FOOD & AGRICULTURE IN TIMES OF CRISIS

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HIGH LEVEL EVENT OF THE GLOBAL NETWORK AGAINST FOOD CRISES

BRUSSELS, 2 - 3 APRIL 2019

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FOOD SYSTEMS AT RISK: TRENDS AND CHALLENGES

A SCIENTIFIC HANDOUT

Bendjebbar Pauline, Bricas Nicolas, Giordano Thierry, 2019. Food systems at risk. A scientific handout for the High Level Event of the Global Network against Food Crises: Food & Agriculture in times of crisis, Brussels, 2-3 April 2019. Montpellier, Cirad. 48 p.

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ISBN 978-2-87614-747-8

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FOOD SYSTEMS AT RISK: TRENDS AND CHALLENGES

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ACKNOWLEDGEMENTS

This booklet was coordinated by Nicolas Bricas, Pauline Bendjebbar and Thierry Giordano from Cirad with the contributions of Ward Anseeuw, Habibou Assouma, Julie Betbeder, Aurélie Binot, Vincent Blanfort, Thierry Brunelle, Christian Cilas, Marc Corbeels, Christian Corniaux, Lionel Dabbadie, Benoit Daviron, Julien Demenois, Patrice Dumas, Sandrine Dury, Guillaume Duteurtre, Céline Dutilly, Stefano Farolfi, Laurène Feintrenie, Muriel Figuié, Franck Galtier, Laurent Gazull, Pierre Girard, Etienne Hainzelin, Amandine Hertzog, Alexandre Hobeïka, Alexandre Ickowicz, Jean-Yves Jamin, Frédéric Lançon, Sylvaine Lemeilleur, Olivier Lepiller, Bruno Losch, Élodie Maître d'Hôtel , Eric Malézieux, Paule Moustier, Marie-Gabrielle Piketty, René Poccard-Chapuis, Ninon Sirdey, Guillaume Soullier, Jean-Michel Sourisseau, Ibra Touré, Elodie Valette, Abdrahmane Wane from CIRAD, Géraldine Chaboud (Montpellier SupAgro), Yves Martin-Prével (IRD), Pierre Fabre, Patrick Herlant and Philippe Thomas (European Commission, Devco), Joint Research Centers (European Commission), Ekaterina Krivonos and colleagues from FAO.

Laurence Laffont made the graphic design of the booklet, and Agnès Stienne made some of the maps.

This work benefitted from European Commission funds through the FAO Agrintel facility.

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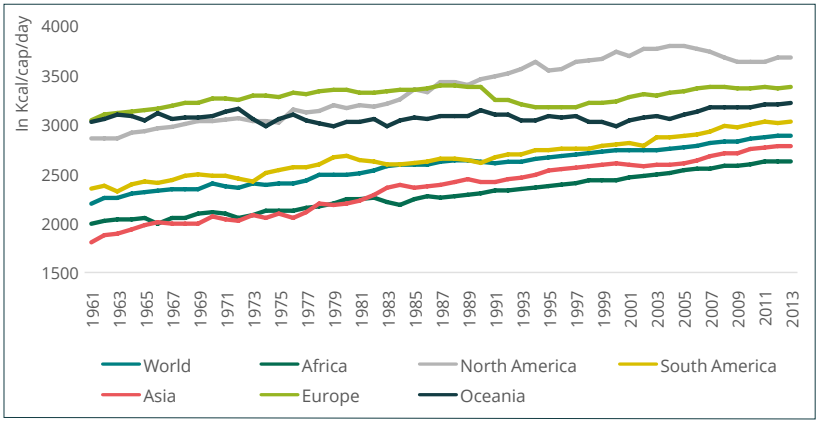


Figure 1: Food availability per capita.
Source: FAOSTAT.

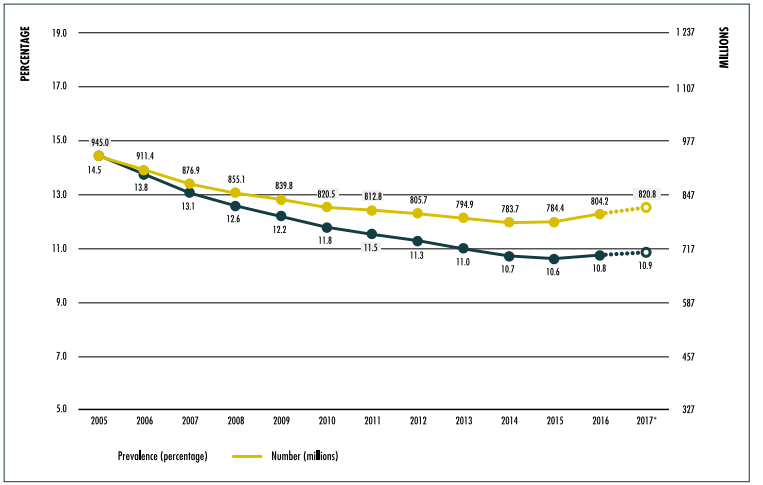


Figure 2: Undernourishment.
Data source: FAO, SOFI, 2018.

The paradox of Food Security

Food production per capita has never been higher (Figure 1). Food production has increased faster than population growth. On average, food production is higher than nutritional needs and should continue to be.

As a result, food security has improved over the same period. But a turning point occurred in 2015 (Figure 2).

Many reasons explain this reversal, and many more might threaten food security of Low Income Countries (LIC) and Lower Middle Income Countries (LMIC) (Map 1) in the decades to come.

821

million of undernourished people in the world in 2017

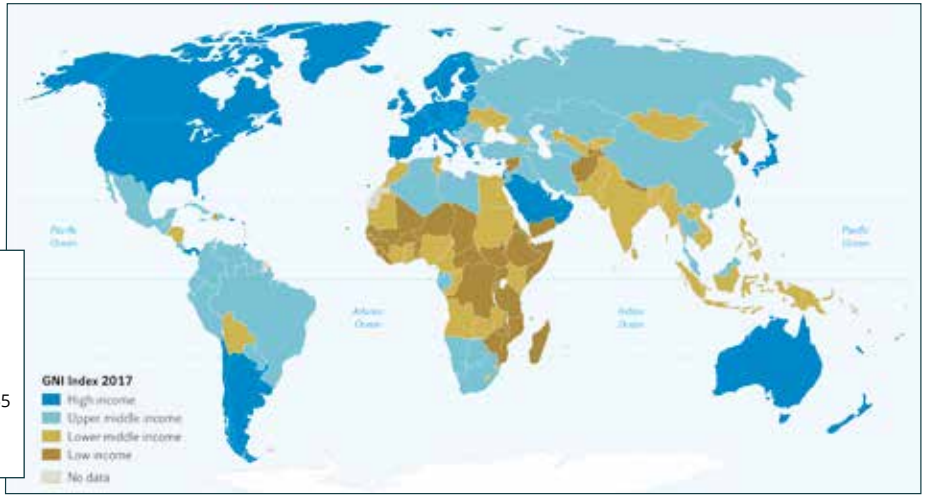
Low income economies =
GNI per capita $995 or less

Lower middle income economies =
GNI per capita between $996 to $3,895

Upper middle income economies =
GNI per capita between $3,896 to $12,055

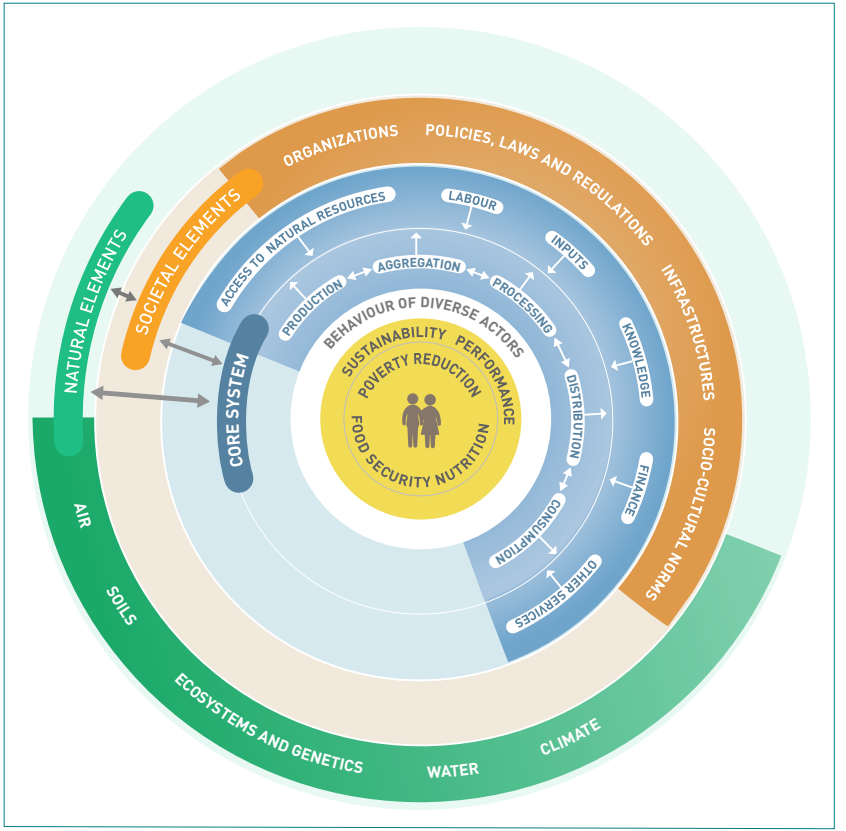
High income economies =
GNI per capita $12,056 or more

Map 1: Low Income and Lower Middle Income Countries.
Data source: World Bank



Cartography: Agnès Stienne

Figure 3: Food system wheel.
Source: FAO, 2018.



1 Food systems

Food systems definition

Food systems (FS): "the entire range of actors and their interlinked value-adding activities involved in the production, aggregation, processing, distribution, consumption and disposal of food products that originate from agriculture, forestry or fisheries, and parts of the broader economic, societal and natural environments in which they are embedded" .

Food systems are made of "sub-systems (e.g. farming system, input supply system, processing system, etc.) and interact with other key systems (e.g. energy system, trade system, health system, etc.)". They hinge on actors, relationships and networks (Figure 3).

They generate environmental and socio-economical outcomes, in addition to food security and nutrition.

Four main categories of drivers are shaping food systems pathways

Four main categories of drivers (not an exhaustive list) that may put food systems at risk are considered:

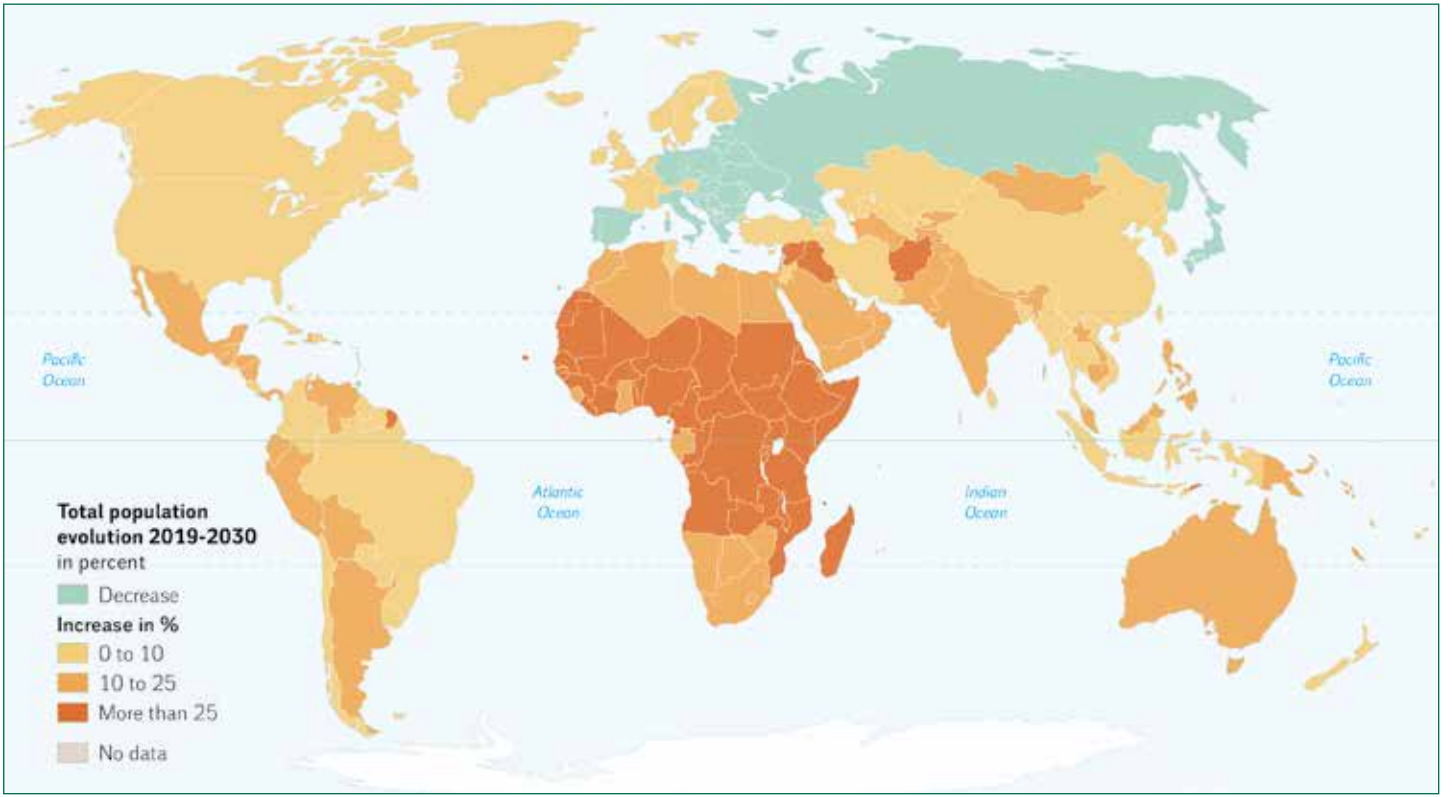
Demographic drivers such as population growth and urbanization, are impacting on food demand: quantity, quality and type of food. They also drive the need for job creation.

Socio-economic drivers such as income and socio-cultural factors, poverty and inequalities, trade and financial systems, are influencing diet and access of consumers to food.

Environmental drivers such as biodiversity losses, pollution or climate change, threaten food systems' sustainability.

Political drivers such as governance, public policies and conflicts, are shaping the institutional environment. Public policies can encourage certain food-systems pathways, while conflicts can disrupt them.

Map 2: Total population evolution from 2019 to 2030 (in %).
Data source: UN population.



Cartography: Agnès Stienne

2 || Demographic trends

■ A fast growing population in some countries

The world population is expected to increase from 7.7 billion in 2019, to 8.5 billion by 2030 and 9.8 billion by 2050.

This growth will be particularly important in LIC and LMIC, even more so in sub-Saharan Africa (SSA) (Map 2).

In the Sahel region, 30 000 persons / million inhabitants / year will enter the workforce over the next 10 years. For a country of 10 million inhabitants, this means creating 300 000 new jobs every year.

Population growth means an increase in food demand and greater pressure on natural resources such as land and water.

Figure 4: Expected increase in population in some country groups. (Million)
Data source : UN Population

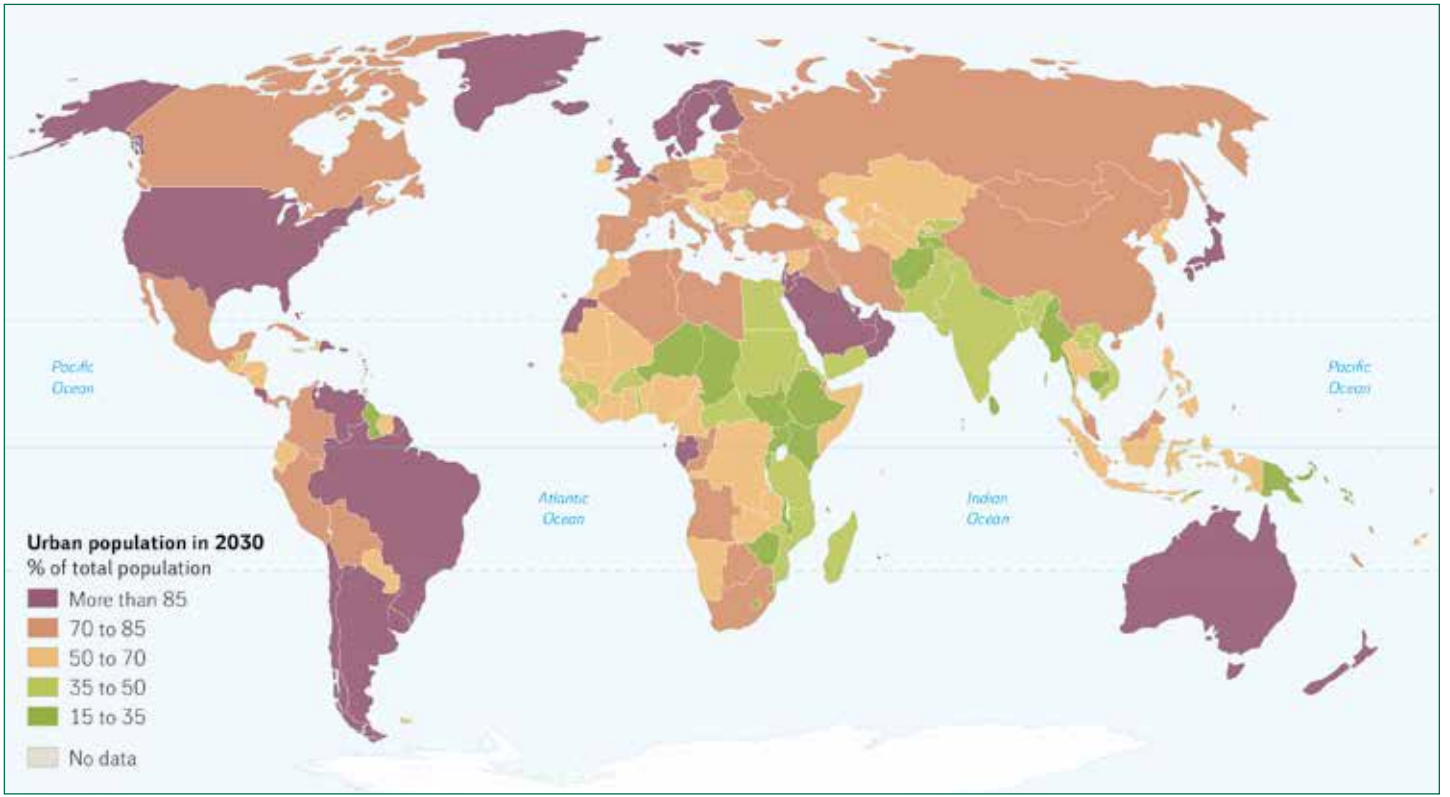
	2019	2030	Increase
LIC*	713	935	+ 222
LMIC**	3 140	3 595	+ 455
SSA***	1 078	1 418	+ 340
Sahel	103	142	+ 39

** LIC: Low Income Countries*

*** LMIC: Lower Middle Income Countries*

**** SSA: Sub-Saharan Africa*

Map 3: Urban population evolution from 2019 to 2030 (in %).
Data source: UN population.



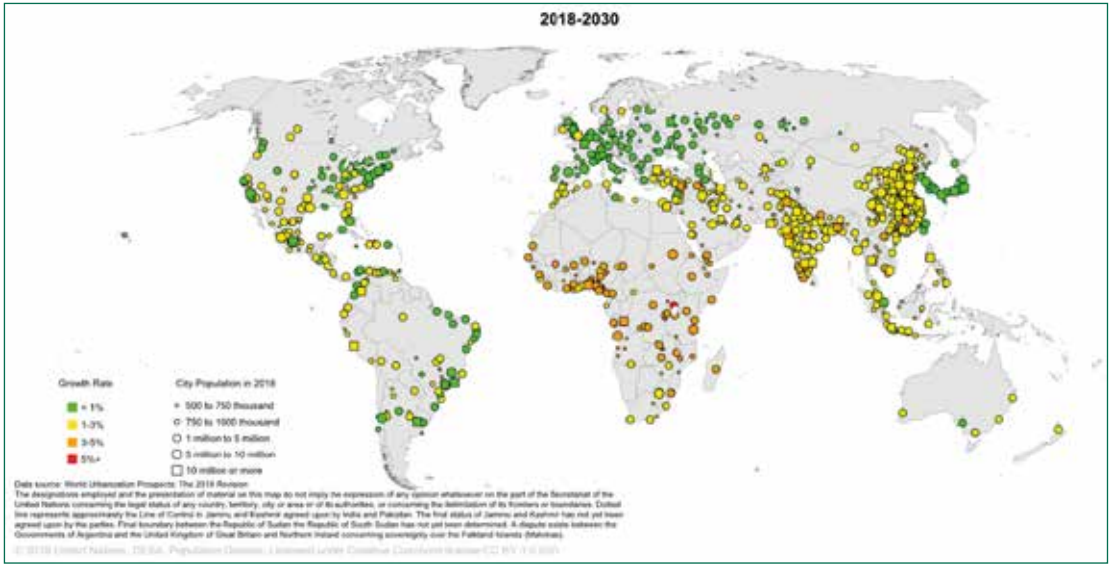
Cartography: Agnès Stienne

2 || Demographic trends

■ Population will grow in urban areas

Low Income Countries (LIC) and Lower Middle Income Countries (LMIC) urban populations will grow at an annual rate of 3.9% and 2.4% respectively over the next 10 years. This means a 50% increase of the urban population between 2019 and 2030. Map 3 shows the countries where urban populations will be larger than rural populations.

Urbanization induces a diversification in food offer, and an evolving food environment for consumers (e.g. new products and stores, advertising and an evolving mass media, etc.) and changes in food practices (e.g. an increase in the out of home consumption) and in consumers' concerns (origin of food products, mistrust in the food system).



Map 4: Cities in 2018 and their growth rate 2018-2030.
Source: UN population, 2018.

Map 5: Rural population growth in % from 2019 to 2030.
Data source: UN population.

Cartography: Agnès Stienne

2 || Demographic trends

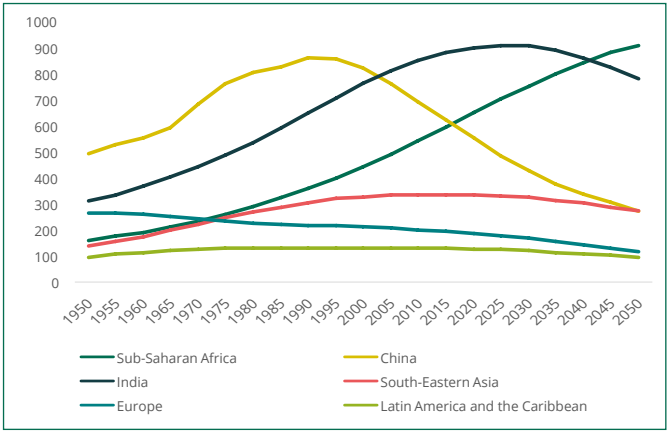
■ Population will also grow in rural areas in LIC

Urbanization should not mask the important increase in rural populations in LI countries (Map 5) and, in particular, in sub-Saharan African countries (Figure 5).

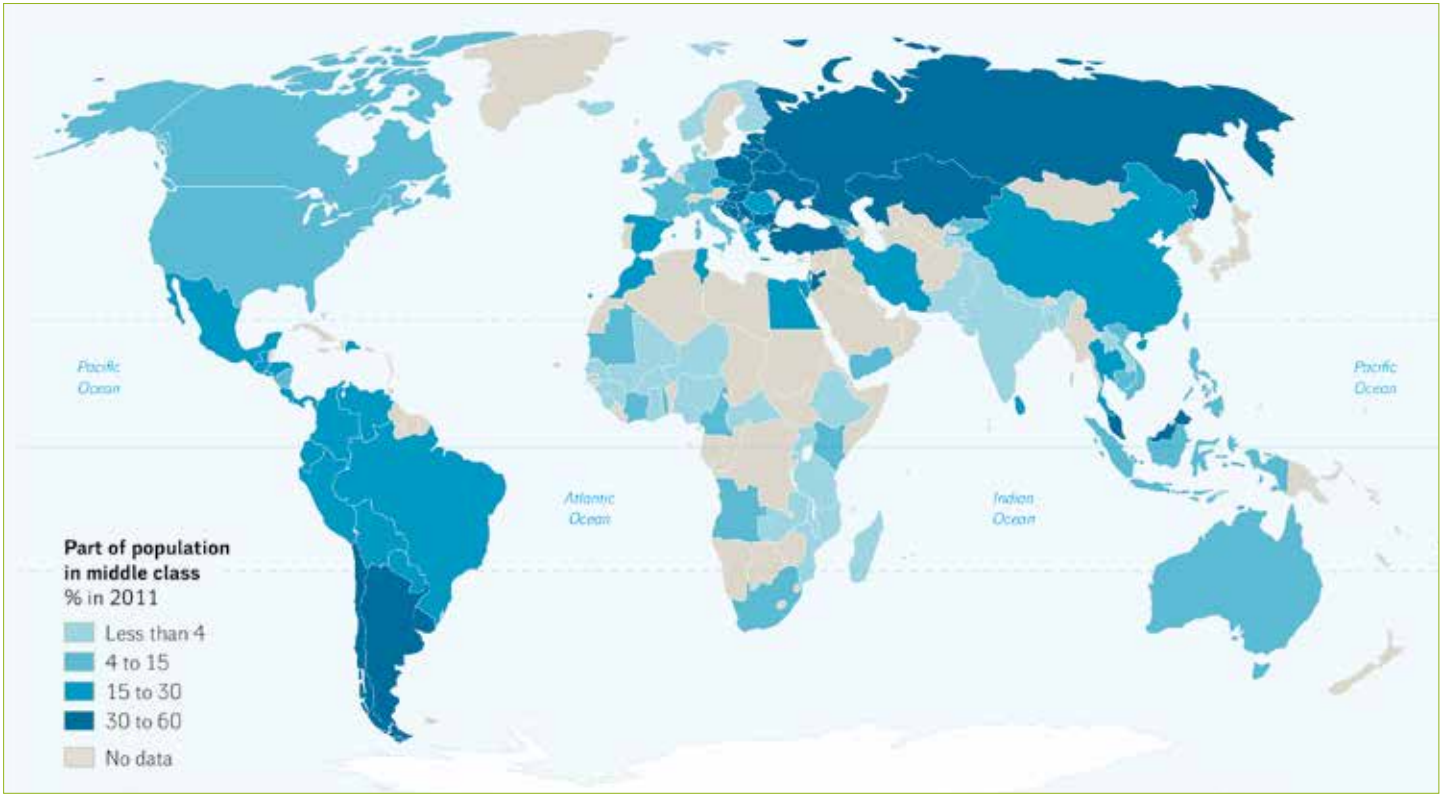
From 2019 up to 2030, in some sub-Saharan countries, the rural population will increase by more than 20%.

Rural population growth means a quantitative increase in food demand and a need to create jobs in rural areas.

Figure 5: Evolution of rural population by major countries and regions (1950-2050) (in million).
Data source: UN Population.



Map 6: Middle class (share of total population) .
Data source: Pew research Center, 2015.



Cartography: Agnès Stienne

3 || Socio-economic trends

Emerging middle class, but remaining poverty

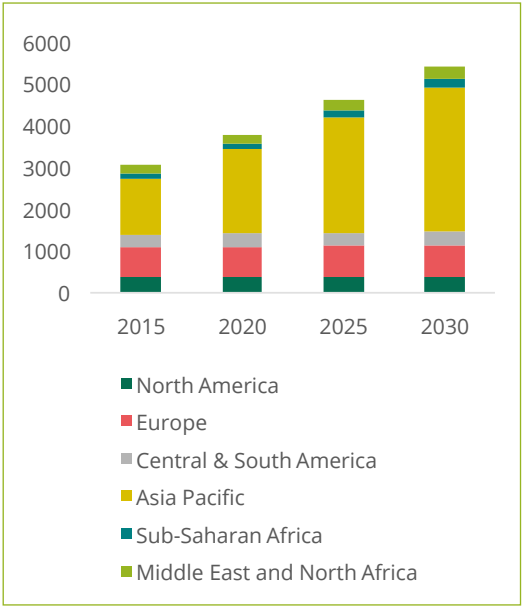
Middle class growth in many parts of the world (Map 6) and mainly in Asia (Figure 6) implies an increase in purchasing power for part of the population.

This translates into a diversification in diets, with a growing consumption of animal products, sugar, fat, and processed food.

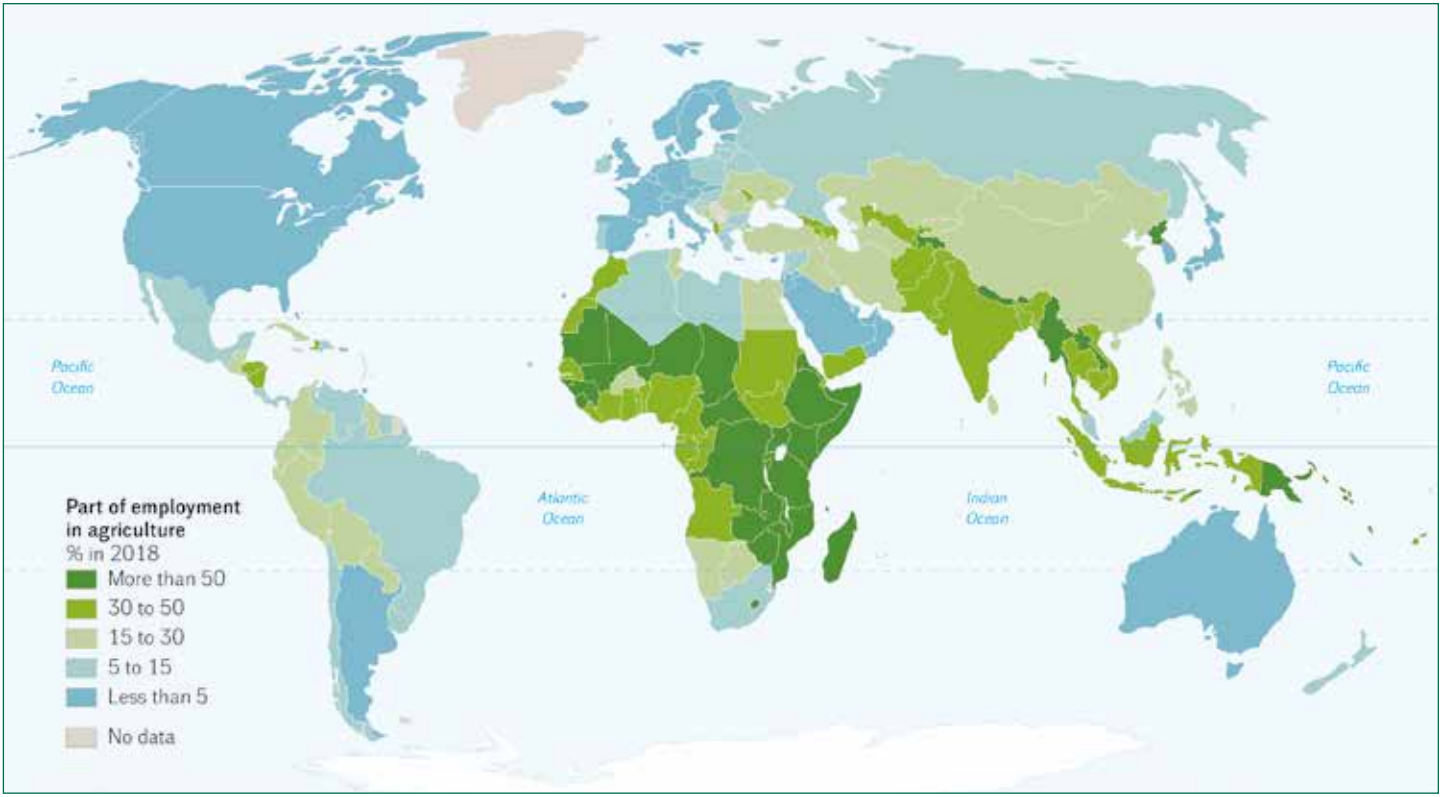
Such an evolution in food diets creates new nutritionnal risks (overconsumption compared to reduced physical activity). It also contributes to an increase in pressure on food production (waste, animal feed) and on resources (water, energy for processed food).

At the same time, poverty rates should remain high in many LI and LMI countries, with strong inequalities within countries, thus upholding the risk of social unrest and conflicts.

Figure 6: The expansion of the global middle class (in millions).
Source: Kharas, 2017.



Map 7: Employment in agriculture in 2018 (share of total employment in %).
Data source: ILOSTAT.



Cartography: Agnès Stienne

3 || Socio-economic trends

Employment and income generation

The challenge of job creation will be particularly high in sub-Saharan African countries.

By 2050, 62% of the worldwide increase of the working age population will be in Africa. By 2030, 175 million additional jobs will need to be created, including 93 million in rural areas (Figure 7).

The employment challenge in sub-Saharan countries is also about the type of jobs: today, 58% of employment are poor jobs (<US$ 1.90 PPP).

Agricultural occupations and their remuneration, and living conditions in rural areas are not very attractive to young people, compared to the opportunities offered by cities. Mechanization and technological innovations, but also investments in rural infrastructure (communication, education, health, sanitation, energy, etc.) contribute to improving this attractiveness and productivity.

But a transformation of agriculture towards highly capital intensive models can increase the exit from agriculture and the demand for non-agricultural labour in a context where the industrial and service sectors already have difficulty absorbing the growth in labour force.

Policies addressing gender inequalities are gaining momentum, thus progressively enhancing women's potential to boost food-systems.

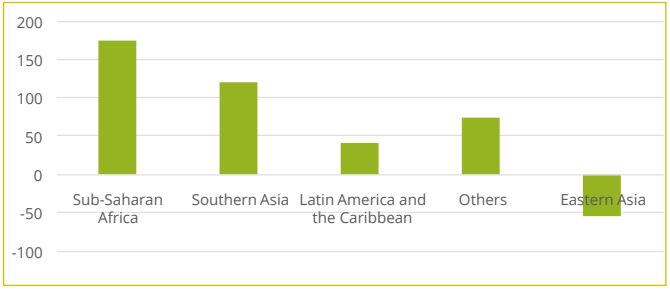
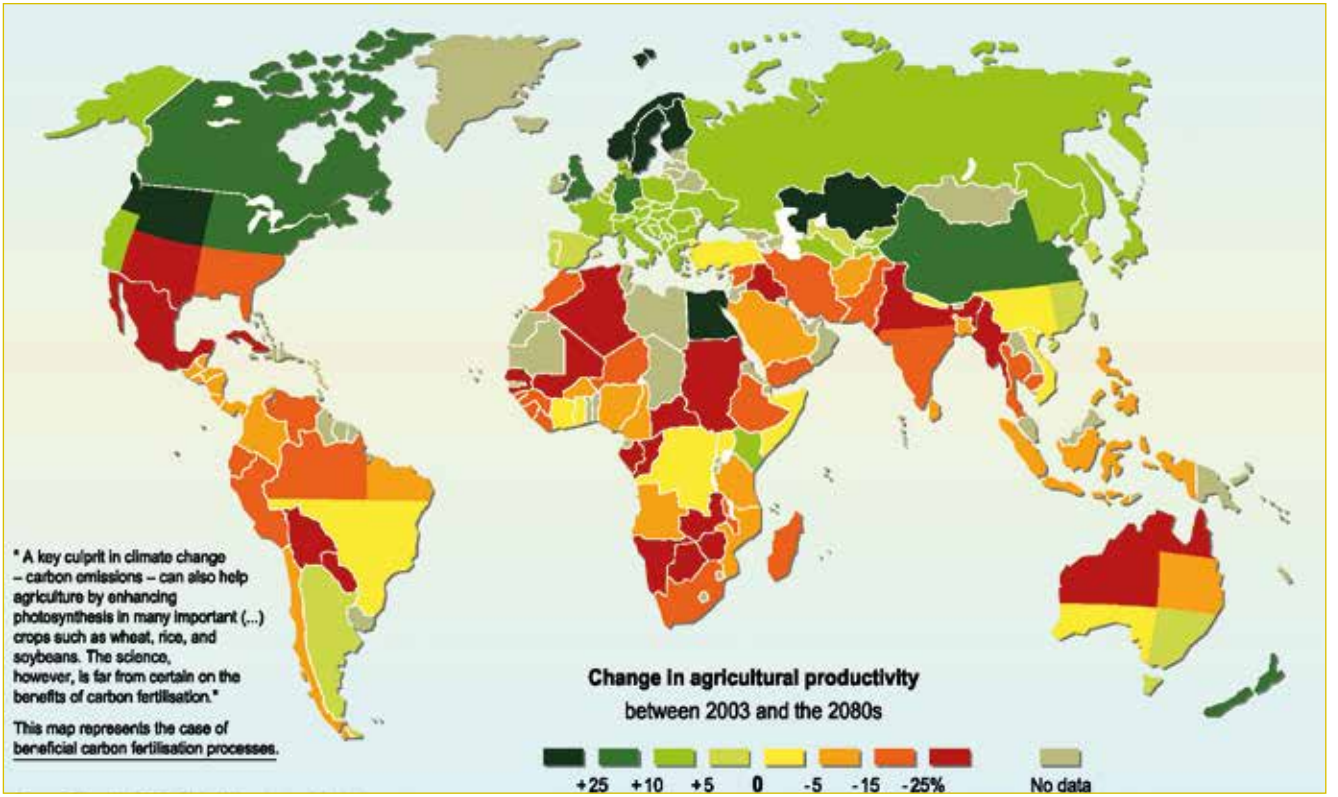


Figure 7: Working age population increase in millions 2018-2030.
Data source: ILOSTAT.

Map 8: Projected impact of climate change on agricultural yields.
Source: Cline, 2007



4 || Environmental trends

Climate change

Climate change is defined as "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods".

Agricultural systems in high income and emerging countries are the biggest producers of greenhouse gases (GHG) while agricultural systems in LIC and LMIC will be the most affected by climate change.

Climate change will affect crop yields, spread of plant and animal diseases, and thereby might limit food availability, especially in LIC and LMIC.

Climate change will lead to more variability and shifting seasons, and an increased severity and frequency of natural disasters such as floods and droughts (Figure 8).

Climate change also affects the geography of food production and of plant and animal diseases; without action, agricultural output might reduce drastically in some regions.

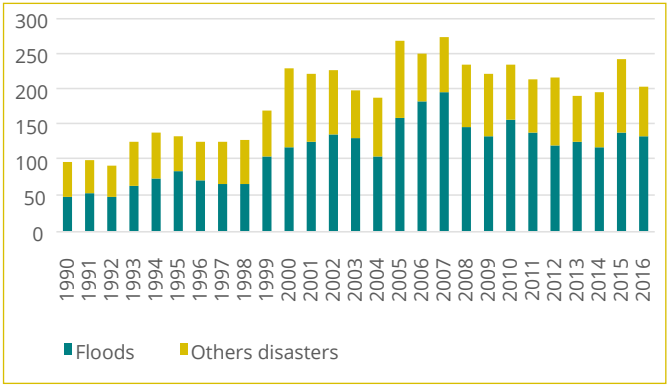
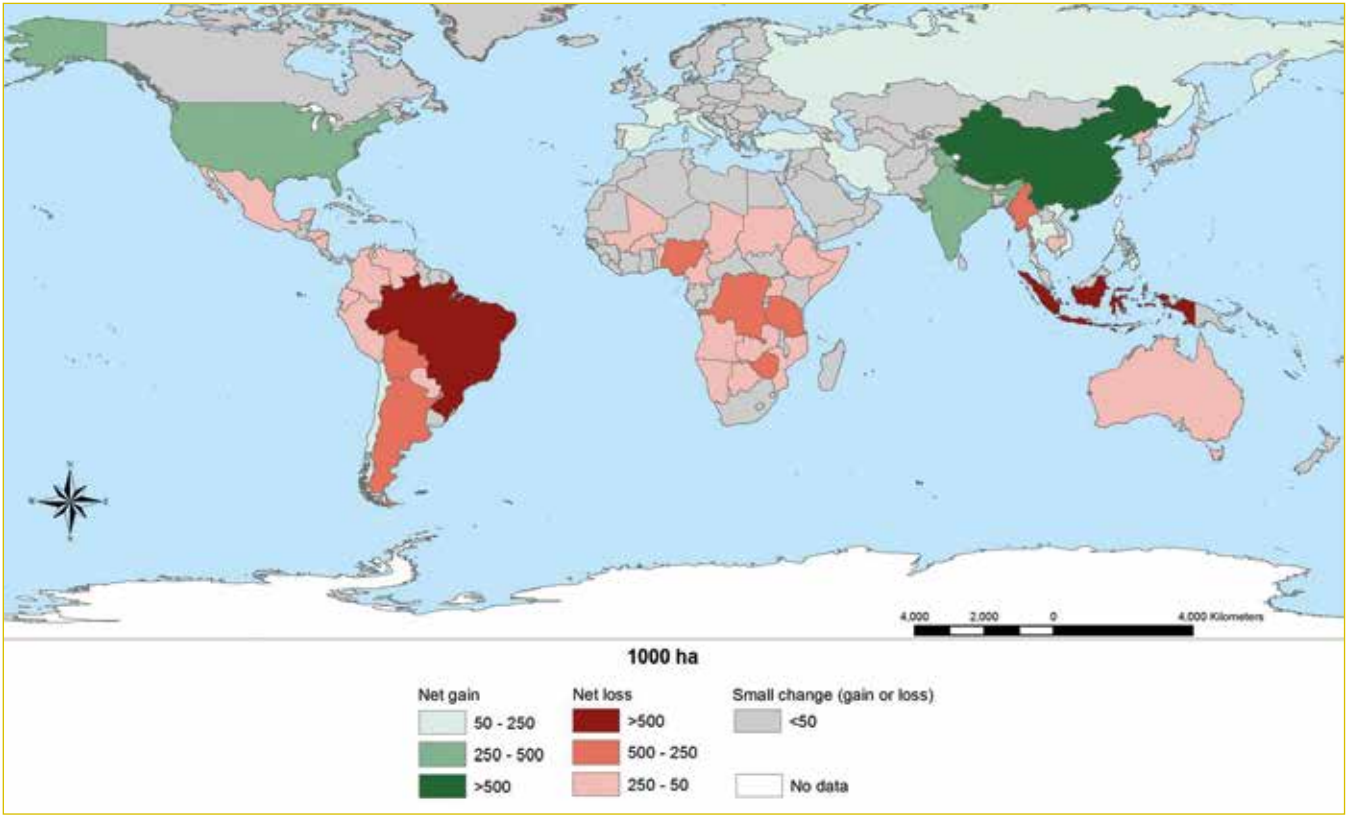


Figure 8: Number of climate disasters.
Source: EM-DAT.

Map 9: Annual net change in forest area (1990 - 2015).
Source: FAO, 2015. Global Forest Resources Assessment.



4 || Environmental trends

Natural resources and biodiversity loss

To fertilize the land, produce and process products, food systems increasingly use resources that are finite (e.g. fossil energy, phosphate), fully renewable (e.g. solar energy) and conditionally renewable (e.g. forest, water and fish) and evolving (e.g. biodiversity).

The scarcity of non-renewable resources, the management of renewable resource stocks and the over-exploitation of conditionally renewable resources, heighten competition, which may lead to conflicts, and affect production capacity. As they usually provide other ecosystem services, resource depletion and overexploitation jeopardize not only future food production but also ecological balances.

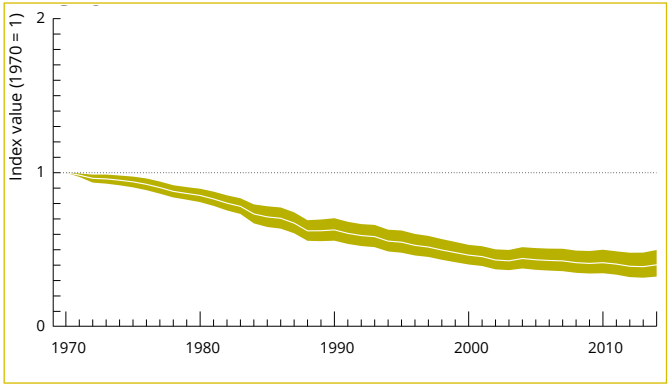
Forests and trees make vital contributions to both people and the planet, but reduction of the forest cover is reaching worrying thresholds in many LICs and MICs (Map 9).

Access to available arable land is progressively limited because of demographic expansion and land degradation (erosion, fertility reduction etc.)

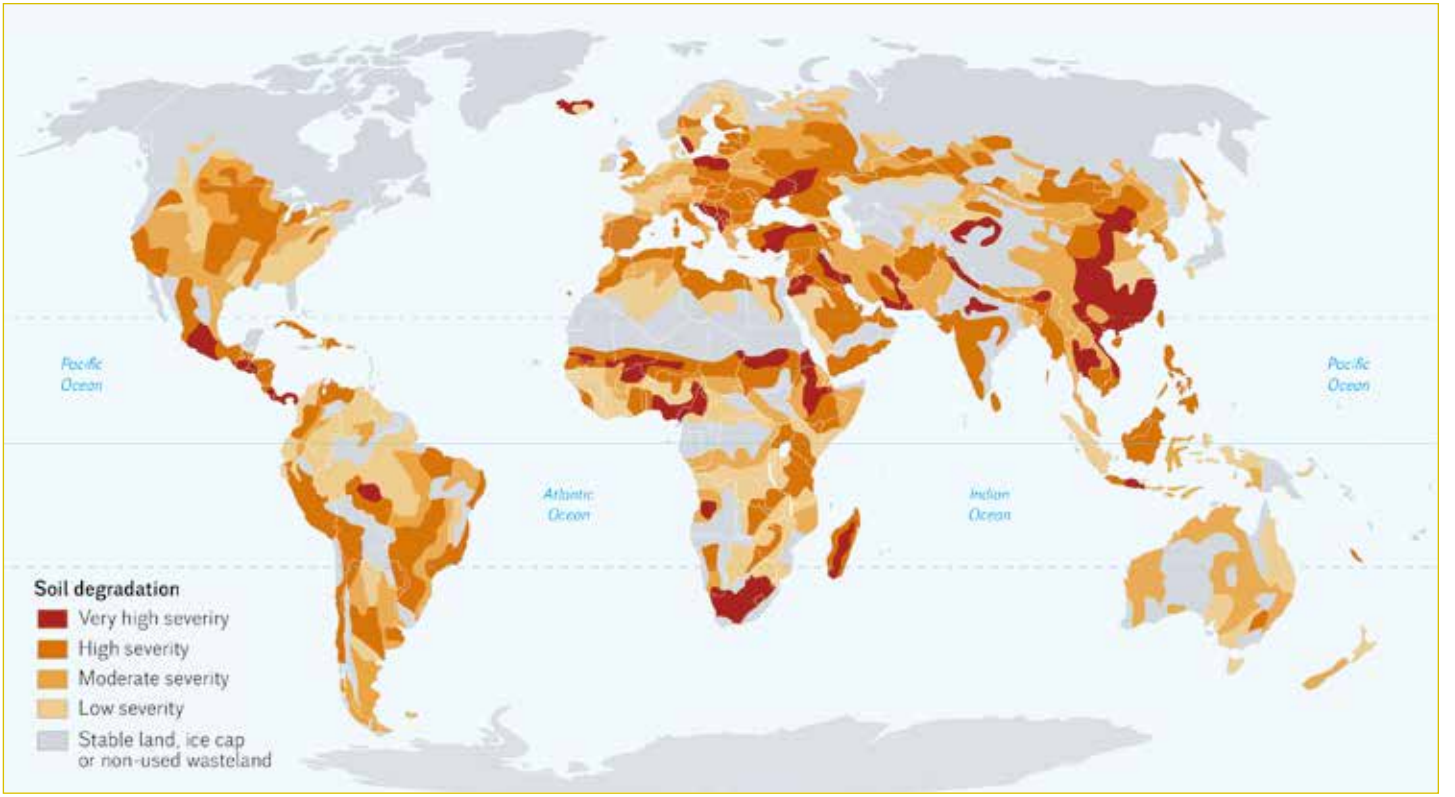
Biodiversity is critical for agriculture. However, many of its key components at genetic, species and ecosystem levels are in decline. Scientists warn that a 6th mass extension of biodiversity is on-going.

The Living Planet Index, which measures trends in the abundance of freshwater, marine and territorial species, shows that the 6th mass extinction of biodiversity has been reached (Figure 9).

Figure 9: The Living Planet Index.
The global LPI shows a 60% (range: -50% to -67%) decline between 1970 and 2014. The white line shows the index values and the shaded areas represent the 95% confidence intervals surrounding the trend.
Source: WWF/ZSL. 2018



Map 10: Global soil degradation induced by humans.
Data source: FAO; Sepuru & Dobe, 2017 based on Oldeman et al.*, 1990.*



Cartography: Agnès Stienne

4 || Environmental trends

Soil degradation and pollution

Soil degradation is a change resulting in a diminished capacity of the ecosystem to provide goods and services.

Rapid growth of cities, industries and industrialized agriculture has accelerated soil losses and threats such as soil erosion, compaction, acidification, contamination, sealing, salinization, waterlogging, nutrient imbalance (both nutrient deficiency and nutrient excess), and losses of soil organic carbon and of biodiversity.

In many parts of the world agriculture is a major contributor to pollution through the use of synthetic inputs, such as chemical fertilizers and pesticides, antimicrobials, or animal wastes. When applied in excess, only a fraction of chemical fertilizers is absorbed by plants, the remaining part contaminates underground and surface freshwater systems.

In some developping countries, the consumption of pesticides is already high (Figure 10).

Agrochemicals are also a major pollutant affecting soils and water. Phosphates generally also bring contaminants of heavy metal, like cadmium. Organochlorine insecticides can persist in the soil for decades and be bioconcentrated from the soil to final consumer along the food chain. Antibiotics, used at a large scale level for animal and fish production, are less and less efficient due to increasing antimicrobial resistance.

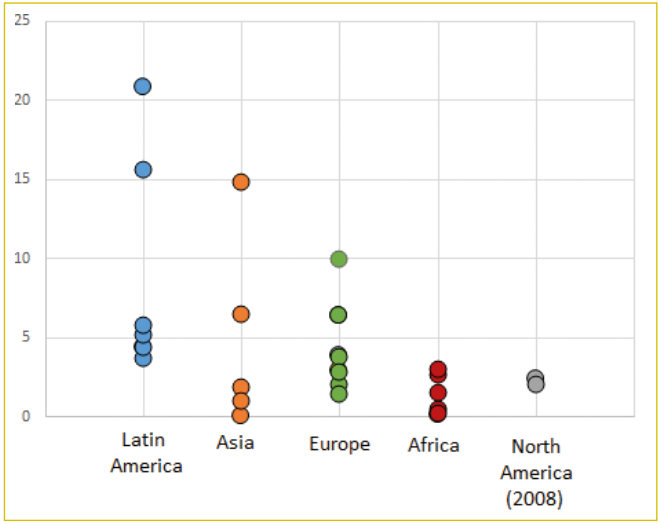
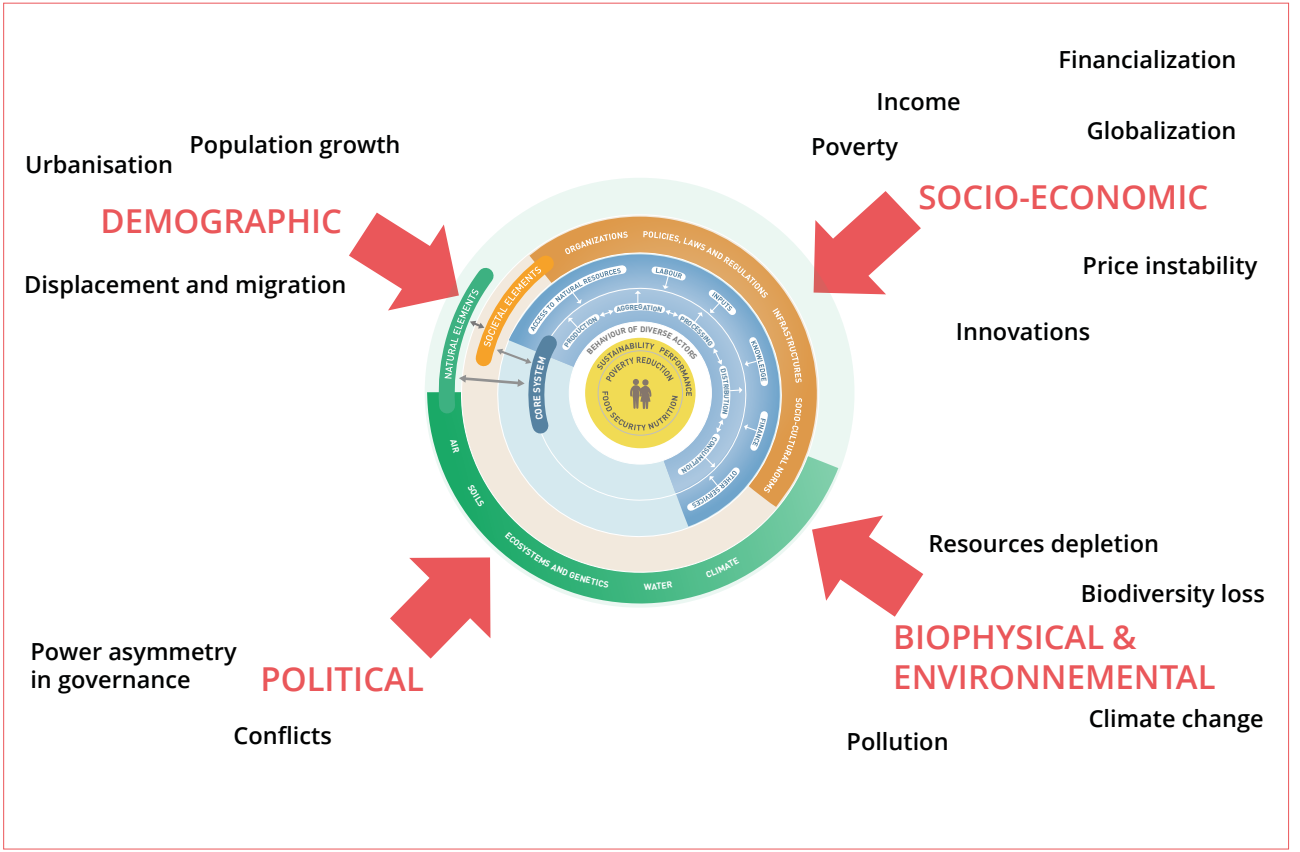


Figure 10: Pesticide use / ha by continents (2014).
Data source: FAOSTAT.

Figure 11: Drivers challenging food systems.
Source: author based on the FAO food systems wheel.

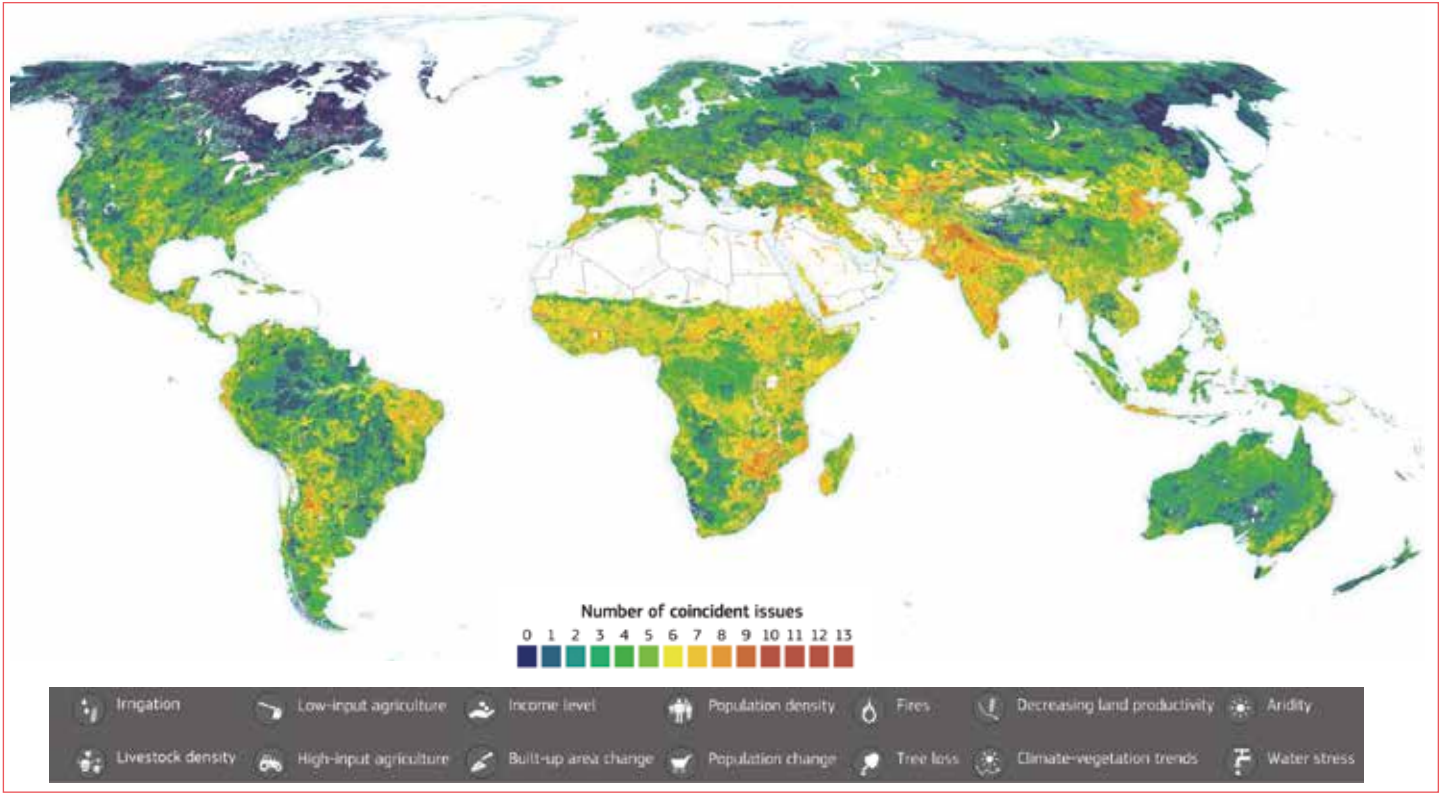


5 || From trends to risks

The set of trends previously presented creates many threats, especially in LI and LMI countries. Combined together, these trends may dramatically amplify the vulnerability of food systems, affecting food access, availability, utilization and stability. They might threaten food systems' capacities not only to meet food nutrition and security but also environmental integrity and inclusive development objectives (Figure 11).

The combination of drivers and their projected trends point to regional hotspots where populations will potentially experience food conflicts and crisis in the near future.

Map 12: Threats to land.
Source: JRC World Atlas of Desertification, 2018.



5 || From trends to risks

Food production capacity

Due to growing population, soil degradation, deforestation and urban development (which aggravates land pressures), food production increased through extending the cropped area will be limited. Food availability is challenged in sub-Saharan countries. Food needs could grow by 29% to 91% over the 2010 - 2050 period depending on the assumptions made on population growth, economic growth, and diet changes, and the rise will be much greater in sub-Saharan Africa.

At the same time, environmental drivers, such as soil degradation, water scarcity and biodiversity losses, challenge the capacity of agricultural production to cope with this growing demand (Part 3). In addition, climate change could reduce yields of major crops (Map 8).

Agricultural production is some countries (Map 12) already struggles to keep up with population growth.

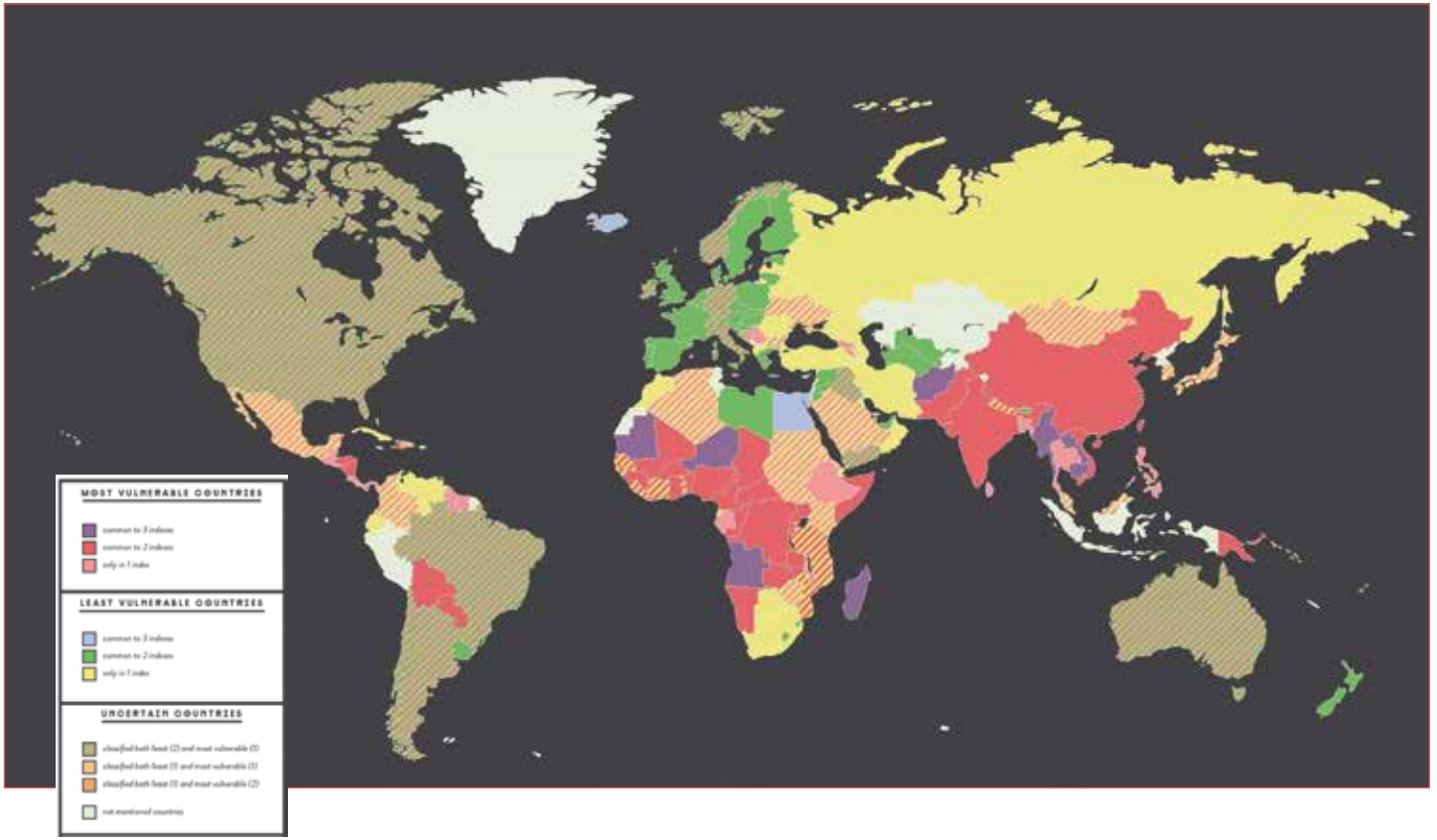
It is now recognized that, on a global scale, future global food security does not necessarily require a significant increase in food production if we move towards more sustainable production systems on the one hand and if incomes and availability are better distributed around the world on the other.

On a more local scale, however, some areas seem threatened with a decline in food production. Agricultural production is some countries (Map 12) already struggles to keep up with population growth. If income diversification opportunities are not sufficient to guarantee access to food, there is a risk that migration to less populated areas, particularly forests, cities or abroad, will accelerate, causing other problems (deforestation, urban poverty, etc.).

Mean yields changes due to climate change by 2050

- **Africa:** **-17%** (wheat)
  -5% (maize)
  -15% (sorghum)
  -10 % (millet)
- **South Asia:** **-16%** (maize)
  -11 % (sorghum)

Map 13: Climate vulnerability world map.
Source: Colombo G. et al. (EMAPS Project), 2013.



5 || From trends to risks

Readiness to face instability

Food accessibility, availability, utilization and stability shape the purpose of food systems. The capacity to produce and import food, and access for all groups of people require a stable environment which may be jeopardized by strong or sustained exposure to risk (technical, environmental, organisational and societal).

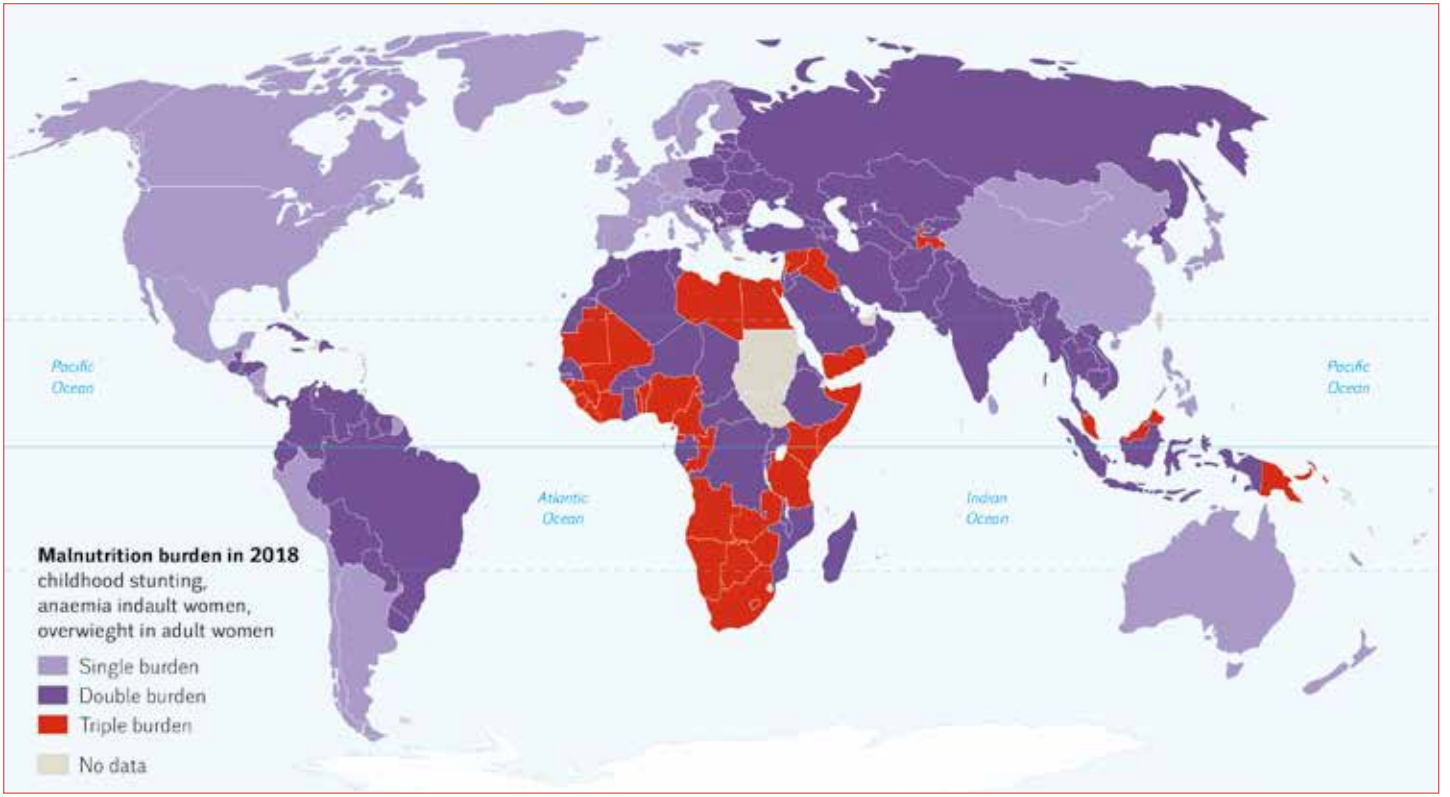
Some countries benefit from stability, allowing food systems to meet their purpose, while others are disrupted by cumulative disorders. Vulnerability stems from environmental and climate change damages, social and economic strains, security issues etc. The food system's capacity to resist and overcome this set of difficulties shape its resilience.

Dozens of indicators attempt to measure individual components that build this resilience. They provide information on vulnerability to climate hazards, ecosystem changes, access to basic services (water, health etc.), economic shocks, quality of habitats and infrastructures etc. They also take into account the institutional capacity to manage social difficulties, control extreme events or encourage innovative behaviour. While all these elements come into play when disasters or sudden shocks happen, they must be analysed in a long term perspective.

To help appraise the complexity of this readiness to face cumulated risks, Map 13 combines 3 different indices:

- The Climate Vulnerability Monitor (environmental disasters, habitat change, health impact, industry stress)
- The ND-GAIN Country Index (vulnerability to climate change, global challenges, readiness to improve resilience)
- The Global Climate Risk Index (weather-related loss events: storms, floods, heat waves etc.)

Map 14: Malnutrition burden across countries.
Data source: Globalnutritionreport.org.



Cartography: Agnès Stienne

5 || From trends to risks

Nutrition: the triple burden

Economic development, globalization and urbanization, along with a decrease in the relative price of many food products, first helped improve access to higher quantities and diversity of food.

However, today increased production of processed food, aggressive marketing, and changing lifestyles have led to a shift in dietary patterns. With urbanization and economic development, demand is growing for processed and convenience food, street food and fast food. Many people in LMIC have access to cheap and empty calories (low in nutrients), particularly from ultra-processed food, while the availability and affordability of nutrient-rich food is too low.

LI and LMI countries are now facing the triple burden of malnutrition, where populations suffer from undernourishment, micro-nutrient deficiencies, and food-related non-communicable diseases (diabetes, cardio-vascular diseases, or cancers). The African continent is the most impacted by the different burdens (Map 14).

Overweight in LIC:

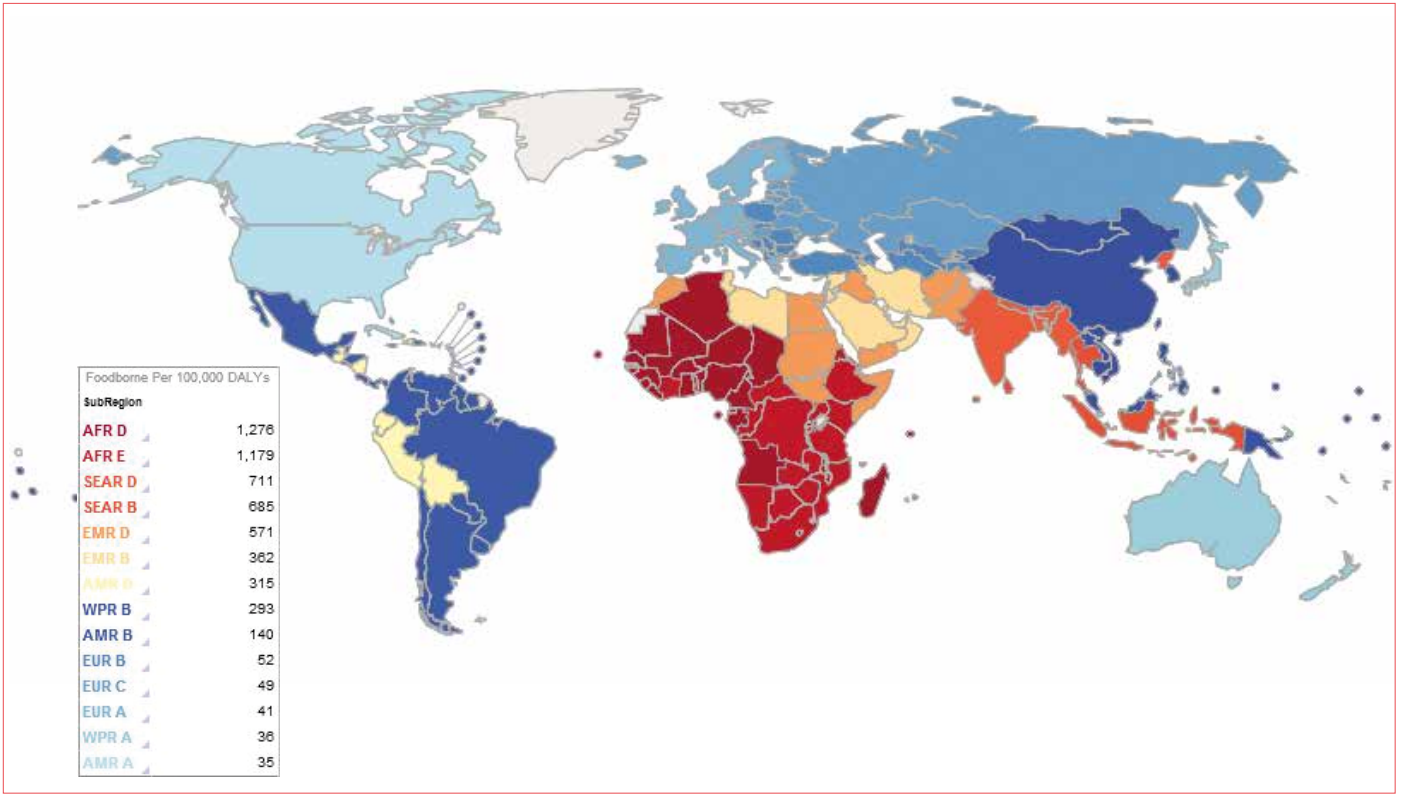
1/3

of women

4 in 5

adults with diabetes live in LMI countries

Map 15: WHO Estimates of the global burden of foodborne diseases.
Source: WHO, 2015.



5 || From trends to risks

Food safety

Unsafe food can be defined as food containing harmful bacteria, viruses or parasites or containing toxic substances.

Harmful amounts of toxins or microorganisms can cause diseases ranging from diarrhoea to various cancers.

1/3 of the world deaths due to food safety are in Africa. However, the development of modern food systems in LI and LMI countries brings with it new risks, for example food anxiety, as well as an increase in potentially dangerous products due to the potential increase in food fraud.

Food safety can be threatened from many angles. Harm can be caused by microbes and mycotoxins, or through the excessive use of pesticides and other chemicals, such as food additives. To supply urban dwellers with food, supply chains are long and complicated and enforcement of food safety may be difficult.

Food safety, especially in LI and LMI countries, will remain a concern for years to come (Map 15). When food is not safe, adequate nutrition can never be achieved.

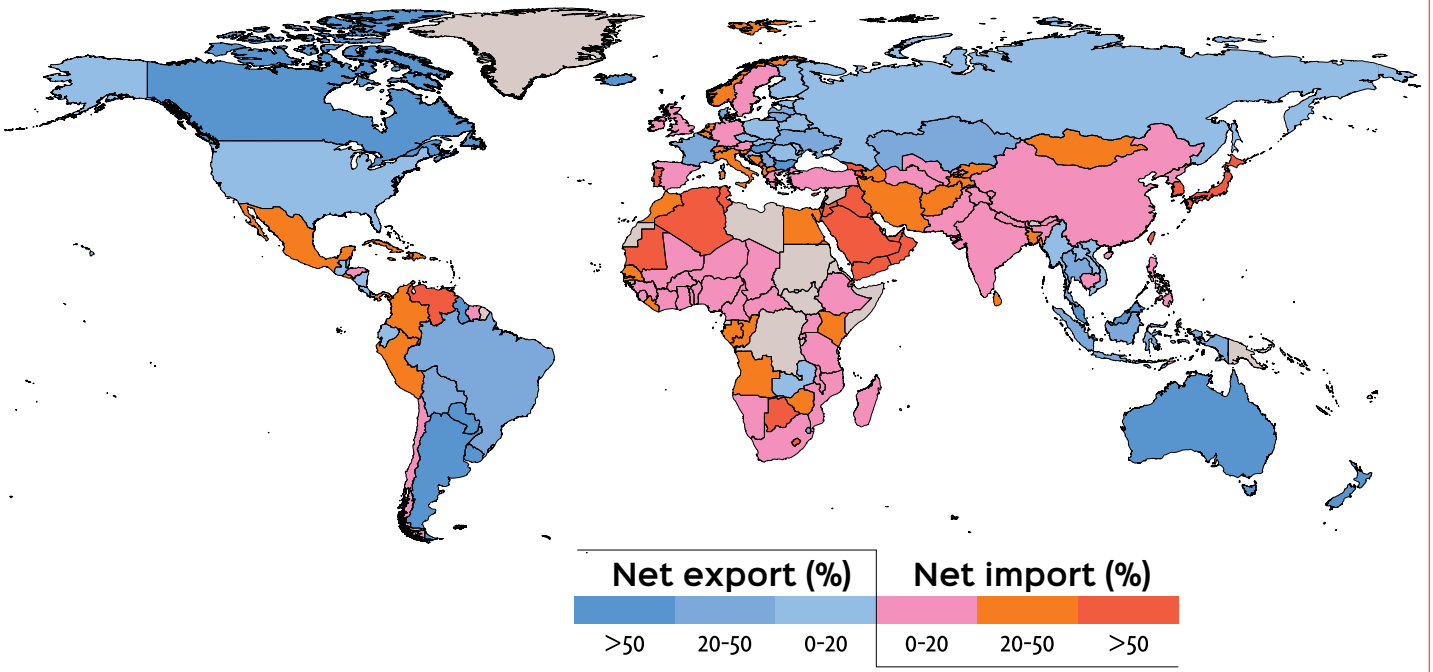
Increasing urban populations, environmental issues, as well as the lack of infrastructure and political support towards improvement and food control on markets, raise concerns for the future. Food safety and resulting foodborne diseases might be one of the major food quality issues in the years to come.

Food safety in the world represents

420 000 deaths/year

600 million ill person due to contaminated food/year

Map 16: Net food imports in domestic food supply (% in total calories).
Source: FAO Global Perspectives Studies, using 2011 food balance sheets from FAO, 2016a.



5 || From trends to risks

International markets

International trade, plays an important role in ensuring food security. Unpredictable events create risks.

Climate change will significantly affect food production, outbreaks and epidemics (such as H1N1 bird flu, etc.) may disrupt supply chains, thereby affecting food supply. Such supply shocks will make food markets more volatile.

The increasing interdependence of food markets with energy markets (e.g. biofuels) and financial markets (with the increased use of agricultural derivatives markets by hedge funds) is likely to augment instability.

International trade can help in reducing domestic price instability, but for countries highly dependent on food imports it can also increase their exposure to more frequent international price shocks.

Countries where staples account for a high share of calories and expenditure in households' diets are particularly vulnerable to price hikes, as opportunities for product substitutions are low.

Over 20 years the international price of a tonne of rice stayed between

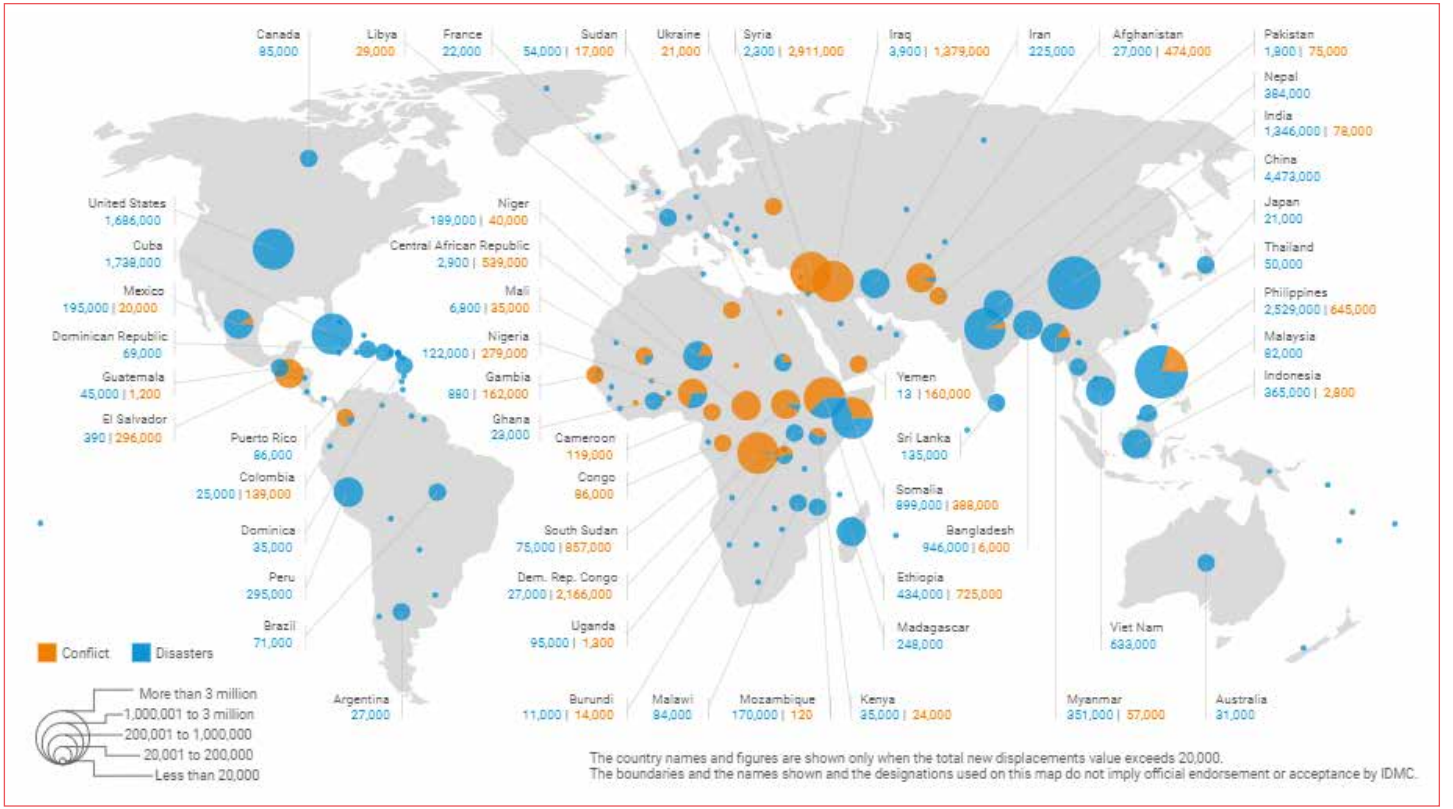
200 and 300 USD,

but soared up to

700 USD

during the 2008 crisis.

Map 17: New internal population displacement by conflict and disaster in 2017.
Source: IDMC.



5 || From trends to risks

Disasters, conflicts, displacements

In 2017, there were 30.6 million new displacements associated with conflict and disasters across 143 countries and territories.

Conflicts highly impact on food security. For example, stunting in children under 5 years old represents 20% of all children in countries without conflicts, but 34% in conflict-affected countries.

Natural disasters remain the main cause of population displacements at the global level, but in Africa conflicts dominate (Map 17). The projected growing impact of global warming will certainly raise disaster-related displacement and potentially fuel social unrest and conflicts, as populations migrate in the search for new land and food.

Unsteady food systems due to low food production capacities, low resilience, high pressure on resources and political insecurity generate more migrations.

75%

of stunted children live in countries affected by conflict

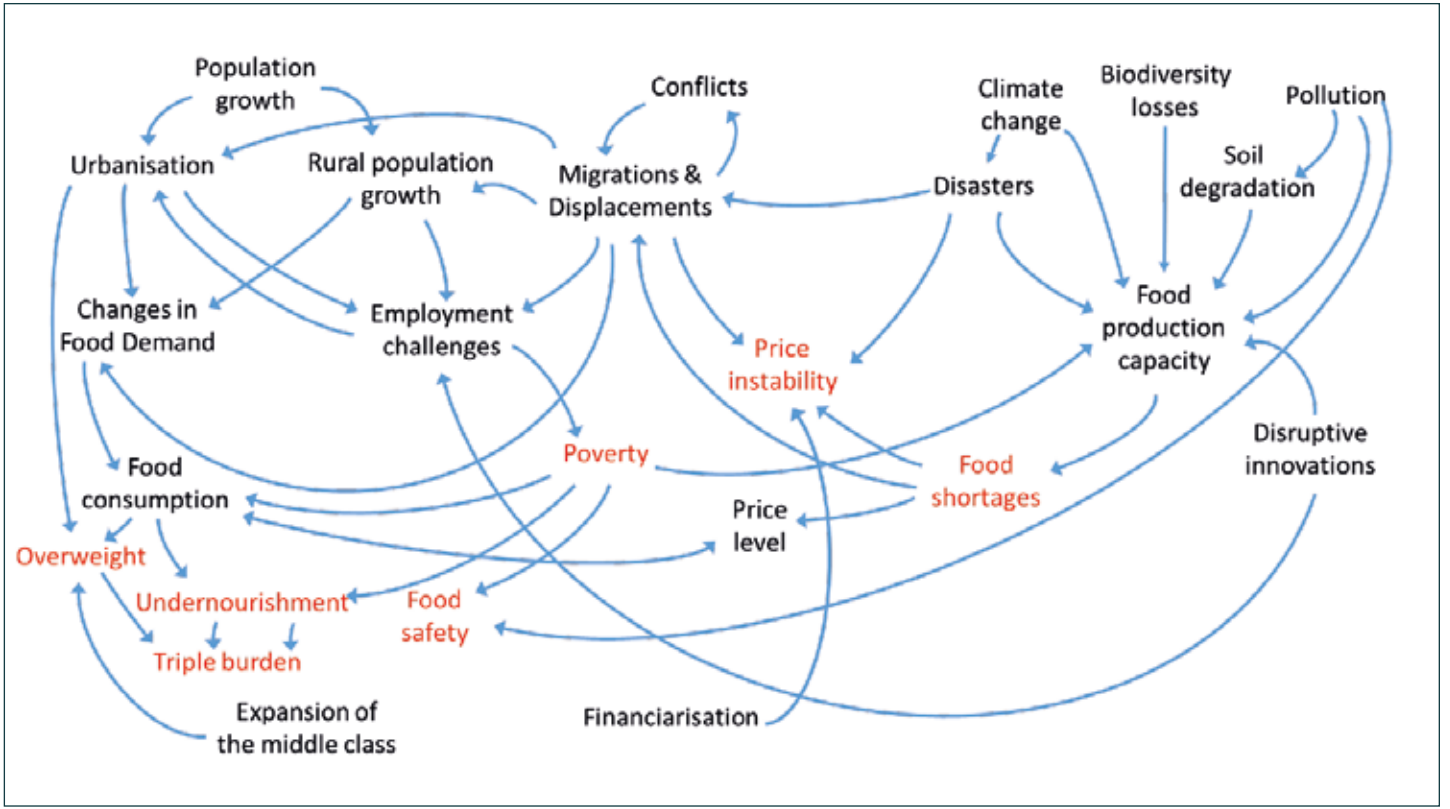
From 2008 to 2017, the mean of internal displacements because of conflicts was

7.1 million/year.

because of disasters was

24.6 million/year

Figure 12: Food system drivers combine and generate cumulative risks



CONCLUSION || An unprecedented combination of risks

Several drivers of food systems, some evolving very rapidly, are now adding up and increasing risks for food security and nutrition. In some regions, rapid population growth, together with a depletion of natural resources, impacts of global warming, or conflicts and displacements, challenge food security and nutrition. Such situation hit poor populations, and make them increasingly vulnerable over time. This drives to unprecedented crises.

Such combinations of risks are relatively new. It calls for a new approach to mitigate the threat of food crisis. Risks cannot be analyzed and addressed in isolation from each other. A systemic approach (Figure 12), taking into account feedback effects, synergies, spill overs, tipping points, irreversibility, or vicious circles (Figure 13), is urgently needed.

On the one hand, such an approach should aim at avoiding crises, for example by reducing the speed of negative drivers or by stabilizing the environment. On the other hand it leads to developing trajectories of resilience that make it possible to resist and recover from unavoidable crisis.

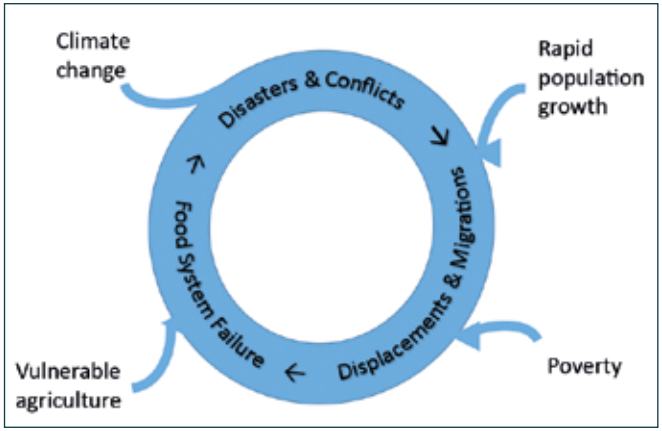
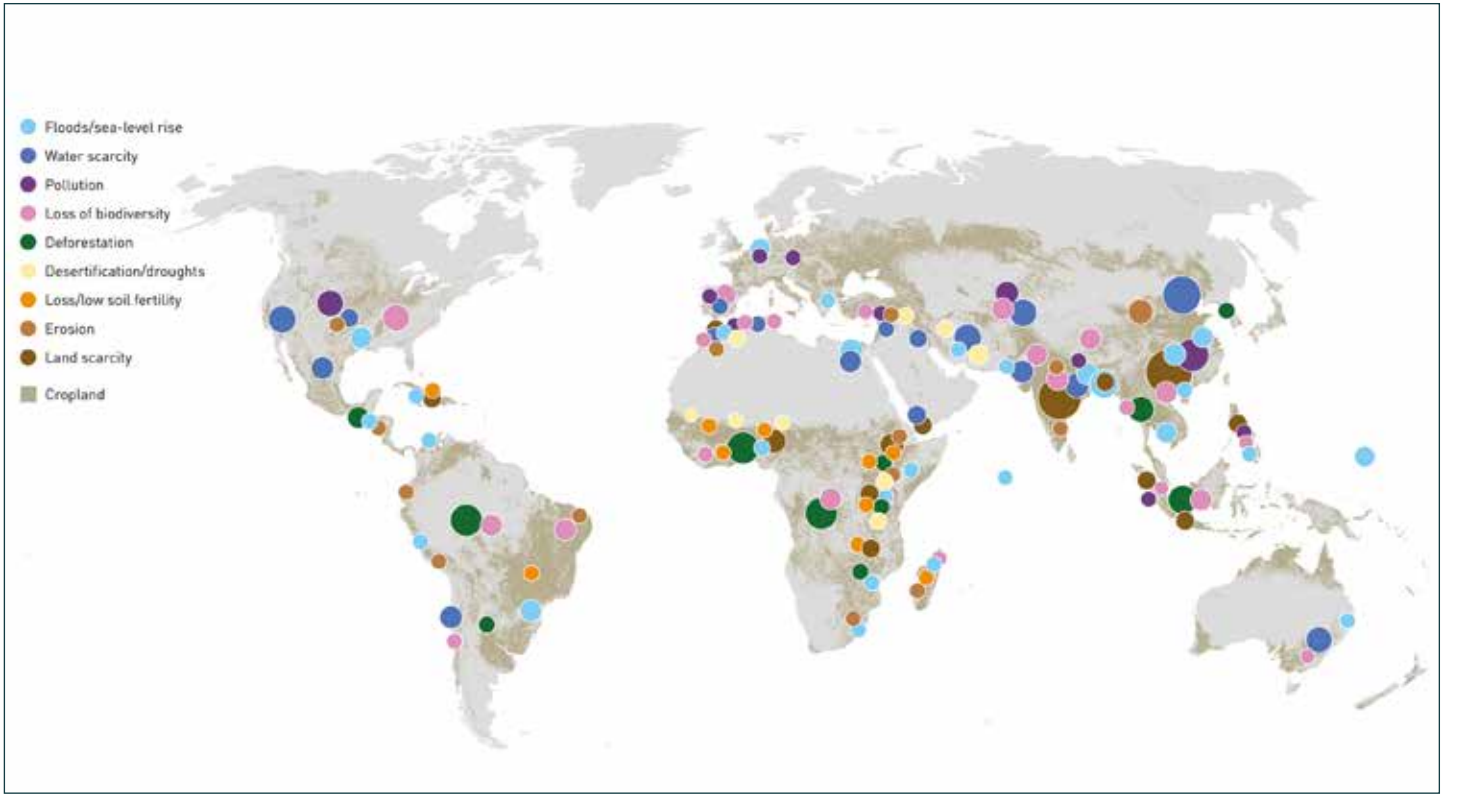


Figure 13: The vicious circle of disasters, displacements and food system failures.

Map 18: Global distribution of risks associated with main agricultural production systems.
Source: FAO, Fisheries and aquaculture Department (fishery and aquaculture statistics).



CONCLUSION || Towards resilient food systems

Drivers are global, but their combination creates risks which have different from one place to another. As shown by the maps in this handout, and even more so on Map 18, each country faces different drivers and risks, So there is no «one-size-fits-all» solution. Two countries, even geographically close do not necessarily face the same risks. It is necessary to be able to establish diagnosis on a case-by-case basis.

Determining risks is not enough to design public policies and take action. It is necessary to identify and understand resilient initiatives and pathways taken by local actors based on their situations. In each specific environment endogeneous and exogeneous innovations multiply and compound. They can contribute to building sustainable, inclusive and resilient food systems.

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FOOD SYSTEMS AT RISK: TRENDS AND CHALLENGES

THE SCIENTIFIC HANDOUT

This work benefitted from European Commission funds through the FAO Agrintel facility. Its content is the sole responsability of its authors and does not necessarily reflect the views of the European Commission.

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