UN environment

Findings on Food Systems in the sixth Global Environment Outlook

Briefing, Expert Group Meeting, 16-17 Sept. 2019

Pierre Boileau

Thanks to funders and partners

- Not possible to conduct a project of this size without significant contributions from funders and partners
- We had contributions of expertise and time from many authors.
- Their institutions also allowed them time away from their main activities to assist us.

GEO-6 Funders

Producing an assessment of this scale requires many generous contributions. The following organizations provided funding directly or indirectly to the sixth *Global Environment Outlook*: The Government of Norway, the European Union, the Governments of Italy, Singapore, China, Mexico, Switzerland, Denmark, Egypt and Thailand. Together with UN Environment's Environment Fund and Regular Budget, these contributions allowed for the production of GEO-6 and its accompanying Summary for Policymakers, as well as subsequent outreach activities.

GEO-6 Partners

GEO-6 also benefited from the generous contributions of several partners, including: GRID-Arendal, World Conservation Monitoring Centre (WCMC), The Centre for Environment and Development in the Arab Region and Europe (CEDARE), The Big Earth Data Science Engineering Program (CASEarth), the European Space Agency (ESA), the Netherlands Environmental Assessment Agency (PBL), the Freie Universität Berlin and the Massachusetts Institute of Technology (MIT).

How we got here

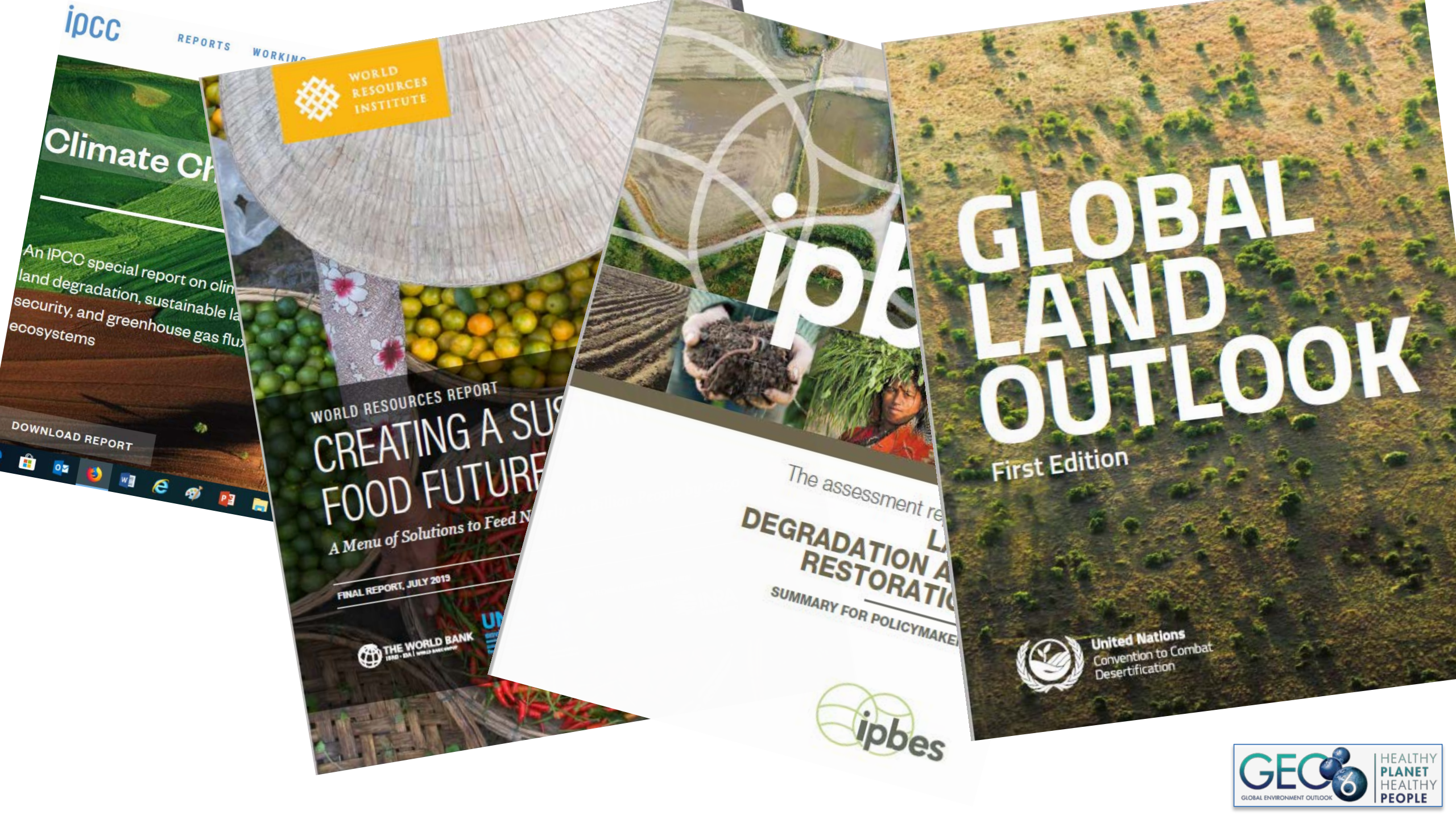
Main report

- 146 authors, 78 members of advisory bodies
- 41 review editors
- From more than 70 countries
- 301 UN reviewers
- More thank 1,000 technical reviewers
- 364 Intergovernmental reviewers
- 5 review periods, 2 of which were intergovernmental reviews

Summary for Policymakers

- Negotiated in January, 2019
- 95 countries, 250 participants, 4 days
- 37 page summary plus ‘Key Messages’

GEO 6 GLOBAL ENVIRONMENT OUTLOOK | HEALTHY PLANET HEALTHY PEOPLE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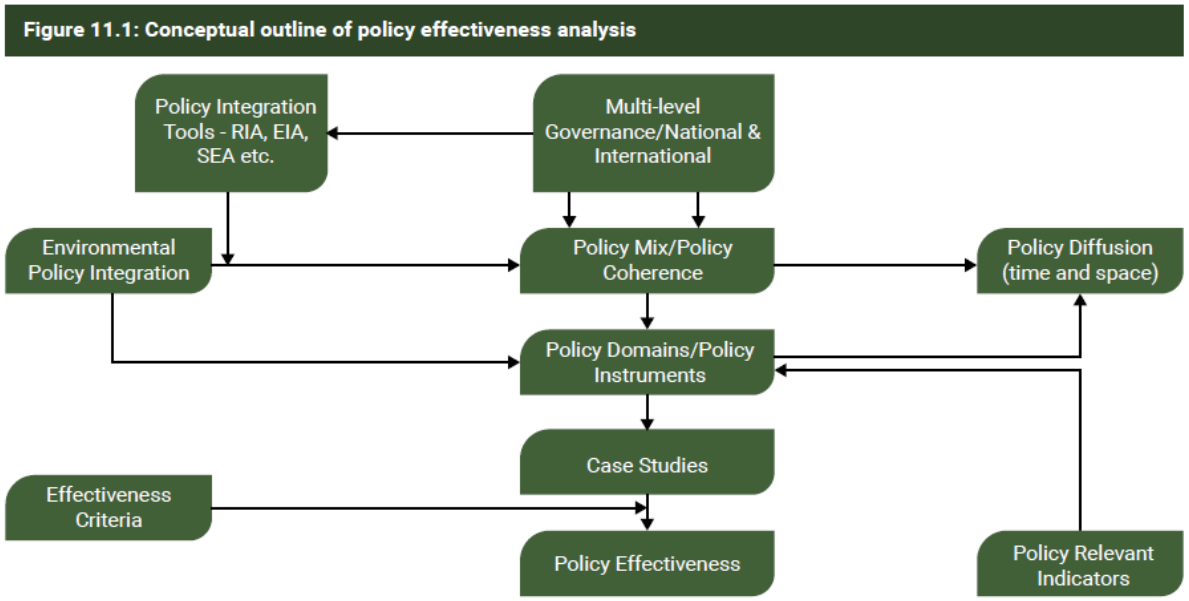
Challenges are three-fold

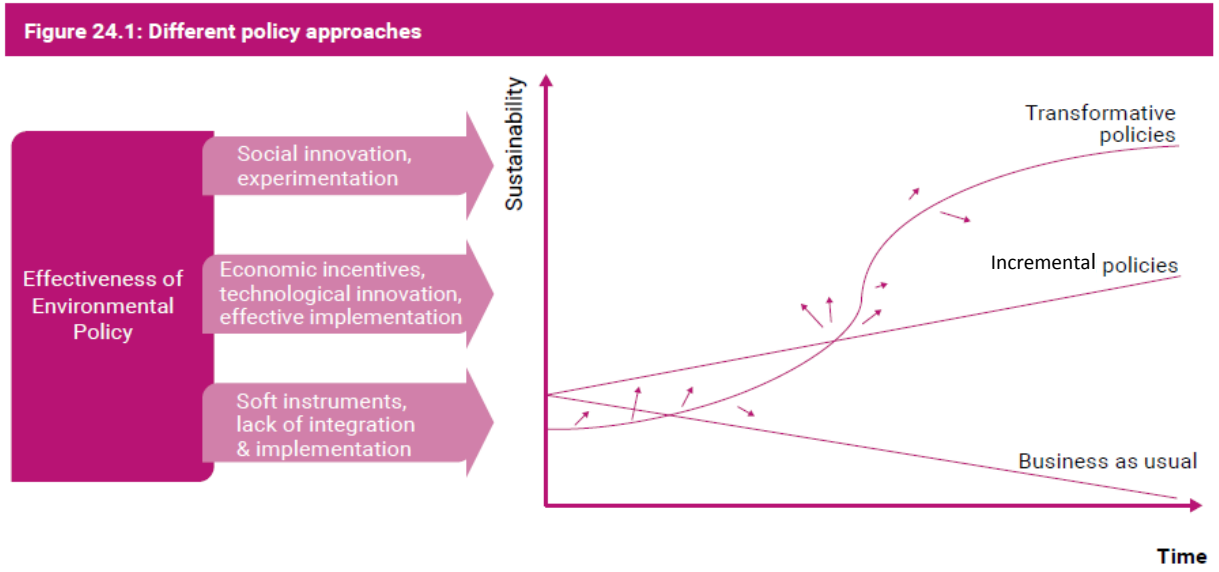
- **Food waste –** globally a third of food is wasted, 56% in developed countries and 44% in developing countries
- **Diminishing land and water resource –** due to climate change, land is being lost to desertification and more frequent droughts are decreasing available freshwater. Biofuels and reforestation compete for land.
- **Health and environmental impacts –** overuse or unmanaged use of chemicals, fertilizers and pharmaceuticals, along with intensive farming practices are making food production unsustainable. 77% of all agricultural land is used for meat production.

Drivers of Environmental Change

- **Population** - 9-10 billion people by 2050
- **Demographics** - older in richer countries, younger in poorer countries
- **Economic development** –people will be moving from poor to middle classes, consuming more resources and food
- **More food needed** – 50% more food will be needed by 2050 to feed the planet
- **Technological change** – can improve agricultural productivity for example, but creates more waste and toxins.
- **Climate change** – already a 1 degree Celsius increase. We will have sea-level rise, more frequent droughts, more severe weather events.

Effectiveness of environmental policies





- **Policy design** – at least as important as policy choice when measuring effectiveness.
- **Effectiveness** – Not enough information is available to assess effectiveness, so policies may not reach their full potential.
- **Diffusion** –successful policies are used as role models for adoption in other countries.
- **Integration** – adding environmental concerns to other sectors of policymaking increases effectiveness.
- **Efforts are insufficient** – existing policies insufficient to address the backlog of environmental problems.
- **Systemic approaches** – transformative change by reconfiguring basic social and production systems and structures is needed.

Outlook for the future (current policies)

- **Improvements in human development, but insufficient to meet environmental dimension of SDGs and IAEGs** – environmental health risks remain prominent in 2030.
- **Further degradation in nearly all environmental areas**– from climate change to biodiversity loss to water scarcity, land degradation and ocean acidification.
- **Failure to act now will lead to ongoing and potentially irreversible impacts** on the environment and human health.

Figure SPM.8. Projected global trends in target achievement for selected Sustainable Development Goals and internationally agreed environmental goals

Human development indicators			Environmental indicators		
Related Sustainable Development Goals	Target	Projection	Related Sustainable Development Goals	Target	Projection
2	2.1 End hunger		6	6.3 Improve water quality 6.4 Reduce water scarcity	
3	3.2 End preventable deaths of children under 5		11	11.6 Improve air quality in cities	
6	6.1 Achieve universal access to safe drinking water 6.2 Universal access to adequate sanitation		13	13 Limit global warming	
7	7.1 Achieve universal access to modern energy services		14	14.1 Reduce marine nutrient pollution 14.3 Minimize ocean acidification 14.4 Sustainably manage ocean resources	
			15	15.2 Achieve land degradation neutrality 15.5 Halt biodiversity loss	

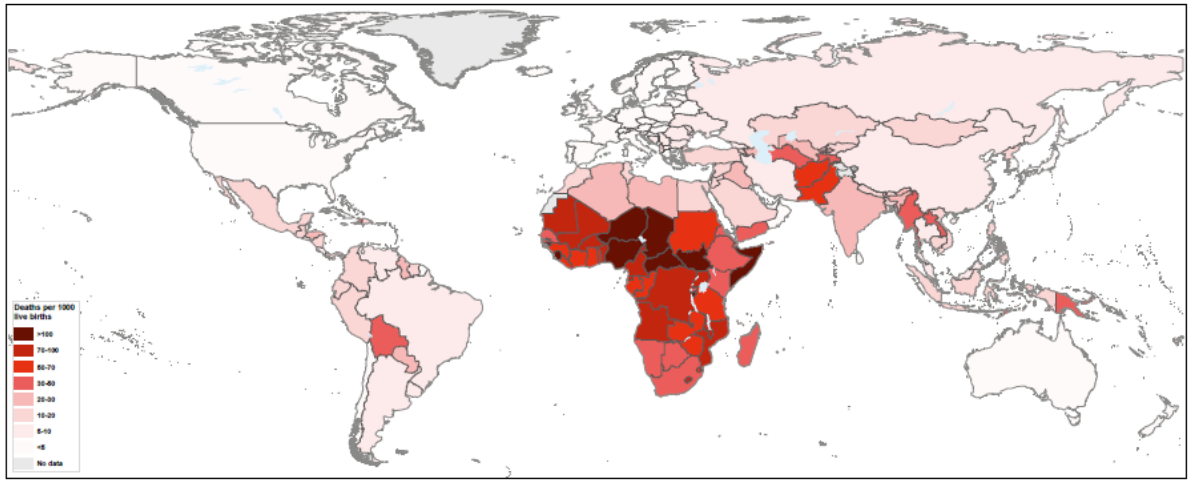
Legend

On track to achieve target (under bbusiness-as-usual scenarios target is projected to be achieved)

Progress towards target, but at an insufficient rate (unless effort is increased, target is projected not to be achieved)

Moving away from target (the trend is projected to be worse, rather than better)

Figure 21.11: Projected under-five mortality rate in 2030



Source: Moyer and Hedden (2018).

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Food loss and waste

- **One third of edible food is wasted** or lost annually **(about 24% of all calories)** accounting for losses of US$750 billion to US$1 trillion
- **Food losses and waste used about 28 per cent** of the world's agricultural land area in 2007
- **Food losses and waste released approximately 4.4 Gigatonnes of CO_2 equivalent**, or about 10 per cent of total global GHG emissions, in 2015
- **If waste cannot be reduced, opportunities to convert to compost, liquid fertilizers,** biogas or higher value end-use products such as animal feed protein or biochemicals could be explored
- **If this waste was reduced, more land would be available for agricultural production methods** that are environmentally friendly such as organic farming

Figure 5-1 | Approximately 24 percent of all food produced (by caloric content) is lost or wasted from farm to fork

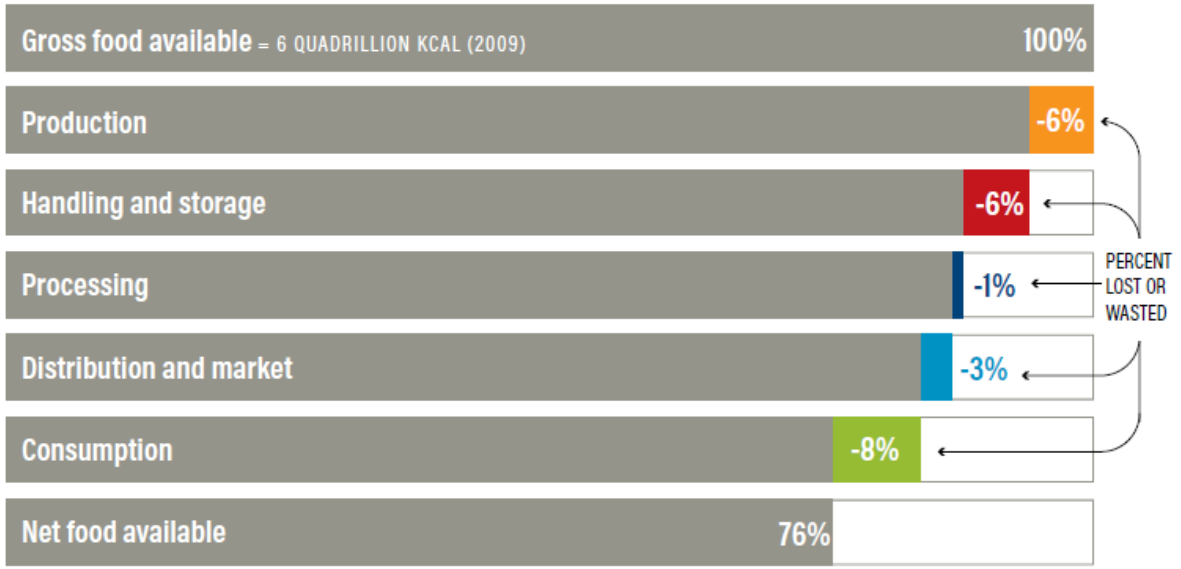
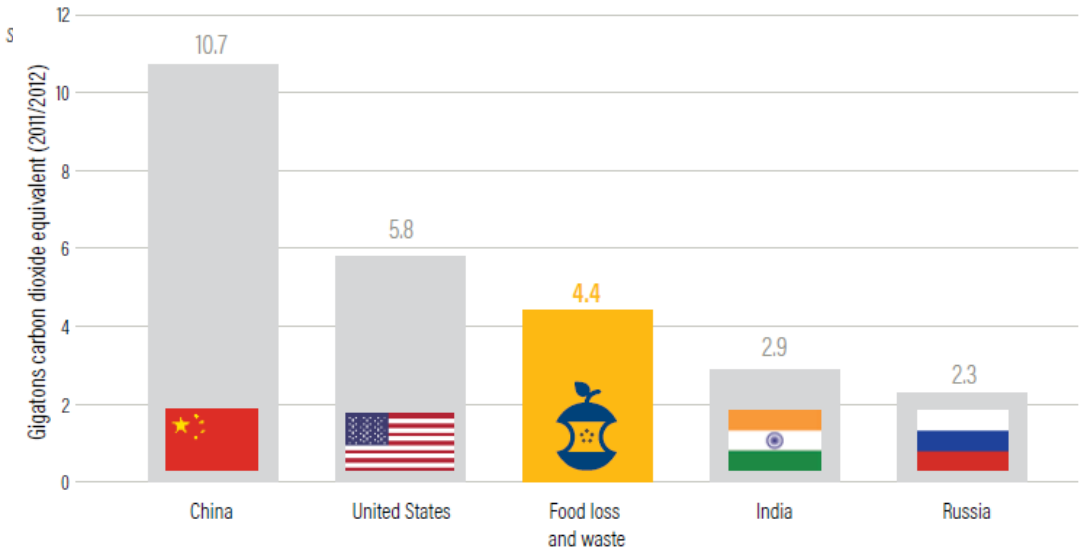
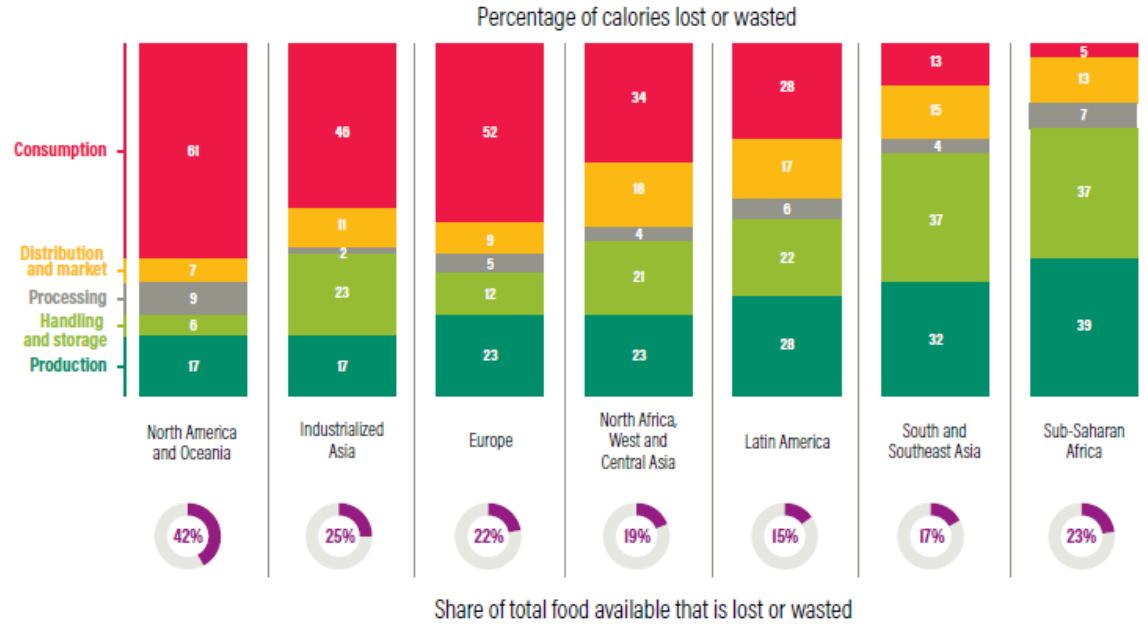


Figure 5-2 | If food loss and waste were a country, it would be the third-largest greenhouse gas emitter in the world



Note: Figures reflect all six anthropogenic GHG emissions, including those from land use, land-use change, and forestry (LULUCF). Country data are for 2012, while the food loss and waste data are for 2011 (the most recent data available). To avoid double counting, the food loss and waste emissions figure should not be added to the country figures.
Sources: CAIT (2017); FAO (2015a).

Figure 5-3 | Where food loss and waste occurs along the food supply chain varies among regions



Note: Numbers may not sum to 100 due to rounding. Data are for the year 2009.
Source: WRI analysis based on FAO (2011c).

Figure 5-5 | Cereals comprise half of food loss and waste in terms of caloric content, while fruits and vegetables comprise just under half in terms of weight

Source: WRI analysis based on FAO (2011c).

Composition of food loss and waste

- **Regionally different** – Food is lost at different stages of the production – consumption chain
- **Sub-Saharan Africa** – Most food is lost in production, handling and storage
- **North America** – Most food is lost at the consumption stage.
- **Types of food lost** – Cereals, fruits and vegetables are mostly wasted or lost in the food system.
- **More than food is lost -** This includes the freshwater, soil nutrients, chemicals, fertilizers and land used to produce them.

Climate change

- **Temperature over land –** Average land surface temperature has increased by 1.5 degrees C, while global average temperature has increased only 1 degree C
- **Desertification** – In 2015, about 500 million people lived in areas experiencing desertification between the 1980s and 2000s. (South and East Asia, circum Sahara region, including North Africa, Middle East, including the Arabian peninsula)
- **Degradation** – About a quarter of Earth's ice-free land area shows human-induced degradation. Soil erosion from agricultural fields is estimated to be 10 to 20 times (no tillage) to more than 100 times (conventional tillage) higher than the soil formation rate

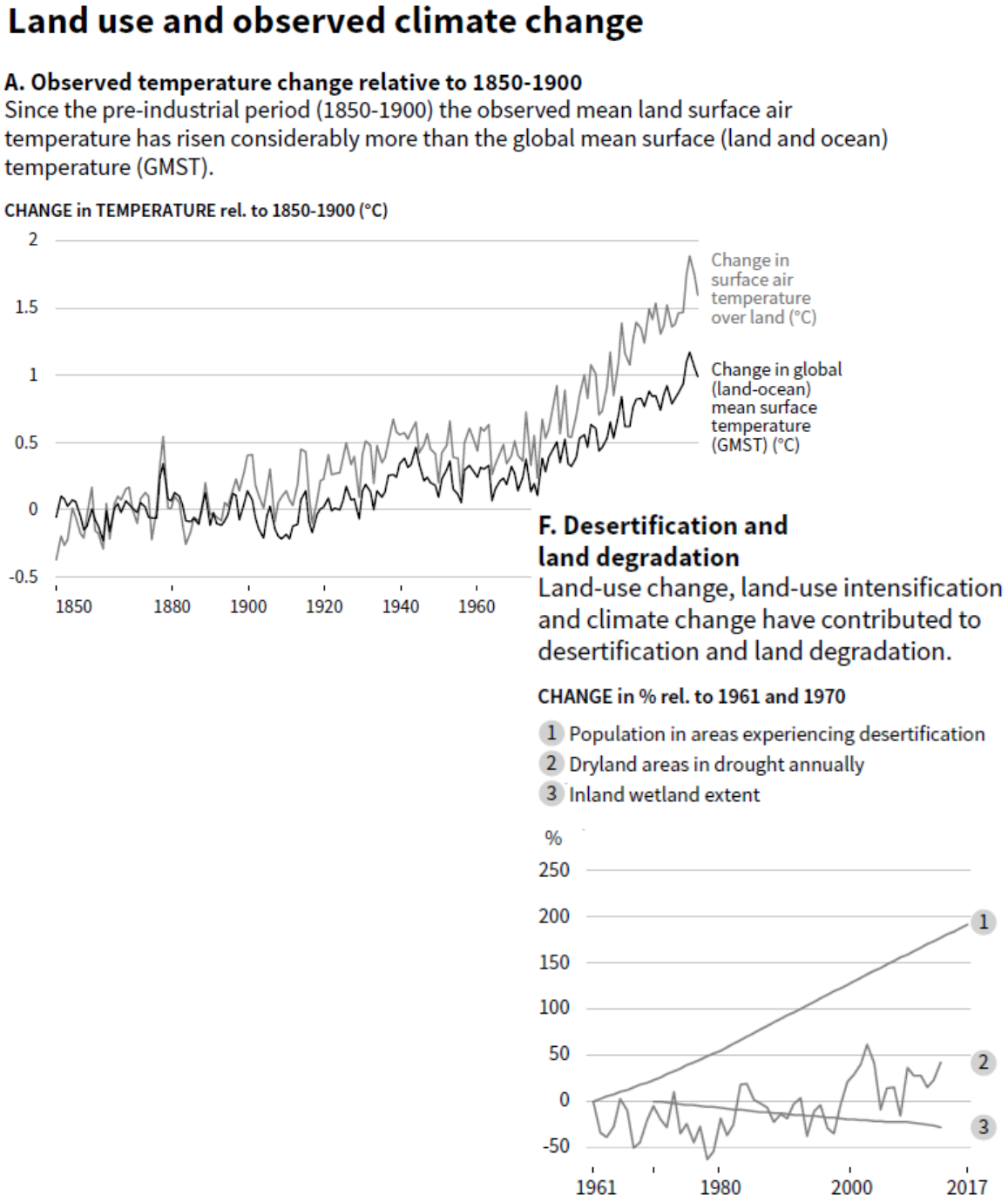
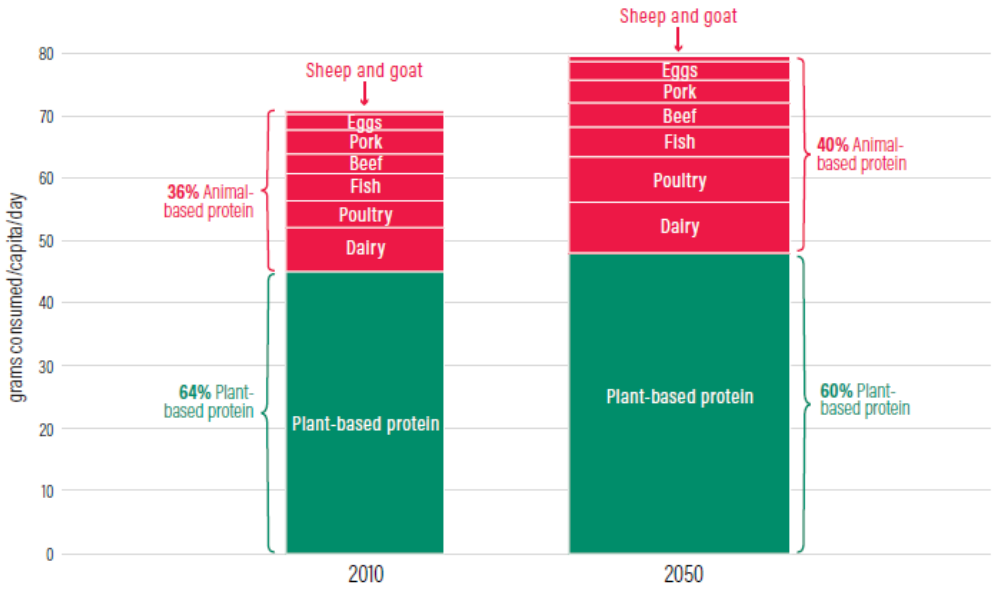
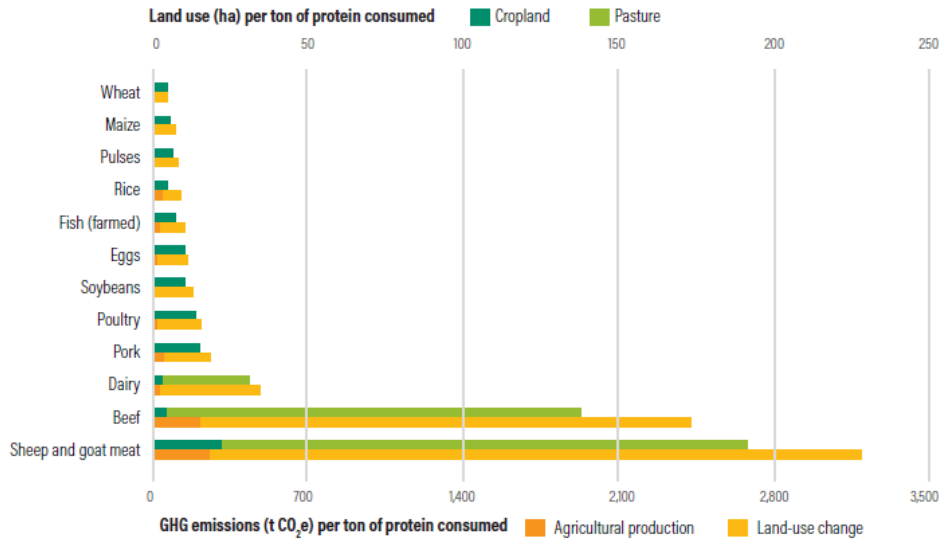


Figure 6-4 | Both global protein consumption and the share from animal-based foods are likely to grow by 2050



Note: Width of bars is proportional to world population.
Source: GlobAgri-WRR model with source data from FAO (2019a) and FAO (2011c).

Figure 6-6b | Foods differ vastly in land-use and greenhouse gas impacts



How we get our protein

- **Plant-based protein** – Over 60% of global protein comes from plant-based sources (ranging from sugar to wheat to lentils and beans)
- **Animal protein** – Beef, goat and sheep (ruminants) are the least efficient sources of protein and also use the most land and produce the most GHGs/ton of protein.
- **Eggs, milk, pork, poultry and fish** – Are the most efficient sources of animal protein and have lighter GHG footprints
- **Regionally** – 'Western-style' diets consume almost double the land and produce nearly double the GHGs compared to the world average.

Figure 6-8 | Less Animal-Based Foods Diet scenarios reduce consumption of animal-based foods in 2050

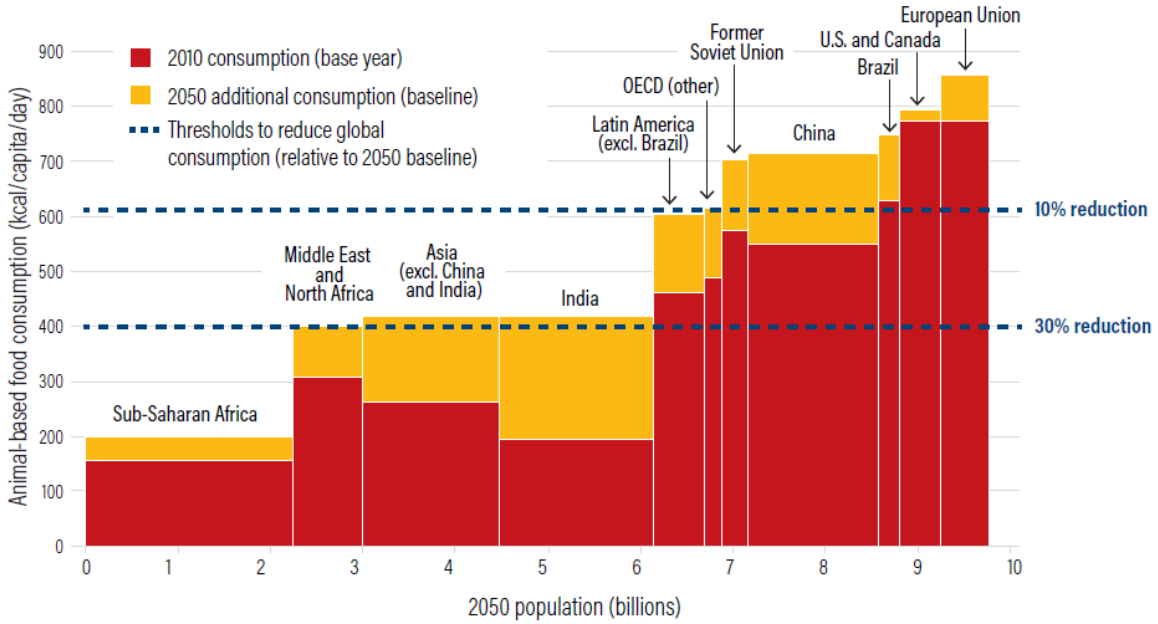
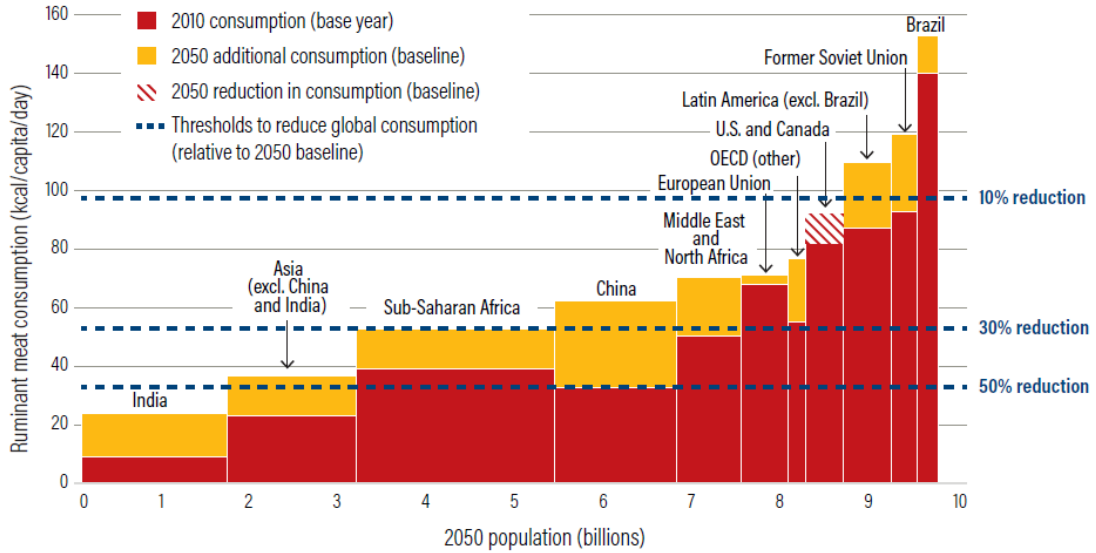


Figure 6-10 | Less Ruminant Meat Diet scenarios reduce ruminant meat consumption in 2050

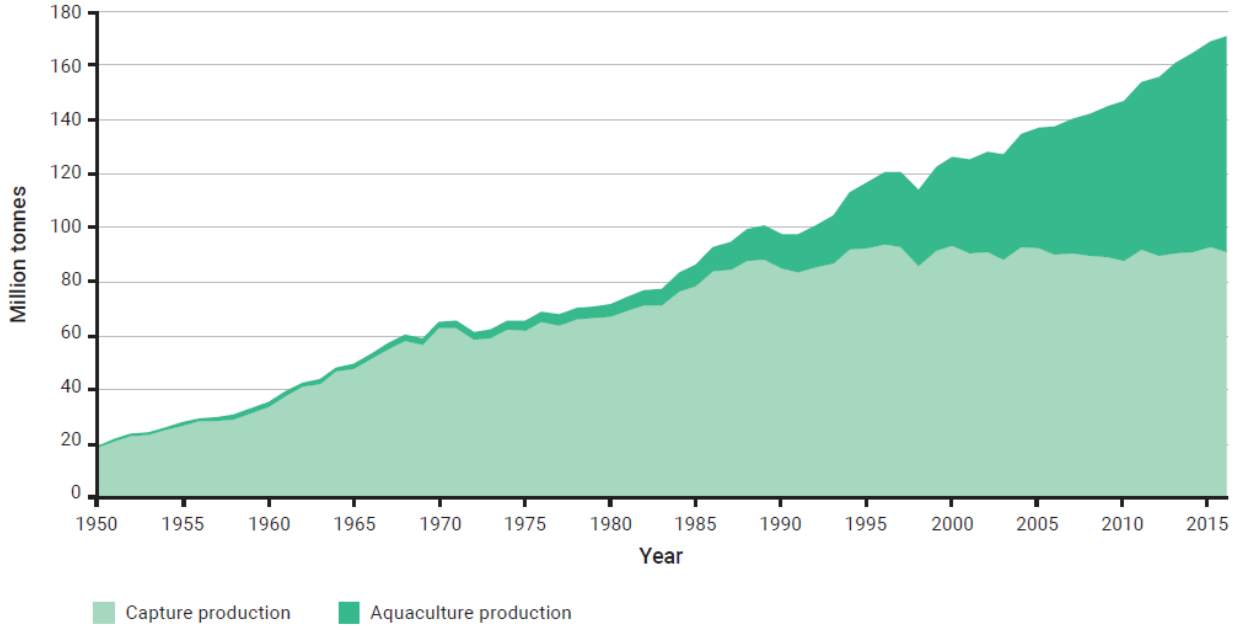


Livestock production

- **Livestock production is responsible for 9% of total GHG emissions,** attributed mainly to dairy and beef cattle. N_2O and CH_4 emissions emanate from manure left on pasture, manure management and enteric fermentation.
- **50% of all GHG emissions from agri-food systems** are from livestock production
- **Livestock sector uses >75% of agricultural land** for feed production, pasture and grazing
- **Pathways that reduce meat consumption** and lead to adoption of more plant-based diets would substantially reduce the environmental footprint of food production.
- **Rotational livestock grazing and other pasture management techniques** are available to decrease the production of GHGs by cattle, and at the same time conserve biodiversity

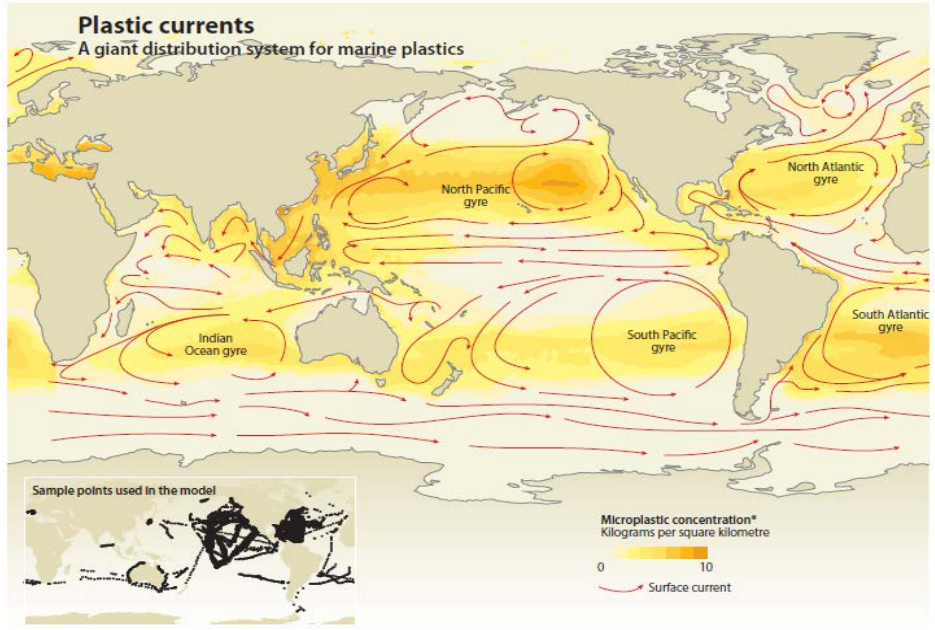
Fish stocks and impacts on our oceans

Figure 7.3: World capture fisheries and aquaculture production



Source: FAO (2018a).

Figure 7.7: Plastic litter in the open ocean



Source: GRID-Arendal (2016b)

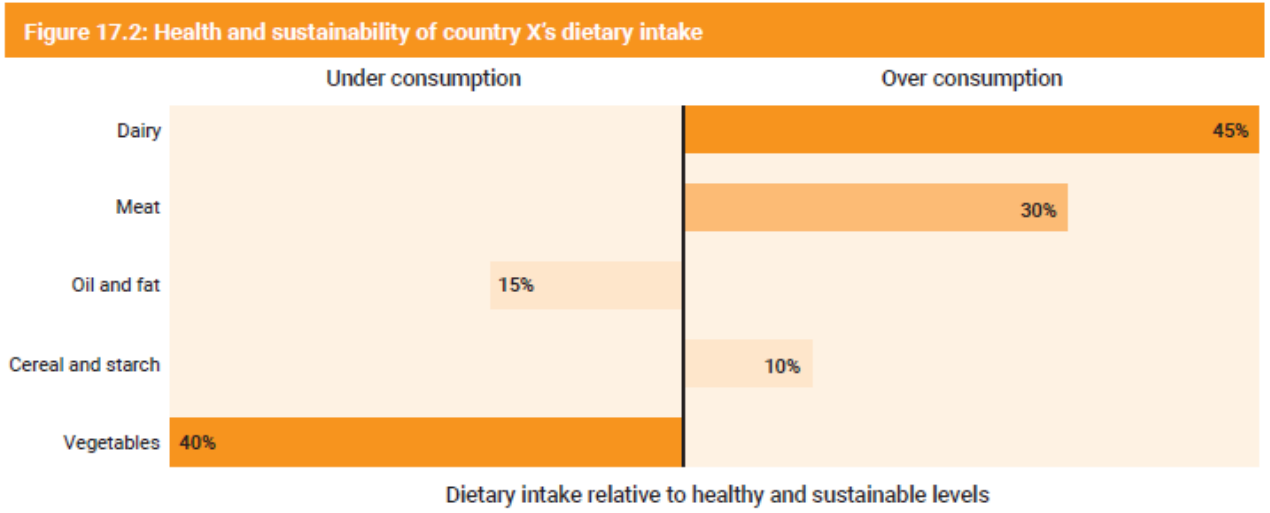
Global fish stocks overexploitation increased from 10 per cent in 1975 to 33 per cent in 2015. Fish provide:

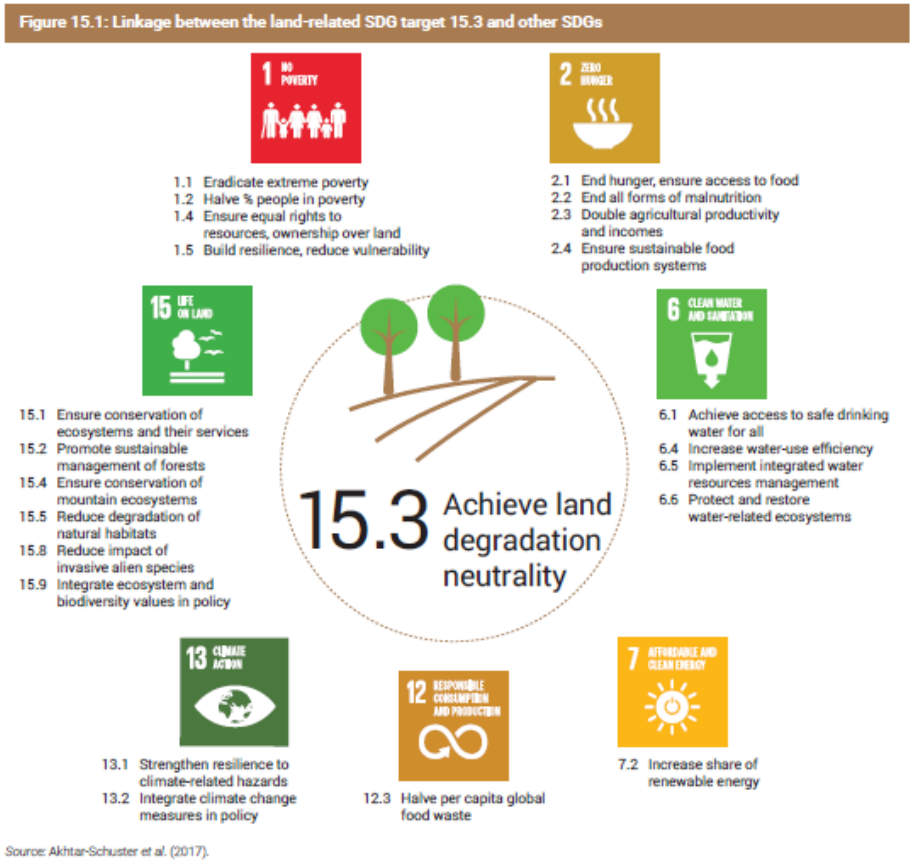
- **Nutrition** –over 3 billion people obtain 20 per cent of their dietary protein from fish.
- **Fisheries and aquaculture** –support between 58-120 million livelihoods and generated US$362 billion in revenue in 2016.
- **Sustainable fisheries** – unsustainability of wild fisheries is growing and aquaculture has important environmental and health impacts.

- **Several rules regulate the oceans** but there is a lack of enforcement mechanisms
- There are **51 trillion microplastic particles** littering our seas, seriously threatening marine wildlife
- **Marine litter affects more than 800 marine and coastal species** through ingestion, entanglement, ghost fishing or dispersal by rafting

Sustainable Diets

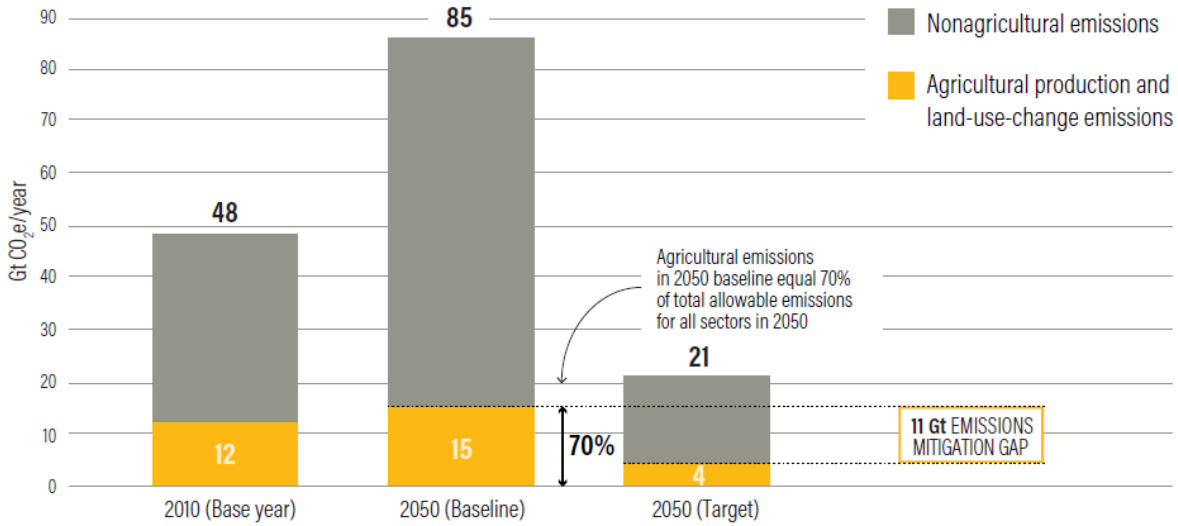
- **Global food systems can produce more than enough** to feed the world's population adequately.
- **Over 800 million people are undernourished**; more than 2 billion suffer from food insecurity; 500 million people are obese or overweight due to overconsumption of saturated fats and processed foods that are now widely available
- **Educating consumers** can help them adopt sustainable and less meat-intensive diets
- **To meet environmental and nutritional goals**, diets with lower animal proteins, more fruits, pulses, whole grains and nuts are recommended





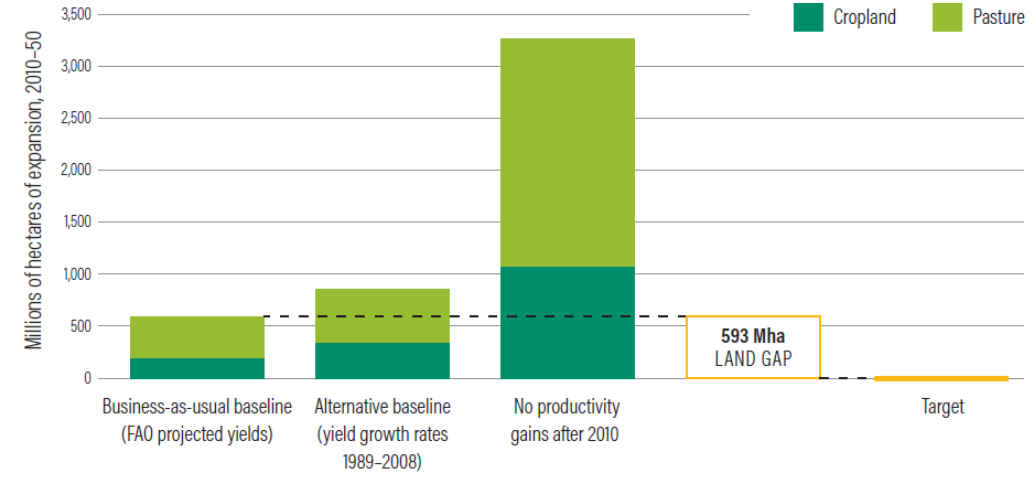
Overall footprint of food production

Figure 2-7 | Agricultural GHG emissions are likely to be at least 70 percent of total allowable emissions from all sectors by 2050, creating an 11 gigaton mitigation gap



Sources: GlobAgri-WRR model, WRI analysis based on IEA (2012); EIA (2012); Houghton (2008); OECD (2012); and UNEP (2013).

Figure 2-4 | The world needs to close a land gap of 593 million hectares to avoid further agricultural expansion



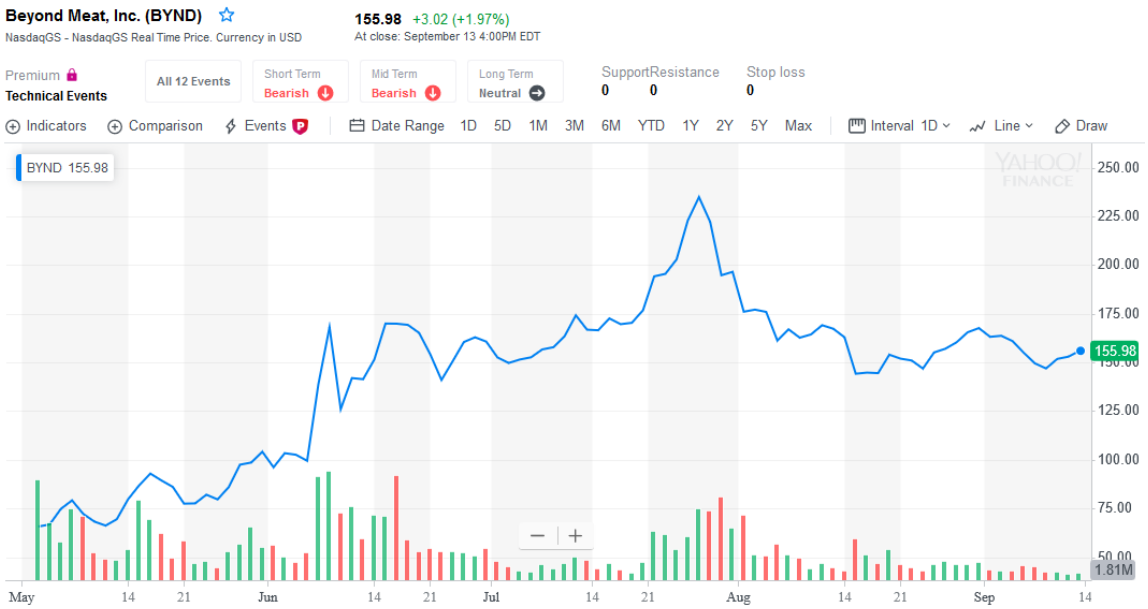
Note: "Cropland" increase includes a 20 Mha increase in aquaculture ponds under the two projected baselines and a 24 Mha increase in the "no productivity gains after 2010" projection.
Source: GlobAgri-WRR model.

- **Freshwater** – About 70% of all withdrawals
- **Land** – Uses 50% of habitable land
- **GHG emissions** – Agriculture produces about a quarter of all GHGs each year
- **Biodiversity** – Food production is the main cause of biodiversity loss globally, through land degradation, increase in methane emissions and loss of carbon sequestration.
- **GHG emissions gap** – More than 70% reduction in GHG emissions from the global food production system to achieve a 2 degree world.
- **Land gap** – producing enough food to feed 10 billion people using no more land that we use today.

Chemicals and pharmaceuticals

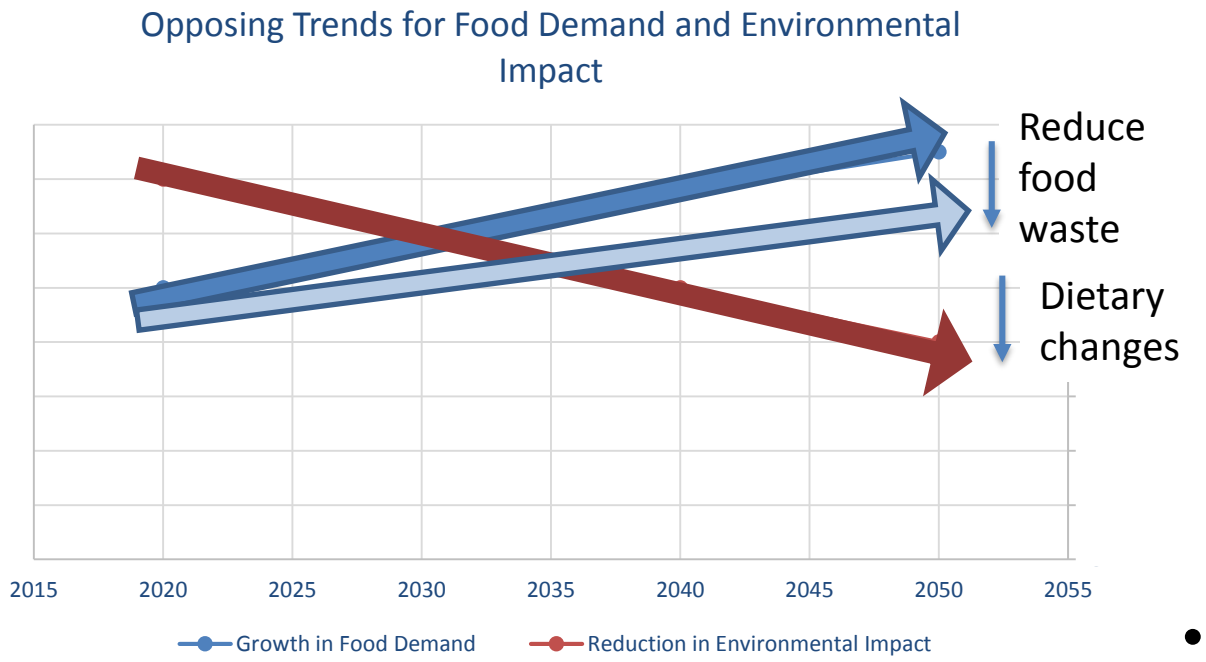
- **Chemicals -** pesticides and antibiotics used in agricultural production and industry are now intensively used.
- **Antibiotic-resistant bacteria have evolved and spread** due to mismanagement of antibacterial drugs, recent research indicates the development of antimicrobial resistance in pathogens is achieved at lower exposure concentrations.
- **Pathogens can be found in the natural environment** including from mismanagement of their use for agricultural production, particularly in livestock.
- **Antimicrobial resistance could become a major cause of deaths globally by 2050 (WHO finding),** whose major source is in human and animal excreta.
- **Pesticides are sometimes composed of industrial chemicals and persistent organic pollutants** that are associated with endocrine disruption, potentially causing multigenerational effects on human and wildlife health.

" Much antibiotic use is linked to animal production. Antibiotics are sometimes used to prevent infections, to prevent the spread of diseases within a herd when infection occurs, and as a growth stimulant, and are often administered through feed and water. Sustainable husbandry practices, including the use of vaccines, can reduce infection rates and dependence on antibiotics as well as the risk that antibiotic-resistant organisms will develop and spread through the food chain."



Positive signs

- **Discussion of plant-based protein** – Narrative is moving from the periphery to the mainstream
- **IPOs of major plant-based protein companies** – Stock price of Beyond Meat has doubled since May.
- **Impossible Whopper** – introduced by Burger King, plant-based, with real meat taste.
- **Food waste** – Major food waste initiatives in the U.S. / France. Entrepreneurs marketing 'ugly' fruit and vegetables.



Changing the path we are on

- **Pathways exist to meet the environmental dimension of SDGs/MEAs** – transitions in consumption, production, access and environmental management.
  Transforming food and energy systems is central to the pathways that could achieve environmental sustainability.
  Incremental policies will not be sufficient – all pathways require rapid and wide-ranging innovations; many beyond historic rates of change.
- **Policy integration and coherence are needed** – integrate environmental concerns in all policy sectors at all levels to deal with possible trade-offs.
- **More synergies than tradeoffs exist** – e.g. phasing out fossil fuels will help achieve air pollution, climate and human health goals.

Systemic approaches for transformational change

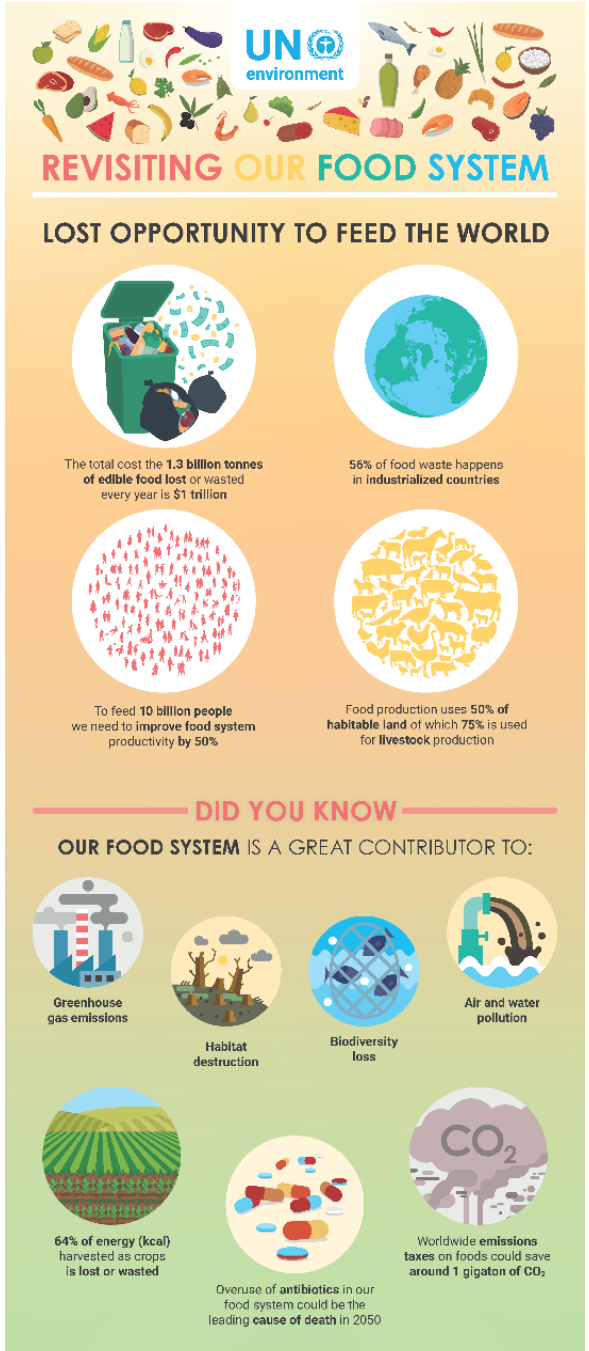
- **Agriculture and food systems represent the ultimate nexus issue** touching inter alia environment, health, agriculture, livelihoods, employment and economic growth.
- **Integrated and context specific approaches are needed** to reduce food and agriculture systems' environmental footprint and increase its overall efficiency and resilience
  - **Approaches that build consensus through dialogue** and the need for transformational change.
  - **Approaches that support local and national governments** to develop their own integrated food and agriculture policies including fiscal reform to reward good practice rather than perpetuate bad
  - **Approaches that consider the reorientation of finance** flowing into more sustainable agriculture and land use
  - **And approaches that recognizes the need for a shift to more sustainable plant-based diets** and a huge reduction in food loss and waste.

We aren't starting from scratch

- **Ecosystem Based Adaptation and integrated landscape management** – or - efforts to reorient public and private finance flows to sustainable agriculture systems – or - sustainable commodity and food systems platforms that tackle food waste reduction and sustainable diets.
- **Policy analysis tools like the TEEB Agri-food** and integrated policy guidance the Collaborative Framework for Food Systems Transformation that enable very concrete action at the local and national context.
- **Nature-based solutions,** an initiative gaining ground in time for next week's SG Climate summit, provide the clear foundation on which sustainable food and agriculture systems can be built. It is vital that we transform our food and agricultural systems, so they work with and not against nature.

Conclusions

- **The global food system is central to sustainable development** and significantly affects and is affected by environmental and socioeconomic dynamics
- **Agriculture provides jobs for over 30% of the global workforce**, smallholder farmers produce more than half of all global food calories, 57m people work in fisheries and aquaculture
- **To achieve a 2°C pathway** – agriculture must reduce its GHG emissions, amount of food wasted, and society must adapt to less meat intense diets
- **A whole systems approach** is needed to reduce the agri-food system's environmental footprint and increase its overall efficiency and resilience



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Norwegian Ministry of Climate and Environment

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Ministry of the Environment and Water Resources

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Ministry of Environment and Food of Denmark
Environmental Protection Agency

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Thank you

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