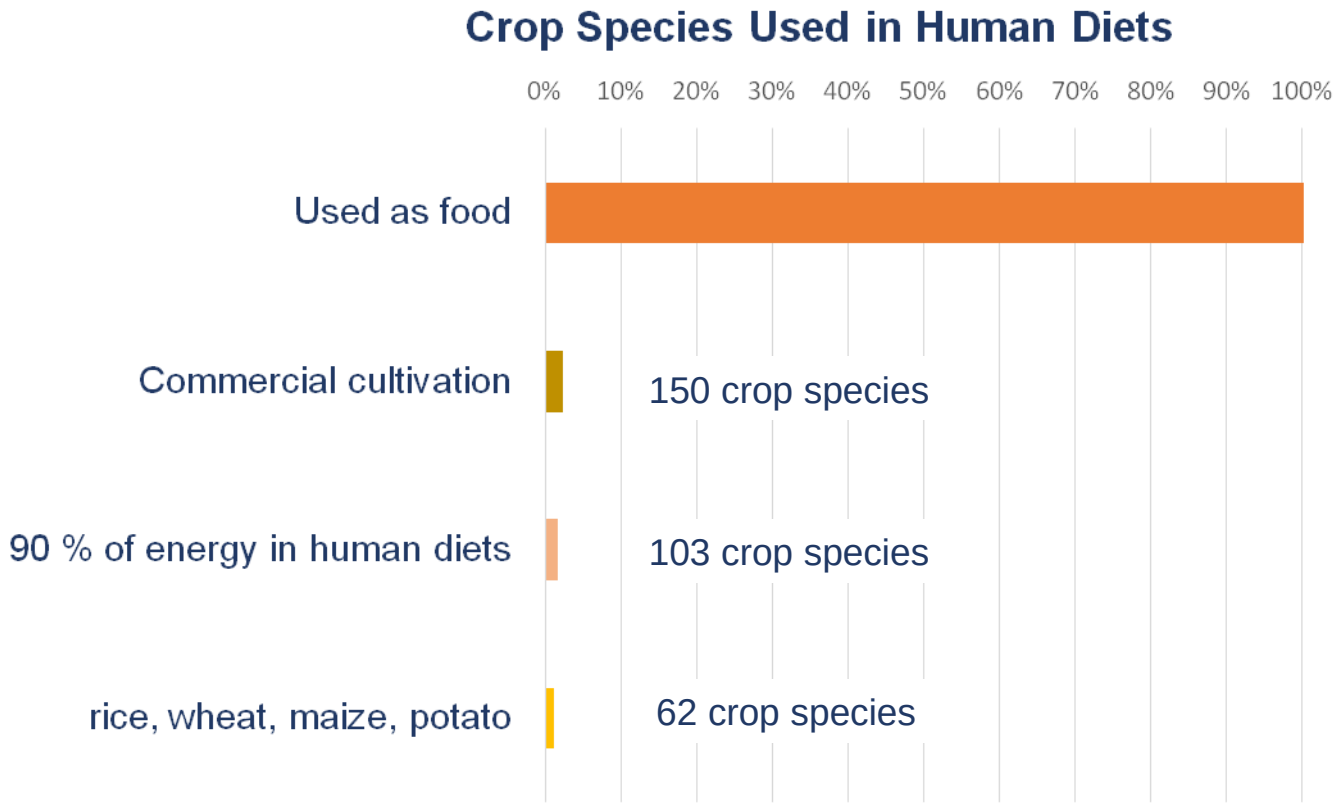


Source: NGM.com using RAFI data.

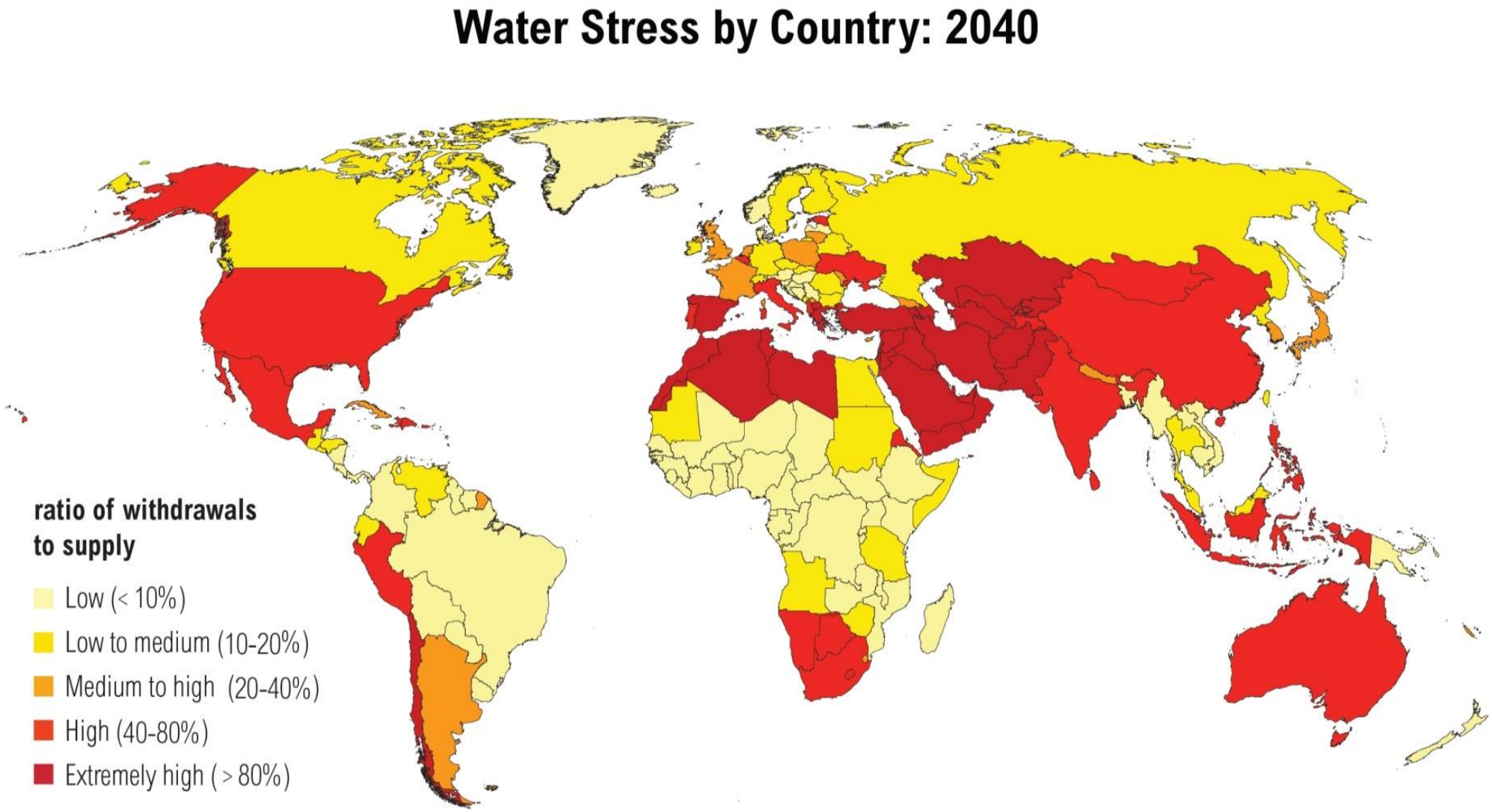
Over-Reliance on Staple Crop

30,000 edible plant species have been identified globally, of which 7,000 crop species have been used as food.



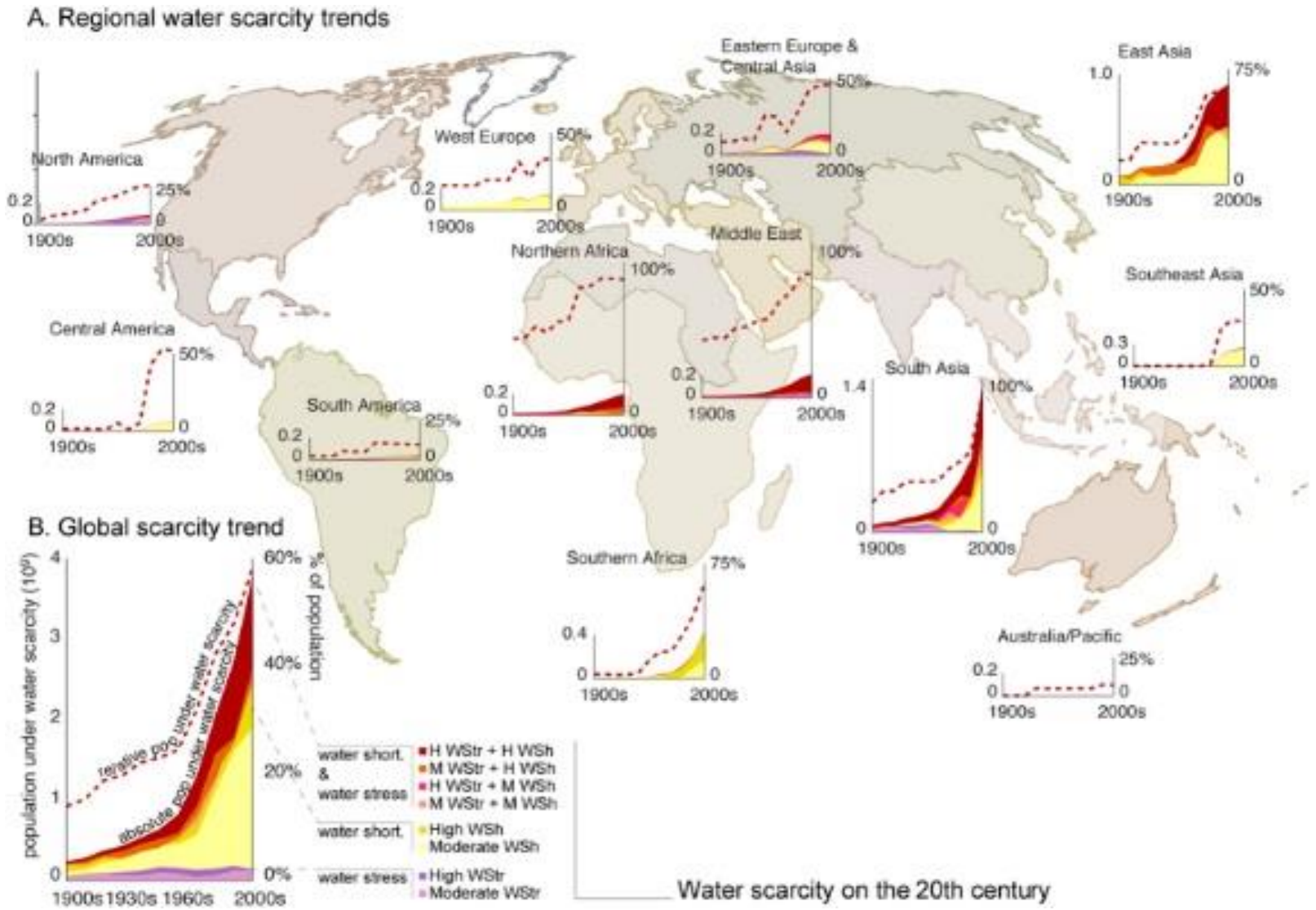


3.2.2 Water Stress



Sources: FAO (2016), World Resources Institute (2015)

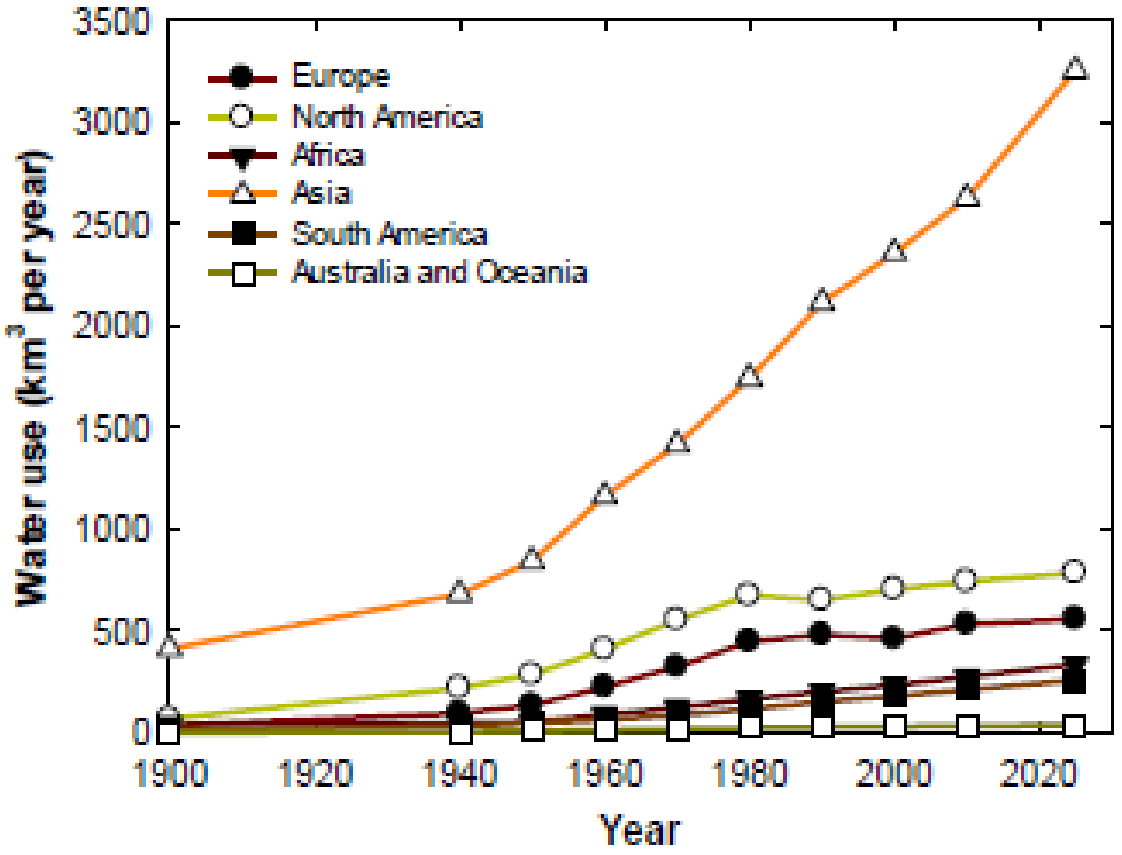
Asia: Regional Water Scarcity Trends

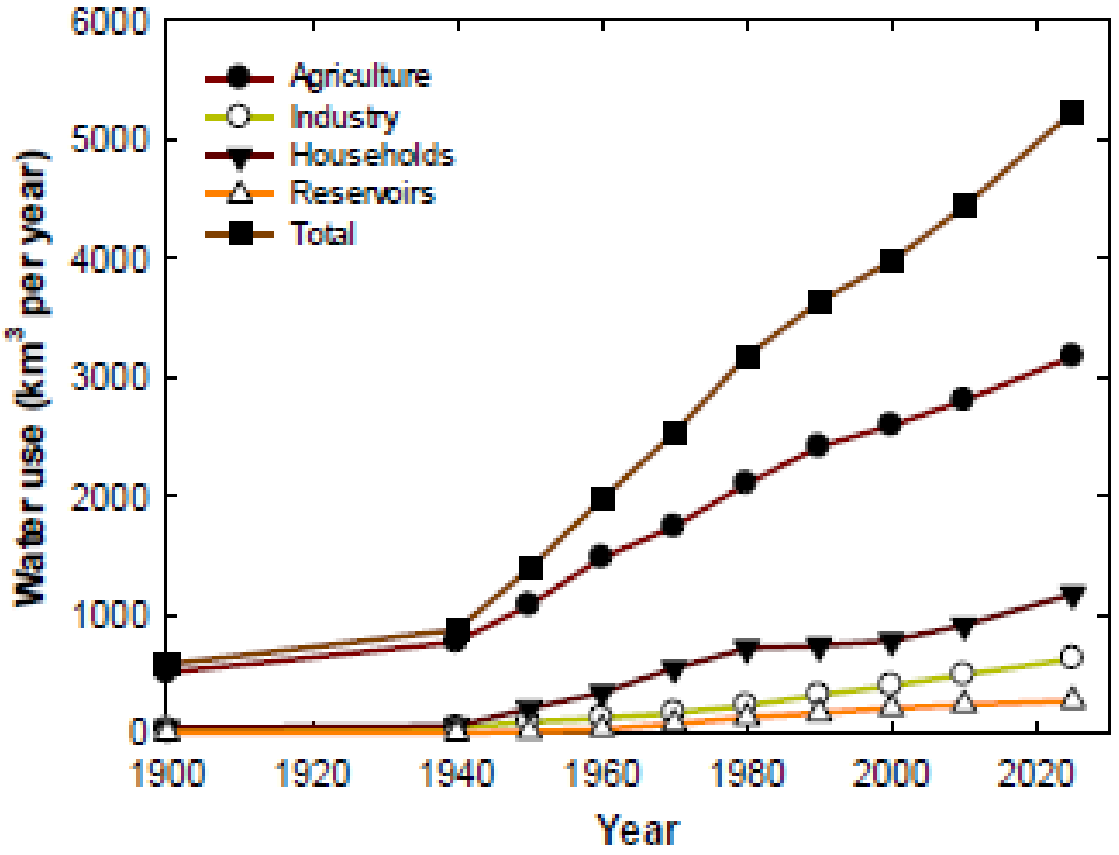


Source: FAO (2016), World Resources Institute (2015)

Low Water Efficiency

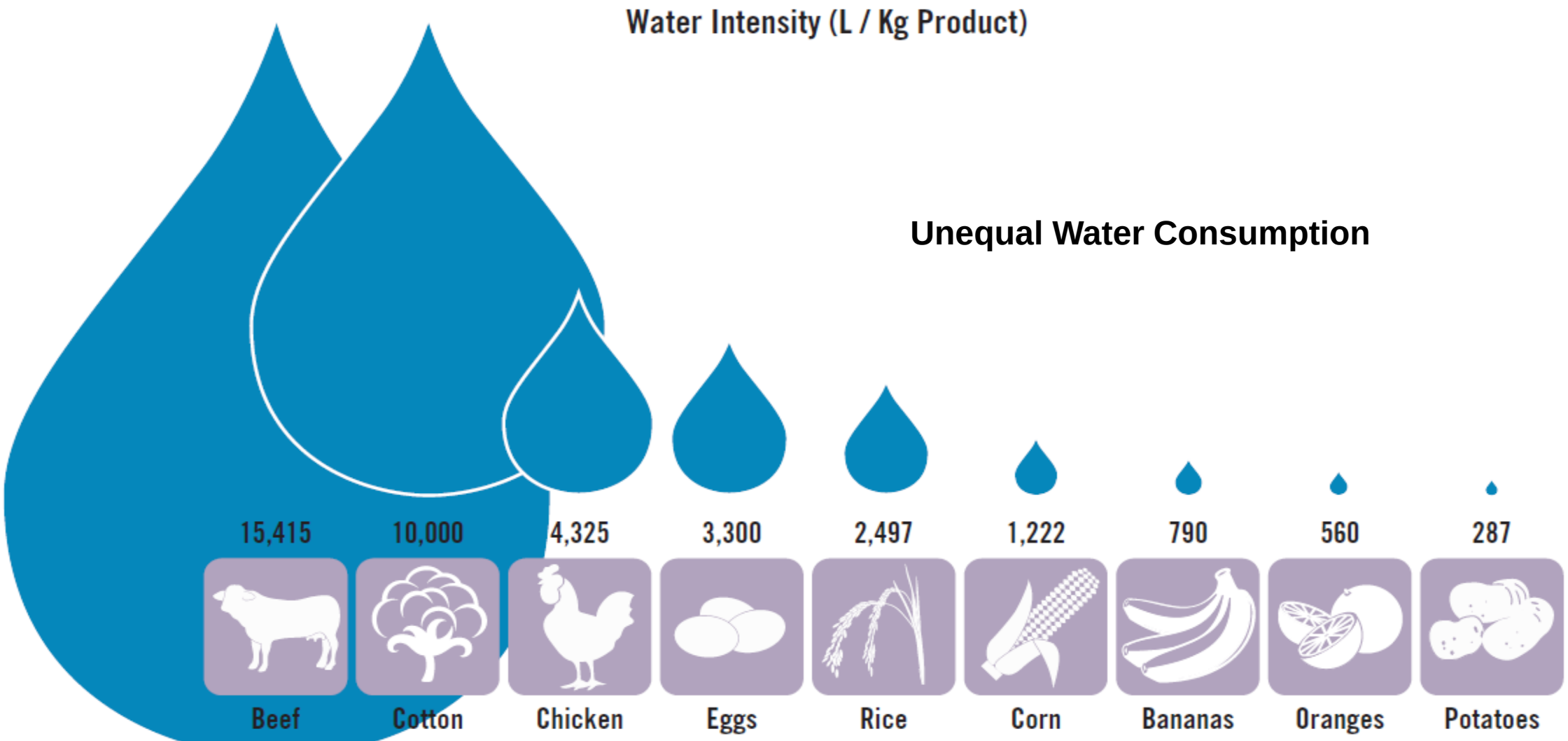
Global Freshwater Use by Regions and Sectors





Source: UNESCO, I. Shiklomanov

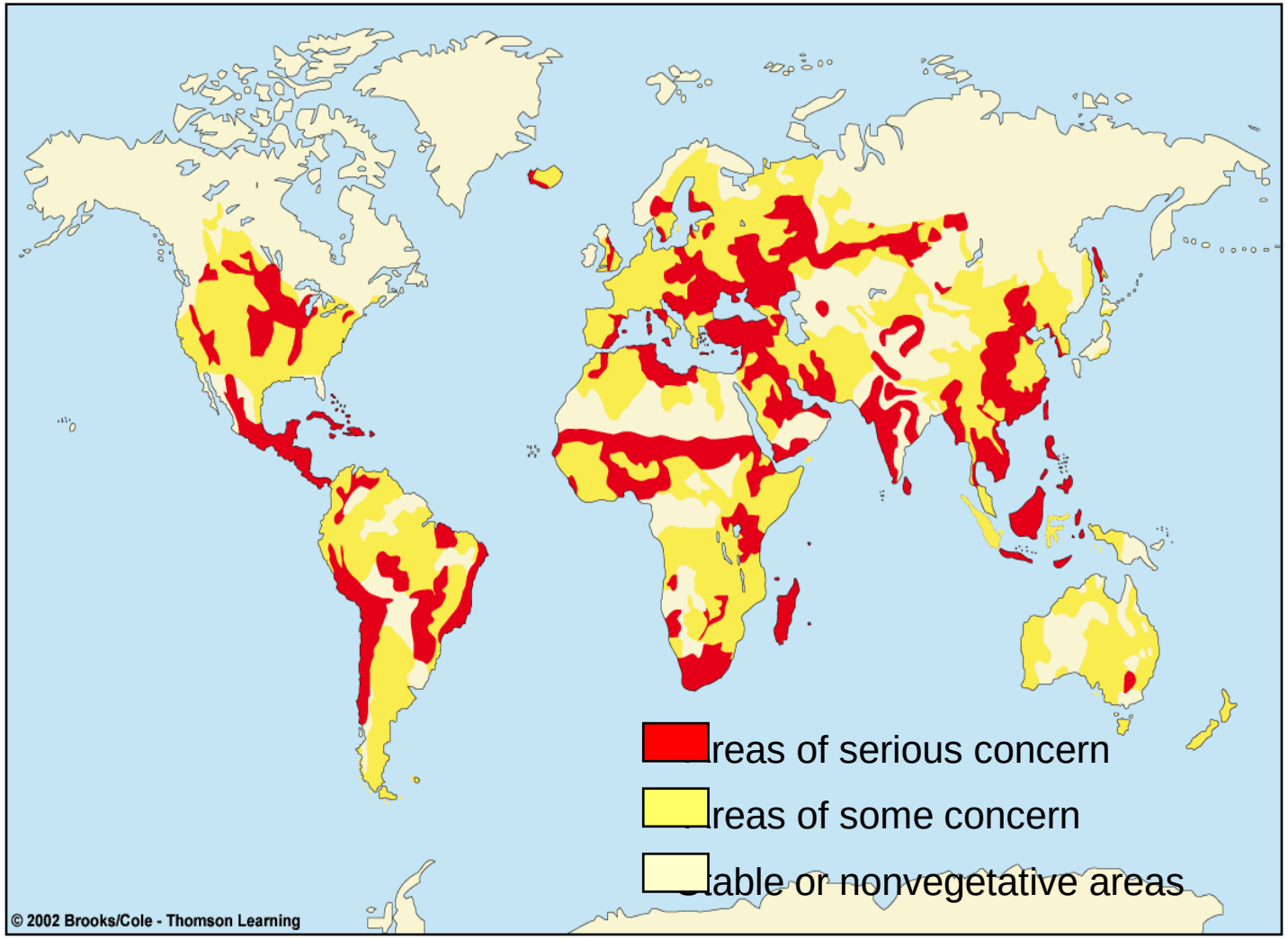
Water Intensity

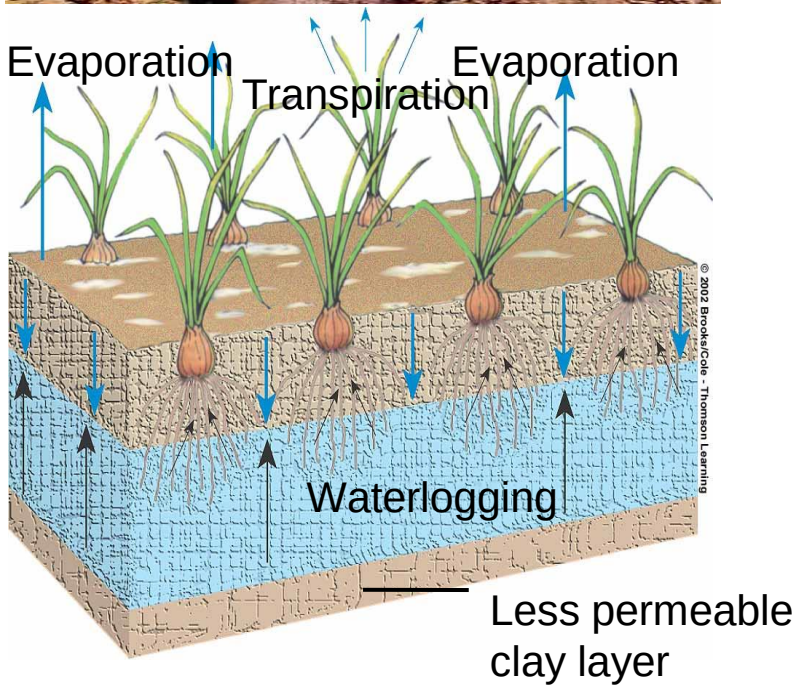


Unequal Water Consumption

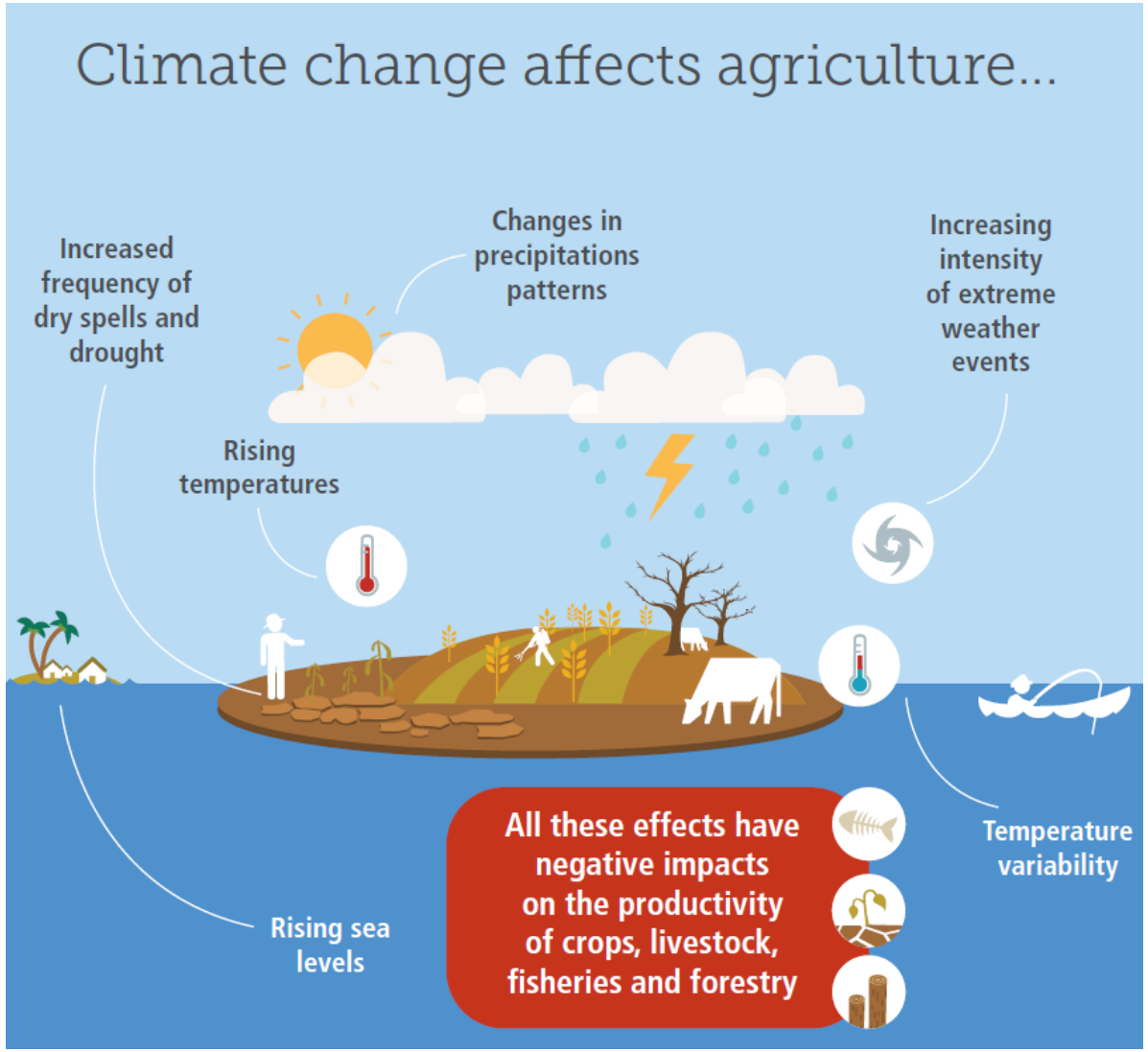
Source: Water Footprint Product Gallery, Water footprint Network, http://www.waterfootprint.org/?page=files/productgallery

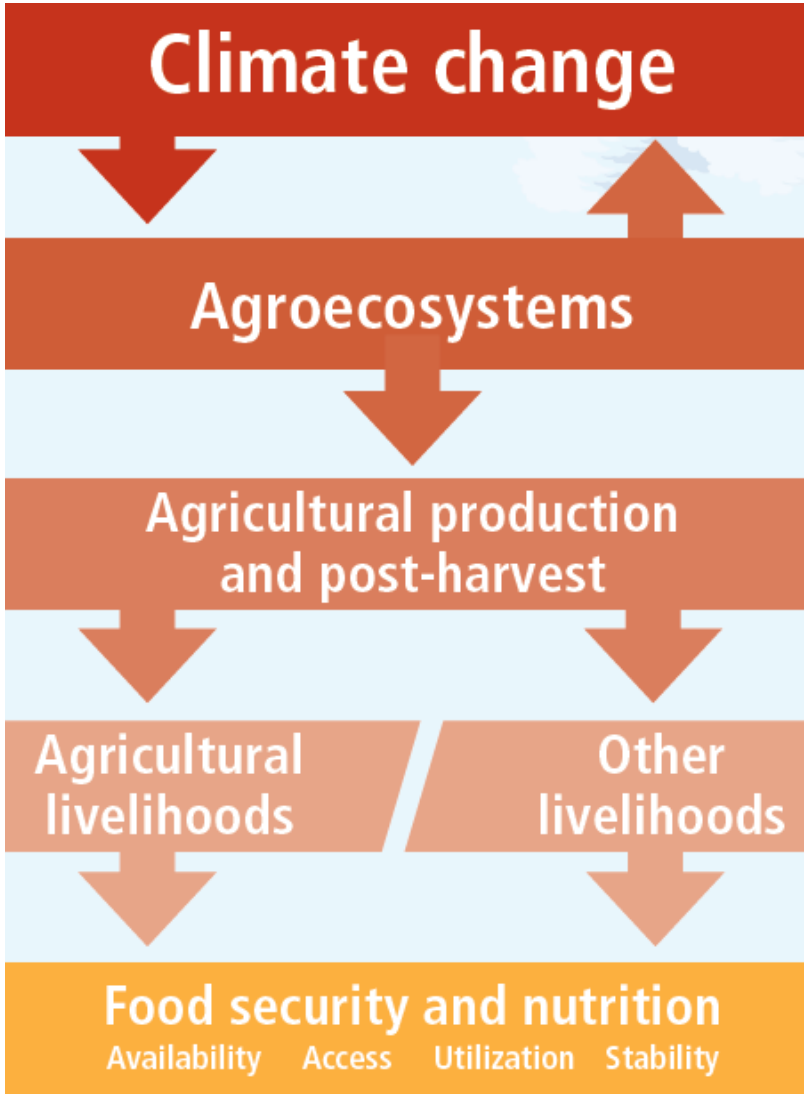
3.2.3 Global Soil Erosion and Degradation





3.2.4. Climate Change

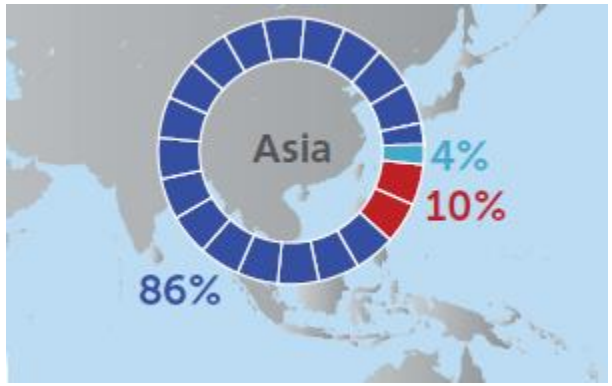




Source: FAO (2016)

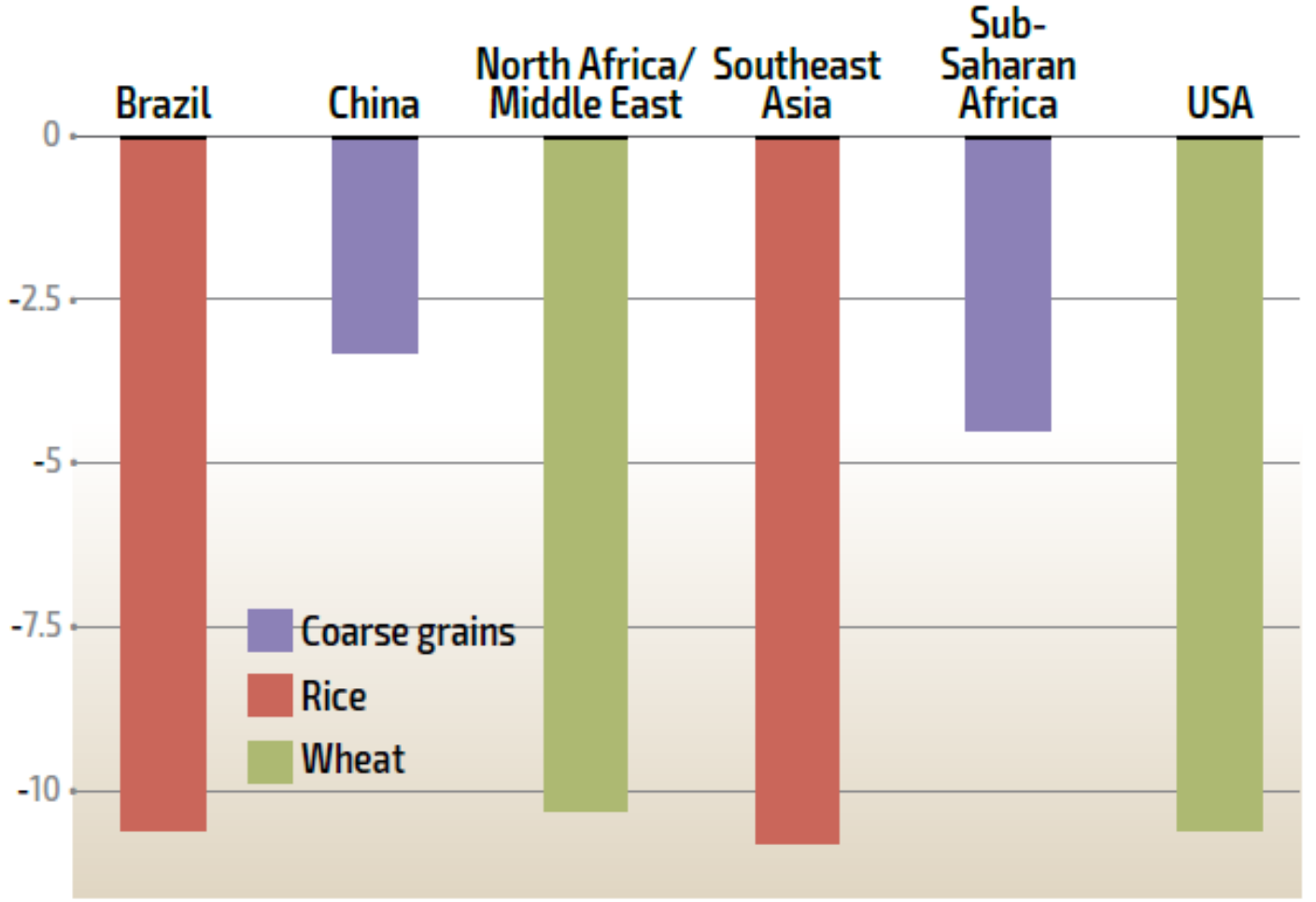
Projected Climate Change impact on Cereal Yield (2050)

Between 2003-2013, Asia was mainly affected by floods.



Relative to baseline values in 2050 without climate change; average result of
three general circulation models
Source: FAO

Projected declines in cereal yields owing to climate change in 2050, without adaptation (%)*

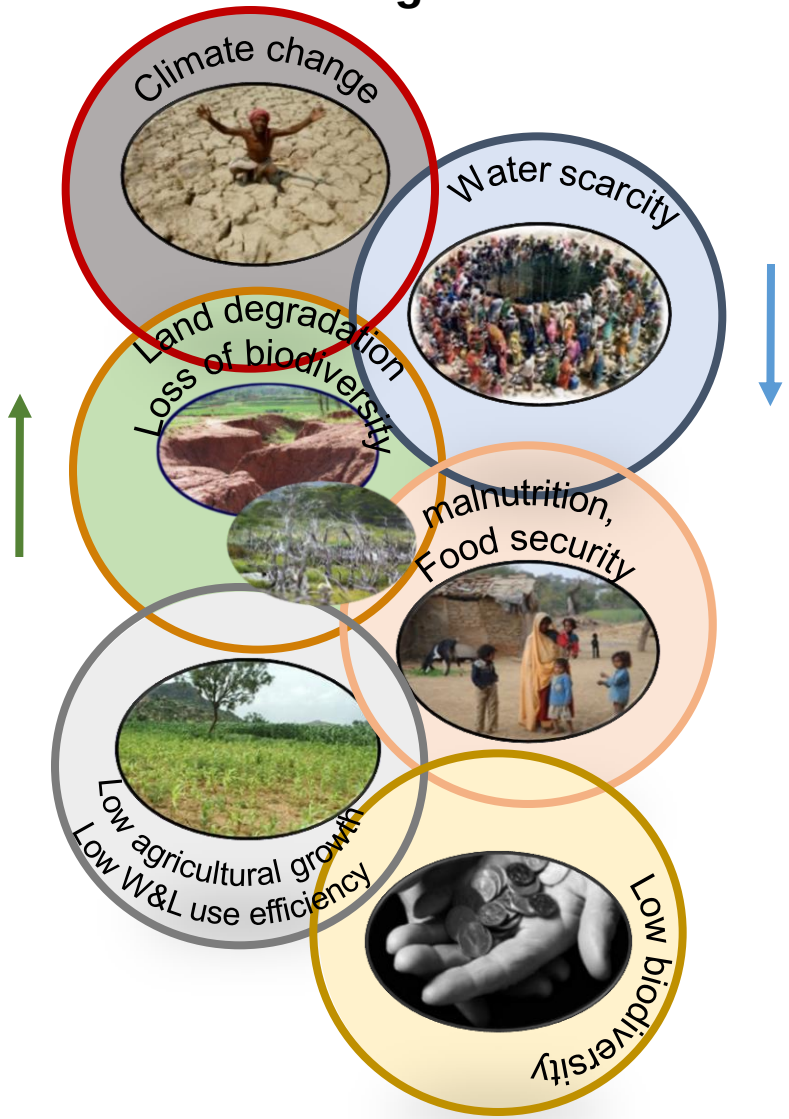


* Relative to baseline values in 2050 without climate change; average result of three general circulation models

3.3 Implications

Implications

Challenges



A Resource-hungry Food System

- World population growth to 9.7 billion in 2050, and growing incomes, pose unprecedented challenges to food systems
- Huge production gaps (To provide enough food – both in quantity and quality; and meet nutritional needs for all)
- Growth in food production must be accommodated within the growing scarcity of natural resources and Planetary boundaries
- Conserving the natural resource base (land, water, plant and animal genetic resources) to produce food for present and future generations
- How can the trade-offs between providing food for the 2050 population and environmental impacts be minimized?

Productivity Gap

• Doubling yields in 2050 – require annual yield growth rates of more than 1.7%.

• Crop yield or partial factor productivities of land, water, fertilizer, and labor not promising: During the 1989-2008 period global yield growth rates maize (1.6%), rice (1.0%), wheat (0.9%) and soybean (1.3%) -- insufficient for meeting future food demand without having to convert a lot more land into agriculture.

• Farm yields are approaching economic upper limits in highly productive areas. In major irrigated wheat, rice, and maize systems, yields appear to be near 80% of the yield potential.

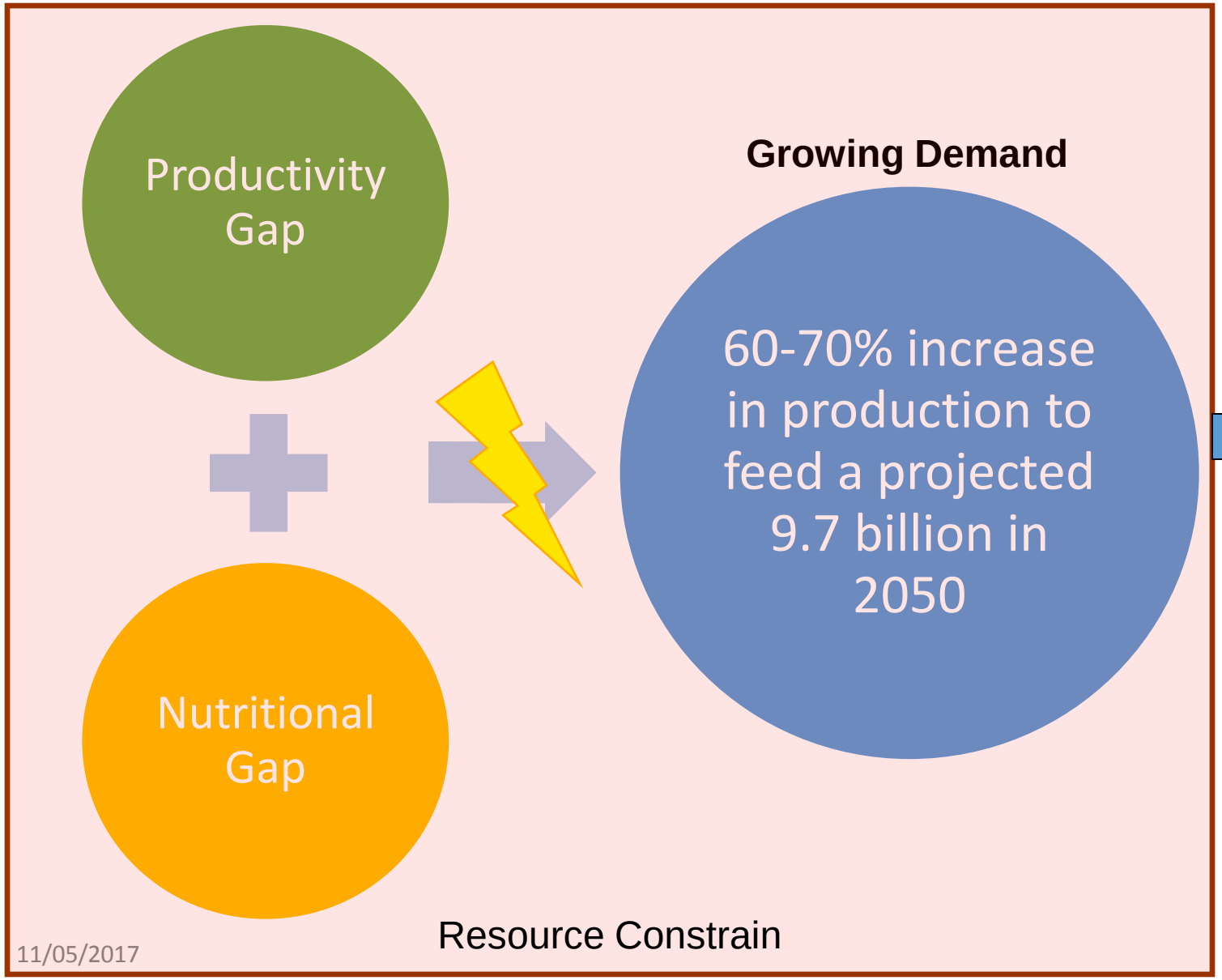
Nutrition Gap

•Increasing production of staple crops is not enough to accelerate reductions in malnutrition.

• “Nutrition gap”: the gap between what foods are grown and available and what foods are needed for a healthy diet. It requires increasing availability and access to the foods necessary for a healthy diet.

• Insufficient supply of nutrient-rich foods

Gaps in the Current Agrifood Systems



Paradigm shift required

IV. Solutions: Towards Sustainable Agrifood Systems

4.1 Production

4.2 Consumption

4.3 Market

Strategies to Promote Sustainable Agrifood Systems

Market

Production = Supply

Consumption = Demand

Market

- Increase productivity through higher resource use efficiency and innovative technologies
- Diversification of existent cropping systems: Create incentives to produce additional crops next to rice
- Manage food loss

- Raise nutrition awareness
- School Feeding/School Meal Programmes
- Save Food Initiative

Sustainable Food and Agriculture

Five Principles

1. Improved resource use efficiency
2. Direct action to conserve, protect and enhance natural resources
3. Ban on agriculture that fails to protect and improve rural livelihoods and social well-being
4. Enhanced resilience of people, communities and ecosystems
5. Responsible and effective governance mechanisms

4.1 Production

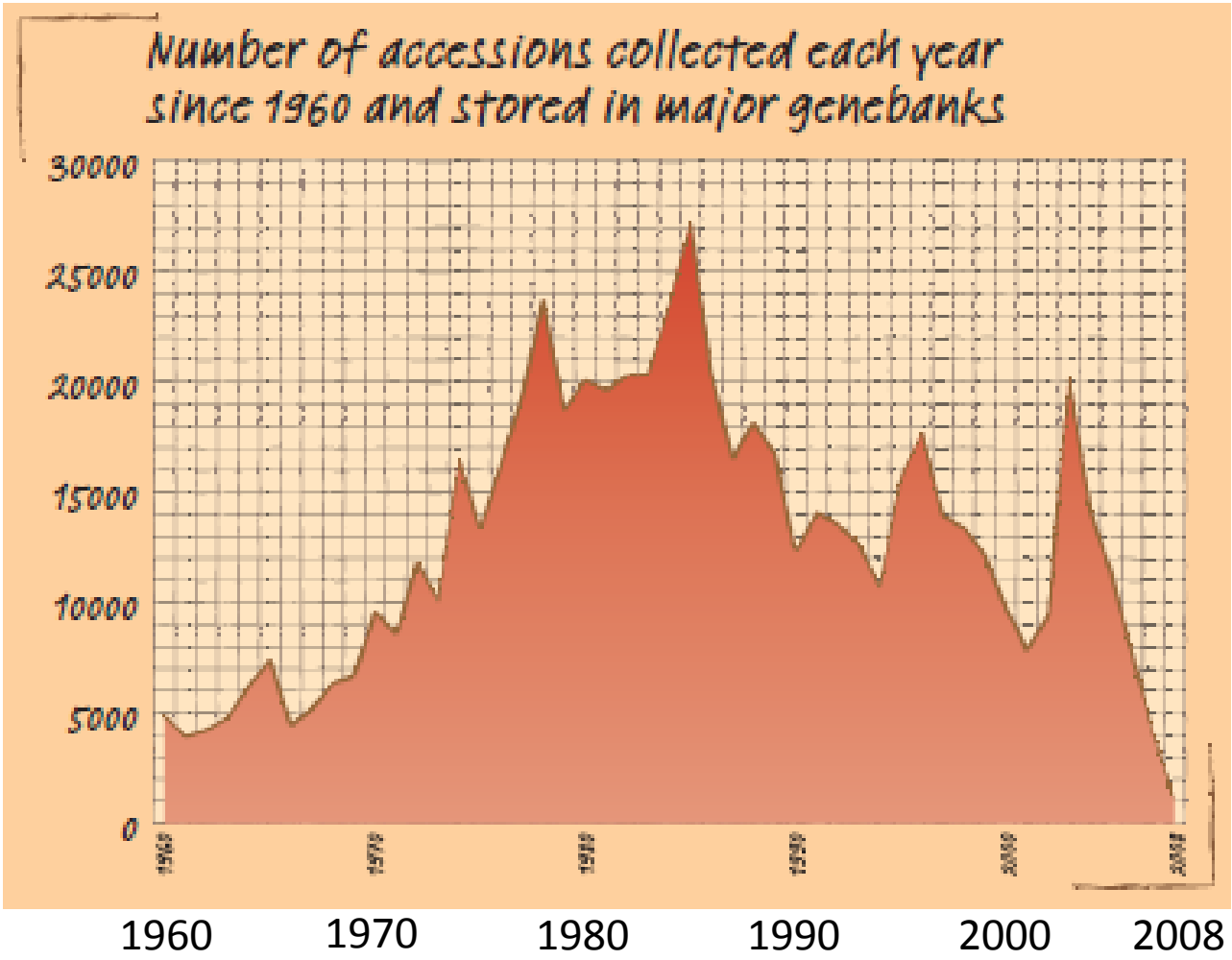
4.1.1 Technologies that Save and Grow

Improved crops and varieties

•Strengthen collection and conservation of improved plant germplasm

•Develop strong plant breeding programmes and seed delivery

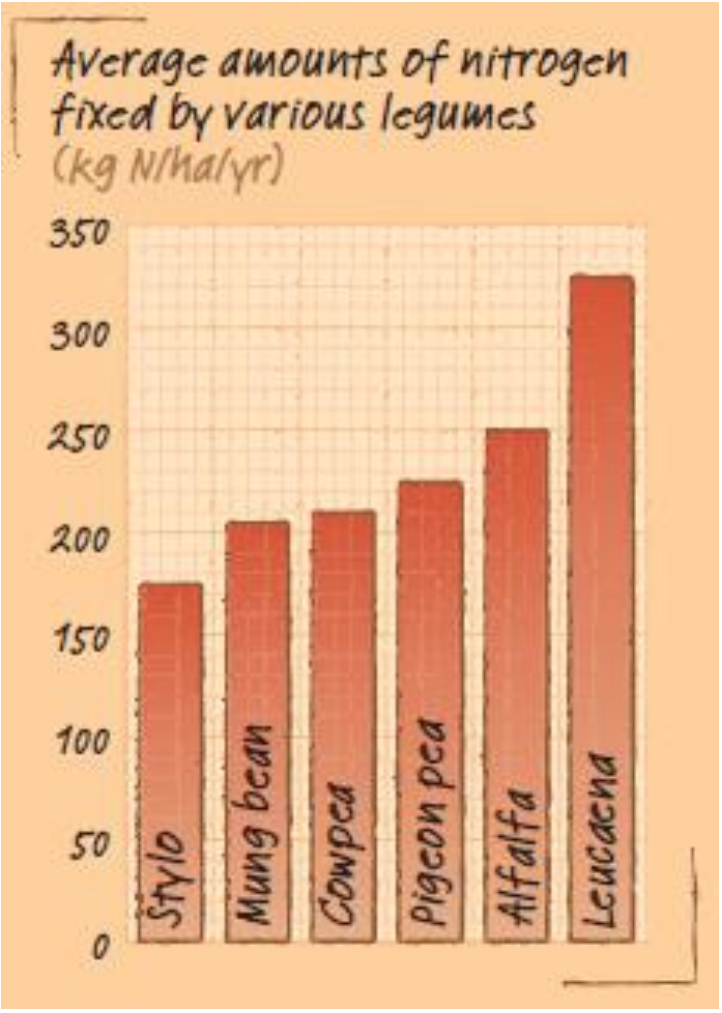
•Promote policies that help to link formal and farmer-saved seed systems, and foster the emergence of local seed enterprises



Technologies that Save and Grow

Promote soil health

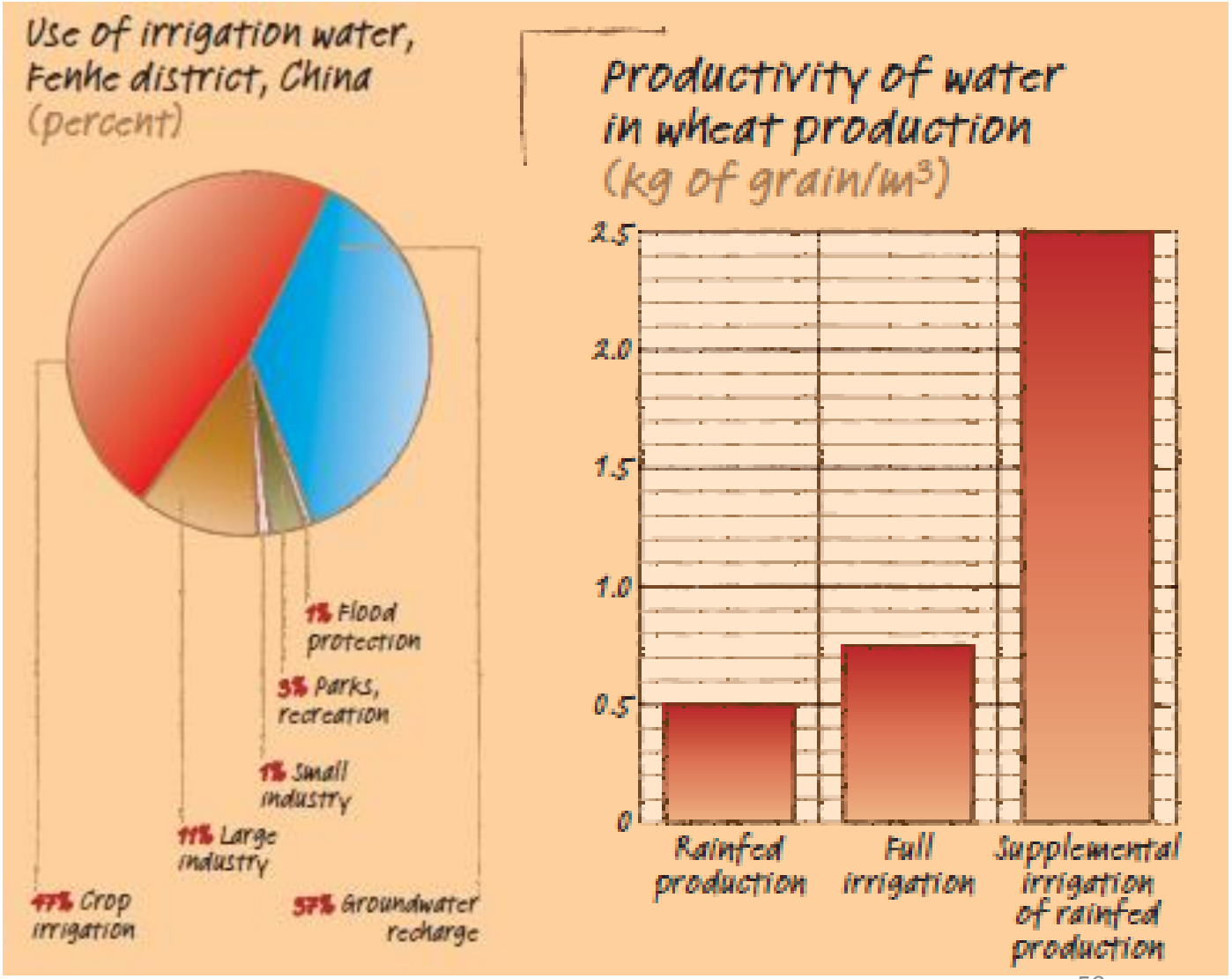
- Reduce use and cost of mineral fertilizers
- Apply a mix of both mineral fertilizers and natural sources (manure, nitrogen-fixing crops and trees)
- Promote policies that encourage agroforestry and mixed crop-livestock systems
- Remove incentives that encourage mechanical tillage and excess use of fertilizers



Technologies that Save and Grow

Improve water management

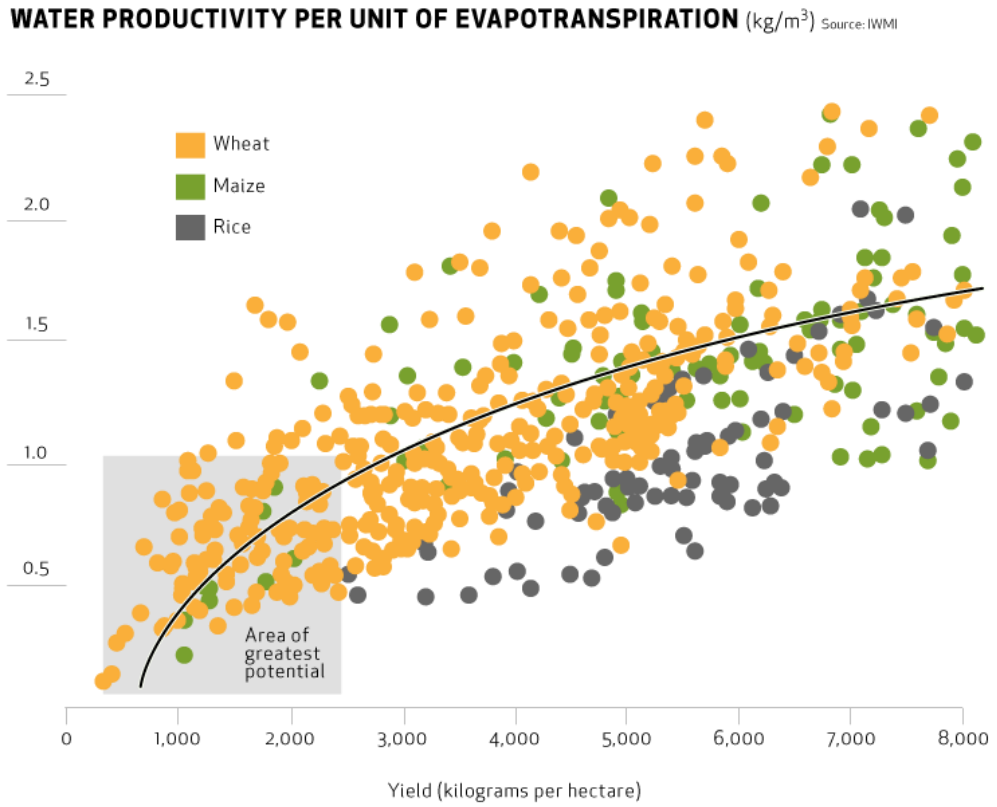
- Apply knowledge-based precision irrigation
- Promote deficit irrigation and wastewater-reuse
- Eliminate policies that encourage to waste water
- Increase rainfed agriculture productivity by introducing drought-tolerant varieties and water-saving practices



Technologies that Save and Grow

Improving water productivity

Water productivity can be improved through increasing yields and drip irrigation.



RESULTS FROM INDIA IN SHIFTING FROM CONVENTIONAL TO DRIP IRRIGATION

Source: IWRA

Crop	Change in yield (%)	Change in water use (%)	Water productivity (%)
Banana	+53	-45	+173
Cabbage	+2	-60	+150
Sugarcane	+39	-60	+205
Sweet Potato	+39	-60	+243
Tomato	+50	-39	+145

Source: http://www.farmingfirst.org/green-economy/

Technologies that Save and Grow

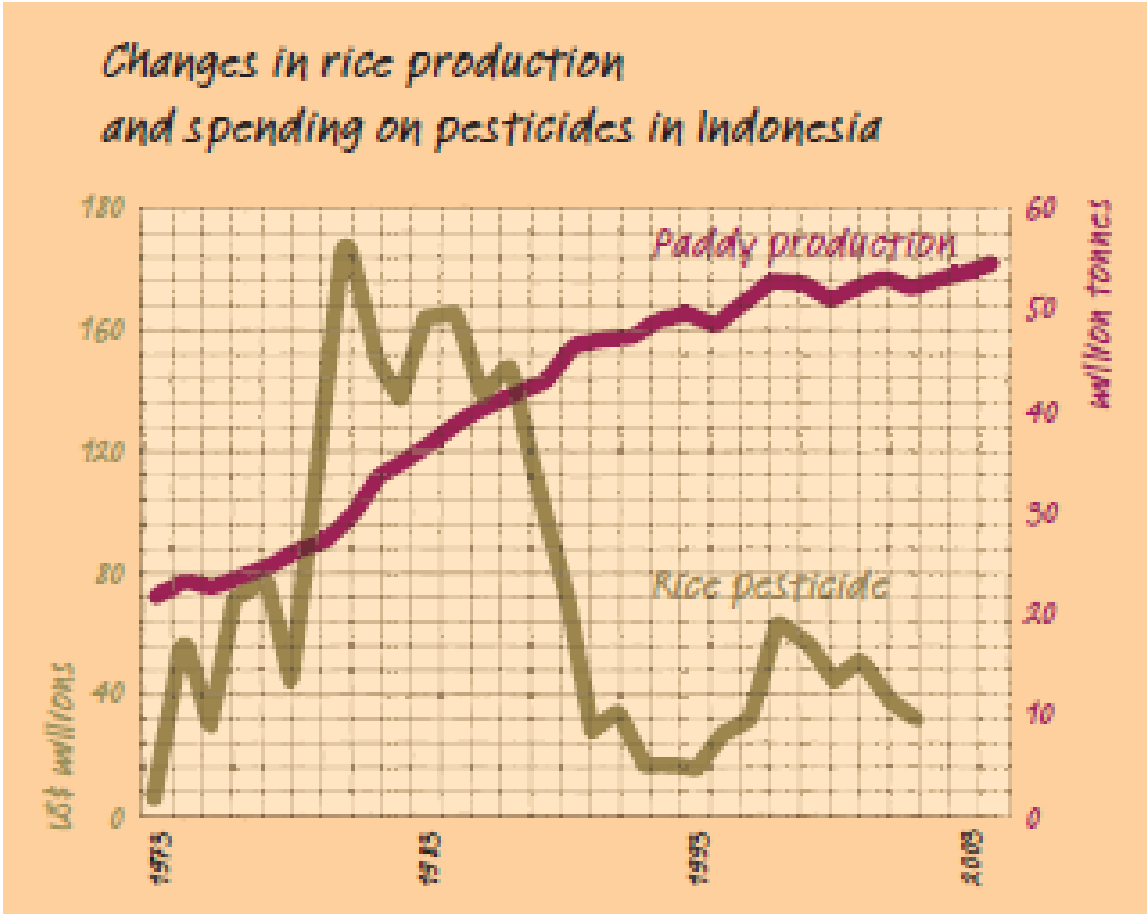
Plant protection

•Grow resistant varieties, conserve predators and manage crop nutrient levels to reduce insect reproduction

•Use clean planting material, introduce crop rotations and eliminate infected host plants to break disease cycles

•Apply timely manual weeding, minimized tillage and use of surface residues

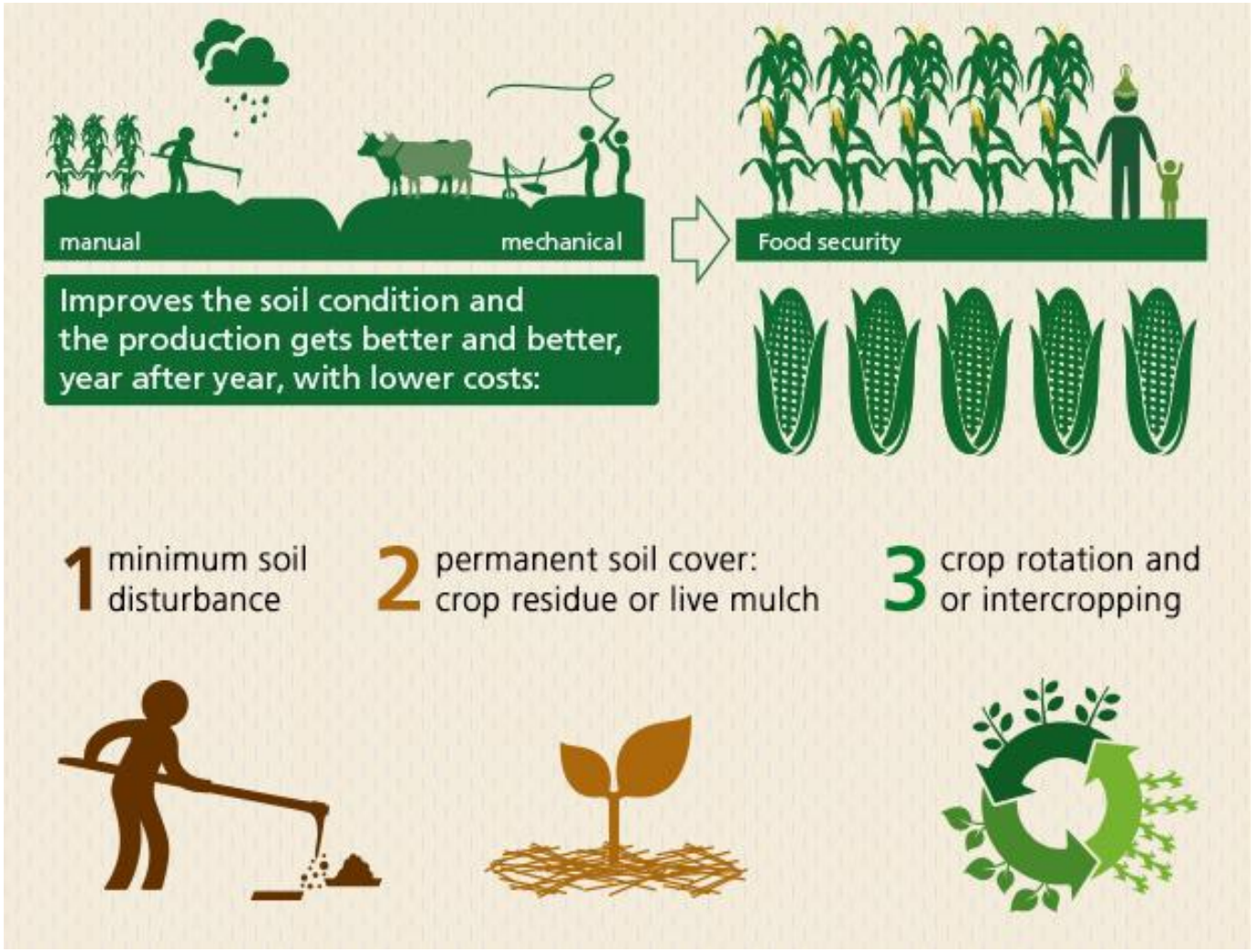
•Use lower risk synthetic pesticides for targeted control at and in the right time and quantity



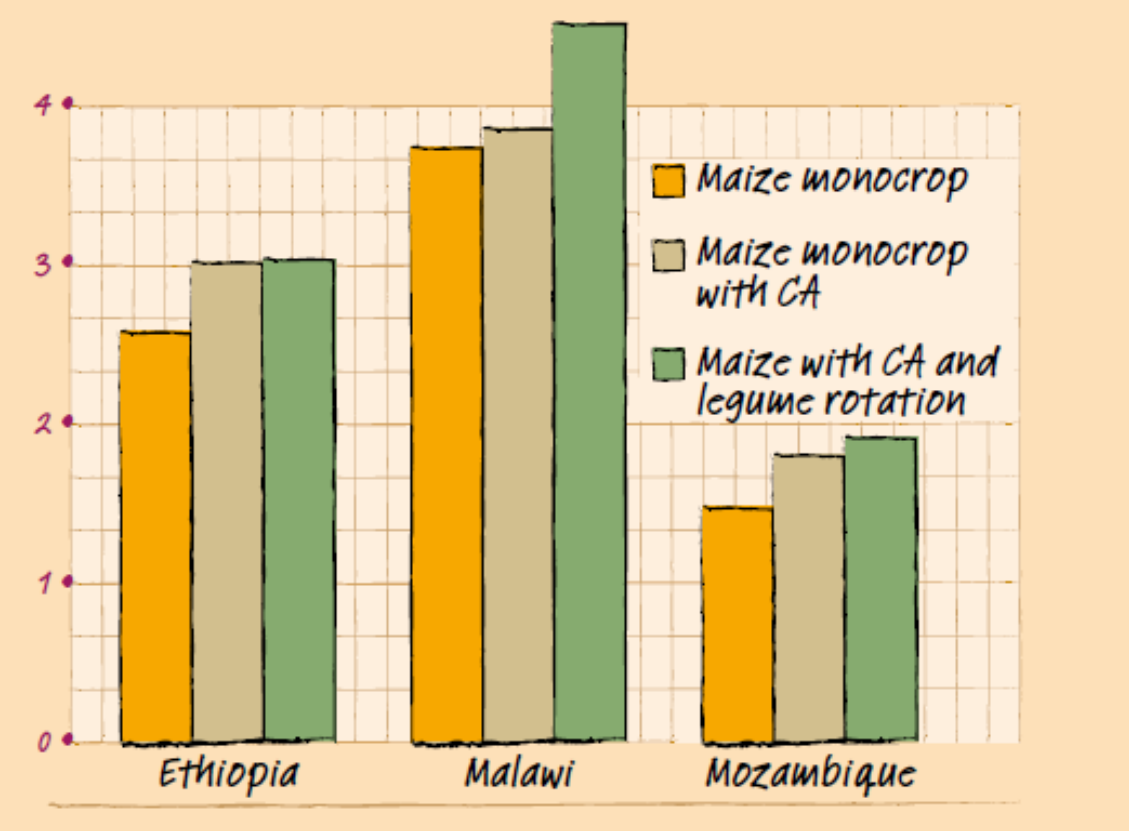
- Introduce policies that promote integrated pest management (IPM), strict pesticide regulations, and removal of pesticide subsidies

4.1.2 Farming Systems that Save and Grow

Conservation Agriculture

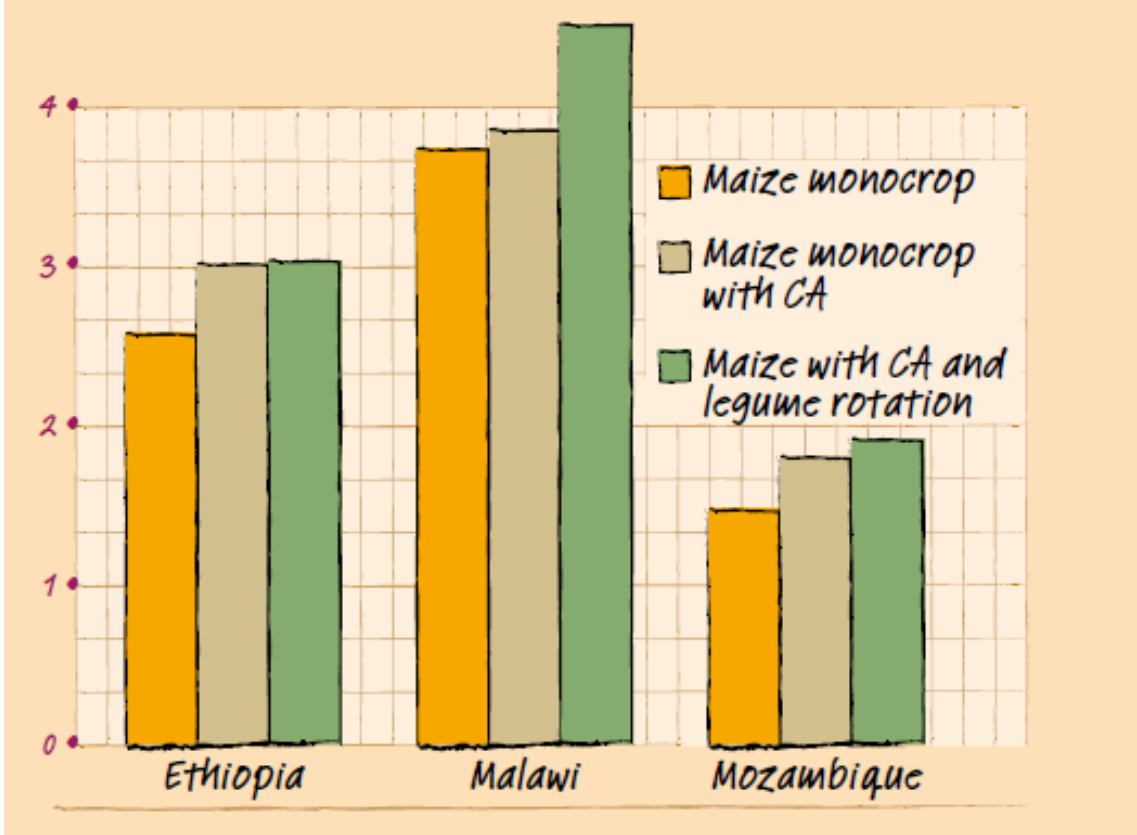


Impact of Conservation Agriculture



Number of farmers adopting legumes in maize production following trials, Ekwendeni, Malawi

Source: FAO

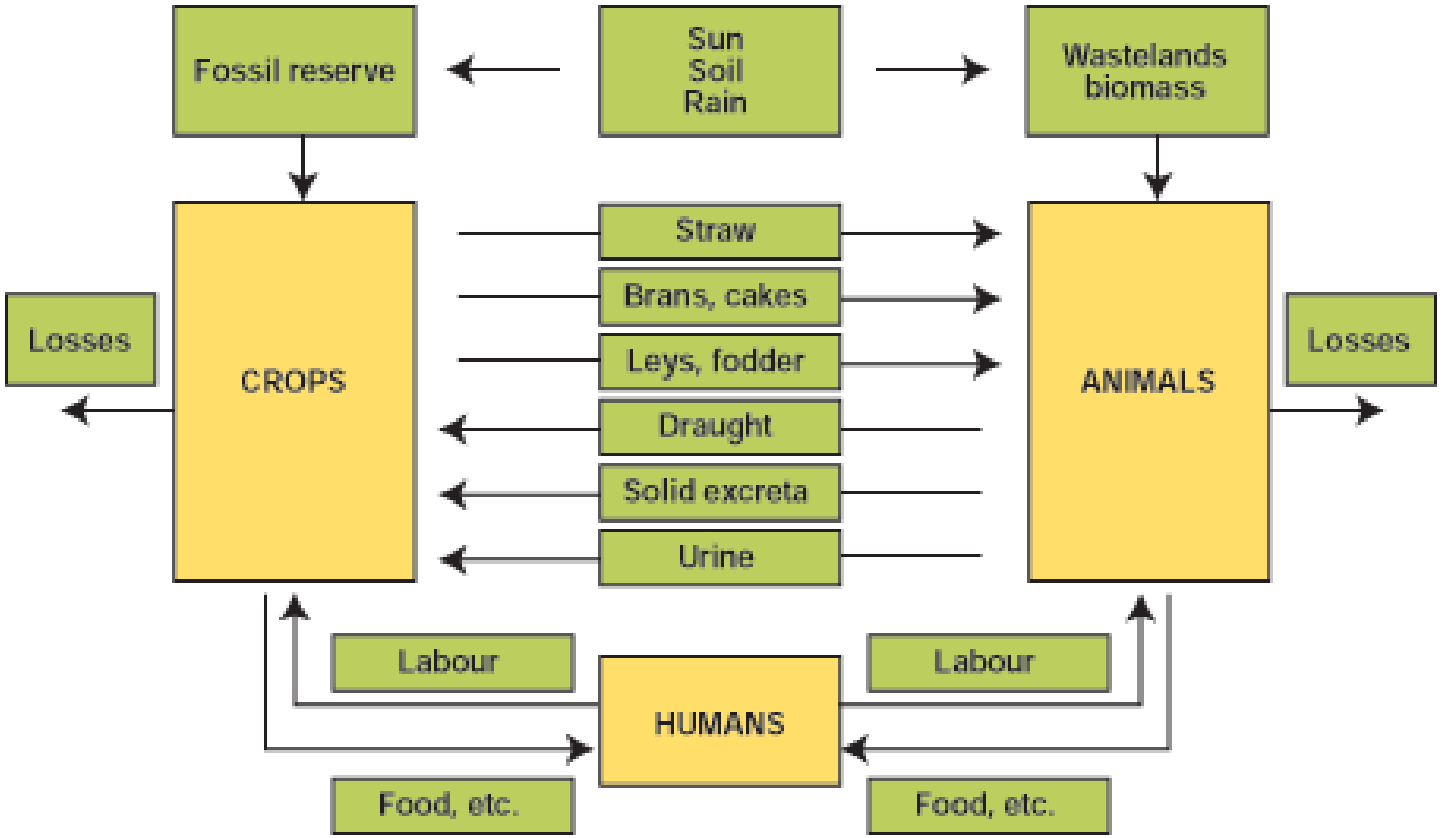


Impact of conservation agriculture (CA) and legume rotation on maize yields (t/ha)

Farming Systems that Save and Grow

Integrated Crop-Livestock Production

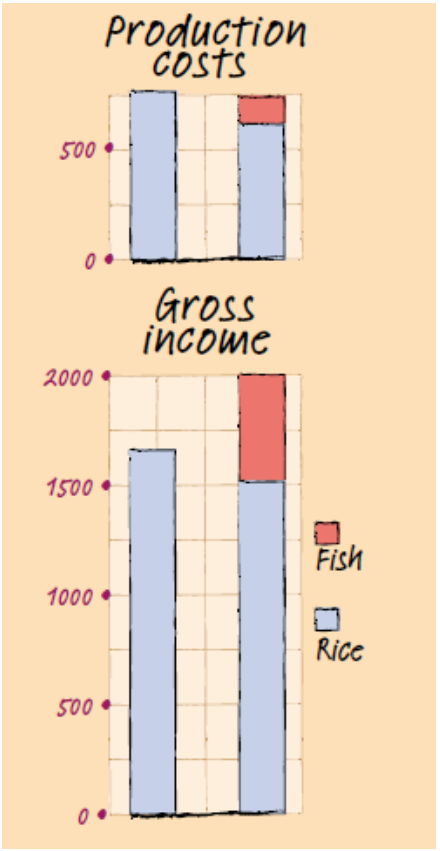
- Practised by most smallholders in developing countries
- Increased biological diversity, efficient nutrient recycling and improved soil health
- Enhance livelihood diversification and efficiency by optimizing inputs, including labour, and increase resilience to economic stress



Farming Systems that Save and Grow

Integrated rice-fish & rice-duck farming

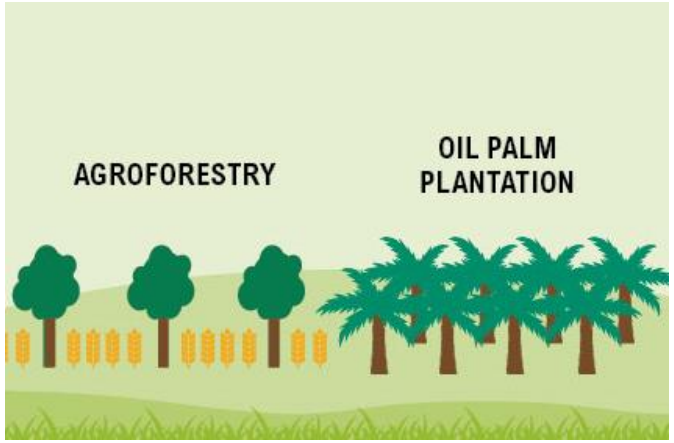
Economics of rice-fish farming and rice monoculture, Indonesia (US$/ha)

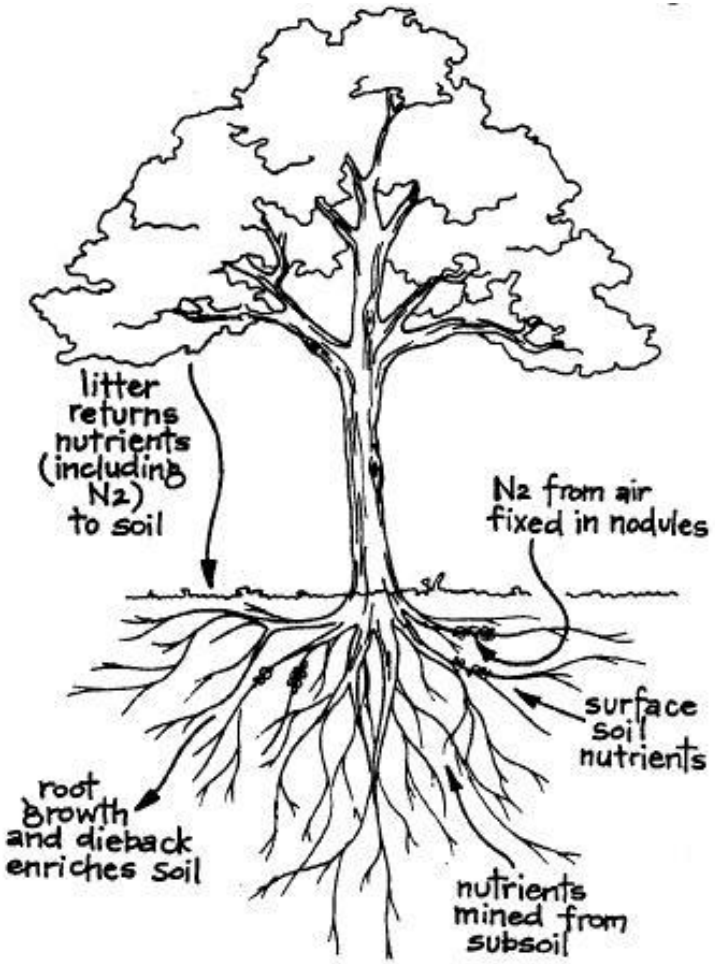


Farming Systems that Save and Grow

Agroforestry

- Cultivation of woody perennials and annual crops
- Works well with conservation agriculture and tree crop systems
- Can be enhanced by improved crop associations, including legumes and “fertilizer trees”, and integration with livestock

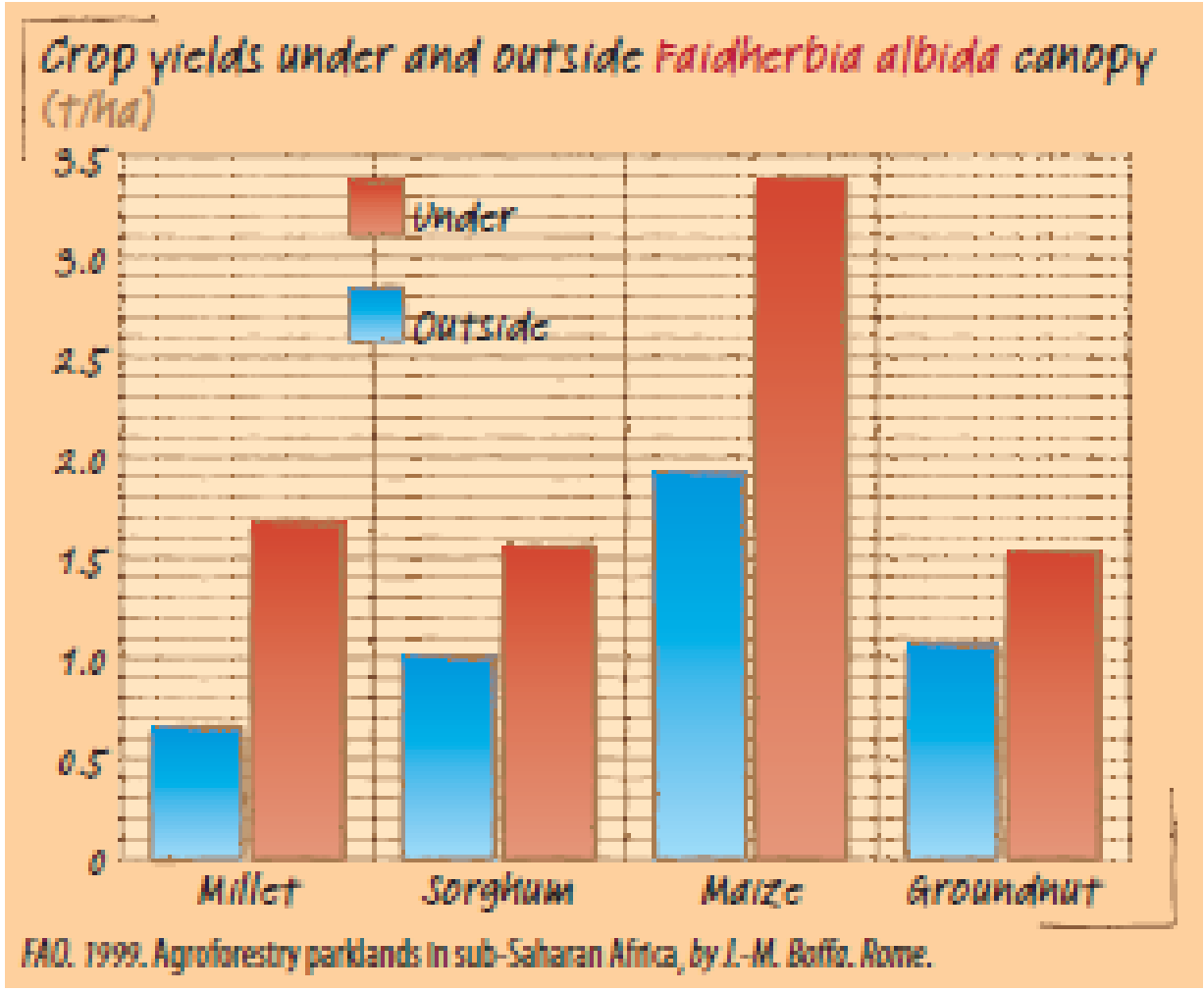




Farming Systems that Save and Grow

Agroforestry

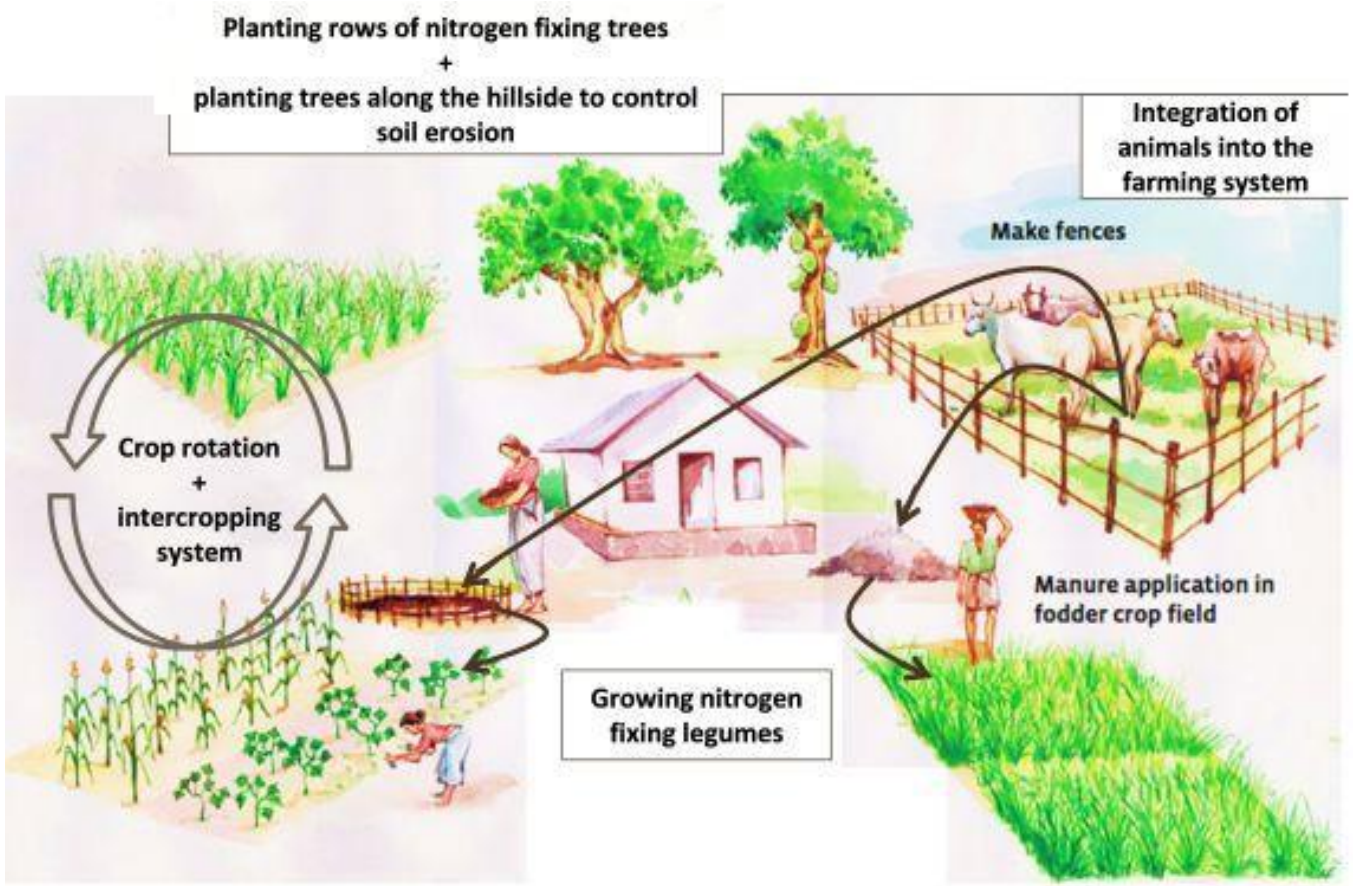
- African acacia, *Faidherbia albida* is a natural component of farming systems in the Sahel.
- Does not compete with crops for light, nutrients and water
- Loses its nitrogen-rich leaves during the rainy season, providing a protective mulch that serves as natural fertilizer



Farming Systems that Save and Grow

Agroforestry + Organic Agriculture

- When practiced in combination with conservation agriculture, can lead to improved soil health and productivity, increased efficiency in the use of organic matter and energy savings
- Products can be sold in niche markets and create new income opportunities

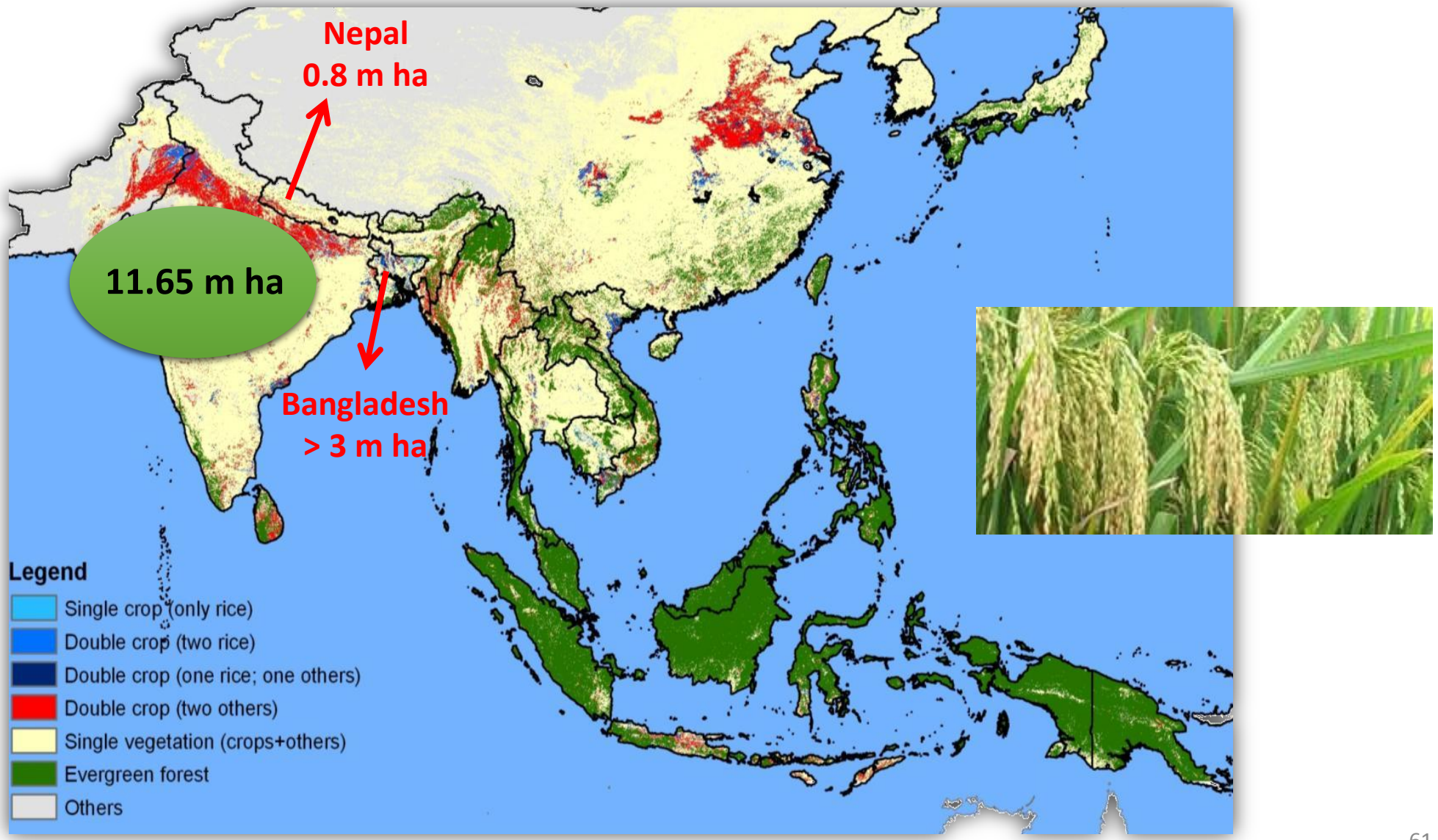


4.1.3. Applications of Multiple Cropping in Asia

- Intensification of cereal-based cropping systems by inclusion of other crops e.g. pulses as cash crop
- Replenishing soil nitrogen
- Introduction in rice-fallows (e.g. South Asia)
- Multiple cropping, relay cropping and mixed cropping

- New niches such as winter planting
- Market opportunities for rural income
- Build capacity through agricultural extension services

Tapping Un-used Potential in Crop-fallows



Source: ICARDA

Integration of Pulses in Rice-fallow

Rice
Jul-Oct

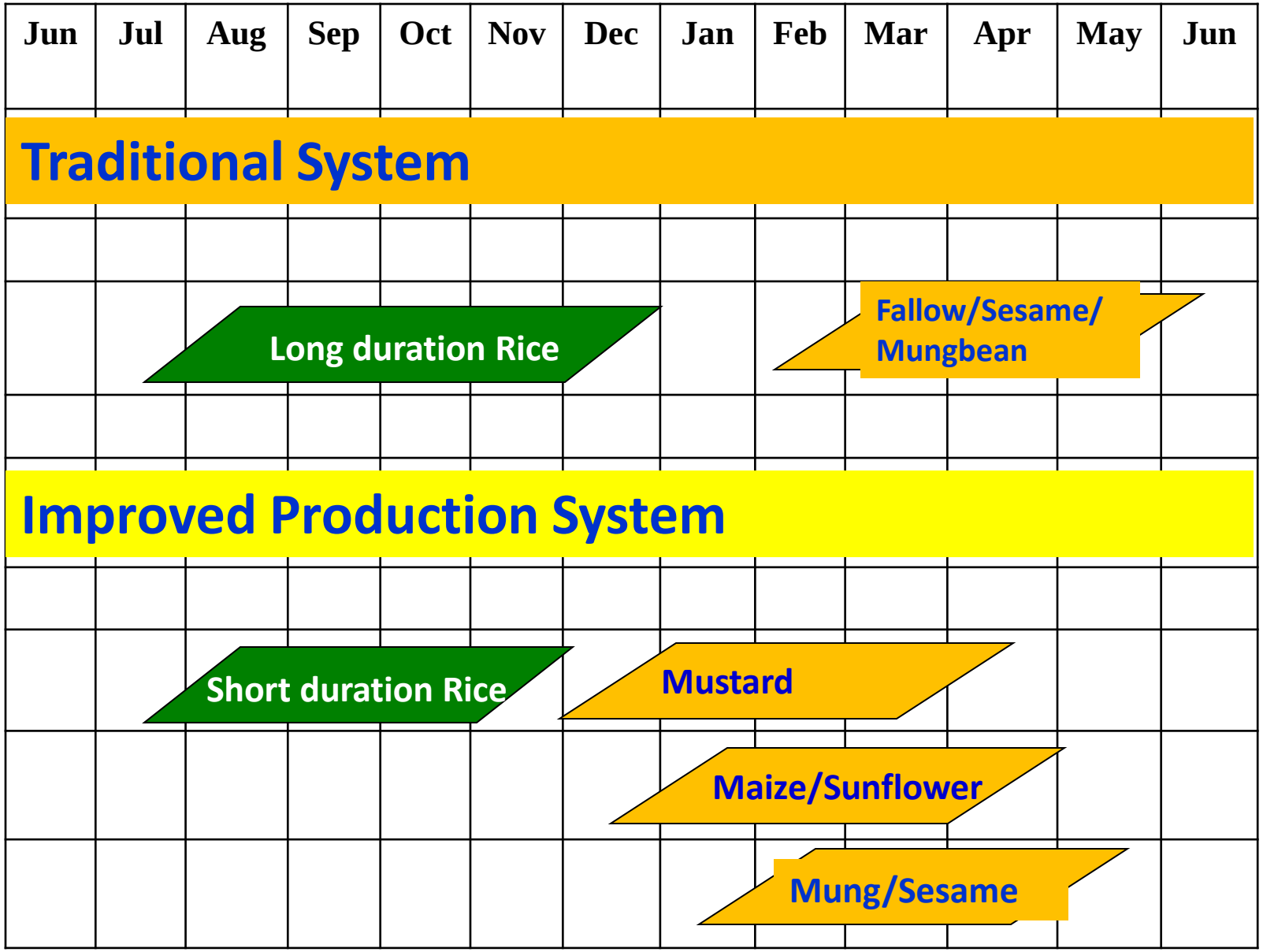
Lentil
Nov - Feb

Fallow after rice
Nov - June

Sesame/ Mung bean
Mar - May

Example: Birbhum district, West Bengal

Capturing Residual Moisture



Integration of Pulses in Rice-fallow

Black gram in rice fallow

Nutrient management practices	Rice yield (kg ha^{-1})	Blackgram yield (kg ha^{-1})	Net return (Rs ha^{-1})	B:C ratio
Farmers practice*	3380	367	11,448	2.07
100% RDF** to rice	3560	478	13,030	2.11
100% RDF + 'P'*** of *utera* crop to rice	3840	587	15,618	2.28
Recommended dose of 'P' to *utera* crop at sowing	3690	467	13,118	2.09

RDF** : Recommenede dose of fertliser (80 : 40 :40 kg N, P_2O_5 and K_2O ha^{-1}) ; Farmers practice* : 60 :30 :30 kg N, P_2O_5 and K_2O ha^{-1} ; 'P'*** of *utera* crop : 20 kg ha^{-1}

- Sowing of black gram as *utera* crop at two weeks after flowering of rice (early November) with medium duration varieties like Swarna, Pooja etc. helps in improving the yield of succeeding *utera* crop

- Application of 100% recommended dose of fertilizer to preceding rice crop along with the 'P' of *utera* crop to rice substantially improved the seed yield as well as net return of black gram as *utera* crop in rice-black gram *utera* cropping sequence

Source: H. Pathak, Natural Resources Research Institute (NRRI)

Zero Hunger Initiative: Prioritized Future Smart Food in the Region

Cereals	Roots & Tubers	Pulses	Fruits & Vegetables	Nuts, Seeds & Spices
Buckwheat Tartary buckwheat Foxtail millet Proso millet Finger millet Sorghum Amaranth Grain amaranth Quinoa Specialty rice	Taro Swamp taro Purple yam Fancy yam Elephant's foot yam Sweet potato	Grass pea Faba bean Cow pea Mung bean Black gram Rice bean Lentil Horse gram Soybean	Drumstick Chayote Fenugreek Snake gourd Pumpkin Roselle Indian gooseberry Jack fruit Wood apple	Linseed Walnut Nepali butter tree Perilla Nepali pepper

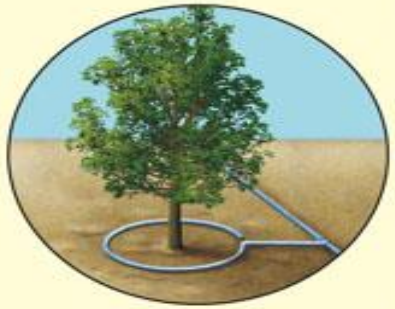
39 crops from eight countries/States:

Cambodia, Lao PDR, Myanmar, Nepal, Bangladesh, Bhutan, Viet Nam, West Bengal (India)

Solutions

Sustainable Agriculture

More	Less
High-yield polyculture	Soil erosion
Organic fertilizers	Soil salinization
Biological pest control	Aquifer depletion
Integrated pest management	Overgrazing
Irrigation efficiency	Overfishing
Perennial crops	Loss of biodiversity
Crop rotation	Loss of prime cropland
Use of more water-efficient crops	Food waste
Soil conservation	Subsidies for unsustainable farming and fishing
Subsidies for more sustainable farming and fishing	Population growth
	Poverty

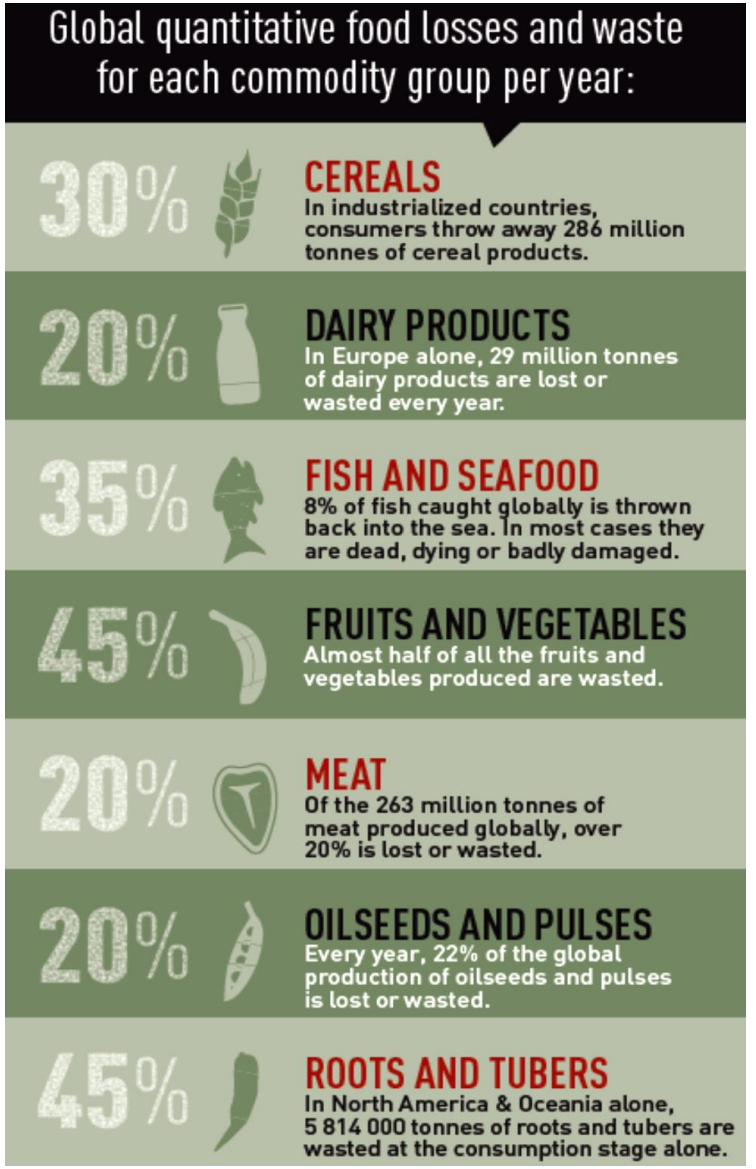


4.1.4 Manage Food Loss and Waste

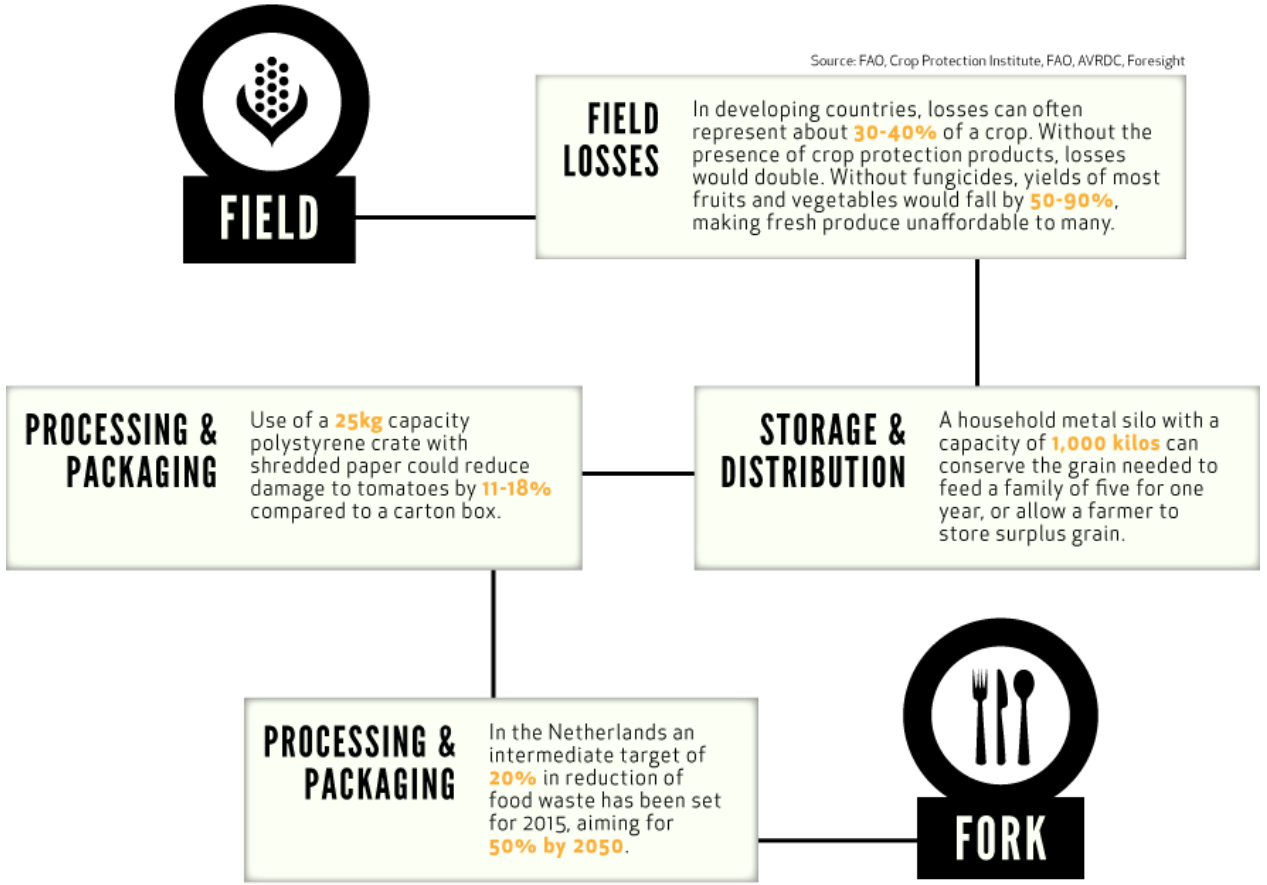
- **1/3 of food** produced for human consumption is lost or wasted globally, which amounts to about 1.3 billion tons per year.
- amounts to roughly US$ 680 billion in industrialized and US$ 310 billion in developing countries

Food losses represent a waste of resources used in production such as land, water, energy and inputs, increasing the green gas emissions in vain.

Food waste is food that is fit for human consumption, but not consumed because it is left to spoil, discarded by retailers or consumers.



Food Loss in the food supply chain



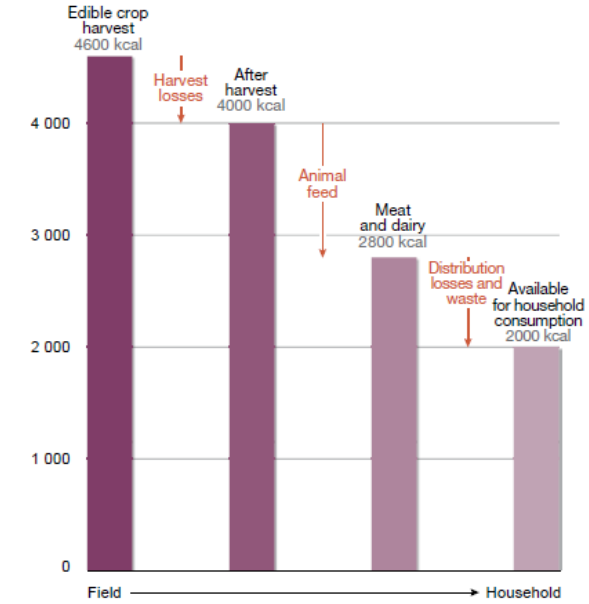


Figure 12: A gross estimate of the global picture of losses, conversion and wastage at different stages of the food supply chain. As a global average, in the late 1990s farmers produced the equivalent of 4,600 kcal/capita/day (Smil, 2000), i.e., before conversion of food to feed. After discounting the losses, conversions and wastage at the various stages, roughly 2,800 kcal are available for supply (mixture of animal and vegetal foods) and, at the end of the chain, 2,000 kcal on average – only 43% of the potential edible crop harvest – are available for consumption. (Source: Lundqvist *et al.*, 2008).

Source: http://www.farmingfirst.org/green-economy/ ;
http://1.bp.blogspot.com/_R4gXIIDAvmg/TIBSGFnyhUI/AAAAAAAAEjo/sZ6mqKj6ous/s1600/figure1.jpg

Manage Food Loss

Cause	Prevention
Production exceeds demand	➢ Communication and cooperation among farmers to reduce risk of overproduction by allowing surplus crops from one farm to solve a shortage of crops on another
Premature harvesting	➢ Organizing small farmers and diversifying and upscaling their production and marketing, e.g. through collective credit
Poor storage facilities and lack of infrastructure	➢ Public investment in infrastructure for roads, energy and markets ➢ Private sector investment in storage, cold chain facilities and transportation
Seasonality and lack of processing facilities	➢ Develop contract farming linkages between processors and farmers
Inadequate market systems with unsuitable storage and sales conditions	➢ Promote marketing cooperatives and establish improved market facilities to assemble produce ➢ Development of wholesale and retail markets through private and public sector investment

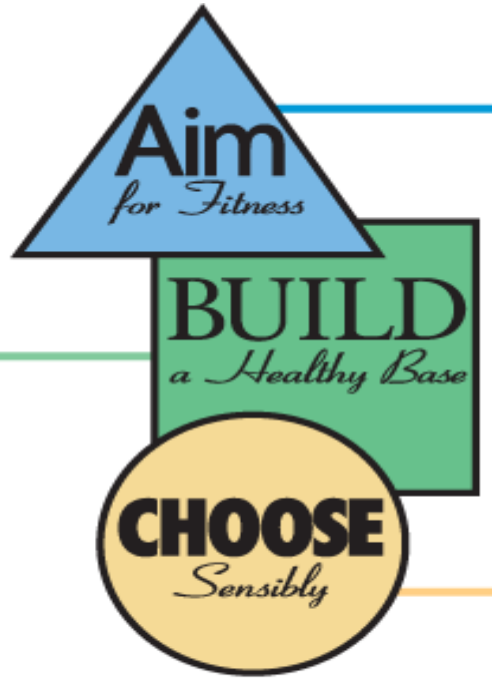
4.2 Consumption

4.2.1. Promotion Healthy Diet: The Eating Well Plate

Use the eatwell plate to help you get the balance right. It shows how much of what you eat should come from each food group.

Department of Health in association with the Welsh Assembly Government, the Scottish Government and the Food Standards Agency in Northern Ireland

Promotion Healthy Diet: Dietary Guidelines



Aim for a healthy weight.
Be physically active each day.

Let the Pyramid guide your food choices.
Choose a variety of grains daily, especially whole grains.
Choose a variety of fruits and vegetables daily.
Keep food safe to eat.

Choose a diet that is low in saturated fat and cholesterol and moderate in total fat.
Choose beverages and foods to moderate your intake of sugars.
Choose and prepare foods with less salt.
If you drink alcoholic beverages, do so in moderation.

NOTE: These guidelines are intended for adults and healthy children ages 2 and older.
SOURCE: U.S. Department of Agriculture and U.S. Department of Health and Human Services, *Nutrition and Your Health: Dietary Guidelines for Americans,* Home and Garden Bulletin no. 232 (Washington, D.C.: 2000).

Nutritional Benefits of Future Smart Food

Values for 100 g dry product

	Energy (Kcal)	Protein (g)	Dietary Fibre (g)	Iron (mg)	Folate (DFE mcg)
Chickpeas	355	21.2	5.4	5.4	557
	x 1	x 3	X 4	x 4	x 70
Rice White, polished, raw	365	7.1	1.3	1.2	8

	Energy (Kcal)	Protein (g)	Dietary Fibre (g)	Iron (mg)	Folate (DFE mcg)
Mung beans	347	23.9	1.15	6.74	625
	x 1	x 3	X 1	x 4	x 78
Rice White, polished, raw	365	7.1	1.3	1.2	8

	Energy (Kcal)	Protein (g)	Dietary Fibre (g)	Iron (mg)	Folate (DFE mcg)
Lupin beans	371	36.7	9.74	4.36	355
	x 1	x 5	X 8	x 4	x 44
Rice White, polished, raw	365	7.1	1.3	1.2	8

Health Benefits of Future Smart Food

Example: Impact of Iron Rich Lentil Diet on Iron Deficient Anemic Children in Sri Lanka

Indicator	0 days	60 days	% improvement
Hemoglobin (g/dL)	11.1	11.8	6.3
Serum Fe (µg/dL)	51.5	89.8	74.4
Total Fe binding capacity (µg/dL)	405.3	377.6	-6.8
Trans ferritin saturation (%)	12.8	24.3	89.8
Serum ferritin (ng/mL)	29.5	41.2	39.7

after 60 days, n=33

WHO's hemoglobin thresholds used to define anemia

(1 g/dL = 0.6206 mmol/L)

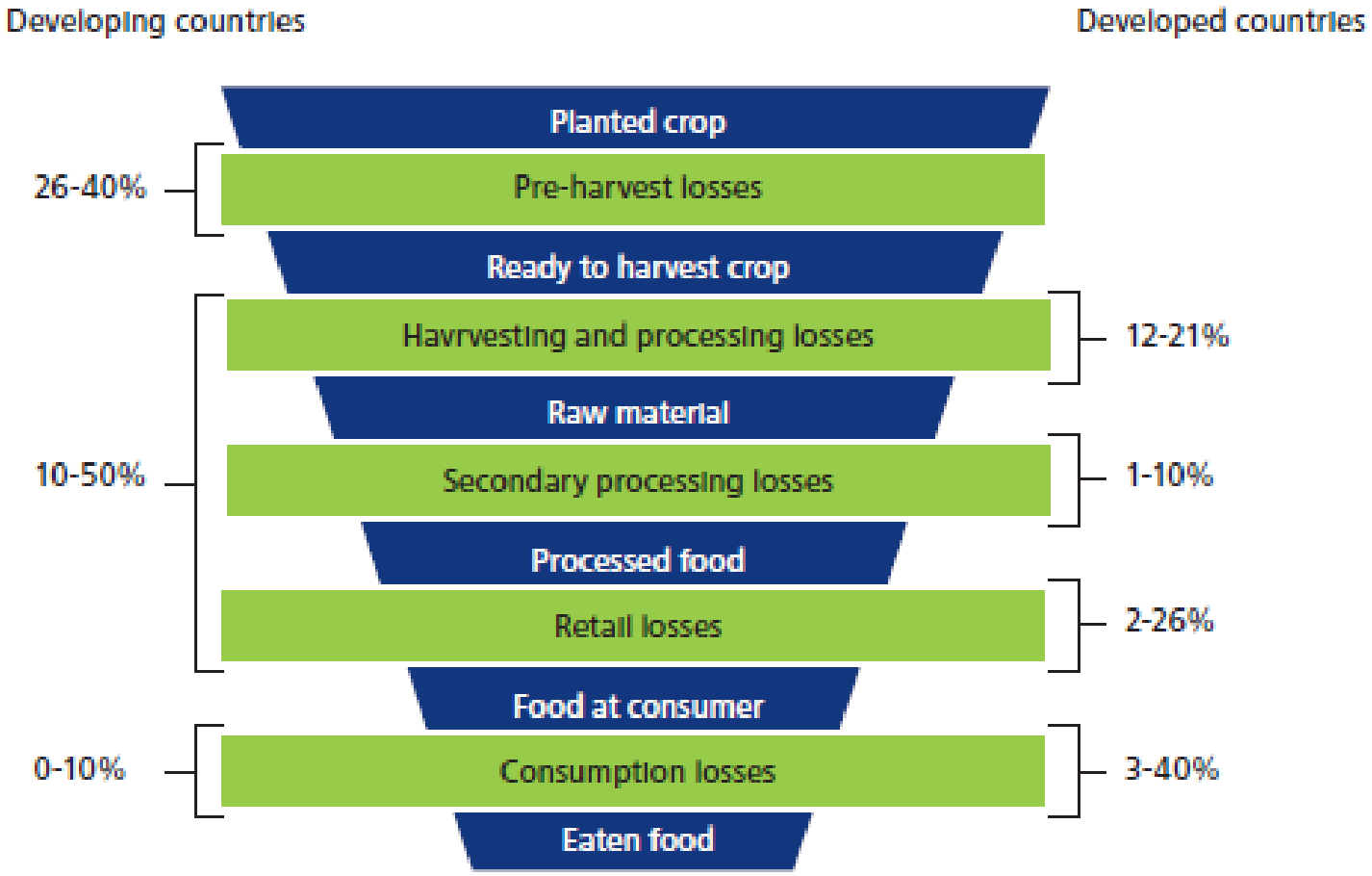
Age or gender group	Hb threshold (g/dl)	Hb threshold (mmol/l)
Children (0.5 - 5 years)	11.0	6.8
Children (5 - 12 years)	11.5	7.1

4.2.2 Building Demand: School Meal Programme/Mid-day Meal Scheme

- School lunch programme/ Mid-Day Meal Scheme
- Recipes based on a combination of pulses, cereals, vegetables, spices, and oils

- ➢ Potential for nutritious crops to be integrated into recipes to improve the nutrition status of school children
- ➢ Potential for replication and scaling-up in ASEAN countries

4.2.3. Save Food Initiative



Source: World Economic Forum, Driving Sustainable Consumption

Save Food Initiative

- Global programme launched by FAO and Messe Düsseldorf at the Interpack2011 trade fair for the packaging and processing industry, held in Düsseldorf, Germany.
- Four main pillars:
  1. **Collaboration and coordination**
  2. **Awareness raising**
  3. **Research**
  4. **Support to projects**
- The Royal Thai Government in collaboration with FAO launched the national Save Food Campaign to address food loss and food waste in Thailand. It is the first of its kind in the ASEAN region.
- Video: Food is Life - Save Food

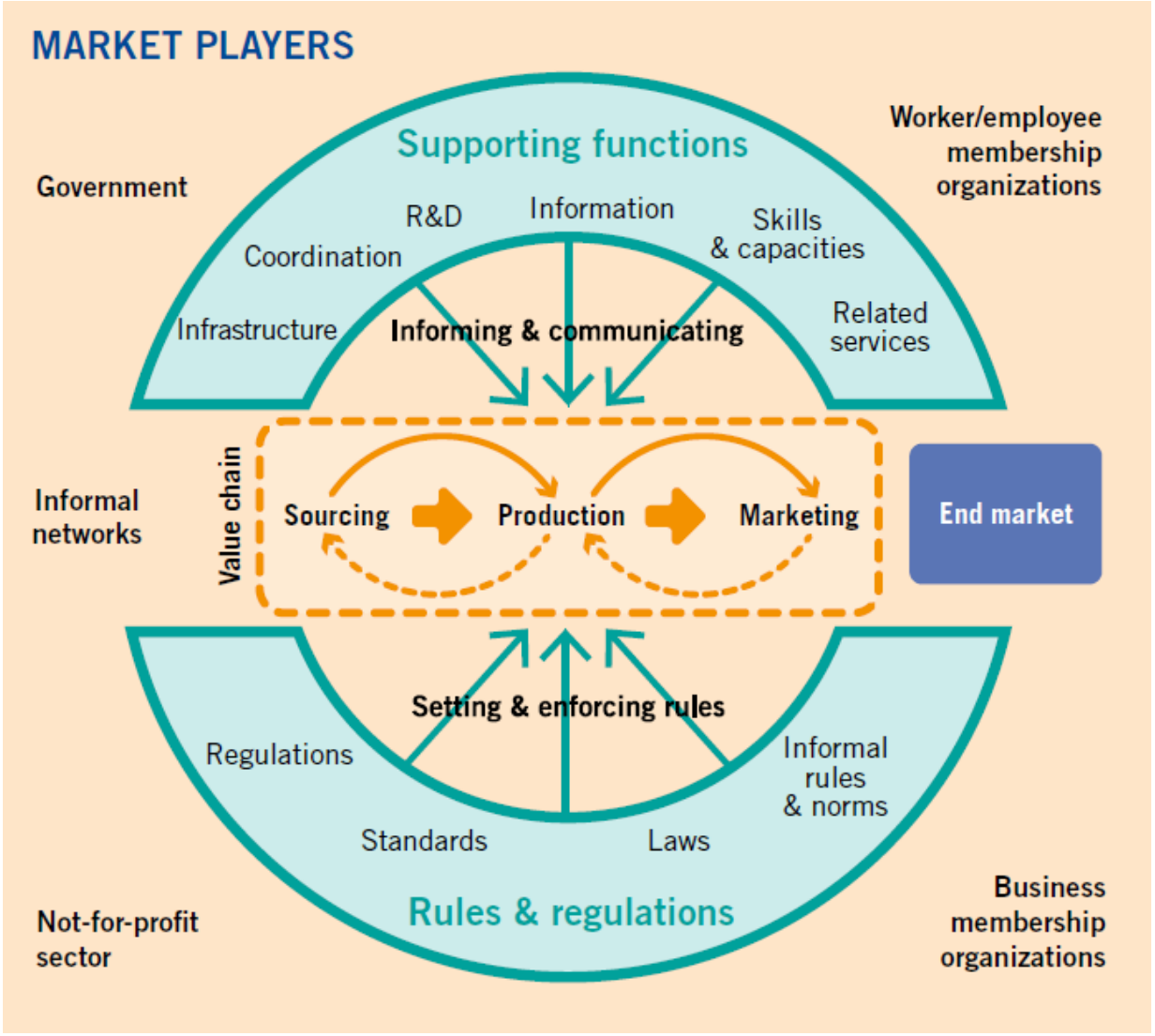
4.3 Market

Dual Face of Agrifood Markets

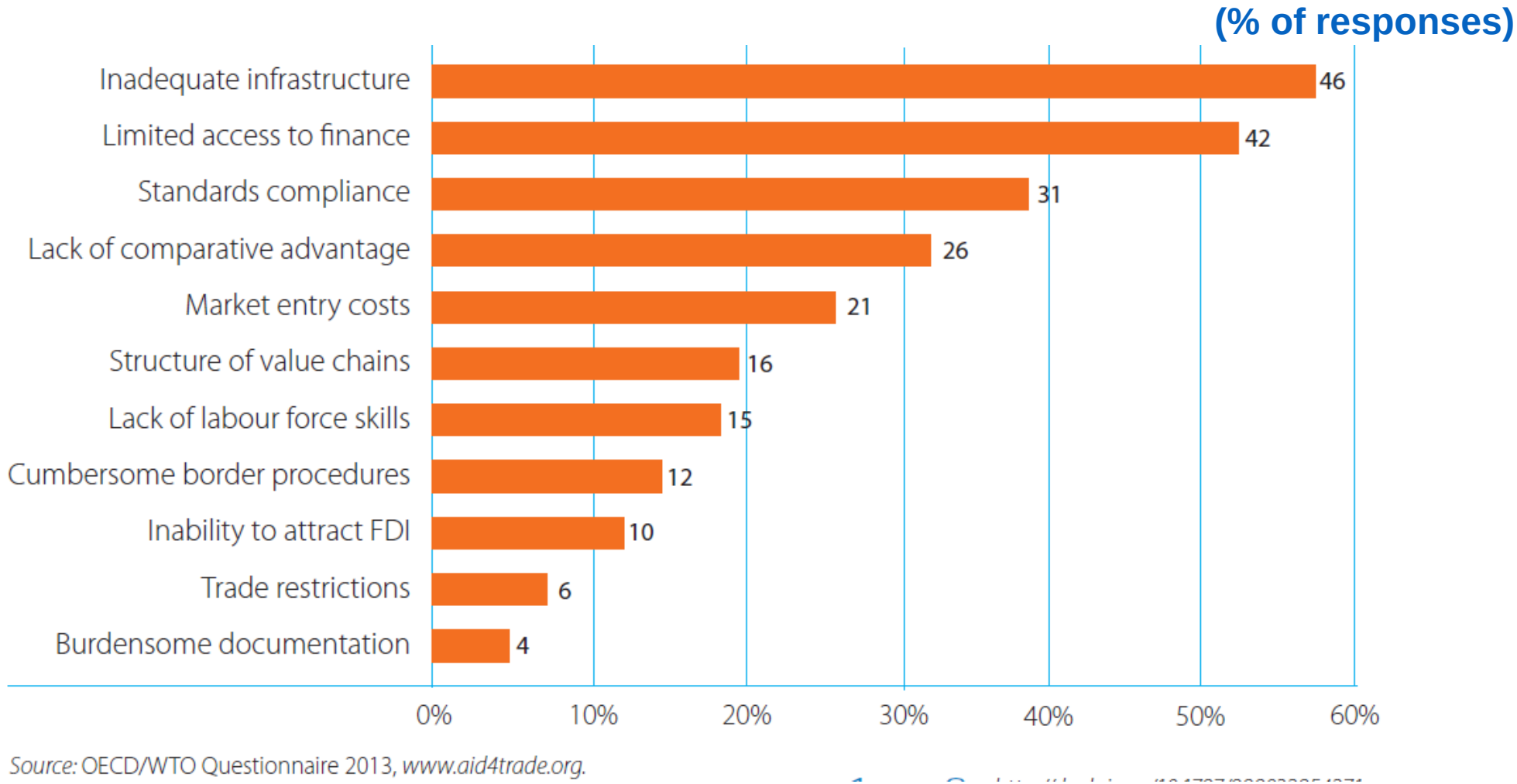
Enhanced Presence of Modern retailers

Popularity of Traditional retail markets

Market System Framework

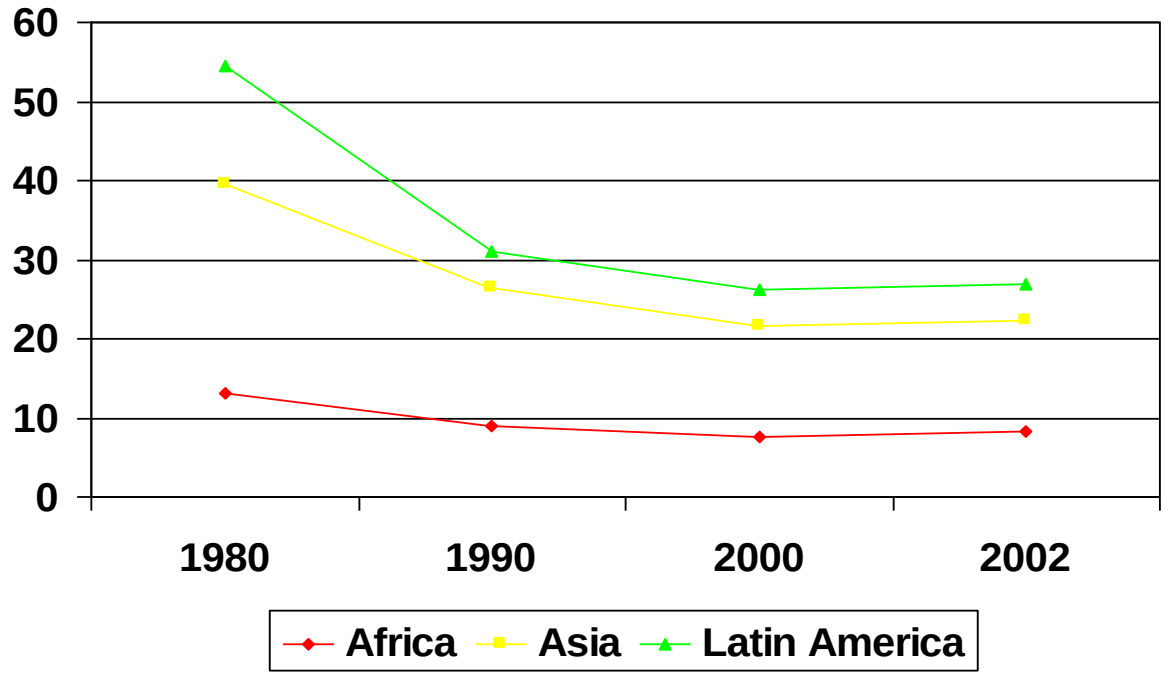


Survey: Partner Countries' Views on Main Barriers to Firms Entering Value Chains



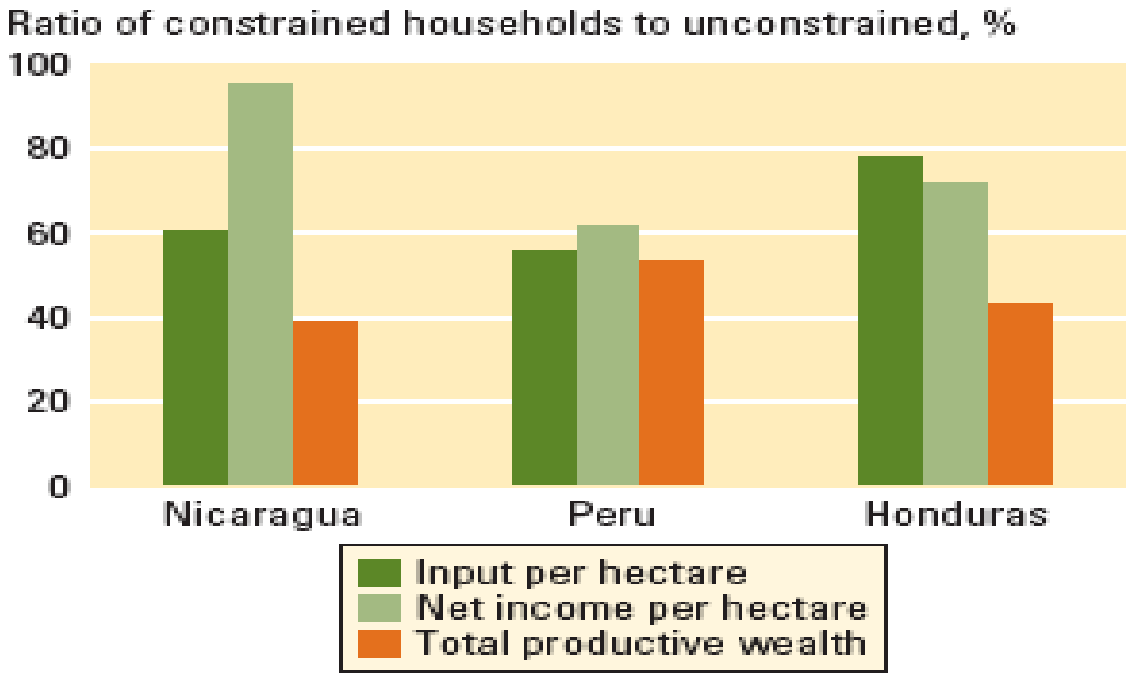
Source: OECD/WTO Questionnaire 2013, *www.aid4trade.org.*

Under-investment in Agriculture and Rural Infrastructure



• Agriculture and rural infrastructure's share of public expenditures have declined significantly

Limited Access to Finance

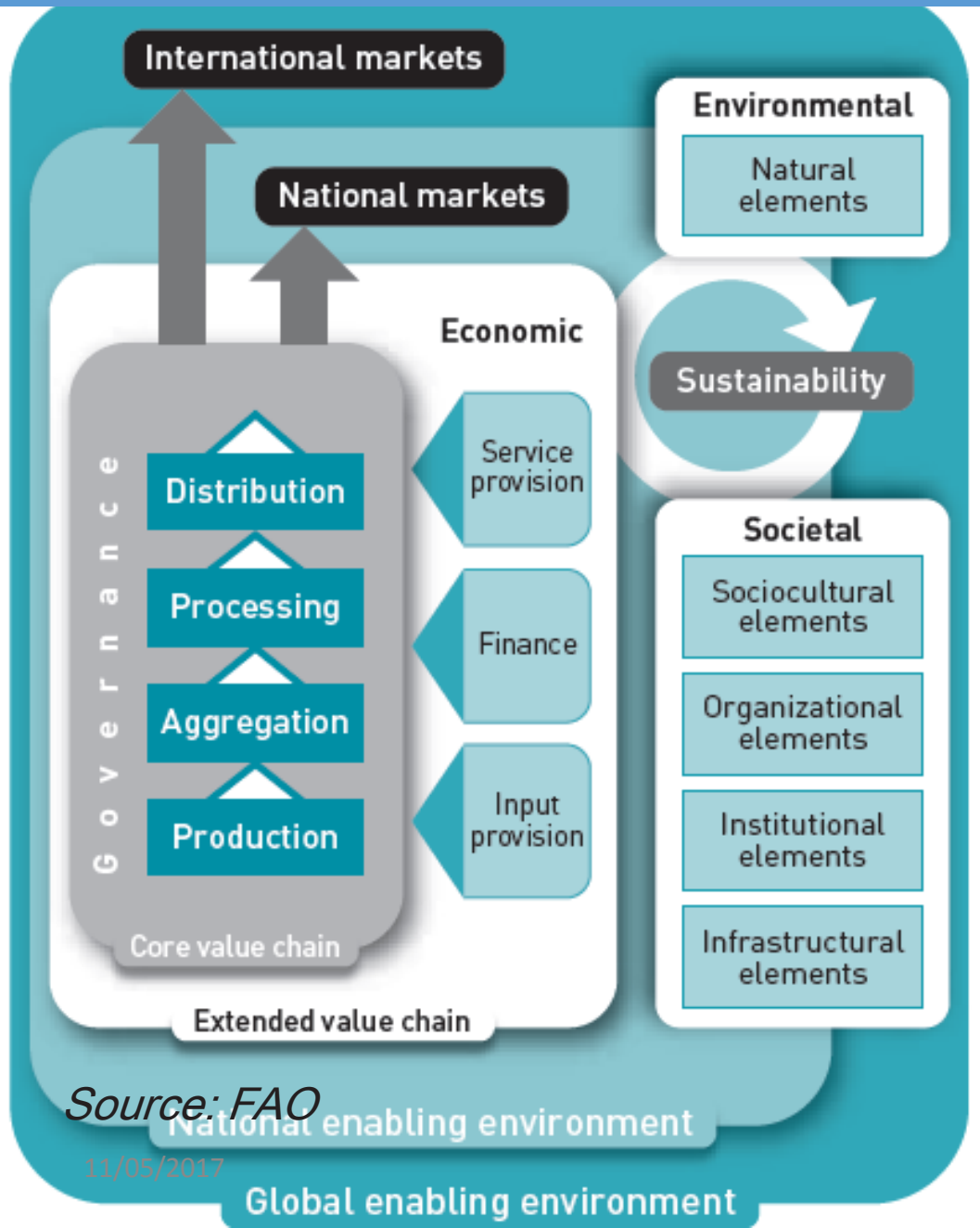


- Credit constrained use less inputs and earn lower incomes
- Credit constraint is often associated with risk rationing as well

Need to improve efficiency of investment in rural development

	China	*India*	*Thailand*	*Vietnam*	*Uganda*
Ranking of Returns to Agricultural Production					
Agriculture R&D	1	1	1	1	1
Irrigation	5	4	5	4	
Education	2	3	3	3	3
Roads	3	2	4	2	2
Telecommunications	4				
Electricity	6	8	2		
Health		7			4
Soil and Water Conservation		6			
Anti-Poverty Programs		5			
Ranking of Returns in Poverty Reduction					
Agriculture R&D	2	2	2	3	1
Irrigation	6	7	5	4	
Education	1	3	4	1	3
Roads	3	1	3	2	2
Telecommunications	5				
Electricity	4	8	1		
Health		6			4
Soil and Water Conservation		5			
Anti-Poverty Programs	7	4			

Building Sustainable Food Value Chain Framework



Source: FAO

Institutional Investment

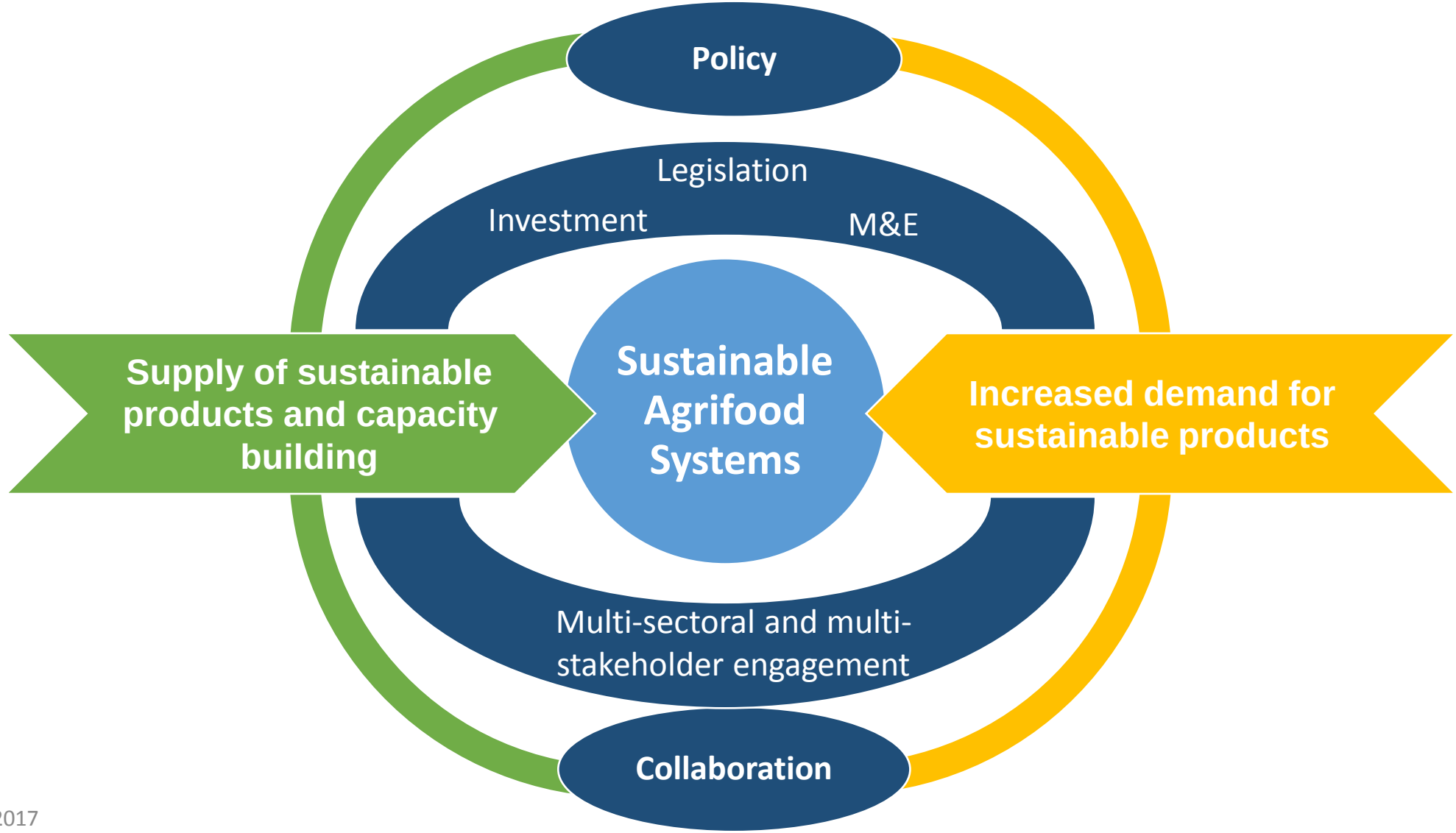
- Business-oriented outreach and knowledge dissemination
- Micro-finance systems
- Crop and climate insurance schemes
- Introduction of Participatory Guarantee System (PGS)

Private Sector

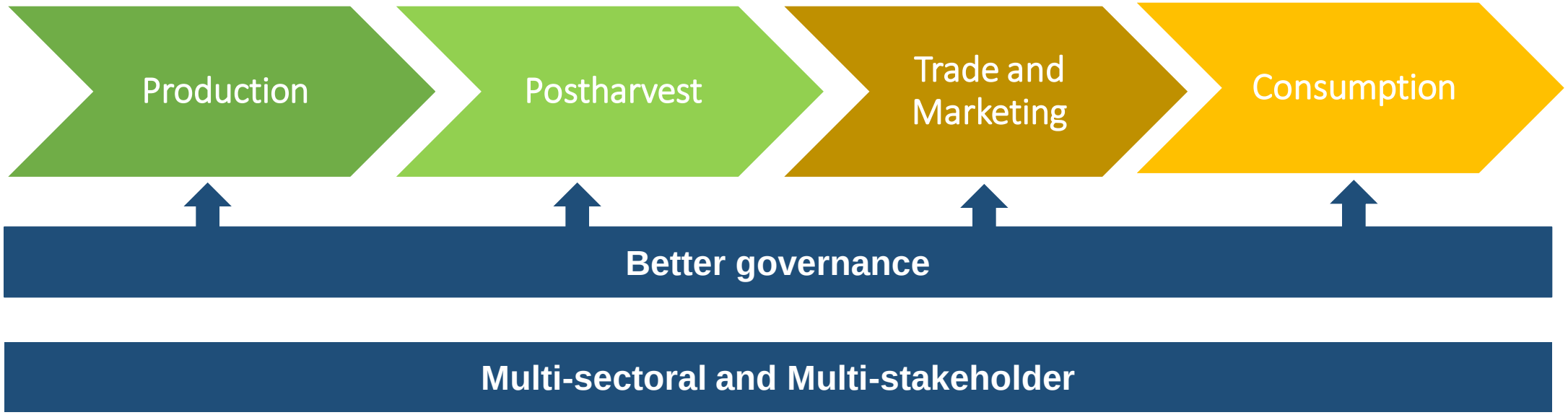
- Public-Private Partnership (PPP)
- Establish market linkages with smallholders through e.g. contract farming
- Development of and investment in infrastructure for storage, processing, sales, etc.
- Investment in improved transportation systems

V. Enabling Environment for Sustainable Agrifood Systems

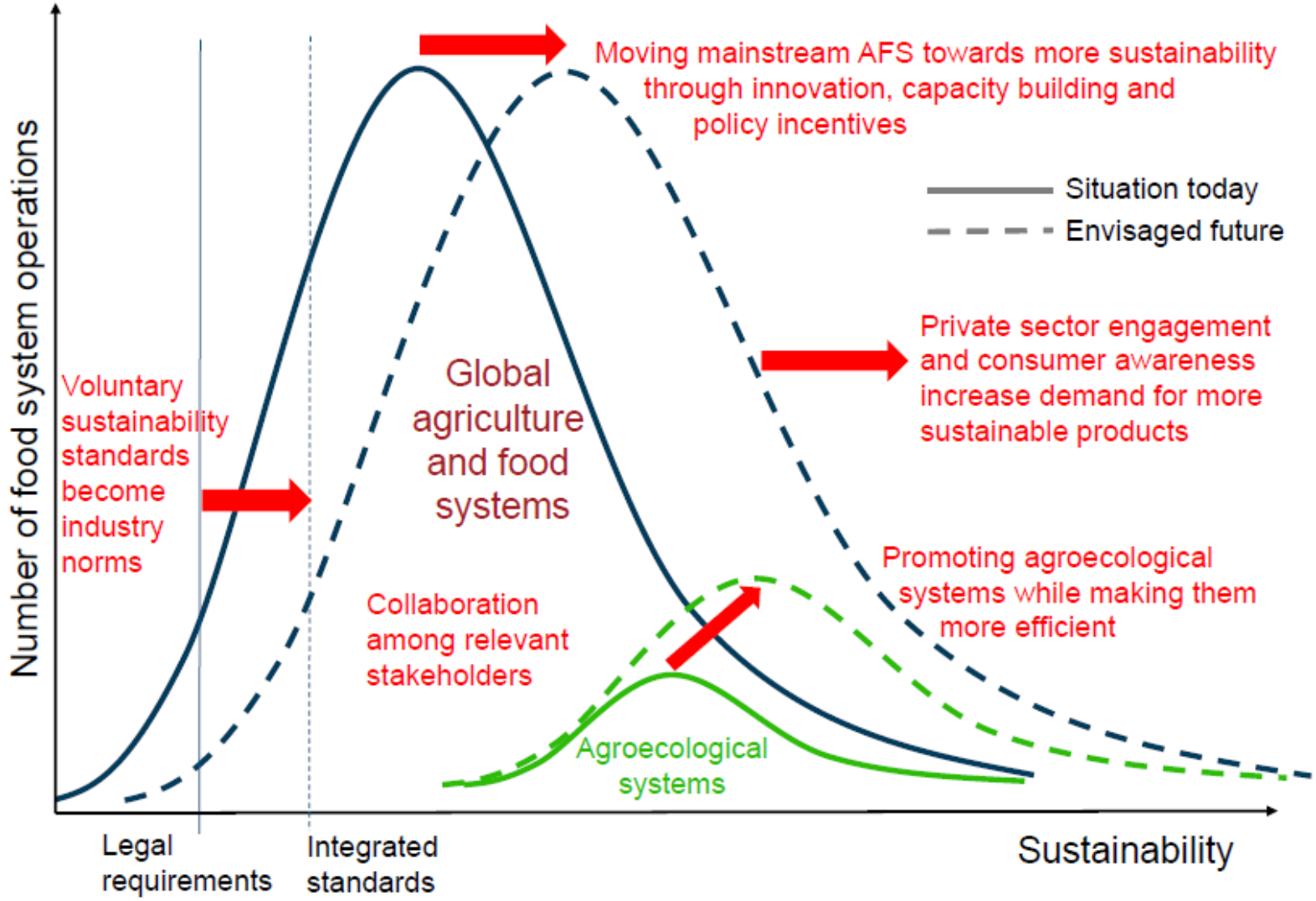
Enabling Environment: A Theory of Change



Enabling Environment: Food System Approach



Shifting Agrifood Systems towards Higher Sustainability



Source: Swiss National FAO Committee (2016)

Thank you!

Food and Agriculture Organization
of the United Nations