INTERNATIONAL AGRIFOOD MARKETS AND POLICY

Lessons on Topic 1 – part A

Prof. Gianluigi Gallenti

1. Agri-food markets

1.1 Demand and supply of agri-food products

1.2 Market models in agri-food sectors

1.3 Instability and uncertainty in agriculture

1.4 Agricultural sector in the developed and in developing countries

Demand and supply of agri-food products
Market models in agri-food sectors

The main question is:

- How does the supply of food become available to those who demand it? (Coordination and process of exchange)

Both suppliers and consumers are part of markets, so it is necessary to study demand and supply and their relationship in the markets (understanding market models).

Demand and supply of agri-food products
Market models in agri-food sectors

Three aspects of market transactions:

- Spatial: transactions occur across space.
- Temporal: transactions occur across time.
- Form: transactions occur in a certain form.

Demand and supply of agri-food products
Market models in agri-food sectors

Specific discussion Topics are:

- ✓ The role of agriculture in modern societies.
- ✓ The relationship between agriculture and other economic sectors.
- ✓ Link between agricultural production and food consumption.
- ✓ Characteristics of agri-food demand.
- ✓ Characteristics of agri-food supply.
- ✓ The theoretical market models in agri-food sectors.

Agri-food sector in modern societies

The role of agriculture and agri-food sector change with:

- Industrialization, post-industrialization.
- Economic growth.
- Technological progress and innovation.
- Society modernization/transformation.
- other socio-economic, technological and cultural transformation process.

Agri-food sector in modern societies

In this way change the characteristics of demand and supply of agri-food products and the characteristics of agri-food products themselves.

Many drivers and governors influence, over time, the changes of demand and supply characteristics.

Agri-food sector in modern societies

Main drivers and governors of change on the **demand** side:

Demographics: growth rate; age distribution; ethnicity; race; geographic distribution; extent of travel; exposure to food-related information and retailer promotion.

Consumer preferences: price vs. quality/condition; convenience; year-round availability; variety; nutritional content; safety; greenness; fair trade; luxury goods.

Buyer specifications: volumes; presentation; labeling; private standards; certification; price point; service.

Agri-food sector in modern societies

Main drivers and governors of change on the **demand** side:

Technology: marketing information systems; category management methods; progress in supply chain management; transport and handling advances.

Regulatory change: official standards and associated certification; labeling (nutrition, COOL, allergens); market access; environmental protection; labor rights; animal rights.

Market access: tariffs; quarantine restrictions; other non-tariff trade barriers (NTBs).

Agri-food sector in modern societies

Main drivers and governors of change on the **demand** side:

Factor costs in distribution and retailing: energy; transport; labor.

Economic growth trends: GDP; disposable income; levels and use of consumer credit; inequality of wealth.

Agri-food sector in modern societies

Main drivers and governors of change on the **supply** side:

Product/market conditions: effective demand; prices; competition.

Procurement practices: value chain integration; compliance with private standards; preferred supplier arrangements; new terms of sale.

Factor prices and availability for production and shipping: land; capital; labor; energy; transport.

Producer preferences: overall investment per crop area; price levels and their variability; production risk.

Agri-food sector in modern societies

Main drivers and governors of change on the **supply** side:

Technology: marketing information systems; supply chain management; quality assurance regimes; transport and handling technologies; post-harvest and production technologies.

Regulatory change: capacity to deal with market access requirements and standards; dealing with local and national restrictions on land use, inputs, labor contracting and treatment.

Agri-food sector in modern societies

Main drivers and governors of change on the **supply** side:

Demographics: availability of seasonal labor; existence of a local market for seconds and an urban market for export-quality product.

Agri-food sector in modern societies

Nowadays, agri-food sector, in EU and Italy, shows the following trends:

Decline of the economic role of agriculture in terms of contribution to GNP and employment ratio.

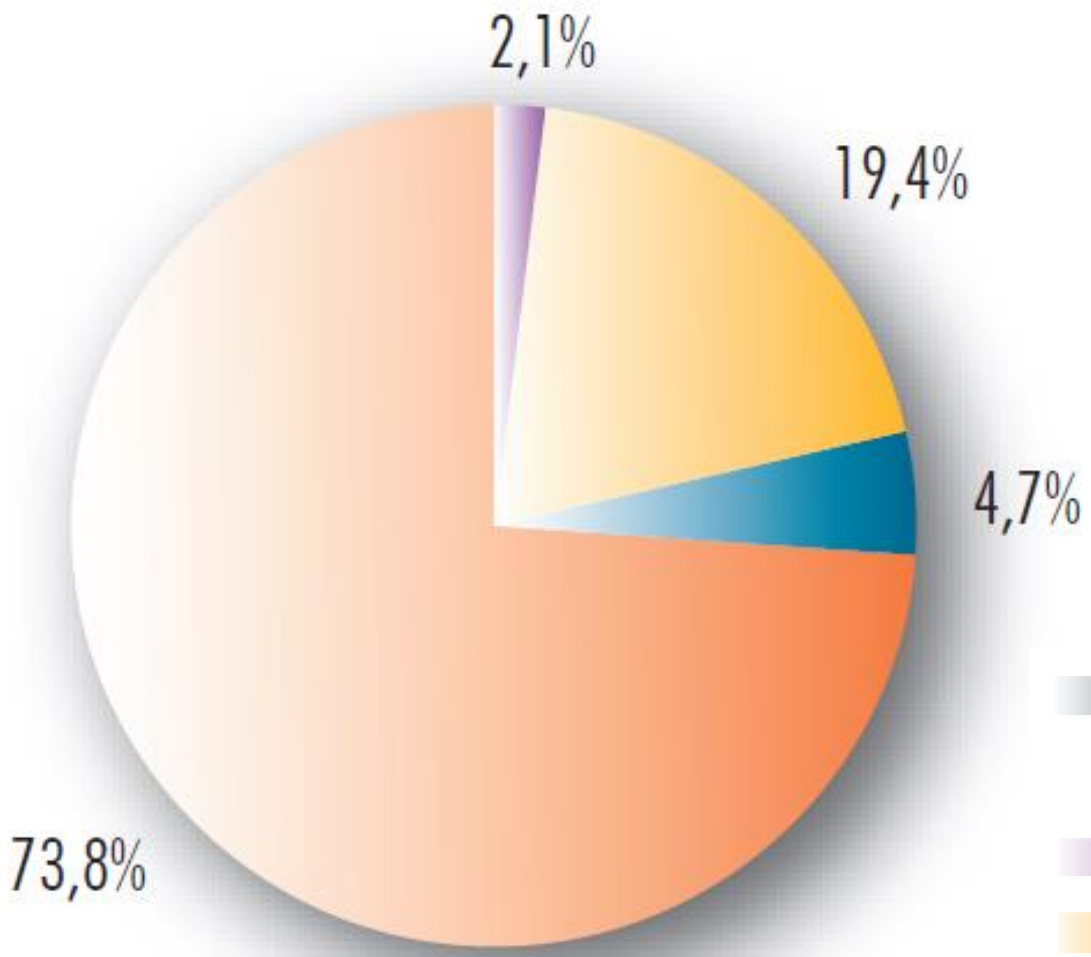
The economic growth is driven by industrial sectors and by services sectors, that mainly produce the GNP.

Industrial sectors and by services sectors have the main number of employees.

Agriculture provide labor force to other sectors.

Agri-food sector in modern societies

% breakdown of the value added at basic prices by sector, 2017



TOTAL

Agriculture, Forestry and Fishing

Industry, in its narrow sense

Construction

Services, including public sector

Source: ISTAT, National accounting

Agri-food sector in modern societies

% share of agricultural value added on the total value added of each EU. 2016

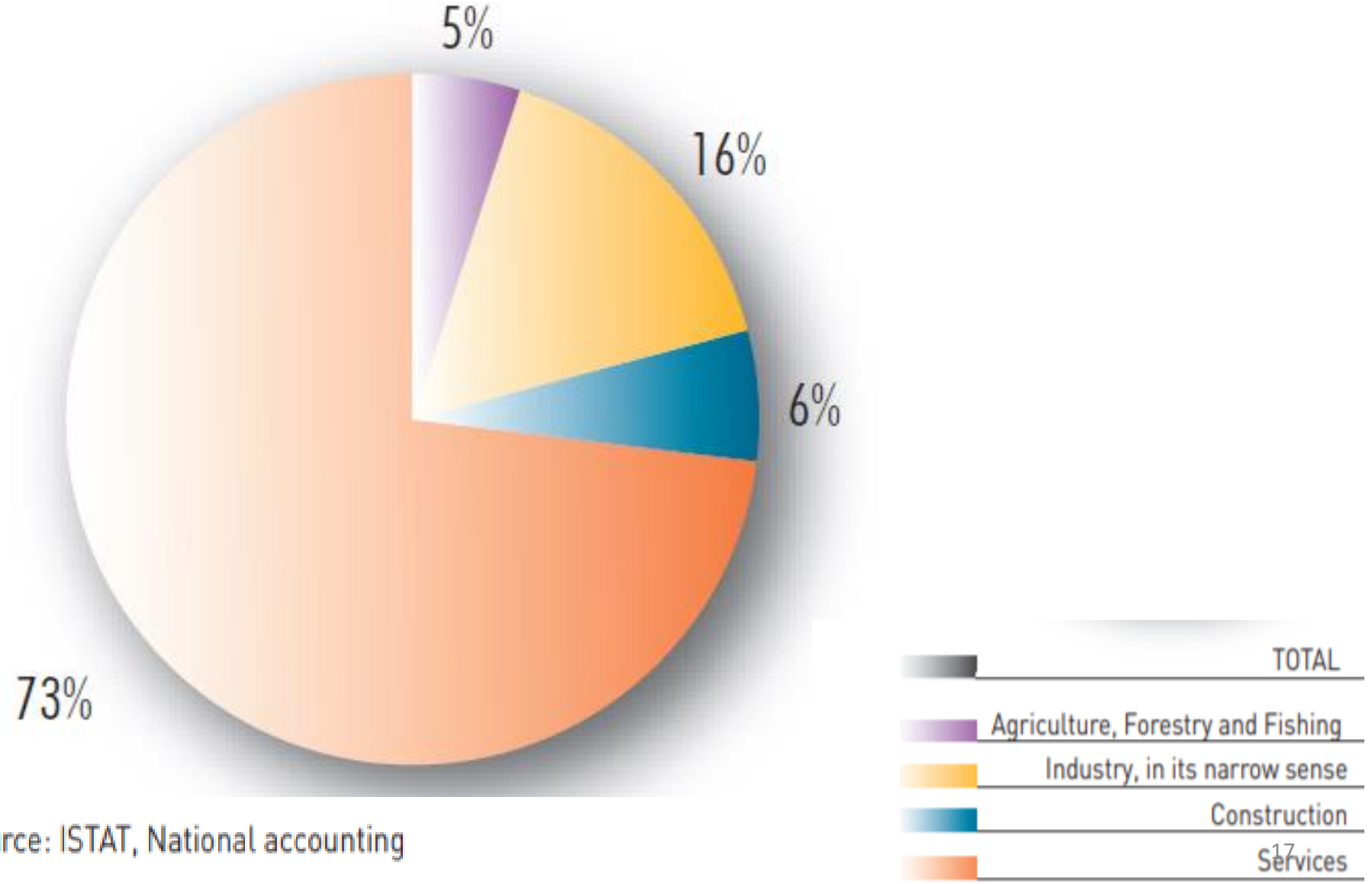
Countries	%	Countries	%
Luxembourg	0.2	Poland	2.4
Germany	0.6	Czech Rep.	2.5
UK	0.6	Estonia	2.6
Belgium	0.7	Finland	2.7
Ireland	1.0	Spain	2.8
Denmark	1.1	Latvia	3.2
Austria	1.3	Lithuania	3.3
Sweden	1.3	Slovakia	3.8
Malta	1.4	Greese	4.0
France	1.6	Croatia	4.1
Netherlands	1.8	Romania	4.3
Italy	2.1	Bulgaria	4.4
Portugal	2.2	Hungary	4.5
Slovenia	2.2	**Eurozone (19 countries)**	**1.5**
Cyprus	2.3	**EU-28**	**1.5**

* Value added at basic prices - current values in million euro

Source: Eurostat

Agri-food sector in modern societies

Employment in Italy, 2017



Source: ISTAT, National accounting

Agri-food sector in modern societies

People employed in agriculture (15 years and over), in the EU (%), 2016

	People employed in agriculture / Total people employed	Female incidence[1]
Austria	4.3	42.5
Belgium	1.3	27.9
Bulgaria	6.8	29.4
Cyprus	3.6	22.0
Croatia	7.6	33.5
Denmark	2.5	19.2
Estonia	3.9	25.2
Finland	3.9	26.1
France	2.8	27.7
Germany	1.3	31.7
Greece	12.4	40.0
Ireland	5.6	11.3
Italy	3.9	27.2
Latvia	7.7	33.5
Lithuania	8.0	35.6
Luxembourg	0.9	25.0
Malta	1.4	-
Netherlands	2.1	28.1
Poland	10.5	39.8
Portugal	6.9	33.7
UK	1.1	26.1
Czech Rep.	2.9	26.1
Romania	23.1	42.2
Slovakia	2.9	21.8
Slovenia	5.0	38.6
Spain	4.2	23.1
Sweden	1.9	25.4
Hungary	5.0	25.8
EU 28	**4.3**	**33.5**
Eurozone	**3.2**	**29.3**

[1] on the total people employed in agriculture
(-) unavailable datum
Source: Eurostat

Agri-food sector in modern societies

Increase of agricultural productivity

In the industrialization and post-industrialization process there is:

- a labor force exodus from agriculture and rural areas;
- an increase in incomes, in particular in no-agricultural incomes (industrial incomes and services incomes);
- a demographic growth;
- an increase in agri-food demand.

Agricultural sector, with less labor force, can provide more food to satisfy a increasing demand only with a increase of productivity.

Agri-food sector in modern societies

More complex relationship of agriculture with other economic sectors/activities (industry, logistic, retail,…): filiere / supply chain of agri-food.

Farms increase the purchase of input and the sell of output.

Change the relationship of agriculture with input industry and with food transformation industry.

Technological progress and innovations change the characteristics of agri-food products.

The links of agriculture with other sectors become more and more important.

Agri-food sector in modern societies

Increase of (geographical) distance between producers and consumers.

Several factors influence this trend:

- Reduction of transportation costs.
- Innovation in storage and conservation food techniques.
- Increase in domestic and international trade.
- Globalization of consumption behavior.

Agri-food sector in modern societies

Increase of (geographical) distance between producers and consumers.

Consequences:

No direct relationship between consumers and producers.

The links of agriculture with other sectors become more and more important.

Asymmetric information – risk of market failure.

New markets for firms and increasing differentiation process.

Agri-food sector in modern societies

Importance of quality of food (multidimensional concept) and the differentiation of the agri-food products.

Diversification of food products:

- Commodities: grain, meat, milk,..
- “Specialties” (differentiation of agri-food products): wine, olive-oil, geographical indication products, organic products, food with brand,…

- Commodities (perfect competition market)
- “Specialties” (imperfect competition market)

Agri-food sector in modern societies

Importance of quality of food (multidimensional concept) and the differentiation of the agri-food products.

The agri-food product from no-differentiated goods became ad differentiated goods.

Commodities *vs* Specialties.

Commodities: perfect competition model.

Specialties: imperfect competition model with product differentiation.

Global market *vs* Local market.

Agri-food sector in modern societies

Environmental concern

Negative externalities (soil and water pollution, CO2 emissions,..).

Positive externalities (landscape, biodiversity conservation,..).

Risk of market failure.

Agri-food sector in modern societies

Environmental concern

Socio-environmental role of agriculture in modern societies.

Multifunctional agriculture (Rural development).

Sustainability.

Economic growth → sustainable development

Green economy, circular economy

Agri-food sector in modern societies

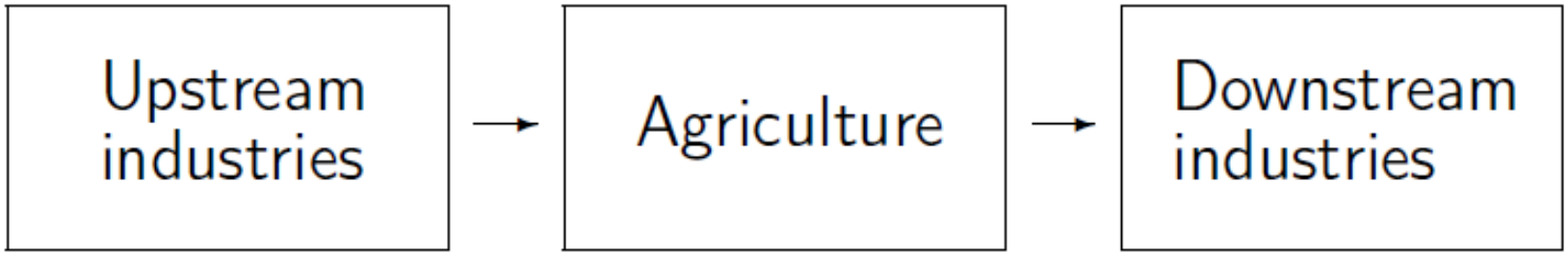
Importance of government regulation and public intervention.

The public intervention is related and justified by the following goals:

- Food security
- Food safety
- Market failure (asymmetric information and externalities)
- Environmental goals
- Social goals
- Economic goals

Agri-food sector in modern societies

The agri-food sector



Examples:

- Feed
- Agricultural machinery
- Fertilizer
- Plant protection
- Seed
- Energy

Other markets:

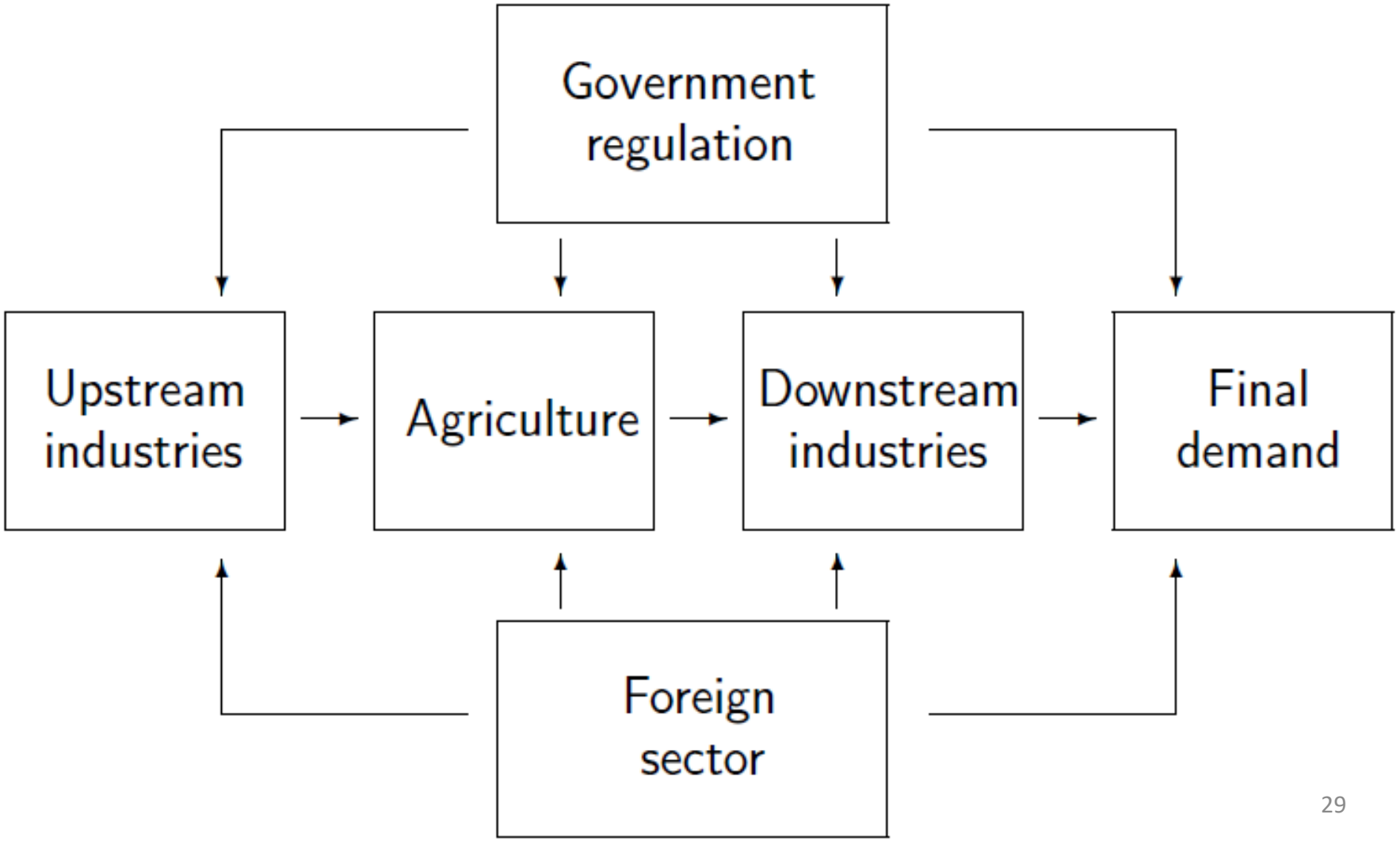
- Labour market
- Land market

Examples:

- Procurement of raw products
- Semiprocessed foods (e.g. flour mills)
- Consumer food products (e.g. food processing, bakeries)
- Grocery wholesalers and retailers

Agri-food sector in modern societies

The agri-food sector in a broader context



Agriculture and other economic sectors

It becomes important not so much the macroeconomic relationship between agriculture and other sectors, but the **supply chain** relationships (**agri-food filière**).

A supply chain is a system of organizations, people, activities, information, and resources involved in moving a product or service from supplier to customer.

Supply chain activities involve the transformation of natural resources, raw materials, and components into a finished product that is delivered to the end customer.

Agriculture and other economic sectors

In sophisticated supply chain systems, used products may re-enter the supply chain at any point where residual value is recyclable. (**Circular economy)**.

Agriculture and other economic sectors

Many agribusinesses and food processors source raw materials from smallholder farmers.

This is particularly true in certain sectors, such as coffee, cocoa and sugar.

Over the past 20 years, there has been a shift towards more traceable supply chains.

Rather than purchasing crops that have passed through several layers of collectors, firms are now sourcing directly from farmers or trusted aggregators.

The drivers for this change include concerns about food safety, child labor and environmental sustainability as well as a desire to increase productivity and improve crop quality (**sustainability**)

Agriculture and other economic sectors

Supply chains link value chains.

A value chain is a set of activities that a firm operating in a specific industry performs in order to deliver a valuable product or service for the market.

The concept comes through business management and was first described by Michael Porter in his 1985 best-seller, Competitive Advantage: Creating and Sustaining Superior Performance.

Agriculture and other economic sectors

The idea of the value chain is based on the process view of organizations, the idea of seeing a manufacturing (or service) organization as a system, made up of subsystems each with inputs, transformation processes and outputs. Inputs, transformation processes, and outputs involve the acquisition and consumption of resources – money, labour, materials, equipment, buildings, land, administration and management. How value chain activities are carried out determines costs and affects profits.

Agriculture and other economic sectors

In Porter's value chains, Inbound Logistics, Operations, Outbound Logistics, Marketing and Sales, and Service are categorized as primary activities.

Secondary activities include Procurement, Human Resource management, Technological Development and Infrastructure.

Agriculture and other economic sectors

What exactly is an agri-food supply chain?

Entire set of processes and activities required to produce a product then deliver it to a target market.

- The term "produce" encompasses growing, transforming, or manufacturing.
- The entire chain goes from "farm to fork," but development projects are usually concerned with a subset of links within the chain.
- For the chain to work, factors of production and technology are not enough; efficient transport, information systems and management are crucial.

Agriculture and other economic sectors

The agri-food filière:

- The upstream pole which includes farming and fisheries activities, agricultural machinery and animal feed producers.
- The downstream pole which comprises catering services, and distribution of finished products.
- The core consists of the food processing industry.

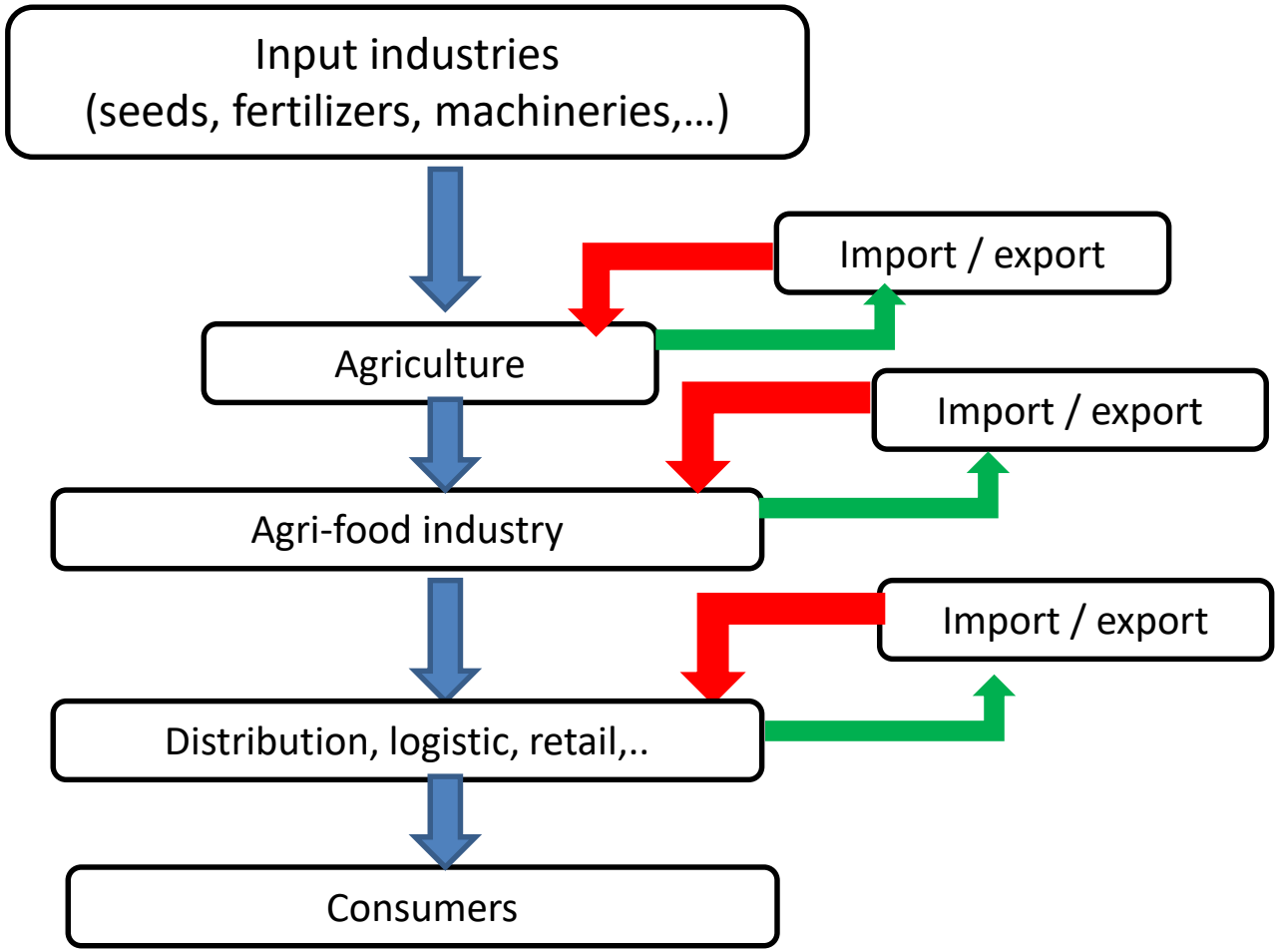
The upstream pole is a set of industries supplying to the core industries of the filière.

The downstream pole consists of the industries that buy from the core industries.

The core comprises all the industries involved in the transformation of inputs such as raw materials and primary products into finished goods.

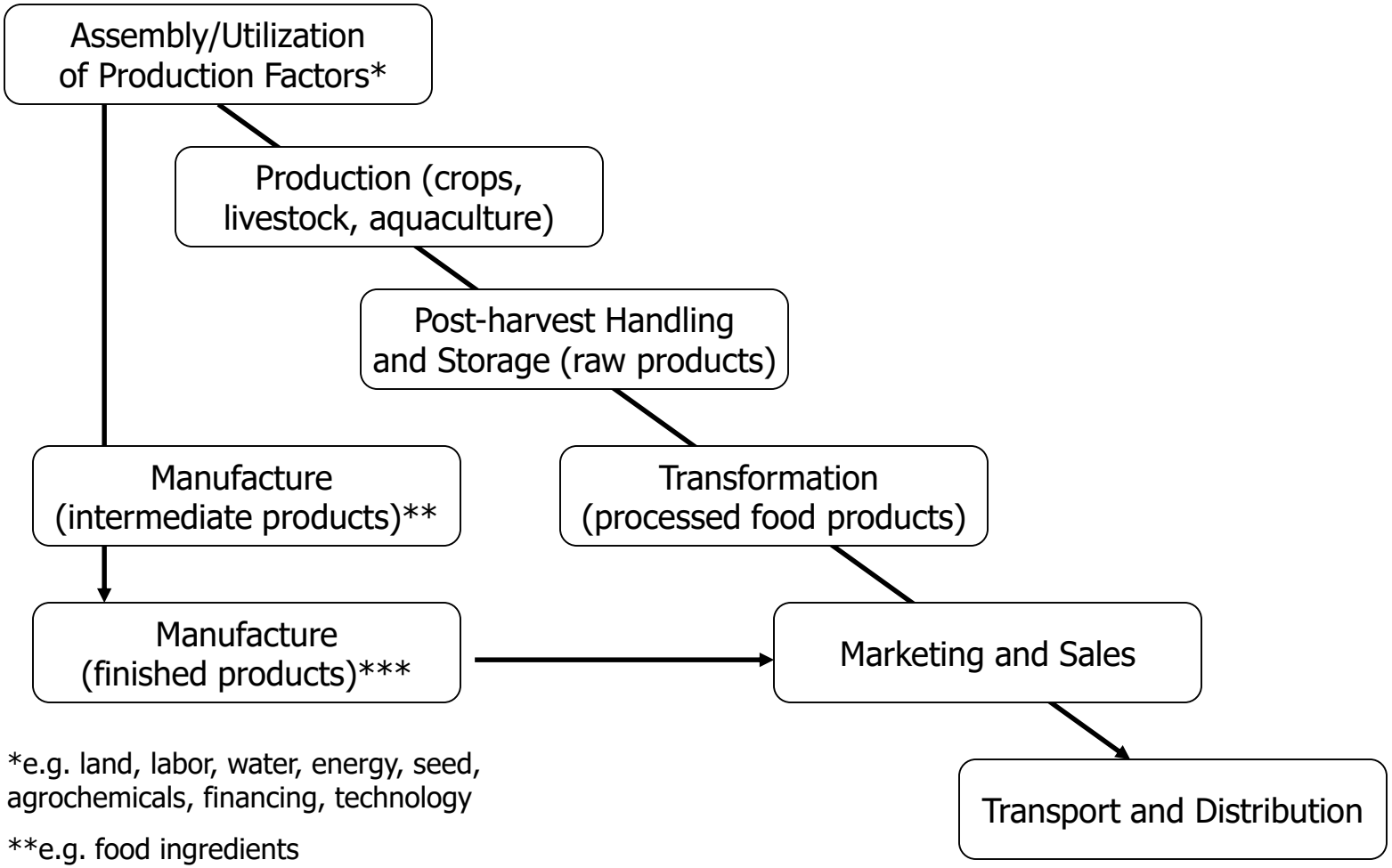
Agriculture and other economic sectors

A scheme to represent a Agri-food supply chain



Agriculture and other economic sectors

A scheme to represent a Agri-food supply chain

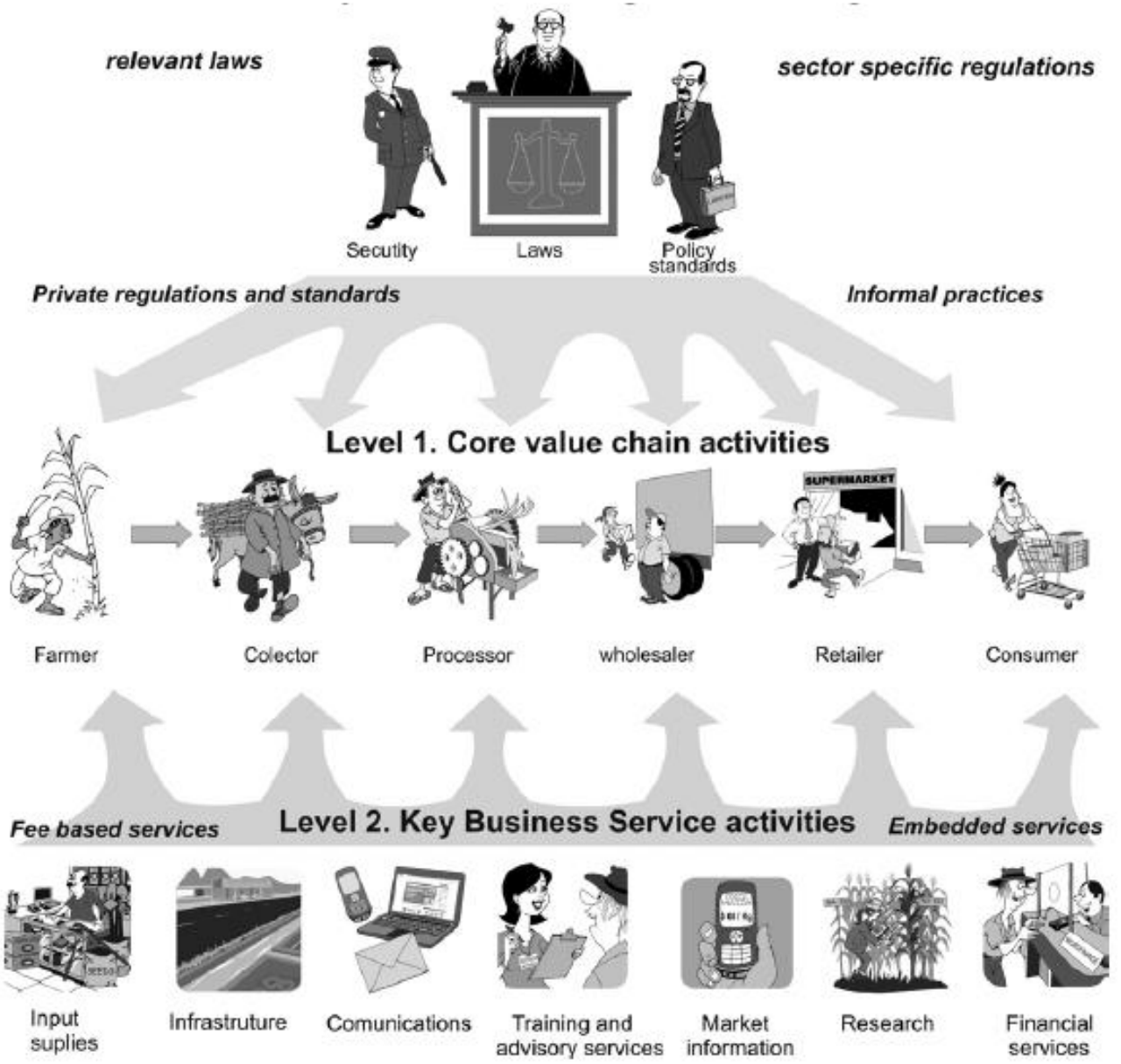


*e.g. land, labor, water, energy, seed, agrochemicals, financing, technology

**e.g. food ingredients

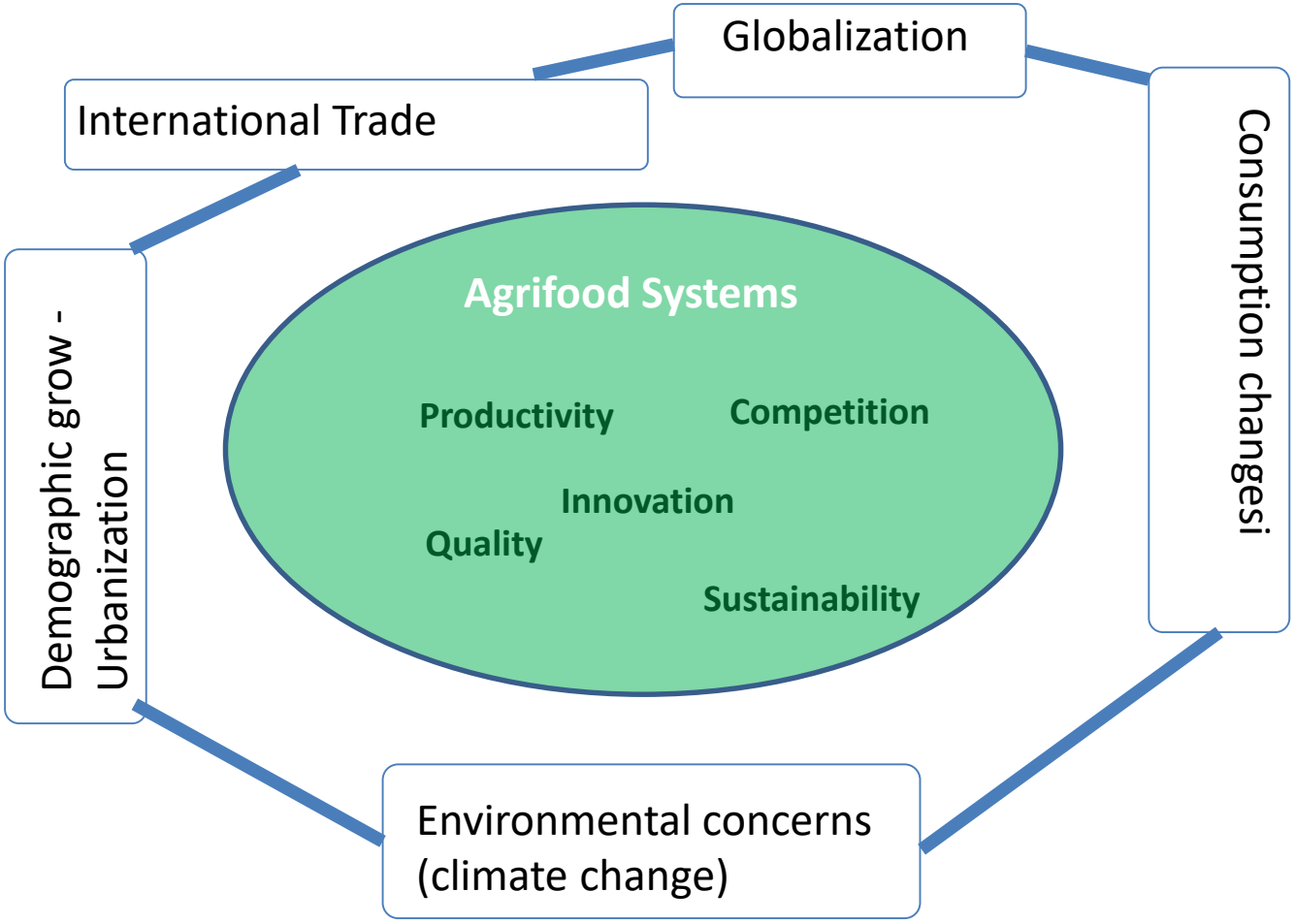
**e.g. packaged foods

Agriculture and other economic sectors



Keyword: Food security – Food safety

- **food security:** is a condition related to the supply of food, and individuals' access to it.
- **food safety:** "**food security**": refers to handling, preparing and storing food in a way to best reduce the risk of individuals becoming sick from foodborne illnesses. Food safety is a global concern that covers a variety of different areas of everyday life.


Globalization
International Trade
Consumption changesi
Demographic grow - Urbanization
Agrifood Systems
Productivity
Competition
Innovation
Quality
Sustainability
Environmental concerns (climate change)

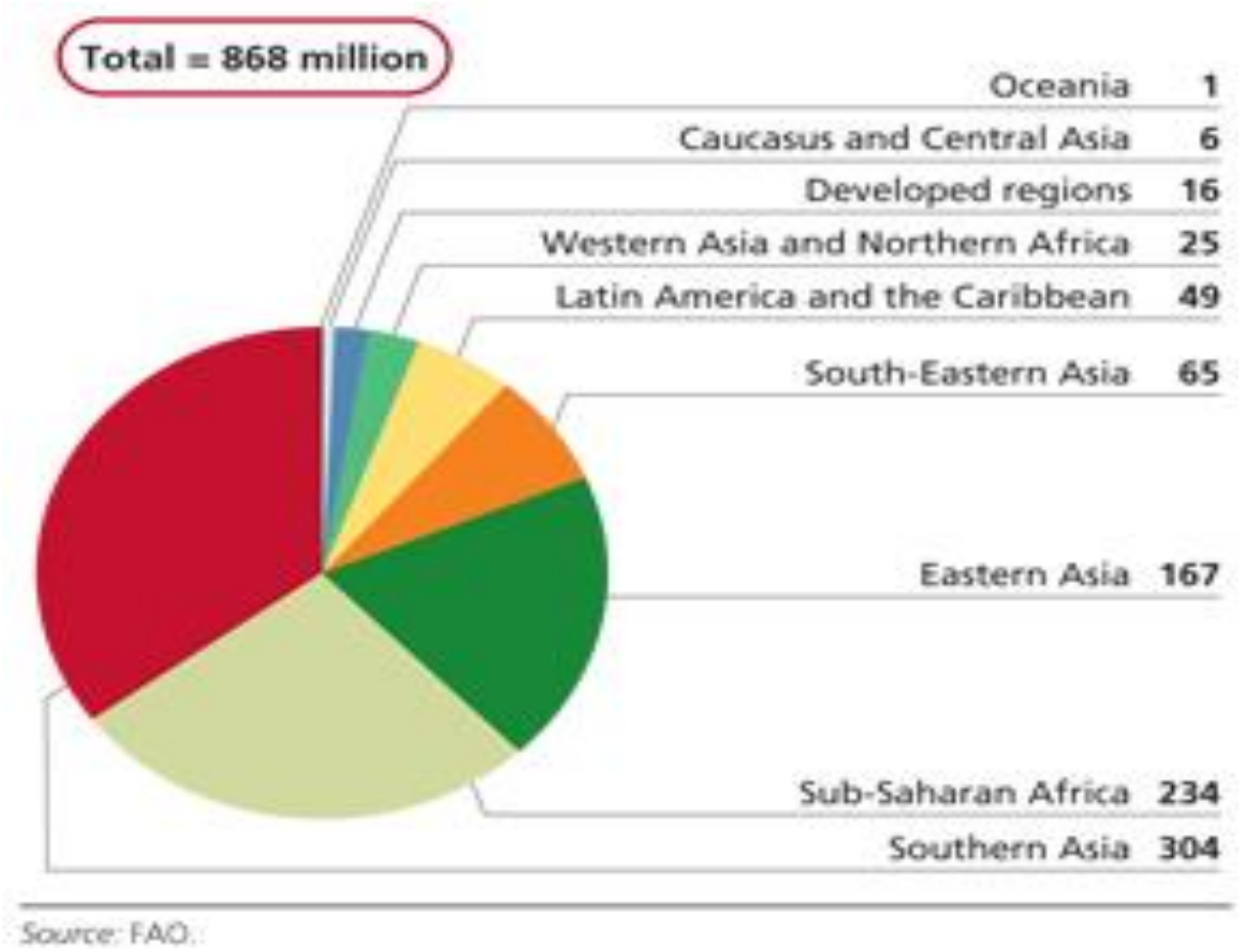
High income countries	Low income countries
Low contribution to GNP	High contribution to GNP
Low contribution to Employment ration (high age of farmers)	High contribution to Employment ration
High relevance of Agrifood Industry, Transport and Logistic	Low relevance of Agrifood Industry, Transport and Logistic
Growing environmental problems	
Growing social and environmental functions of agriculture	
Growing demand of high quality food	Demand of normal/necessary food (quality food in emerging countries)
Quality certification systems - labels	
Food Safety (Food Security)	Food Security and Food Safety

World population

- Today, the world's population continues to grow, albeit more slowly than in the recent past.
- Ten years ago, the global population was growing by 1.24 per cent per year.
- Today, it is growing by 1.10 per cent per year, yielding an additional 83 million people annually.
- The world's population is projected to increase by slightly more than one billion people over the next 13 years, reaching 8.6 billion in 2030, and to increase further to 9.8 billion in 2050 and 11.2 billion by 2100

Demographic growth and urbanization

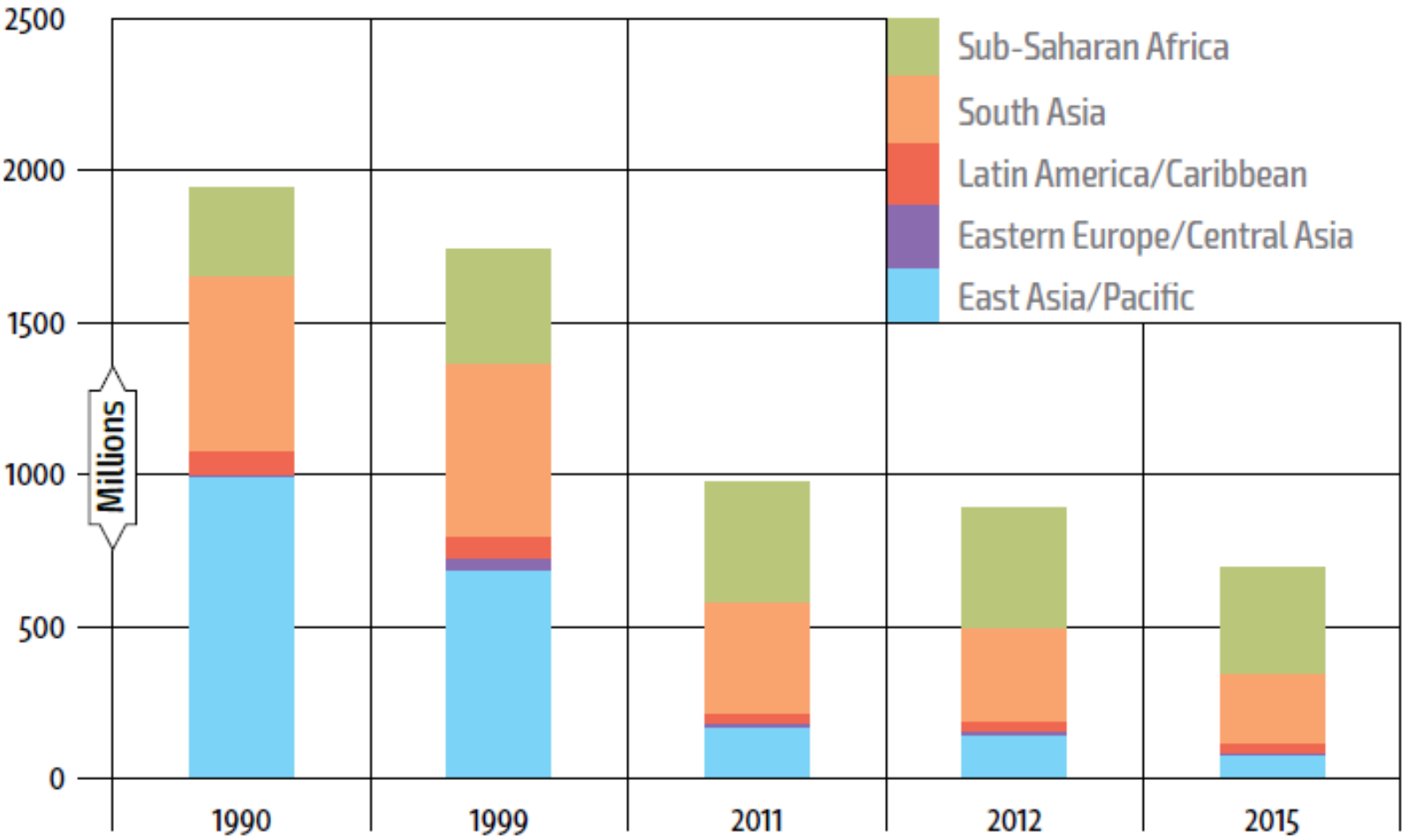
- Africa should double their population : from 1 to 2 billion people until 2050
- In the development countries should 2,5 billions people will live in urban areas, in particular in Africa and Asia
- The urbanization process is related to the increase in income and changes in food consumption
- Currently, 40% of the world's lands are dry, and the increasing temperatures make the deserts move forward. At the current rate it could feed only half the world's population in 2050
- 28% of agriculture is located in regions that suffer from water stress, where agriculture needs 1,500 liters of water to produce 1 kg of wheat and 16,000 liters of water to produce 1 kg of meat



Number of people affected by undernourishment in 2010–12 (by region, in millions)

Food security

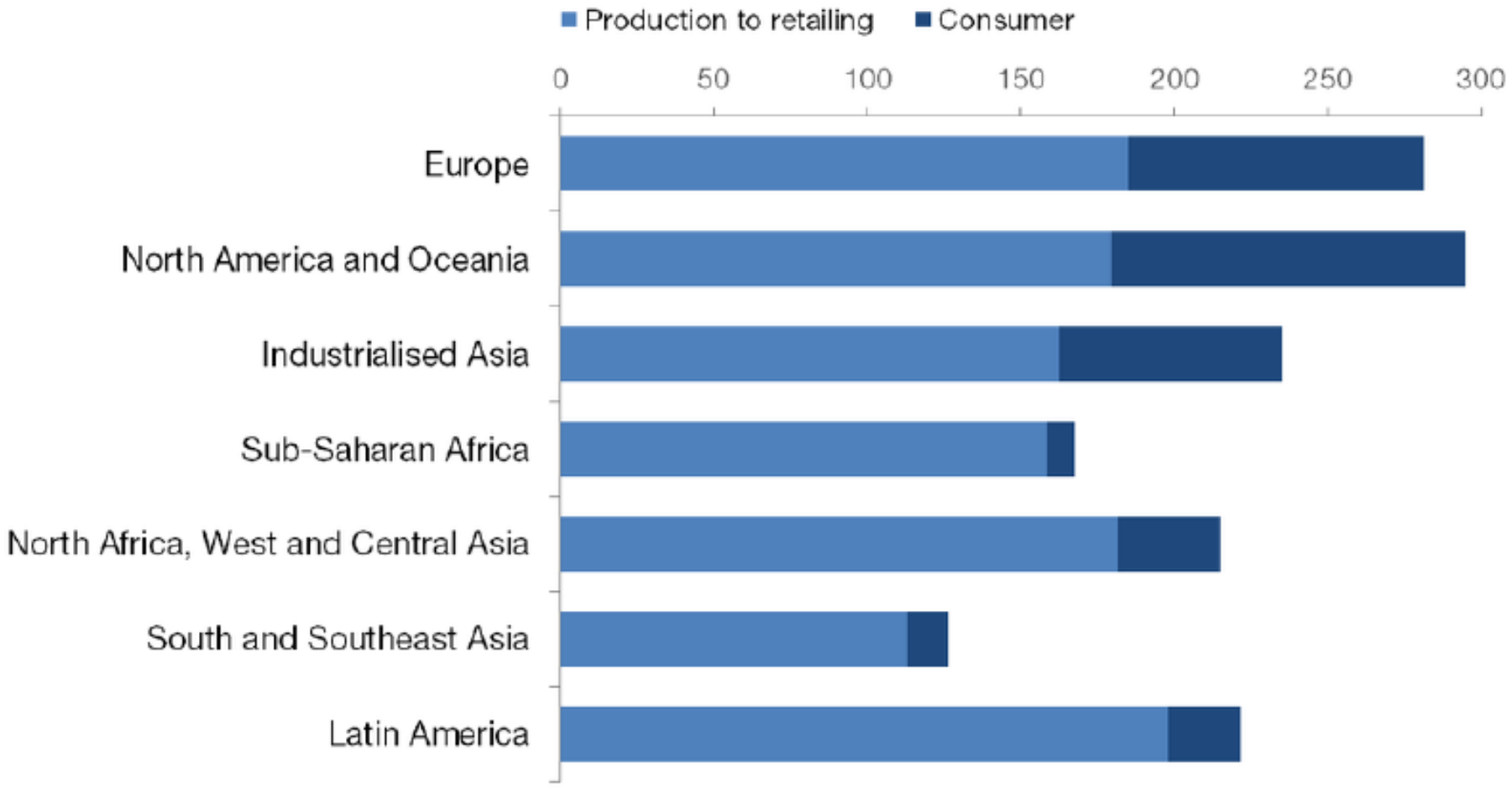
People below the poverty line (PPP) of US$ 1.90 per day, 1990–2015



Note: Data for the Near East and North Africa are not available.
Source: FAO Global Perspectives Studies, based on World Bank, 2015.

Which regions waste the most food?

Per capita food losses and waste, kg/year



Source: The Food and Agriculture Organization of the United Nations (FAO)

PERCENTAGE AND NUMBER OF PEOPLE AFFECTED BY SEVERE FOOD NSECURITY, MEASURED USING THE FIES (2014–16)

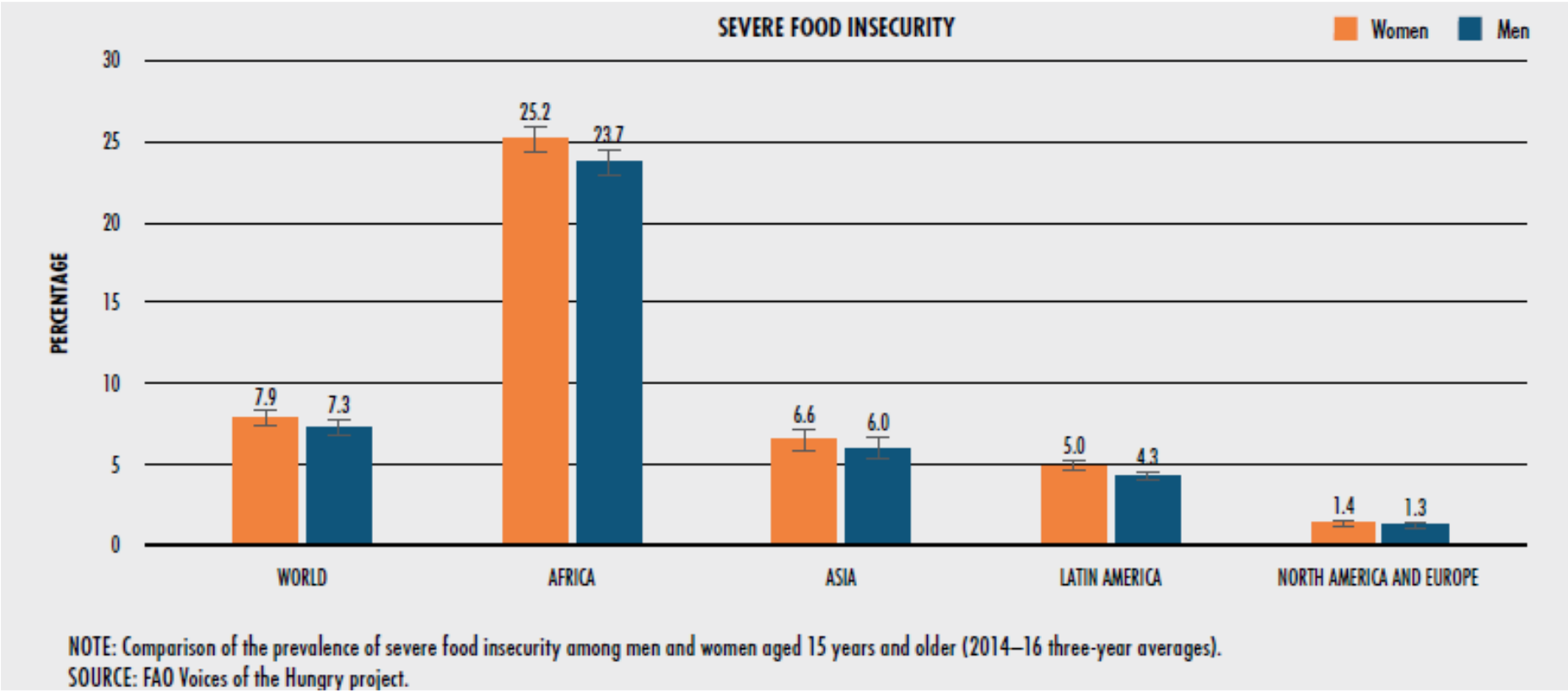
	Severe food insecurity – prevalence			Severe food insecurity – number of people		
	2014	2015	2016	2014	2015	2016
	Percentage			*Millions*		
WORLD	**9.2 (±0.5)**	**8.8 (±0.4)**	**9.3 (±0.4)**	**665.9 (±35.7)**	**645.1(±31.7)**	**688.5 (±27.6)**
AFRICA	**25.0 (±0.8)**	**25.1 (±0.7)**	**27.4 (±0.7)**	**289.5 (±9.6)**	**298.0 (±8.7)**	**333.2 (±8.6)**
Of which:						
Sub-Saharan Africa	28.3 (±1.0)	28.7 (±0.9)	31.0 (±0.8)	265.0 (±9.5)	275.7 (±8.6)	306.7 (±8.3)
ASIA	**7.7 (±0.1)**	**7.0 (±0.7)**	**7.0 (±0.6)**	**337.0 (±34.1)**	**306.7(±30.1)**	**309.9 (±26)**
Of which:						
Central Asia and Southern Asia	14.4 (±0.5)	12.3 (±1.6)	11.1 (±1.3)	268.7 (±36.2)	233.1(±31.1)	211.9 (±24.4)
Eastern Asia and South-Eastern Asia	2.0 (±0.2)	2.1 (±0.3)	3.1 (±0.5)	44.7 (±5.1)	48.1 (±7.6)	70.5 (±11.8)
LATIN AMERICA	**4.7 (±0.3)**	**4.8 (±0.3)**	**6.4 (±0.3)**	**27.7 (±1.8)**	**28.1 (±1.6)**	**38.3 (±2.0)**
NORTHERN AMERICA AND EUROPE	**1.4 (±0.1)**	**1.6 (±0.1)**	**1.2 (±0.1)**	**15.6 (±1.6)**	**17.1 (±1.6)**	**13.0 (±1.3)**
Other country group:						
Western Asia and Northern Africa	10.7 (±0.6)	10.5 (±0.6)	11.8 (±0.7)	50.3 (±2.9)	50.7 (±2.9)	57.9 (±3.2)

NOTES: Prevalence is calculated as the number of people living in households where at least one adult has been found to be severely food insecure, as a percentage of the total population. Margins of error are in parentheses.

SOURCE: FAO, Voices of the Hungry project.

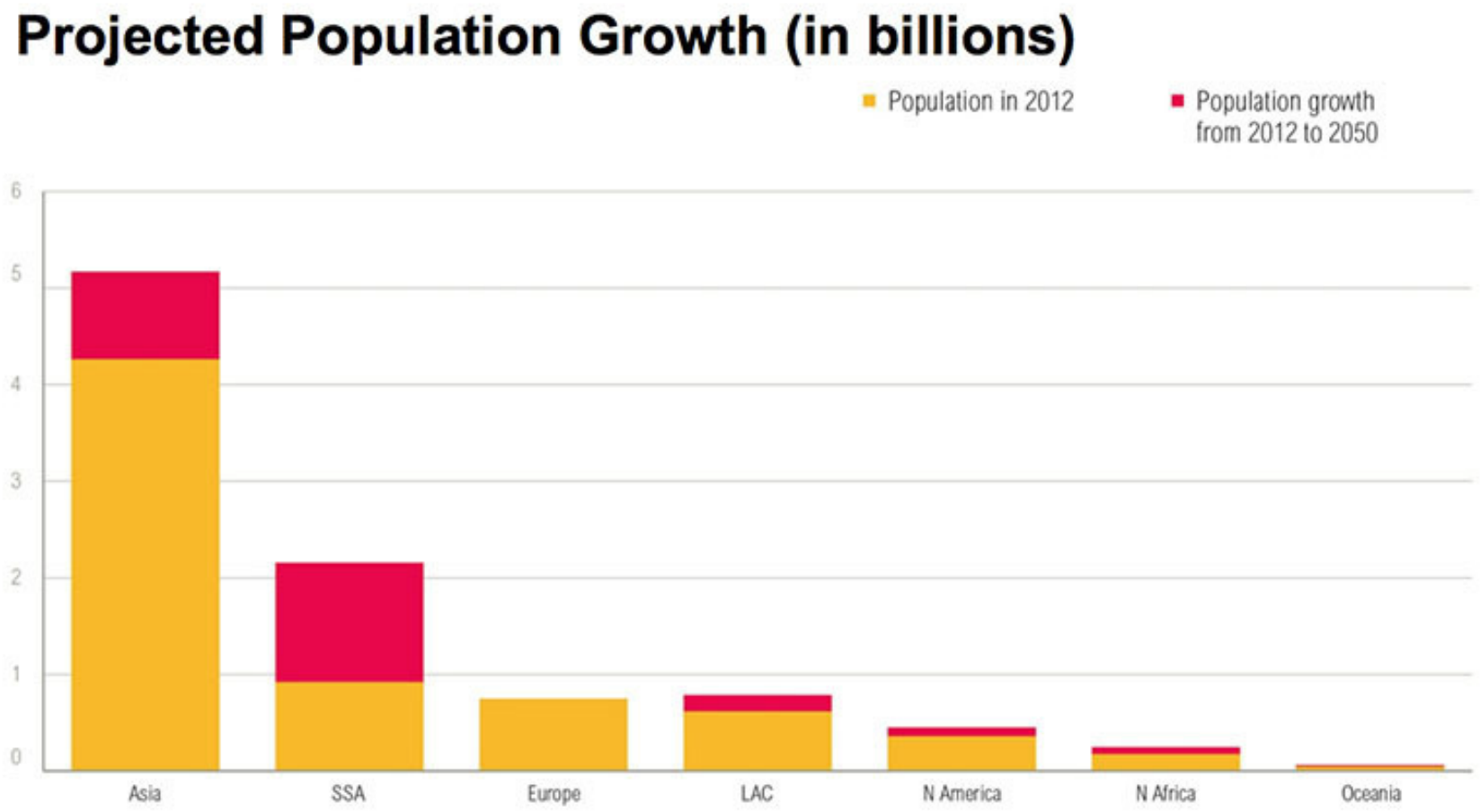
Food security

WOMEN ARE SLIGHTLY MORE LIKELY TO BE FOOD INSECURE THAN MEN IN EVERY REGION OF THE WORLD



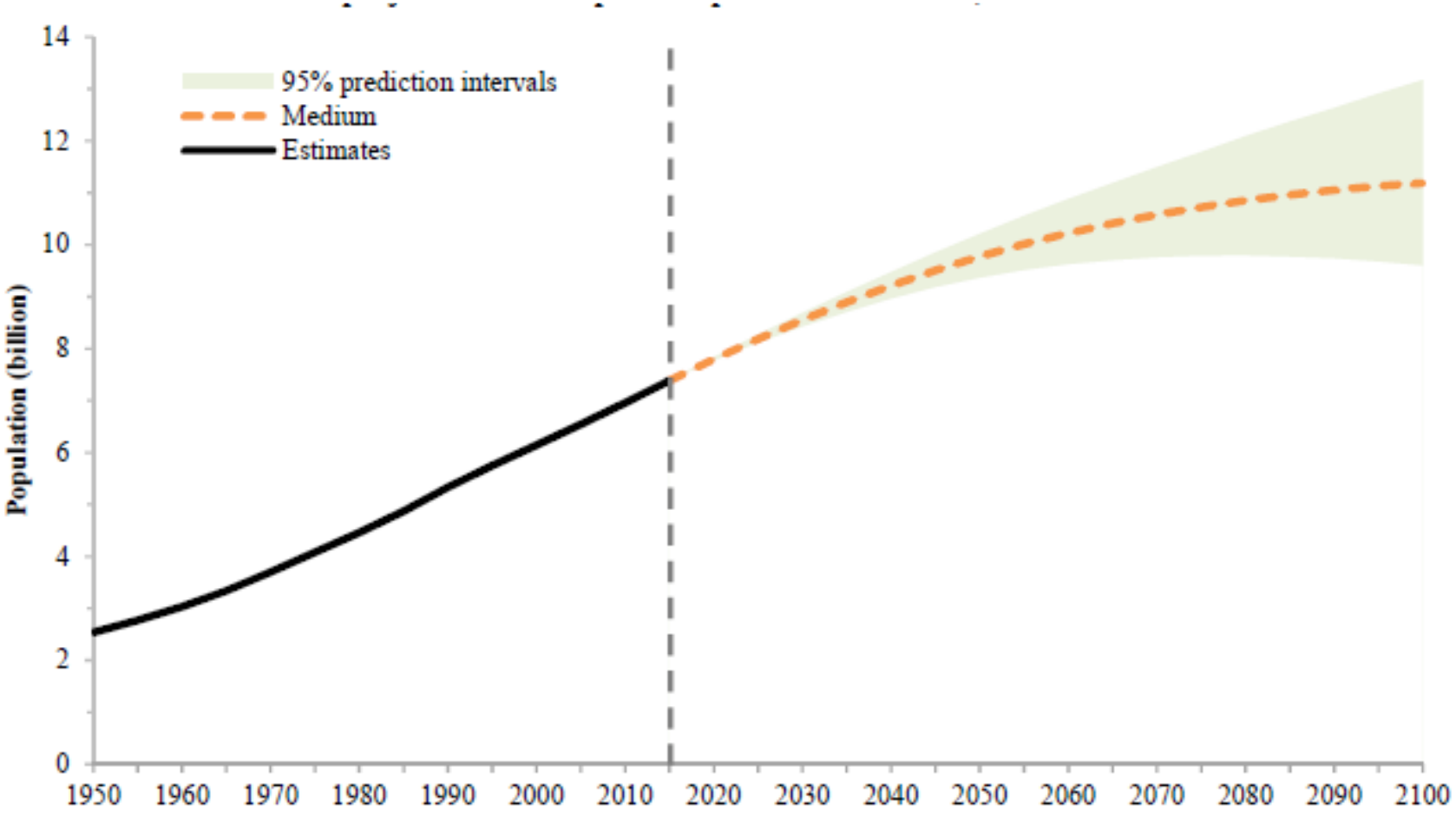
NOTE: Comparison of the prevalence of severe food insecurity among men and women aged 15 years and older (2014–16 three-year averages).
SOURCE: FAO Voices of the Hungry project.

Demographic growth and urbanization



Note: "SSA" = Sub-Saharan Africa, including Sudan. "LAC" = Latin America and Caribbean. "N America" = North America. "N Africa" = Rest of Africa.

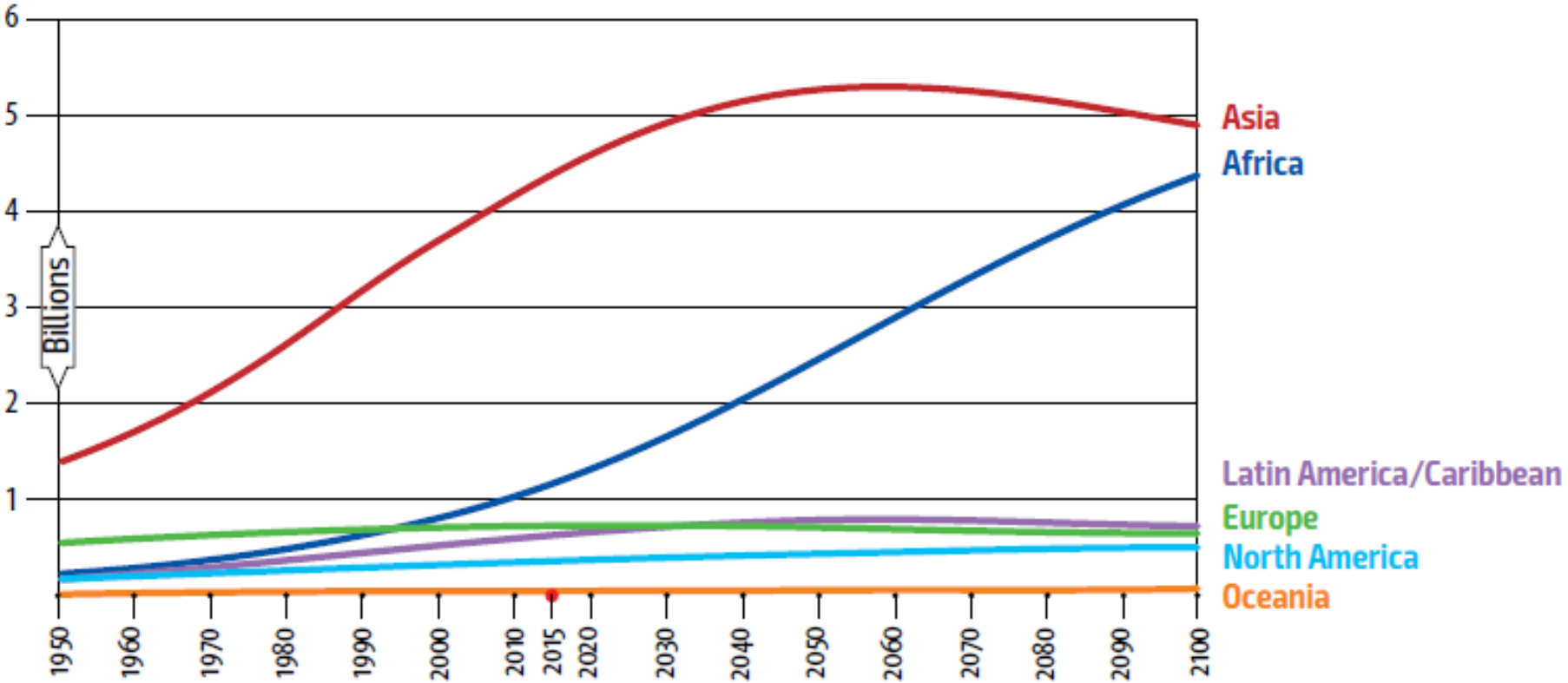
Demographic growth and urbanization



Source: United Nations, Department of Economic and Social Affairs, Population Division (2017). *World Population Prospects: The 2017 Revision*. New York: United Nations.

Demographic growth and urbanization

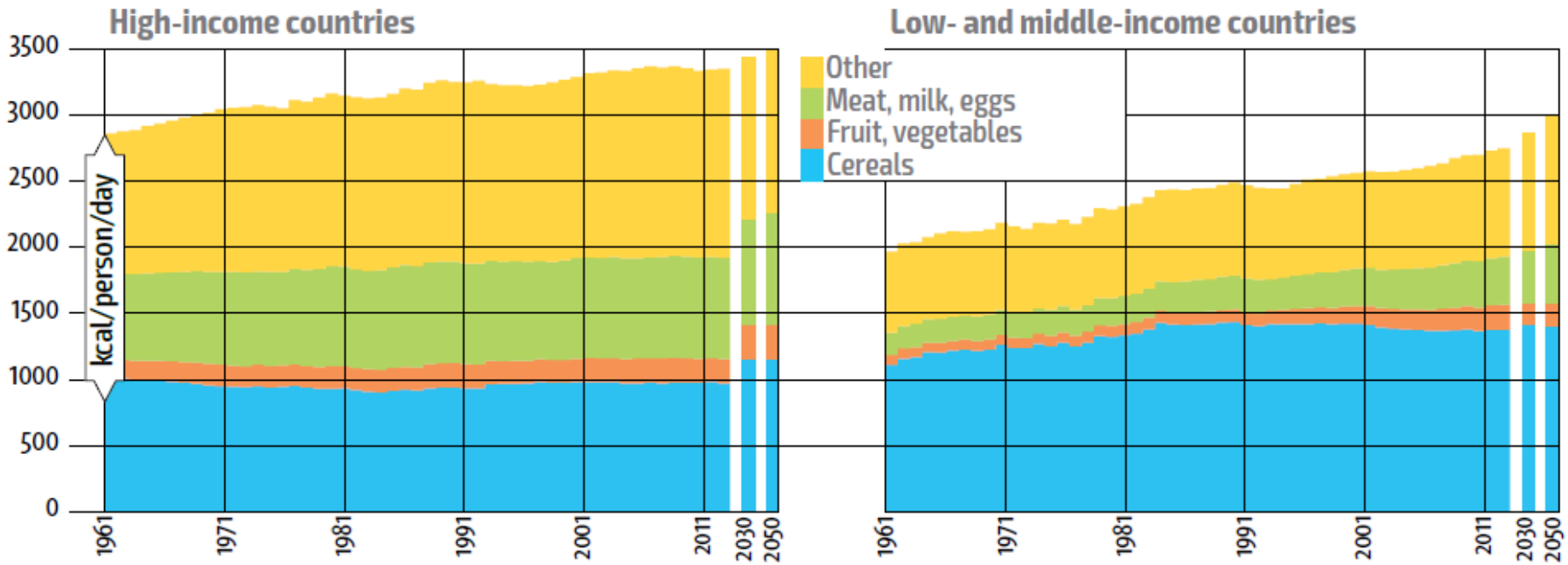
Population growth to 2100, by region (medium variant)



Source: UN, 2015.

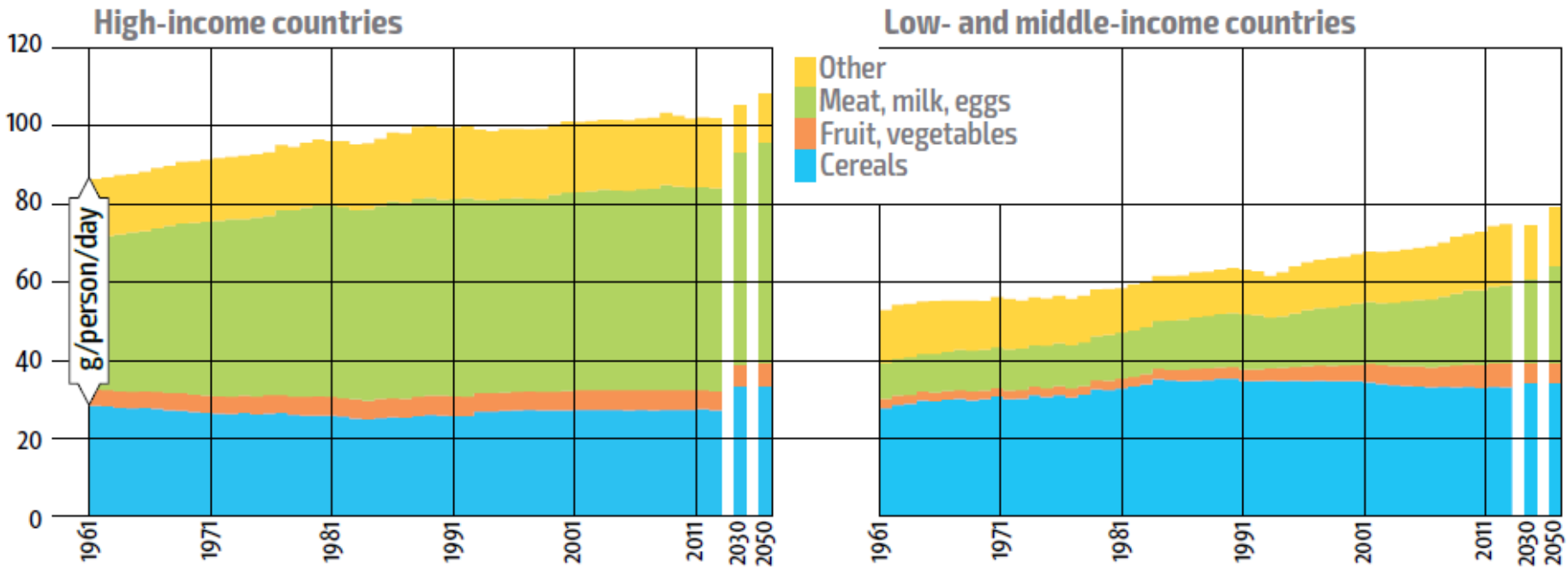
Demographic growth and urbanization

Per capita calorie intake by source, 1961–2050



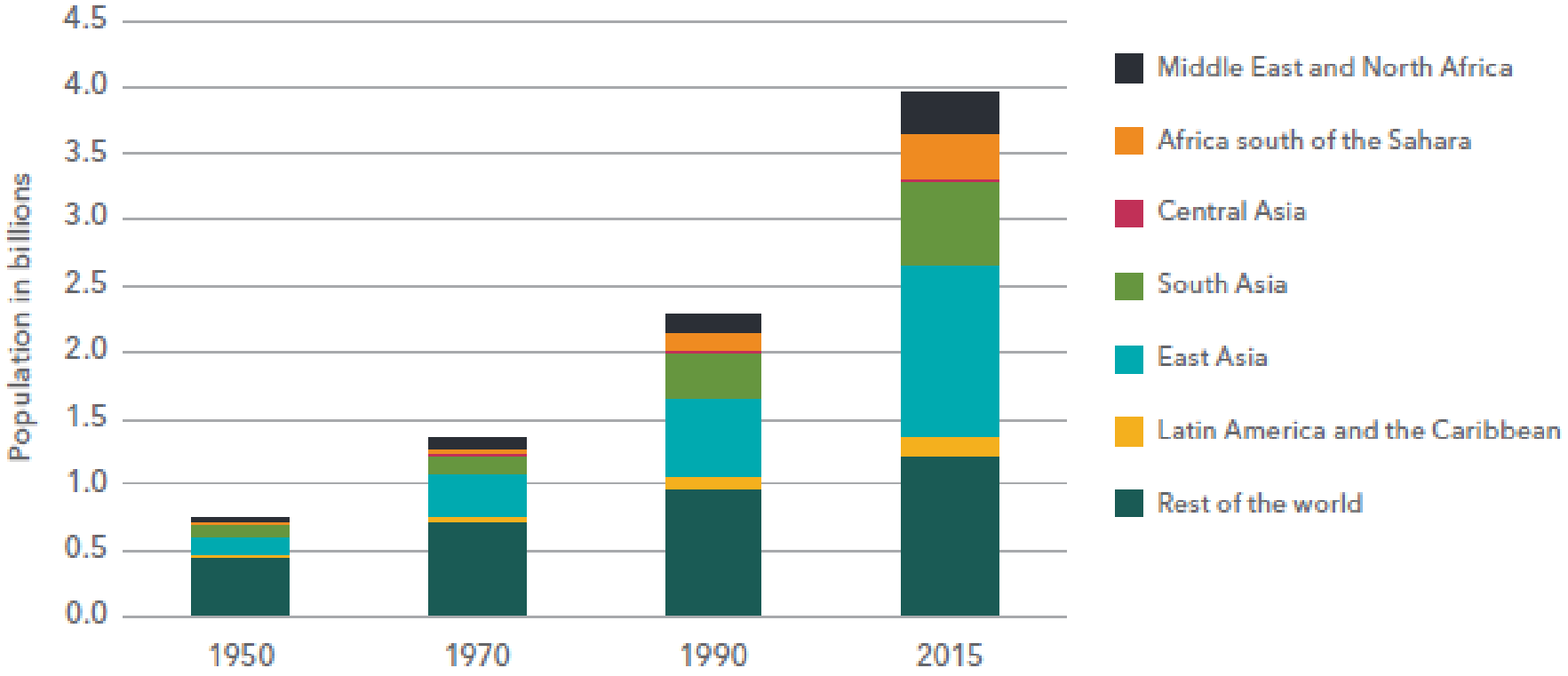
Demographic growth and urbanization

Per capita protein intake by source, 1961–2050



Demographic growth and urbanization

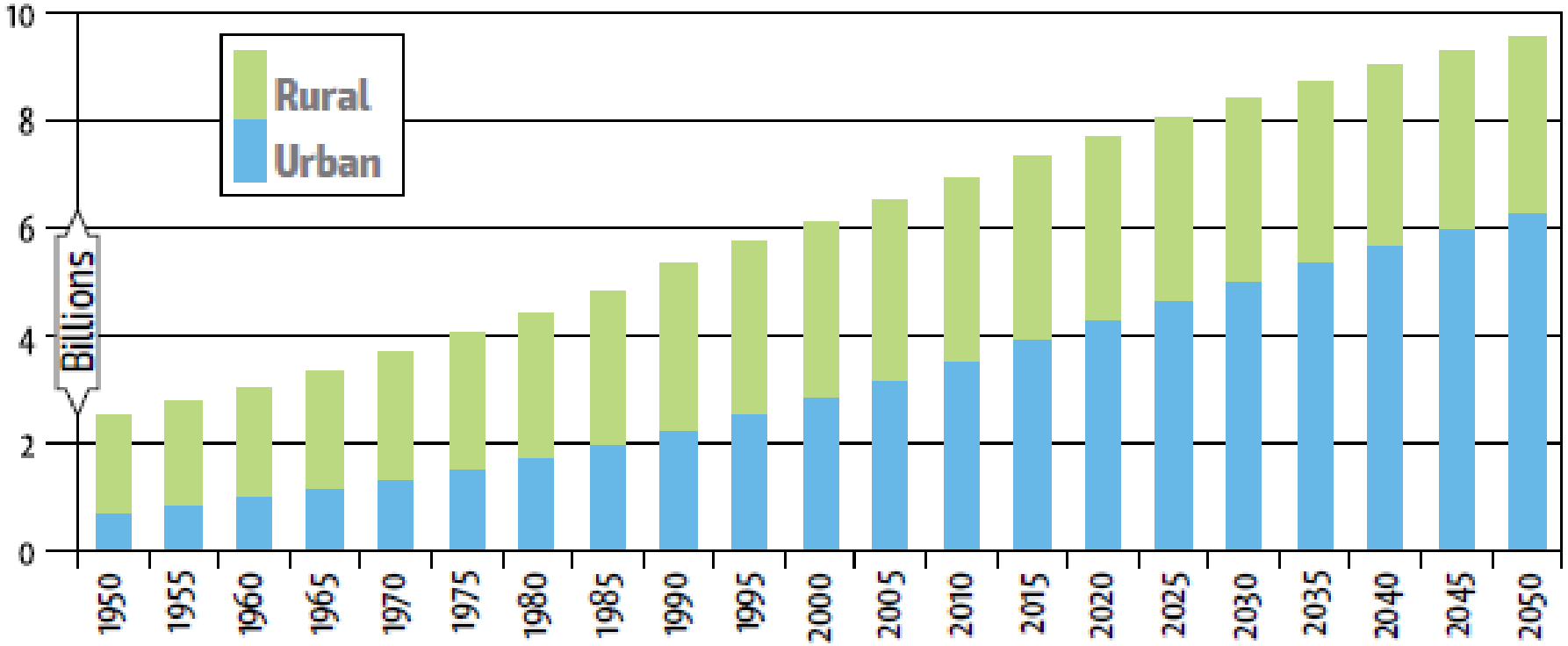
Growth of urban population in major developing regions



Source: Food and Agriculture Organization of the United Nations, FAOSTAT (2016), www.fao.org/faostat/.

Demographic growth and urbanization

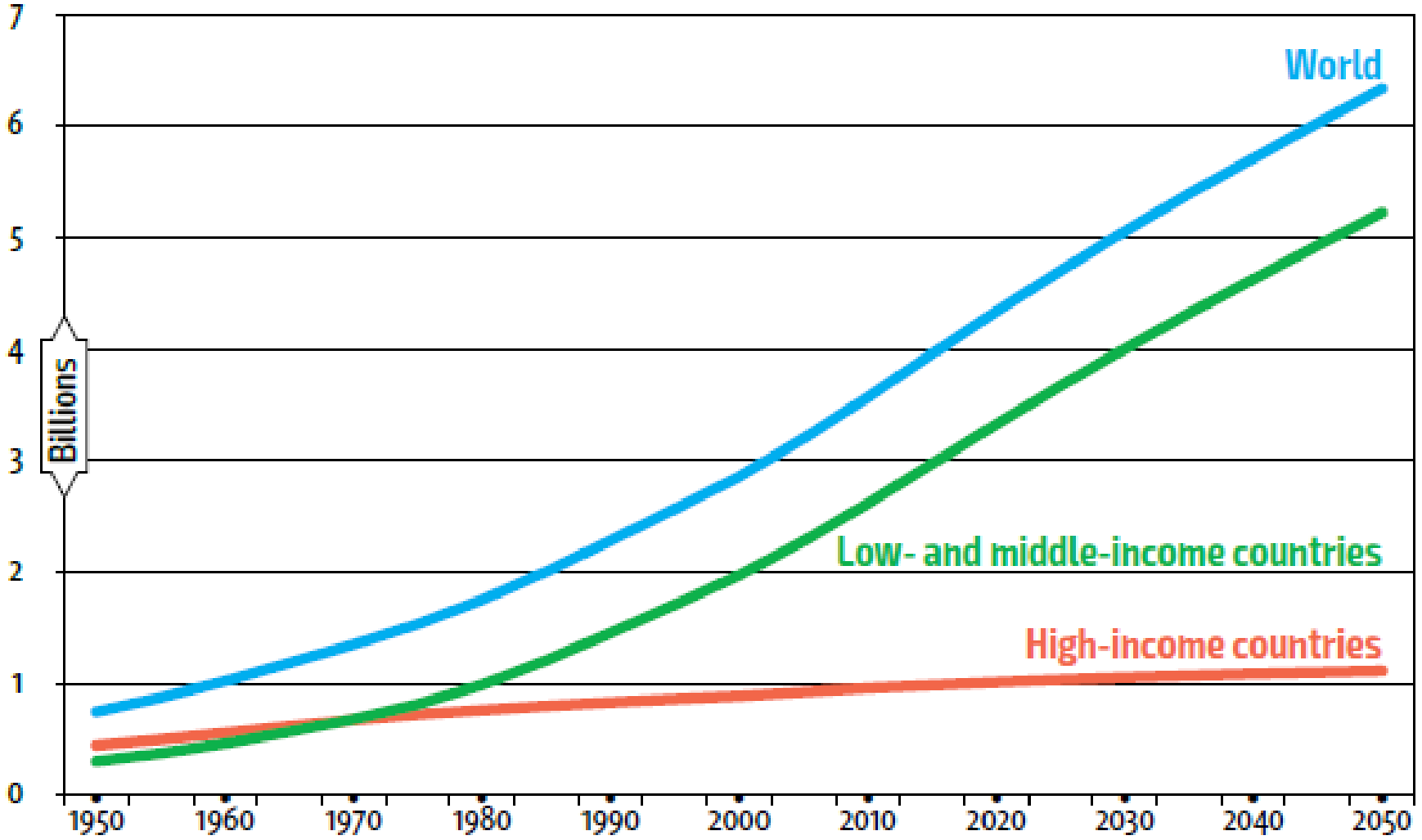
Growth in global urban and rural populations to 2050



Source: UN, 2015.

Demographic growth and urbanization

Urbanization trends, by region



Source: UN, 2015.

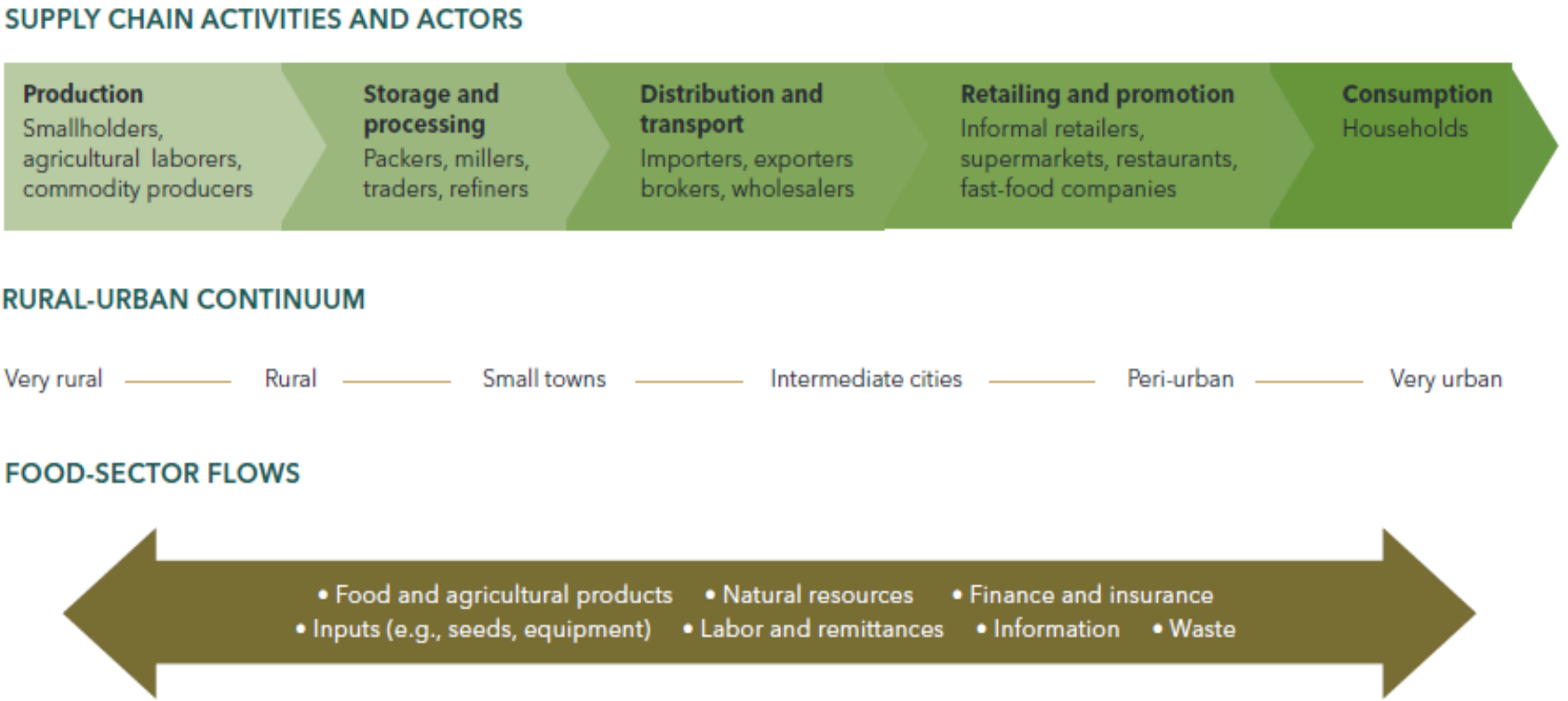
Demographic growth and urbanization

Global Consumption of Meat and Milk Products

REGION	LIVESTOCK (KCAL/PERSON/DAY)			BEEF AND MUTTON (KCAL/PERSON/DAY)		
	2006	2050	% CHANGE	2006	2050	% CHANGE
European Union	864	925	7%	80	75	-6%
Canada & USA	907	887	-2%	117	95	-19%
China	561	820	46%	41	89	116%
Brazil	606	803	33%	151	173	15%
Former Soviet Union	601	768	28%	118	156	32%
Other OECD	529	674	27%	64	84	31%
Latin America (ex. Brazil)	475	628	32%	59	86	45%
Middle East and North Africa	303	416	37%	59	86	45%
Asia (ex. China, India)	233	400	72%	24	43	79%
India	184	357	94%	8	19	138%
Sub-Saharan Africa	144	185	29%	41	51	26%
World	**413**	**506**	**23%**	**50**	**65**	**30%**

Demographic growth and urbanization

Food from small farms to big cities



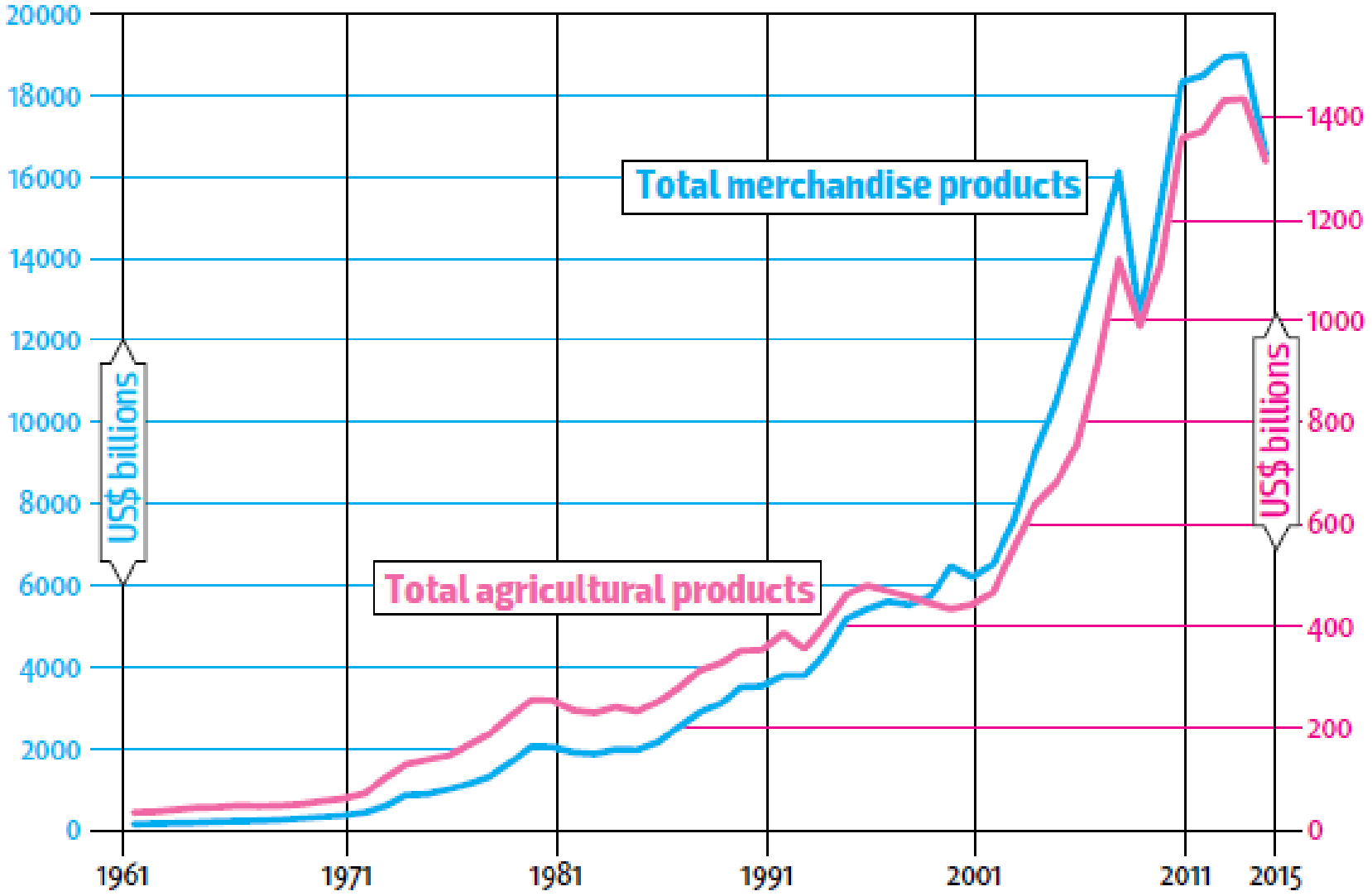
Source: Adapted from J. von Braun, "Rural-Urban Linkages for Growth, Employment, and Poverty Reduction," presented at the Fifth International Conference on the Ethiopian Economy, Ethiopian Economics Association, Addis Ababa, June 7–9, 2007.

Demographic growth and urbanization

- Increase in agricultural production and agricultural productivity.
- Growing distance between the places of consumption and the place of production.
- Increase in international trade.
- Increase in the transport of goods (investments in transport, logistics, food security).
- Risks of greater environmental impact.
- Information asymmetries (between producer and consumer).

Agri-food international Trade

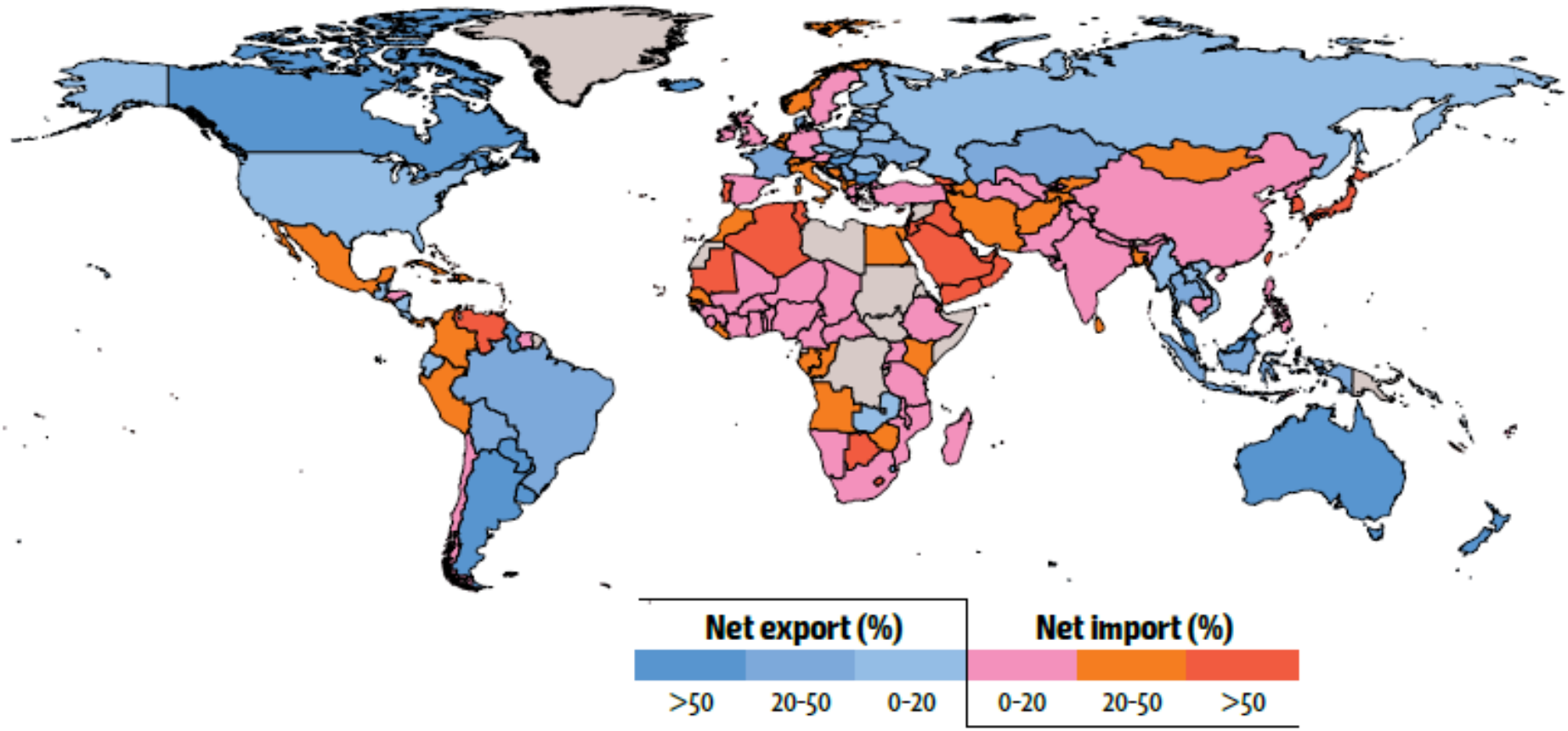
Total and agricultural international trade volume, 1961–2015



Source: Data from 1961–2013 are based on FAO, 2016a; data for 2014 and 2015 are based on ITC, 2016.

Agri-food international Trade

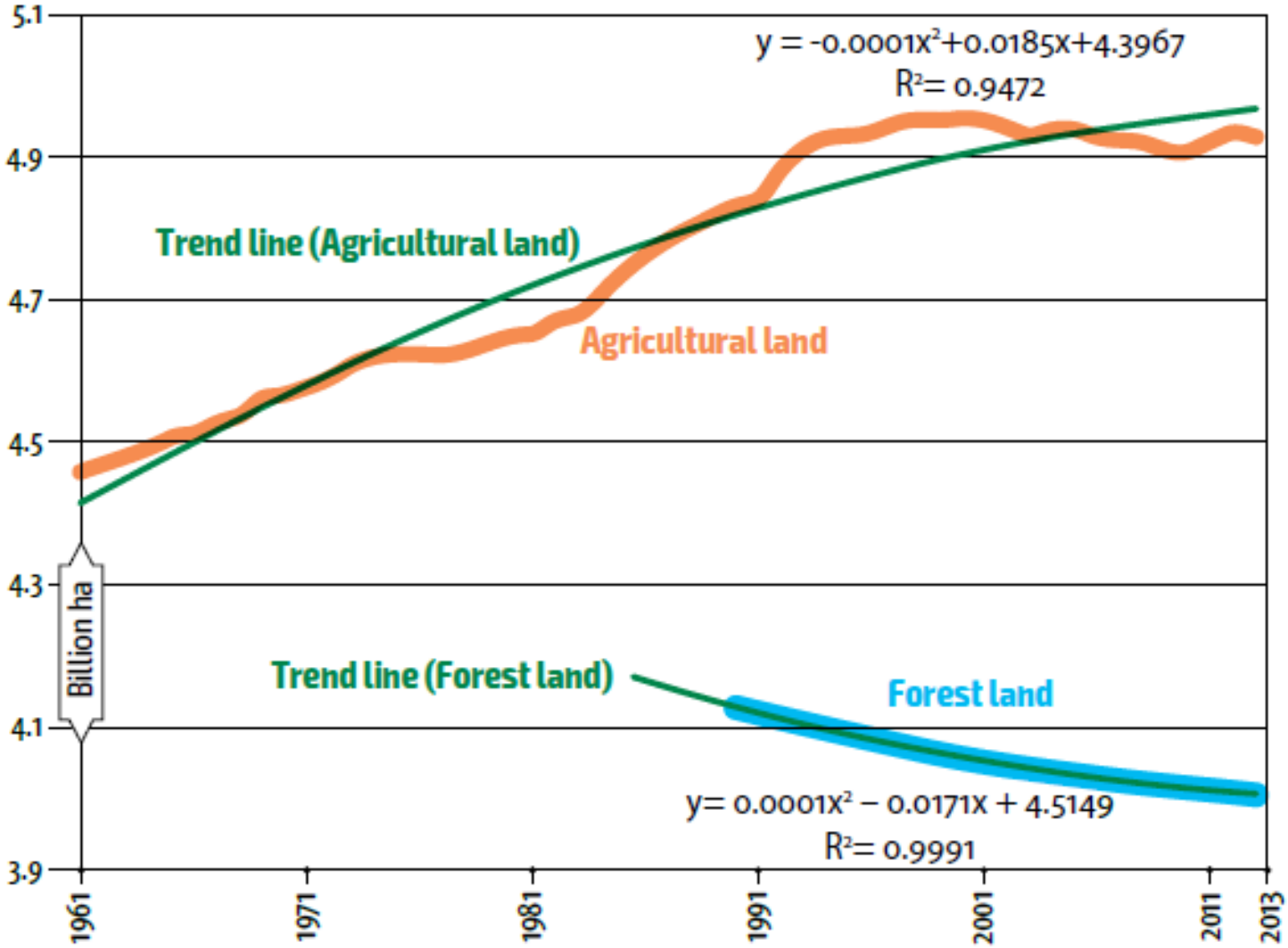
Percentage of net food imports in domestic food supply in total calories



Source: FAO Global Perspectives Studies, using 2011 food balance sheets from FAO, 2016a.

Environmental problems

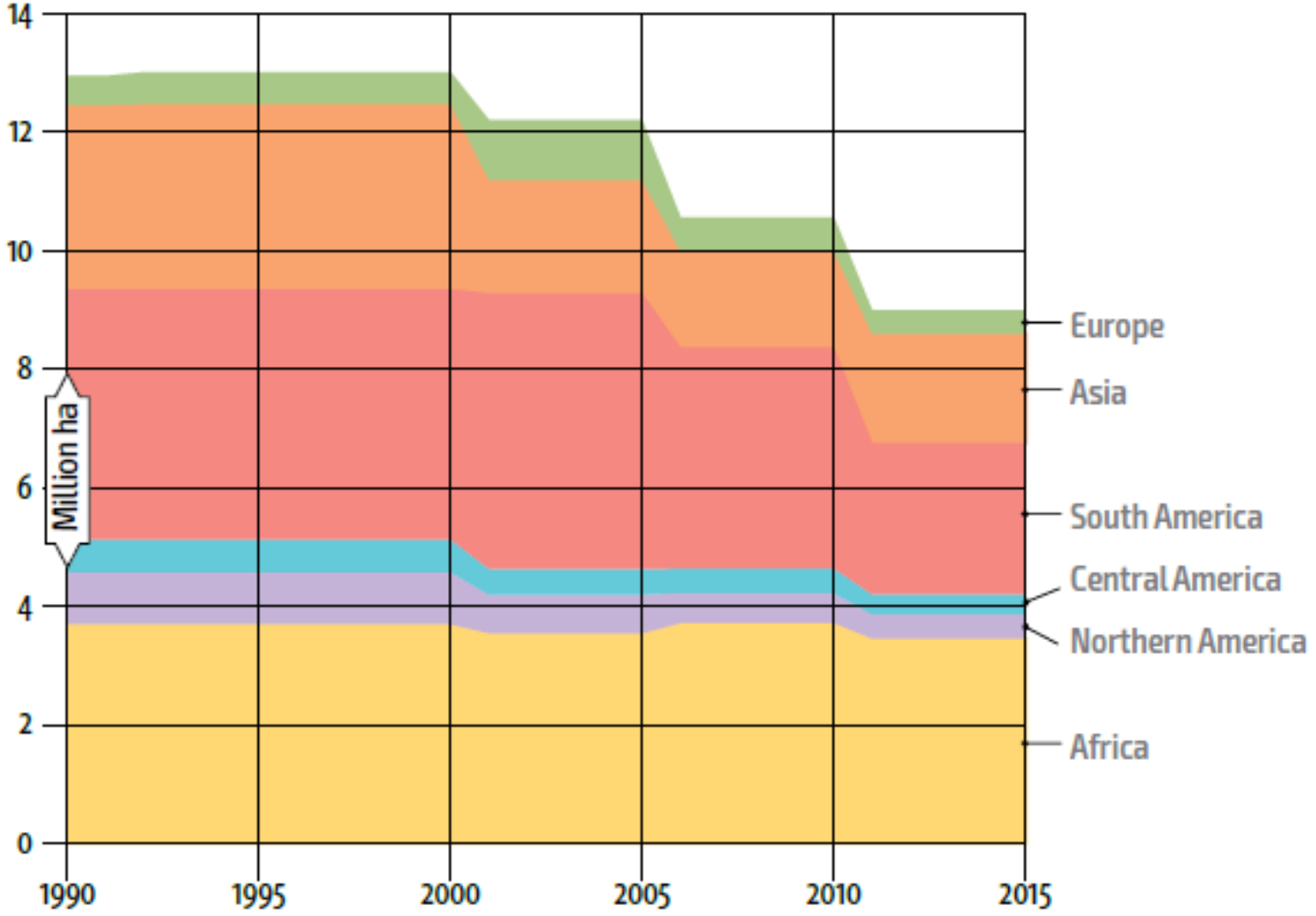
Agricultural and forest land use 1961–2013



Source: FAO Global Perspectives Studies calculations based on FAO, 2016b.

Environmental problems

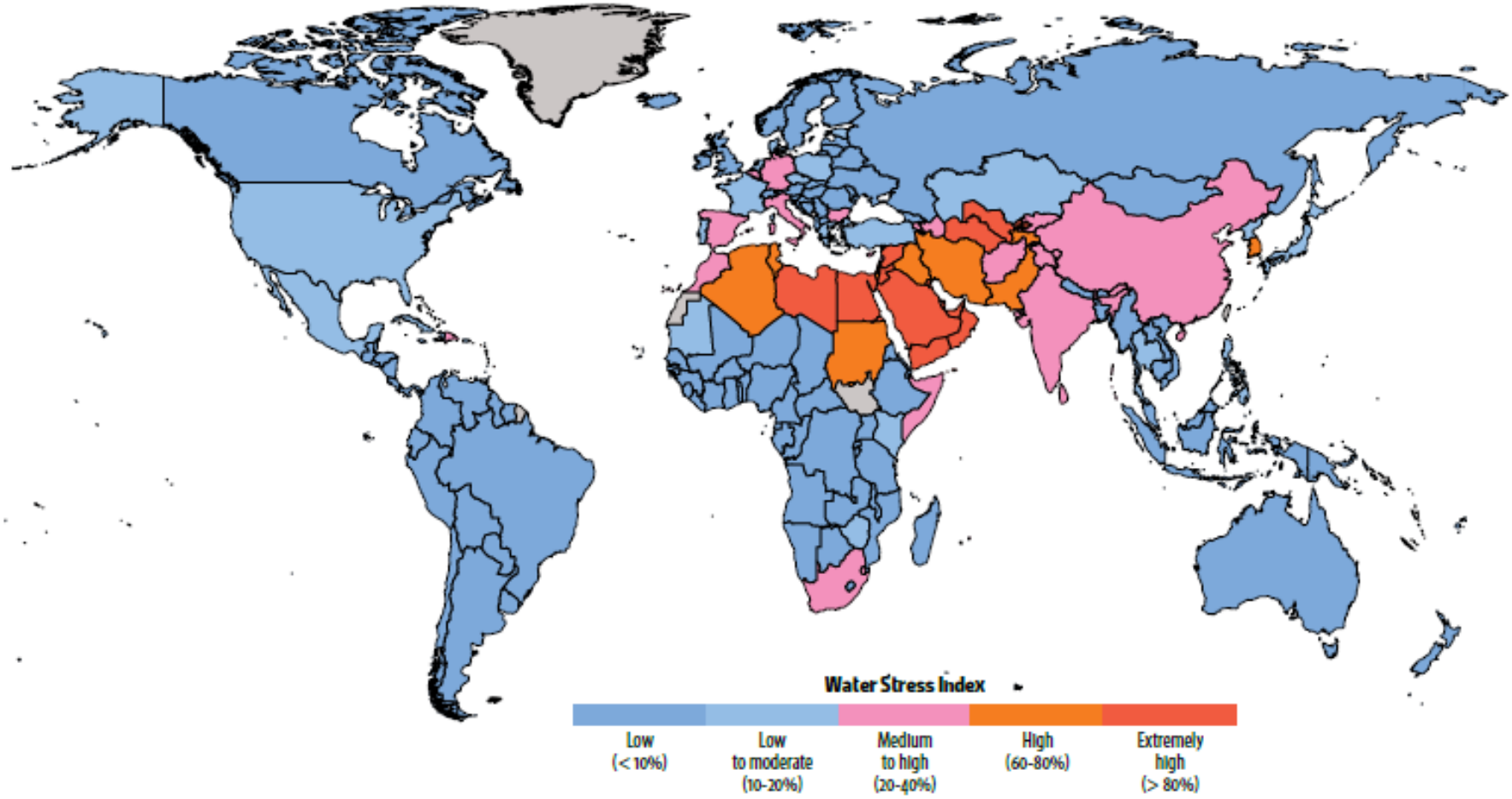
Net forests conversion, by region, 1990–2015



Source: FAO, 2016b.

Environmental problems

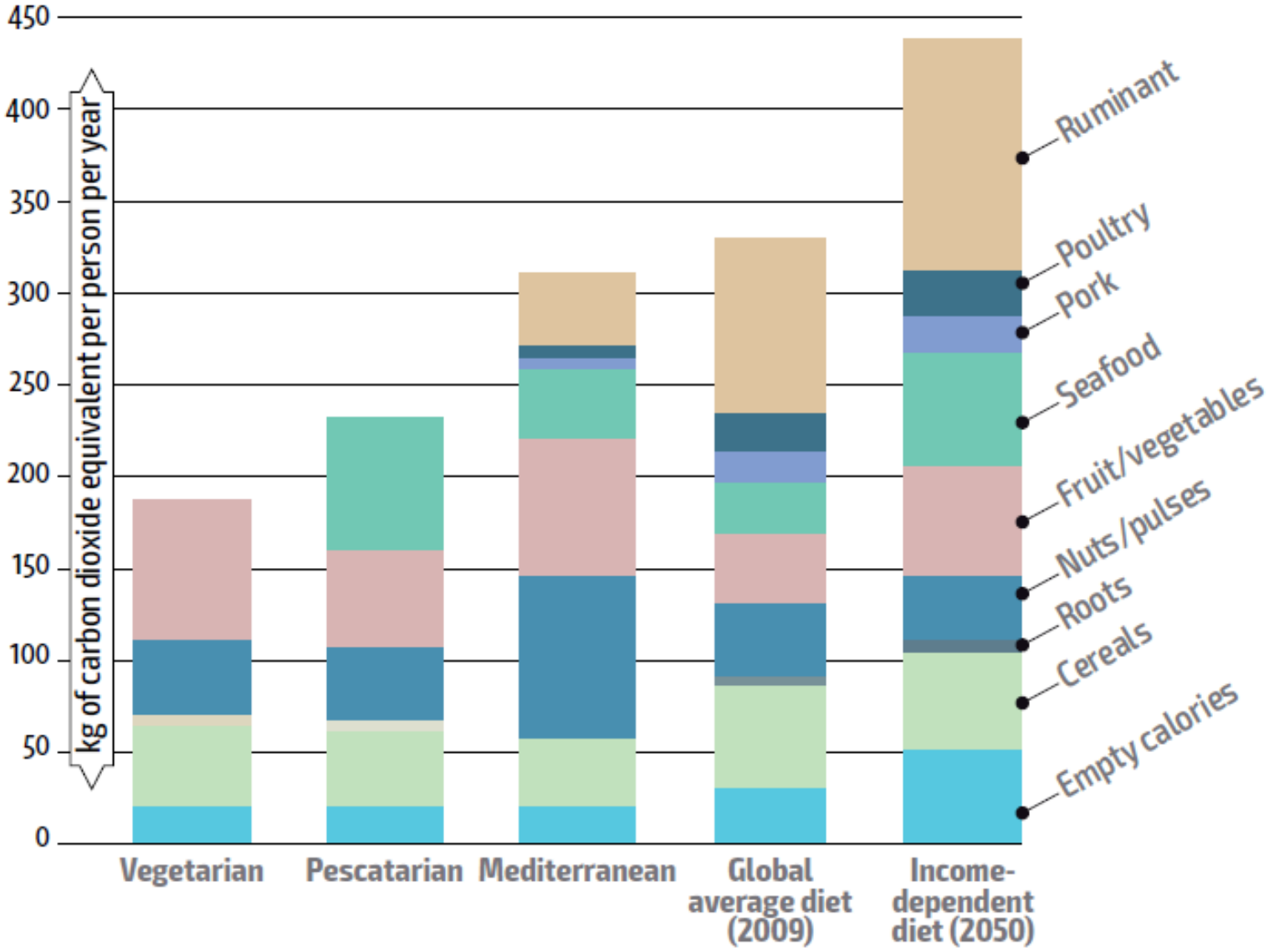
Freshwater withdrawals as a percentage of total renewable resources



Source: FAO, 2016a.

Environmental problems

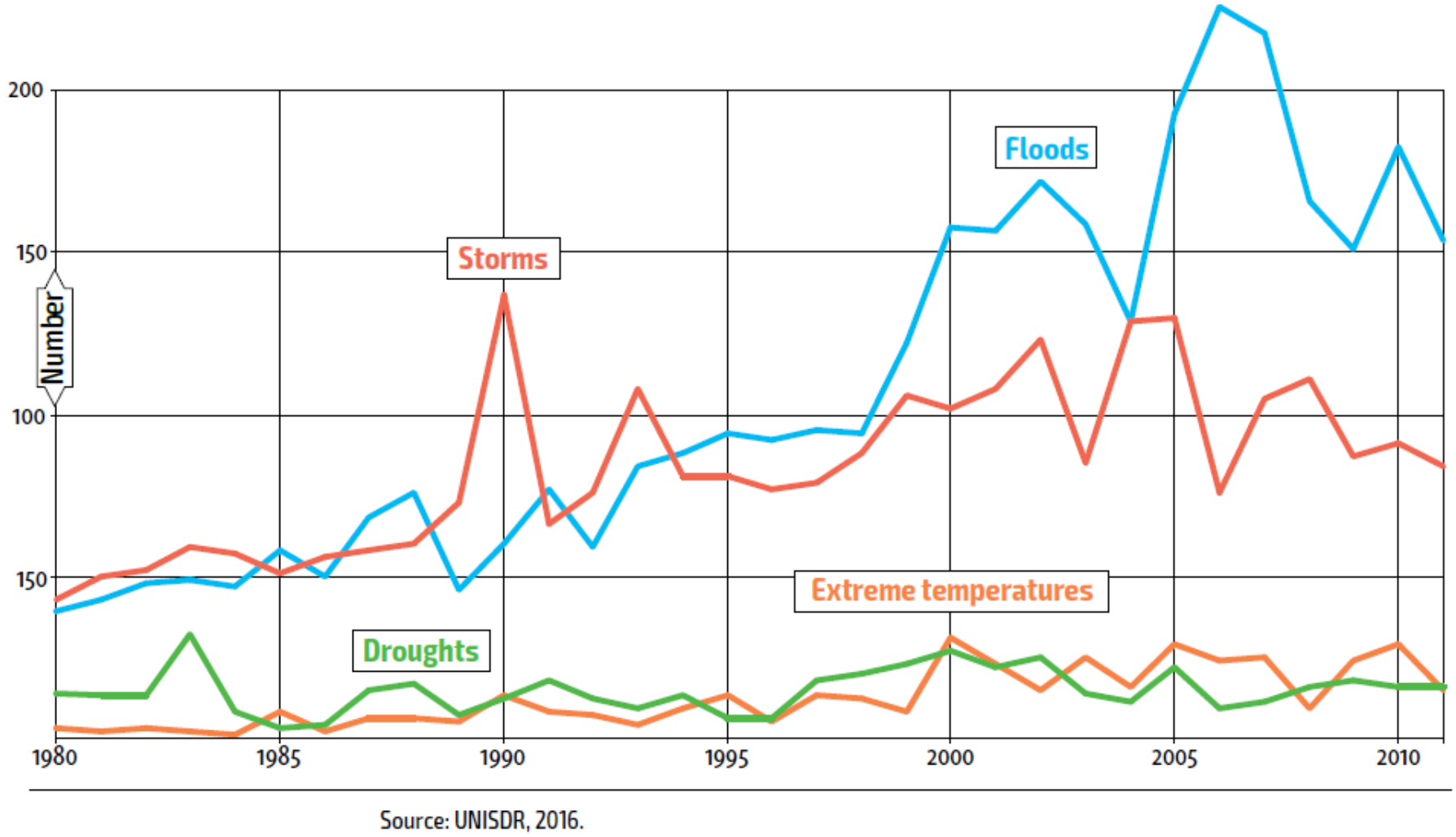
Greenhouse gas emissions by diet type



Source: IFPRI, 2015.

Environmental problems

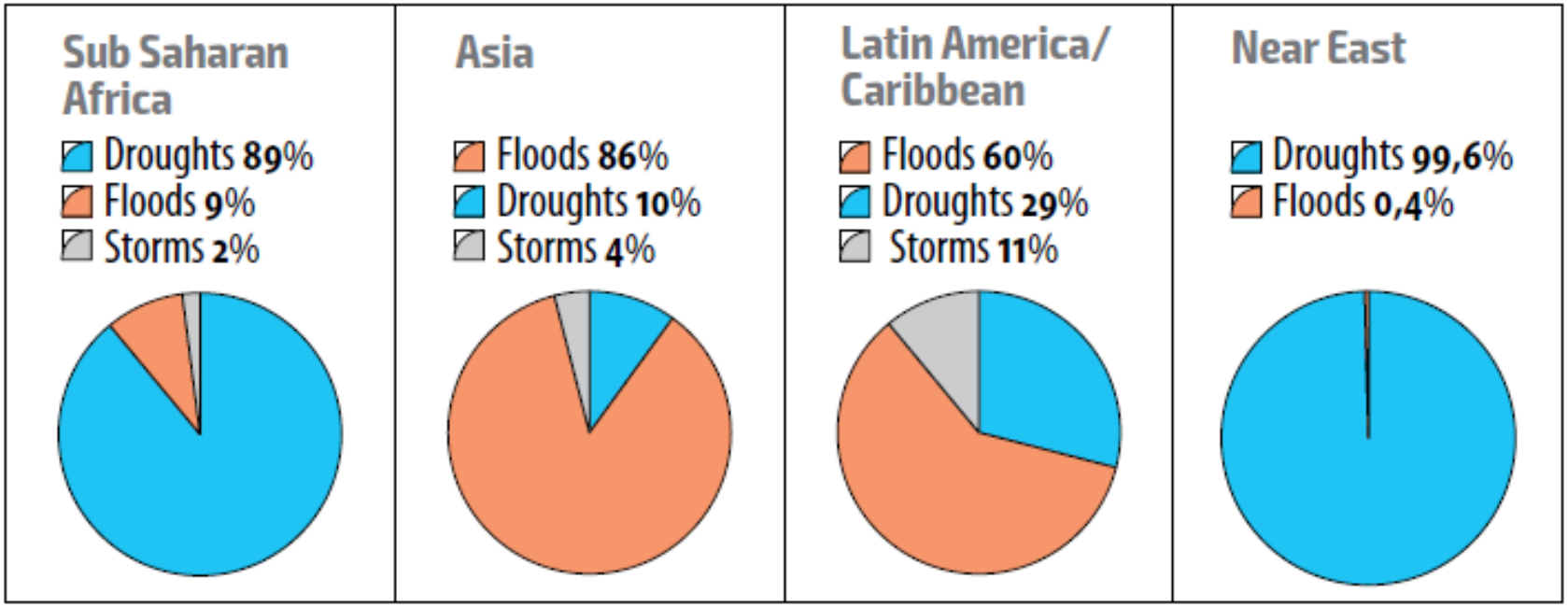
Climate-related disasters, 1980–2011



Source: UNISDR, 2016.

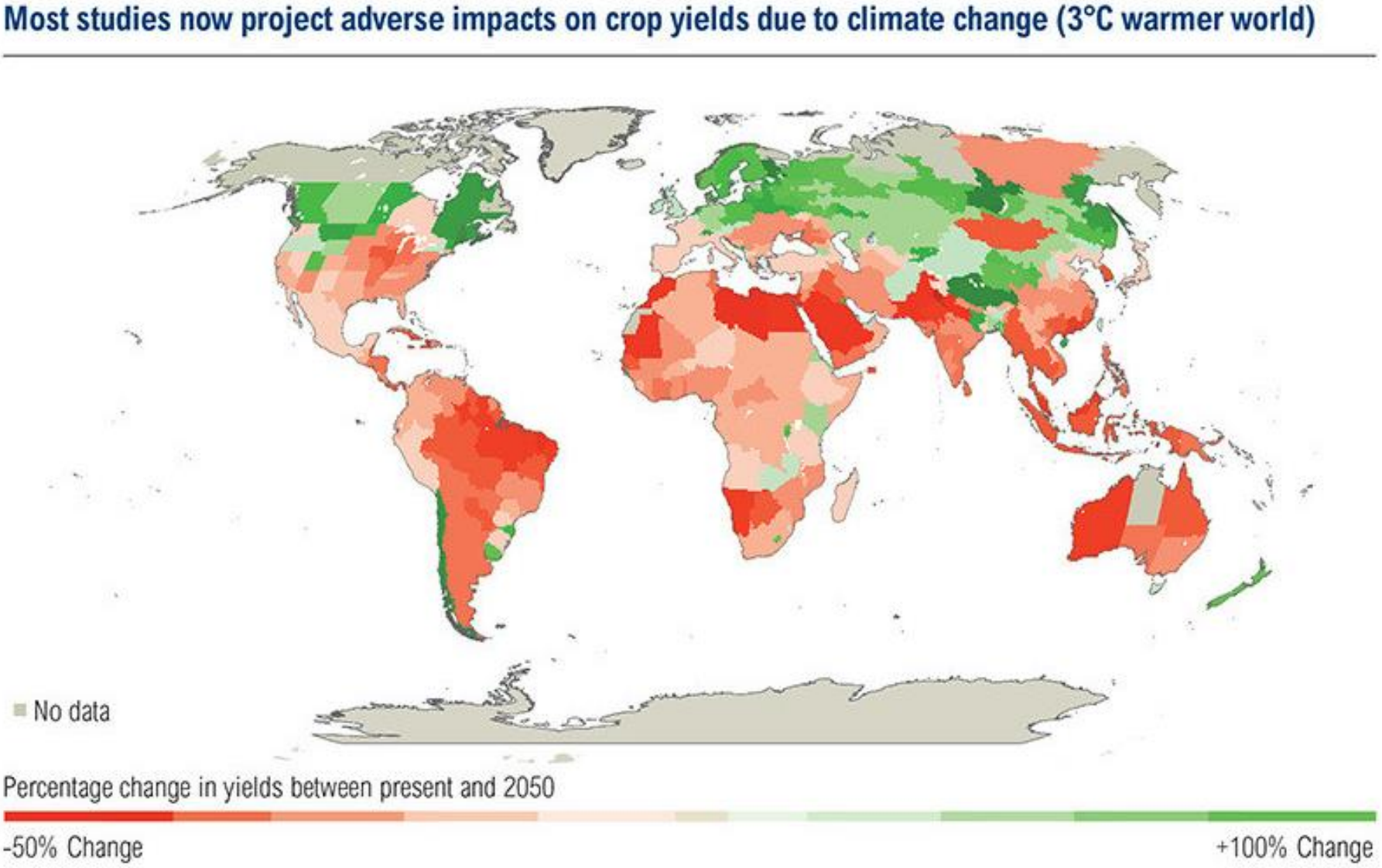
Environmental problems

Agricultural production losses after medium- to large-scale disasters in developing countries, by cause and region, 2003–2013



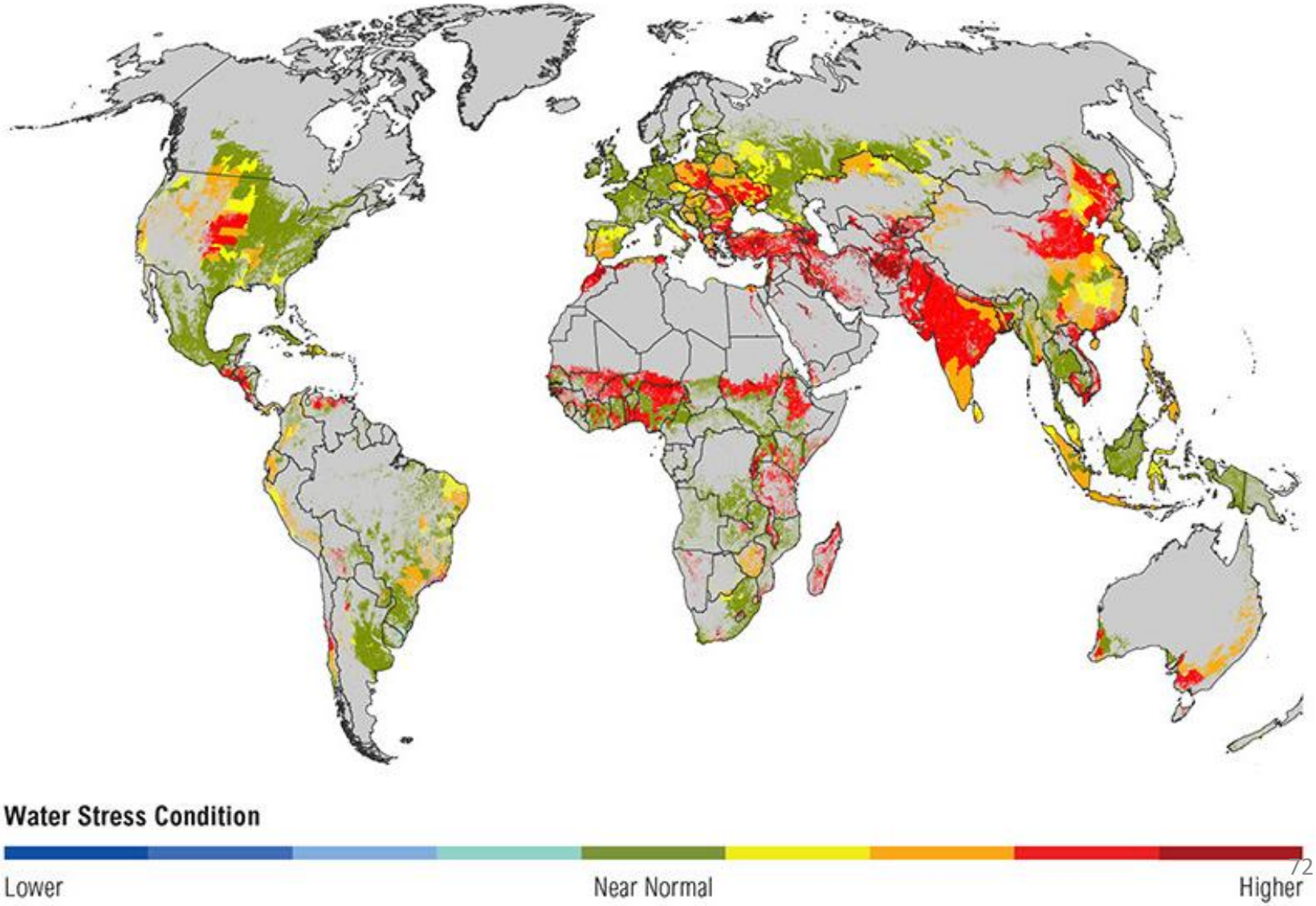
Source: FAO, 2015.

Environmental problems



Environmental problems

Water stress will increase in many agricultural areas by 2025 due to growing water use and higher temperatures (based on IPCC scenario A1B)



Sustainable development

- Sustainable development is the organizing principle for meeting human development goals while at the same time sustaining the ability of natural systems to provide the natural resources and ecosystem services upon which the economy and society depend.
- The desired result is a state of society where living conditions and resource use continue to meet human needs without undermining the integrity and stability of the natural system and sustainable development can be classified as development that meet the needs of the present without compromising the ability of the future generation.

Sustainable development

- The modern concept of sustainable development is derived mostly from the 1987 Brundtland Report.
- As the concept developed, it has shifted to focus more on economic development, social development and environmental protection for future generations.
- Formerly known as the World Commission on Environment and Development (WCED), the mission of the Brundtland Commission is to unite countries to pursue sustainable development together.

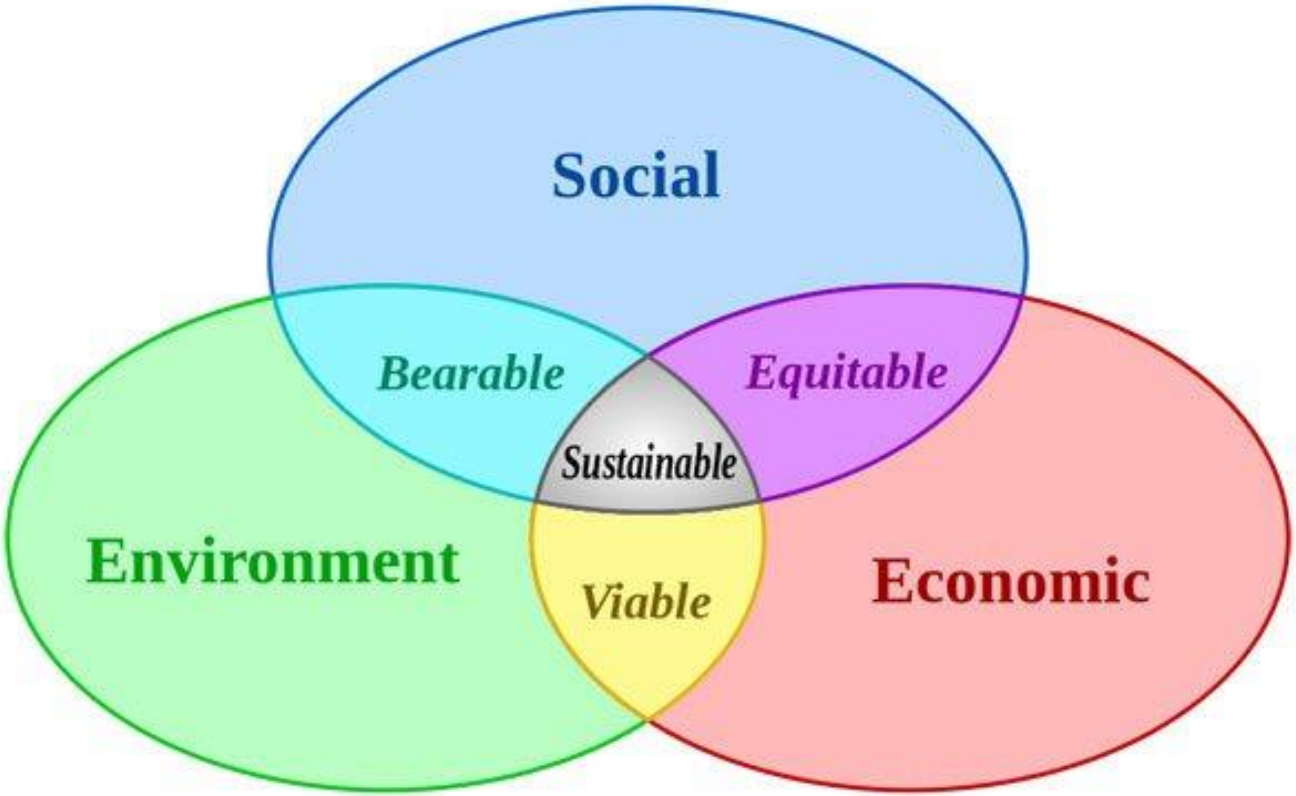
Sustainable development

- Gro Harlem Brundtland was the former Prime Minister of Norway and was chosen due to her strong background in the sciences and public health.
- At the time, the UN General Assembly realized that there was a heavy deterioration of the human environment and natural resources.

Sustainable development

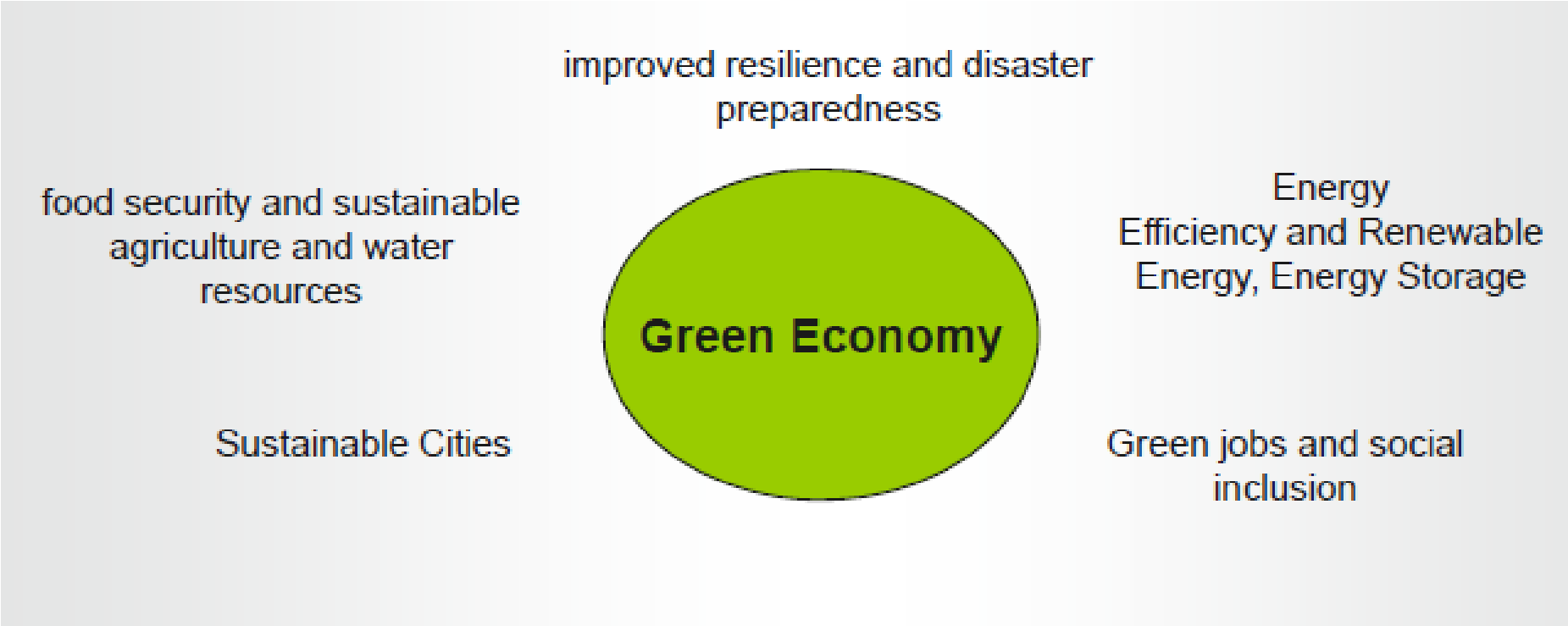
- To rally countries to work and pursue sustainable development together, the UN decided to establish the Brundtland Commission. The Brundtland Commission officially dissolved in December 1987 after releasing Our Common Future, also known as the Brundtland Report, in October 1987, a document which coined, and defined the meaning of the term "Sustainable Development".
- The organization Center for Our Common Future was started in April 1988 to take the place of the Commission.

Sustainable development



Green Economy

Green Economy: a way to sustainable development



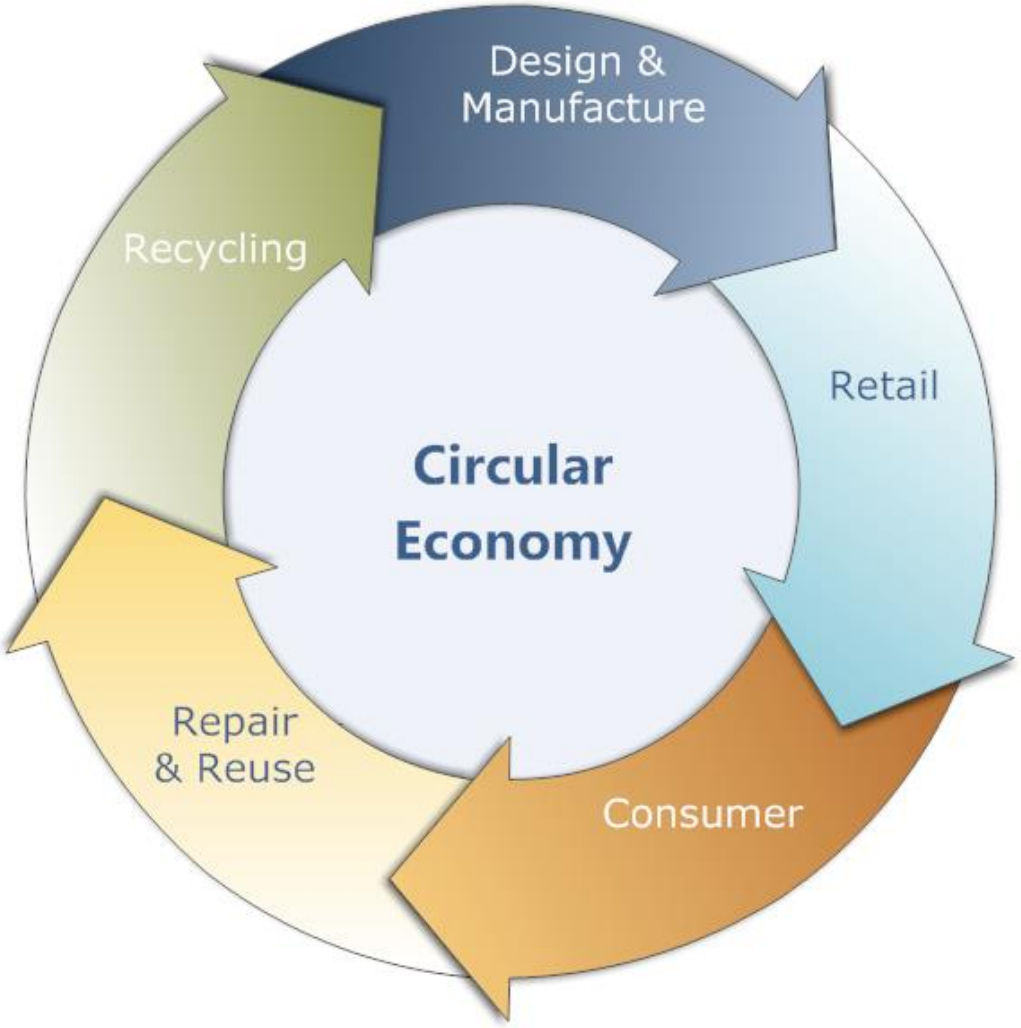
Circular Economy

A circular economy seeks to rebuild capital, whether this is financial, manufactured, human, social or natural.

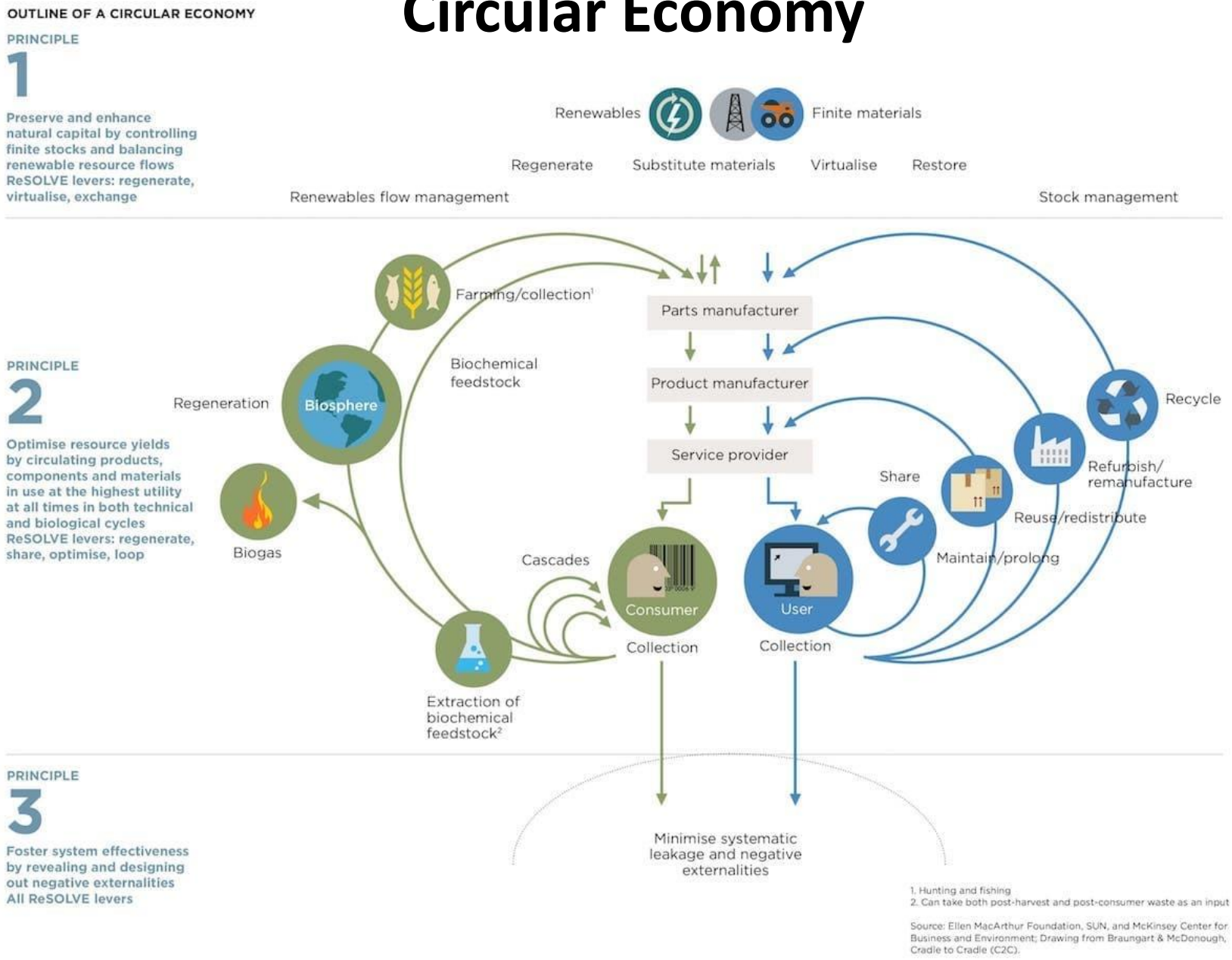
This ensures enhanced flows of goods and services.

The system diagram illustrates the continuous flow of technical and biological materials through the ‘value circle’.

Circular Economy



Circular Economy



Circular Economy

- **The concept of a circular economy**

In a circular economy, economic activity builds and rebuilds overall system health. The concept recognizes the importance of the economy needing to work effectively at all scales – for large and small businesses, for organizations and individuals, globally and locally.

Transitioning to a circular economy does not only amount to adjustments aimed at reducing the negative impacts of the linear economy. Rather, it represents a systemic shift that builds long-term resilience, generates business and economic opportunities, and provides environmental and societal benefits.

Circular Economy

- **Technical and biological cycles**

The model distinguishes between technical and biological cycles.

Consumption happens only in biological cycles, where food and biologically-based materials (such as cotton or wood) are designed to feed back into the system through processes like composting and anaerobic digestion.

These cycles regenerate living systems, such as soil, which provide renewable resources for the economy. Technical cycles recover and restore products, components, and materials through strategies like reuse, repair, remanufacture or (in the last resort) recycling.

Circular Economy

- **Origins of the circular economy concept**

The notion of circularity has deep historical and philosophical origins.

The idea of feedback, of cycles in real-world systems, is ancient and has echoes in various schools of philosophy.

It enjoyed a revival in industrialised countries after World War II when the advent of computer-based studies of non-linear systems unambiguously revealed the complex, interrelated, and therefore unpredictable nature of the world we live in – more akin to a metabolism than a machine.

Circular Economy

- **Origins of the circular economy concept**

With current advances, digital technology has the power to support the transition to a circular economy by radically increasing virtualisation, de-materialisation, transparency, and feedback-driven intelligence.

Circular Economy

- **Circular economy schools of thought**

The circular economy model synthesises several major schools of thought.

They include the functional service economy (performance economy) of Walter Stahel; the Cradle to Cradle design philosophy of William McDonough and Michael Braungart; biomimicry as articulated by Janine Benyus; the industrial ecology of Reid Lifset and Thomas Graedel; natural capitalism by Amory and Hunter Lovins and Paul Hawken; and the blue economy systems approach described by Gunter Pauli.

See also: https://www.ellenmacarthurfoundation.org/circular-economy/concept

Agriculture and Circular Economy

- Agriculture can play and important role to develop a circular economy

See the slides included in files:

Agriculture and circular economy 1.pdf

Agriculture and circular economy 1.pdf

17 SDG - Sustainable Development Goals of UN

- The Sustainable Development Goals are a universal call to action to end poverty, protect the planet and improve the lives and prospects of everyone, everywhere. The 17 Goals were adopted by all UN Member States in 2015, as part of the 2030 Agenda for Sustainable Development which set out a 15-year plan to achieve the Goals.
- Today, progress is being made in many places, but, overall, action to meet the Goals is not yet advancing at the speed or scale required. 2020 needs to usher in a decade of ambitious action to deliver the Goals by 2030.

17 SDG - Sustainable Development Goals of UN

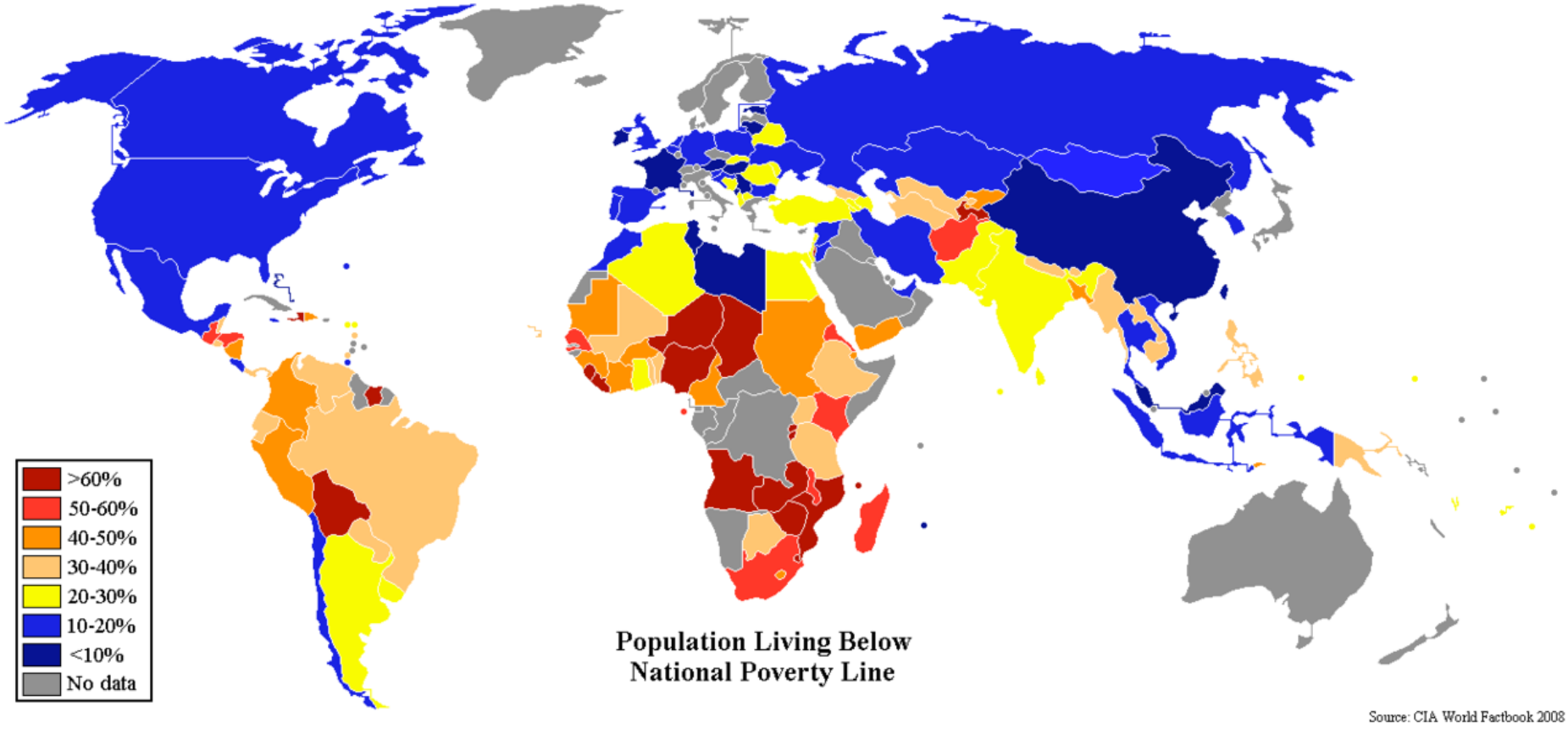
17 SDG - Sustainable Development Goals of UN

- The SDGs are a collection of 17 global goals set by the United Nations.
- The broad goals are interrelated though each has its own targets to achieve. The total number of targets is 169.
- The SDGs cover a broad range of social and economic development issues:
  poverty, hunger, health, education, climate change, gender equality, water, sanitation, energy, environment and social justice.
- The SDGs are also known as "Transforming our World: the 2030 Agenda for Sustainable Development" or 2030 Agenda in short.

17 SDG - Sustainable Development Goals of UN

- The goals were developed to replace the Millennium Development Goals (MDGs) which ended in 2015.
- Unlike the MDGs, the SDG framework does not distinguish between "developed" and "developing" nations. Instead, the goals apply to all countries.
- Many of these goals and targets concern nutrition, food, food security, food safety, agriculture, rural areas,…

17 SDG - Sustainable Development Goals of UN



17 SDG - Sustainable Development Goals of UN

Goal 1 – No Poverty

Goal 2 – Zero Hunger

Goal 3 - Good health and well-being

Goal 4 - Quality education

Goal 5 - Gender equality

Goal 6 – Clean Water and Sanitation

Goal 7 – Affordable and Clean Energy

Goal 8 - Decent work and economic growth

Goal 9 - Industry, innovation and infrastructure

Goal 10 - Reduced inequalities

Goal 11 – Sustainable cities and countries

17 SDG - Sustainable Development Goals of UN

Goal 12 – Responsible Consumption and Production

Goal 13 – Climate Action

Goal 14 – Life Below Water

Goal 15 – Life on Land

Goal 16 – Peace, Justice and Strong Institutions

Goal 17 - Partnerships for the goals

17 SDG - Sustainable Development Goals of UN

Goal 1 – No Poverty

Includes targets for the eradication of extreme poverty (incomes of less than USD 1.25 a day) and 50% reduction of poverty by 2030.

Agriculture is a potent force for poverty reduction in many developing countries in particular

Almost 80 percent of the world's extreme poor live in rural areas where most are dependent on agriculture.

Agriculture is the single largest employer in the world.

Agricultural growth in low-income and agrarian economies is at least twice as effective as growth in other sectors in reducing hunger and poverty

17 SDG - Sustainable Development Goals of UN

Goal 2 – Zero Hunger

Numerous relevant targets, including the ending of hunger and malnutrition; the doubling of agricultural productivity and incomes of small-scale food producers; the correction of international trade restrictions; increased investment in agricultural research, extension services and technology; and the implementation of environmentally sustainable food production systems by 2030

17 SDG - Sustainable Development Goals of UN

Goal 2 – Zero Hunger

In particular:

- The number of undernourished has fallen by 216 million since 1990–92, but one in nine people on the planet still suffer from hunger.
- Only a small fraction of the around 800 million hungry have access to some form of social protection.
- Malnutrition exacts high economic and social costs on society.

17 SDG - Sustainable Development Goals of UN

Goal 2 – Zero Hunger

In particular:

- While two billion people do not consume enough vitamins and minerals, obesity rates have doubled over the past 30 years.
- Some 1.4 billion people are overweight, and 500 million obese.

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Goal 3 - Good health and well-being

- Includes the reduction of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination.
- Relevant for agro-chemical and manure use

17 SDG - Sustainable Development Goals of UN

Goal 4 - Quality education

- Relevant for agricultural training and extension, both of which can enable farmers to adopt environmentally sustainable farming practices and improve competitiveness

17 SDG - Sustainable Development Goals of UN

Goal 5 - Gender equality

- Includes the eradication of gender discrimination, including in land ownership.
- Bridging the yield gap which currently exists between male and female farmers in developing countries could increase total agricultural output of these countries by 2.5-4%, thereby reducing global hunger by 12-17%.1

17 SDG - Sustainable Development Goals of UN

Goal 6 – Clean Water and Sanitation

- Relevant for water use efficiency of agricultural production, the improvement of water quality via the reduction of pollution, and the protection of water-related ecosystems.
- Farming accounts for around 70% of water used worldwide and contributes to water pollution from excess nutrients, pesticides and other pollutants.
- How to increase food production using less water is one of the great challenges of the future.

17 SDG - Sustainable Development Goals of UN

Goal 6 – Clean Water and Sanitation

- Crops and livestock use 70 percent of all water withdrawals and up to 95 percent is some developing countries.
- By 2025, 1.8 billion people are projected to be living in countries or regions with absolute water scarcity.

17 SDG - Sustainable Development Goals of UN

Goal 7 – Affordable and Clean Energy

- Includes targets for the substantial increase of renewable energy and doubling of the improvement in global energy efficiency by 2030.
- Energy has a key enabling role in achieving food security and better nutrition.
- Food systems, which currently consume 30 percent of the world's energy, will gradually need to decouple from fossil fuel dependence to deliver more food with less and cleaner energy.
- Energy prices influence food prices.
- Relevant for agricultural energy use efficiency and bioenergy production.

17 SDG - Sustainable Development Goals of UN

Goal 8 - Decent work and economic growth

- Features relevant targets for sustainable per capita economic growth.
- Improvement of resource use efficiency.
- Access to financial services and insurance.

17 SDG - Sustainable Development Goals of UN

Goal 9 - Industry, innovation and infrastructure.

- Agriculture-relevant targets include the development of sustainable and resilient infrastructure.
- Increased SME access to financial services and their integration into value chains.
- The encouragement of innovation.

17 SDG - Sustainable Development Goals of UN

Goal 10 - Reduced inequalities

- Targets include the achievement, by 2030, of the sustainable income growth of the bottom 40% of the population at a higher rate than the national average.
- Relevant for reasons mentioned under Goal 1.

17 SDG - Sustainable Development Goals of UN

Goal 11 – Sustainable cities and countries

- Food security and food safety goals contribute to ensure the sustainability of the cities.
- Food security, food safety and sustainable agriculture contribute to ensure the sustainability of the countries.

17 SDG - Sustainable Development Goals of UN

Goal 12 – Responsible Consumption and Production

Sustainable consumption and production

Includes the reduction of post-harvest losses; efficient use of natural resources; environmentally-sound management of chemicals and waste; and the reduction of fossilfuel subsidies.

17 SDG - Sustainable Development Goals of UN

Goal 12 – Responsible Consumption and Production

- Every year, the world loses or wastes about a third of the food it produces.
- To feed the world sustainably, producers need to grow more food while reducing negative environmental impacts such as soil, water and nutrient loss, greenhouse gas emissions, and degradation of ecosystems.
- Consumers must be encouraged to shift to nutritious and safe diets with a lower environmental footprint.

17 SDG - Sustainable Development Goals of UN

Goal 13 – Climate Action

Combat Climate change

- Targets strengthened resilience to climate-related hazards and the joint mobilisation of USD 100 billion annually by 2020 to facilitate climate change mitigation by developing countries.
- Climate change is highly relevant for agriculture, both impacting and being impacted by it.
- Agriculture has a major role to play in responding to climate change.

17 SDG - Sustainable Development Goals of UN

Goal 13 – Climate Action

Combat Climate change

- While temperature rises pose a real threat to global food production, investments in all sectors of agriculture can simultaneously support climate change adaptation and mitigation while improving rural people's livelihoods.

17 SDG - Sustainable Development Goals of UN

Goal 14 – Life Below Water

Oceans, Seas and Marine resources

- Includes the prevention and significant reduction by 2025 of marine pollution, nutrient pollution in particular; the effective regulation of fishing to ensure sustainable fishing practices; and the prohibition of certain fisheries subsidies by 2020.
- Worldwide nearly three billion people receive 20 percent of their daily animal protein intake from fish.
- About 29 percent of commercially important assessed marine fish stocks are overfished and 61 percent fully fished.

17 SDG - Sustainable Development Goals of UN

Goal 15 – Life on land

- Targets the conservation and sustainable use of freshwater ecosystems and the promotion of sustainable forest management (the halting of deforestation included) by 2020.
- The combatting of desertification and restoration of degraded soil by 2030.
- The prevention of biodiversity loss.
- As farming is the human activity which occupies the largest share of total land in many OECD countries, agriculture can not only significantly impact biodiversity, but is also dependent upon it.

17 SDG - Sustainable Development Goals of UN

Goal 15 – Life on land

In particular:

- Forests make vital contributions to biodiversity; they act as a source of food, medicine and fuel for more than a billion people.
- Mountains supply more than half of humankind with water.
- A third of farmland is degraded, up to 75 percent of crop genetic diversity has been lost and 22 percent of animal breeds are at risk.
- Soil is non-renewable – its loss is not recoverable within a human lifespan.

17 SDG - Sustainable Development Goals of UN

Goal 16 – Peace, Justice and Strong Institutions

Food security, food safety and rural development contribute to ensure the goal n. 16.

17 SDG - Sustainable Development Goals of UN

Goal 17 - Partnerships for the goals

Features agriculture-relevant targets on international trade, including the promotion of an open, non-discriminatory and equitable multilateral trading system and the conclusion of the WTO Doha Development Round.

17 SDG - Sustainable Development Goals of UN

FAO's Strategic Objectives are:

1. Help eliminate hunger, food insecurity and malnutrition.
2. Make agriculture, forestry and fisheries more productive and sustainable.
3. Reduce rural poverty.
4. Enable inclusive and efficient agricultural and food systems.
5. Increase the resilience of livelihoods to threats and crises.

SDGs, food and agriculture

- Recently the Stockholm Resilience Centre of University of Stockholm presented a new way of viewing the Sustainable Development Goals and how they are all linked to food.
- This model represents new way of viewing the Sustainable Development Goals and how they are all linked to food.
- It calls for a shift away from the current sectorial approach where social, economic, and ecological development are seen as separate parts.
- Instead we must transition toward a logic where the economy serves society so that it evolves within the safe operating space of the planet.

SDGs, food and agriculture

Graphics by Jerker Lokrantz/Azote

SDGs, food and agriculture

- The new illustration is based on one of the iconic figures of the center, “the wedding cake”.
- It implies that economies and societies are seen as embedded parts of the biosphere.
- This model try to changes the paradigm for development, moving away from the current sectorial approach where social, economic, and ecological development are seen as separate parts.
- The model take into account a transition toward a world logic where the economy serves society so that it evolves within the safe operating space of the planet.
- See the video of the presentation: **https://youtu.be/tah8QlhQLeQ**