

NANYANG
TECHNOLOGICAL
UNIVERSITY
SINGAPORE

C0006 Sustainability: Society, Economy & Environment

Module 3

Introduction to Food Security and the Global Food System

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The Challenge:

Feeding 10 billion people, eradicating hunger, and being healthy while also promoting economic growth, securing jobs, and saving the planet...





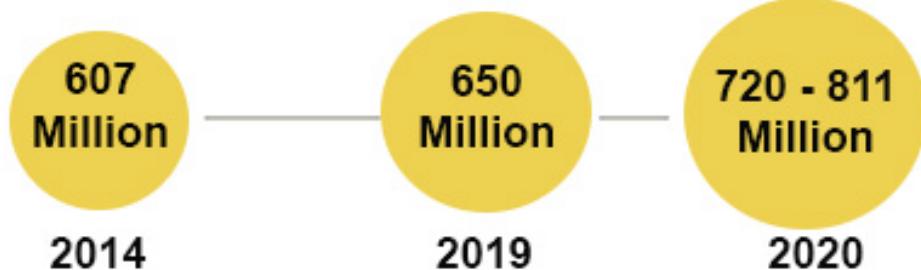
Overview

- Here in Singapore, most of us have access to enough food and have never suffered from hunger or malnutrition. So, what is the problem with the global food system and why should we think about food security?
- How can the agri-food sector meet the rising demand from a growing world population while at the same time reducing its environmental footprint?
- Singapore is on the front lines of developing plant-based meat options. How is plant-based food better for the environment than real meat?



*THESE 2020 ESTIMATES DO NOT REFLECT IMPACT OF PANDEMIC

NUMBER OF UNDERNOURISHED PEOPLE IN THE WORLD



UN Sustainability Goal 2:

End hunger, achieve food security and improved nutrition and promote sustainable agriculture



The Nobel Peace Prize 2020



**World Food
Programme**

*"for its efforts to combat hunger,
for its contribution to bettering conditions for
peace in conflict-affected areas and for acting as a
driving force in efforts to prevent the use of hunger
as a weapon of war and conflict."*

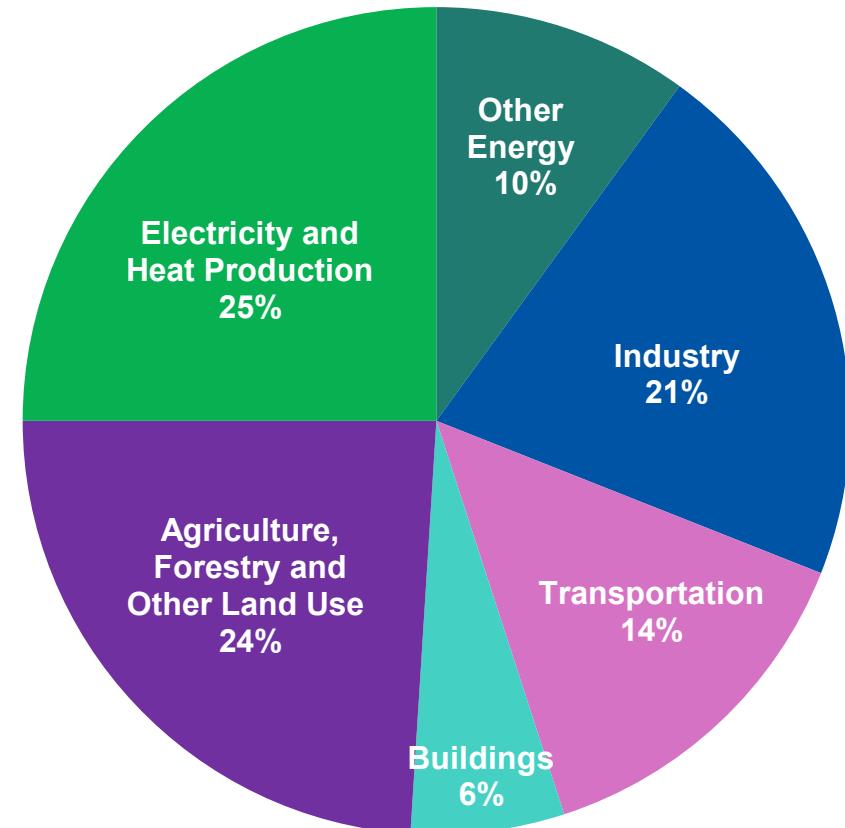


*“...war and conflict can cause food
insecurity and hunger, just as hunger and
food insecurity can cause latent conflicts to
flare up and trigger the use of violence...”*

Climate Change and Food Security

- Climate change directly and indirectly threatens food production and livelihoods, particularly in poor countries.
- Agriculture is also a major source of greenhouse gas, which causes climate change.

Global Greenhouse Gas Emissions by Economic Sector



Adapted from United States Environmental Protection Agency. (2014). *Global greenhouse gas emissions data*. <https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data>

When Climate Change Threatens Food Security and People's Livelihoods (Example)

- Bangladesh and Vietnam are 'hot spots' for climate change impacts such as sea-level rise and saltwater intrusion.
- Specifically, rice production is increasingly difficult.
- Salinity issues in Bangladesh will most likely lead to significant shortages of water for drinking and irrigation by 2050 (according to the World Bank).
- Climate migration/refugees



Refers to the availability of sufficient quantities and appropriate quality of food products that are either locally produced or supplied by imports, including food aid.

Food Availability

Refers to adequate access to food resources for a nutritious diet.

Food Accessibility

Food Security

Utilisation

Refers to the utilisation of food in conjunction with adequate diet, clean water, sanitation and healthcare to a state of nutritional well-being, demonstrating the importance of non-food inputs for food security.

Stability

Refers to a secure population, household or individual access to adequate food at all times, protected from sudden shocks or cyclical events that can threaten availability of and access to food resources.

Food Security in Singapore

- Imports 90% of food today
- Diversifying sources of import supply
- Boosting local production
- “30 by 30”
- Food technology



The Sky Greens vertical in Singapore

Stop and Think

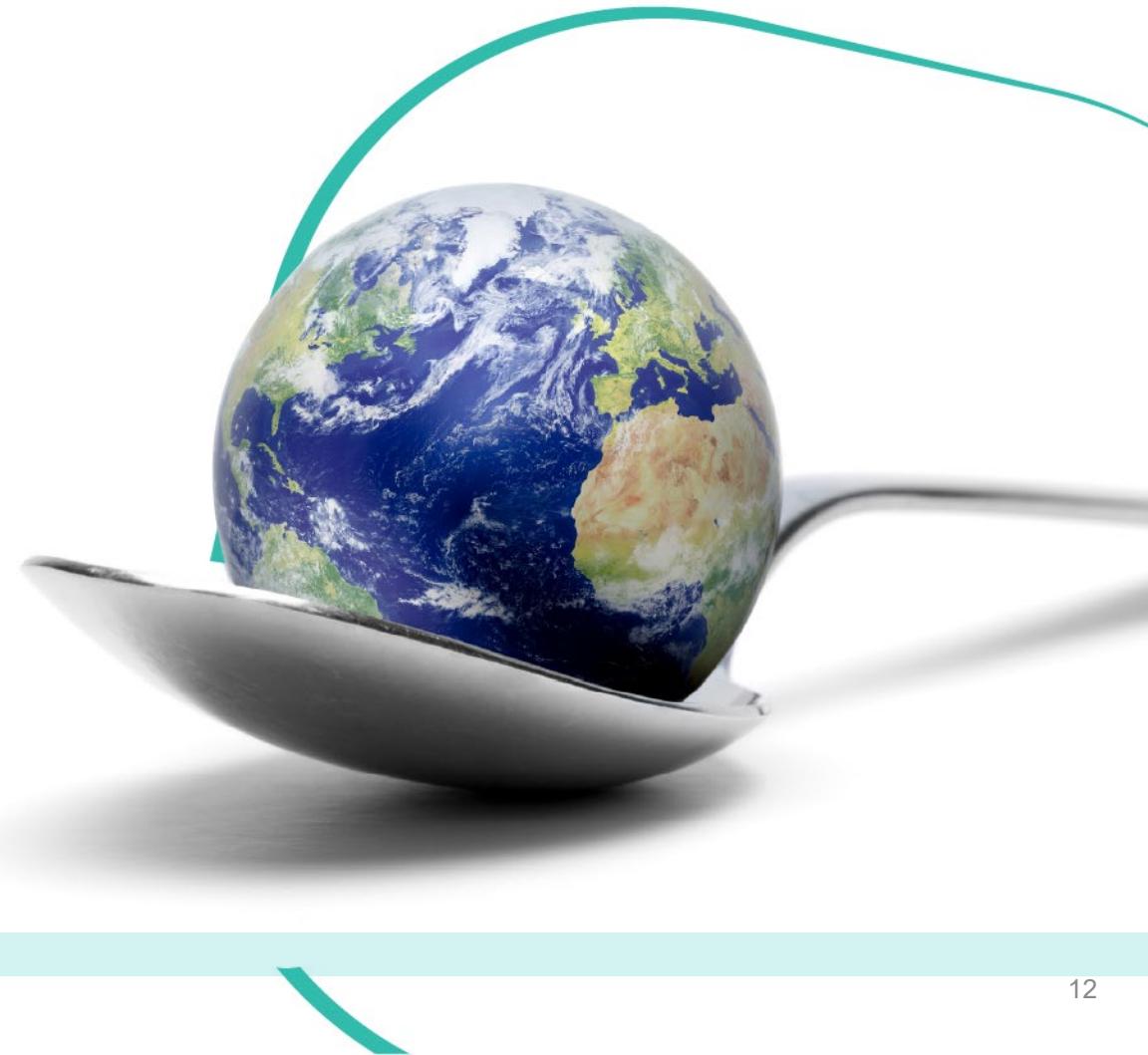
- Historically, agricultural production has been dependent to a large part on available land area, and since the green revolution on inorganic fertilisers, pesticides and machinery.
- In the future, what factors do you think will limit food production? Think of at least three.



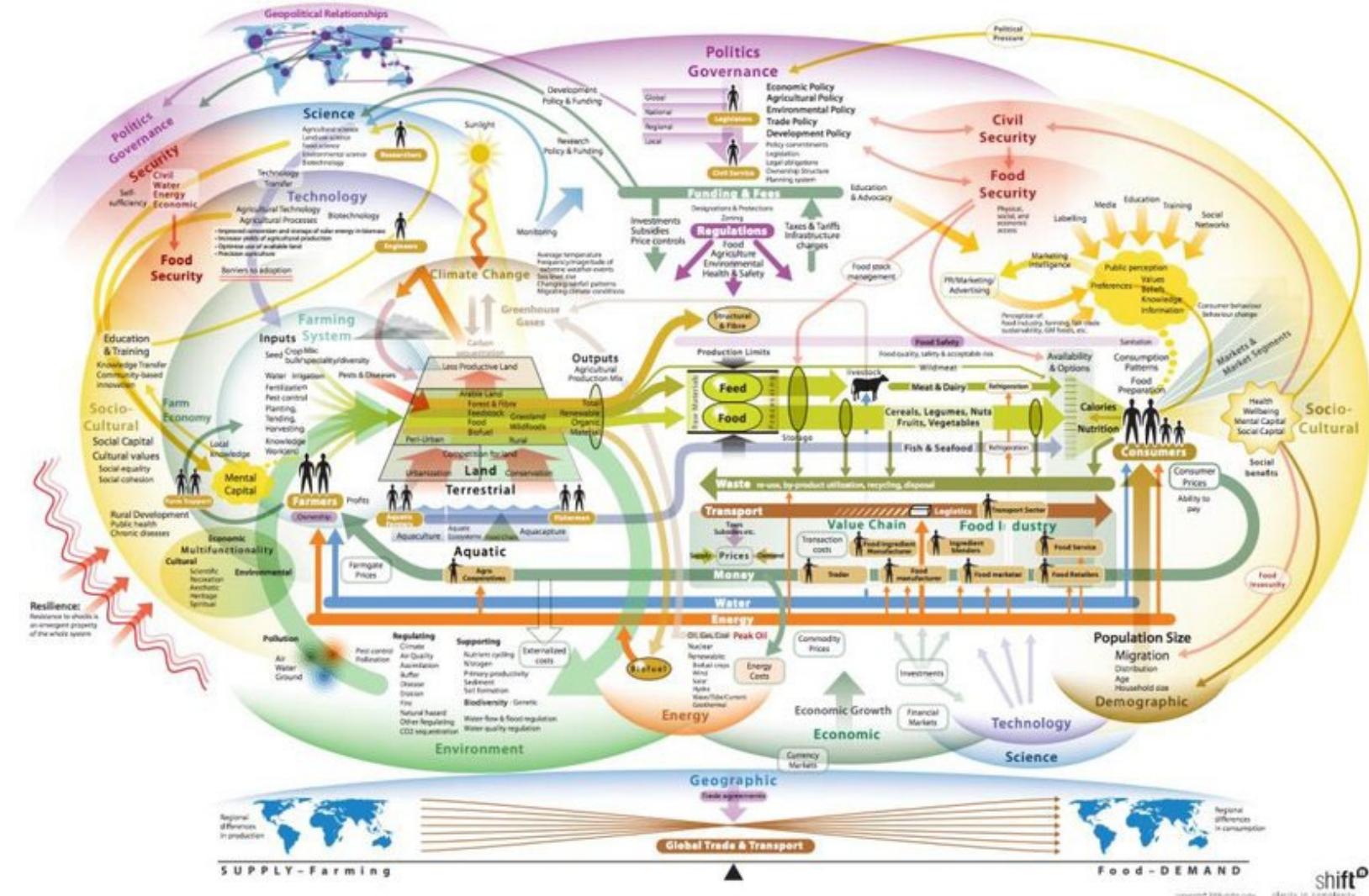
What is the Global Food System?

- A complex global web of production and consumption
- People, institutions, activities, processes, and infrastructure involved in the production and consumption food
- Definition of the global food system:

“...the sum of actors, sectors and interactions along the food value chains — R&D, input supply, production, harvesting, storage, transportation, processing, retailing, wholesaling, preparation, consumption and disposal of food.” (Fan, 2021)



Global Food System Map

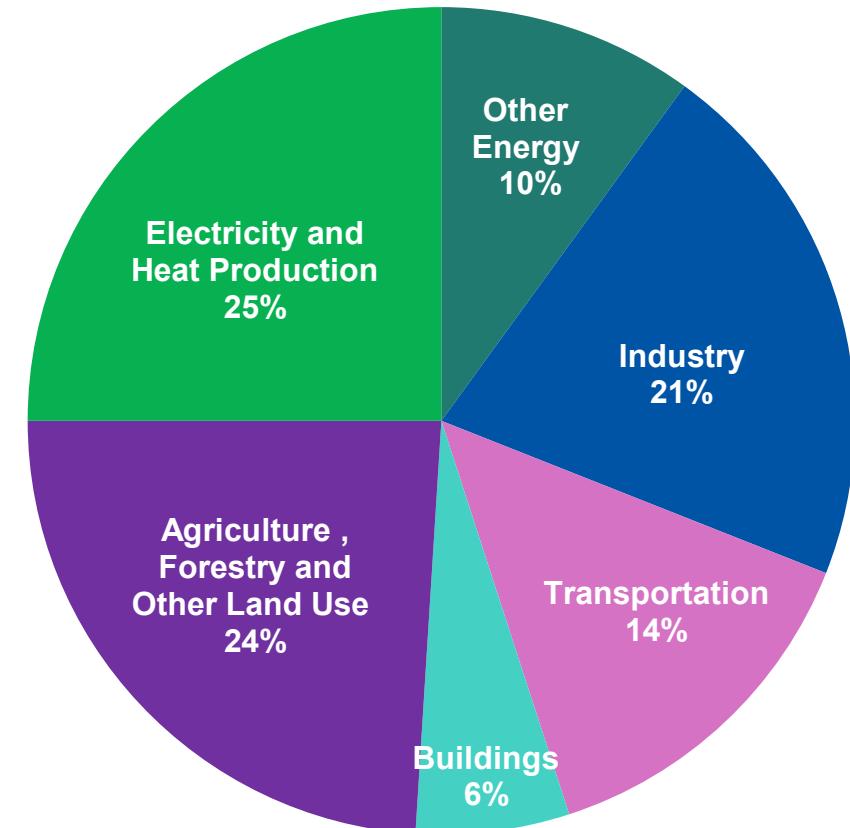


Nicholson CF, Stephens EC, Jones AD, Kopainsky B, Parsons D, Garrett J. 2019. Setting priorities to address the research gaps between agricultural systems analysis and food security outcomes in low- and middle-income countries. CCAFS Working Paper no. 255. Wageningen, the Netherlands: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Available online at: www.ccafs.cgiar.org

The Agri-Food Industry

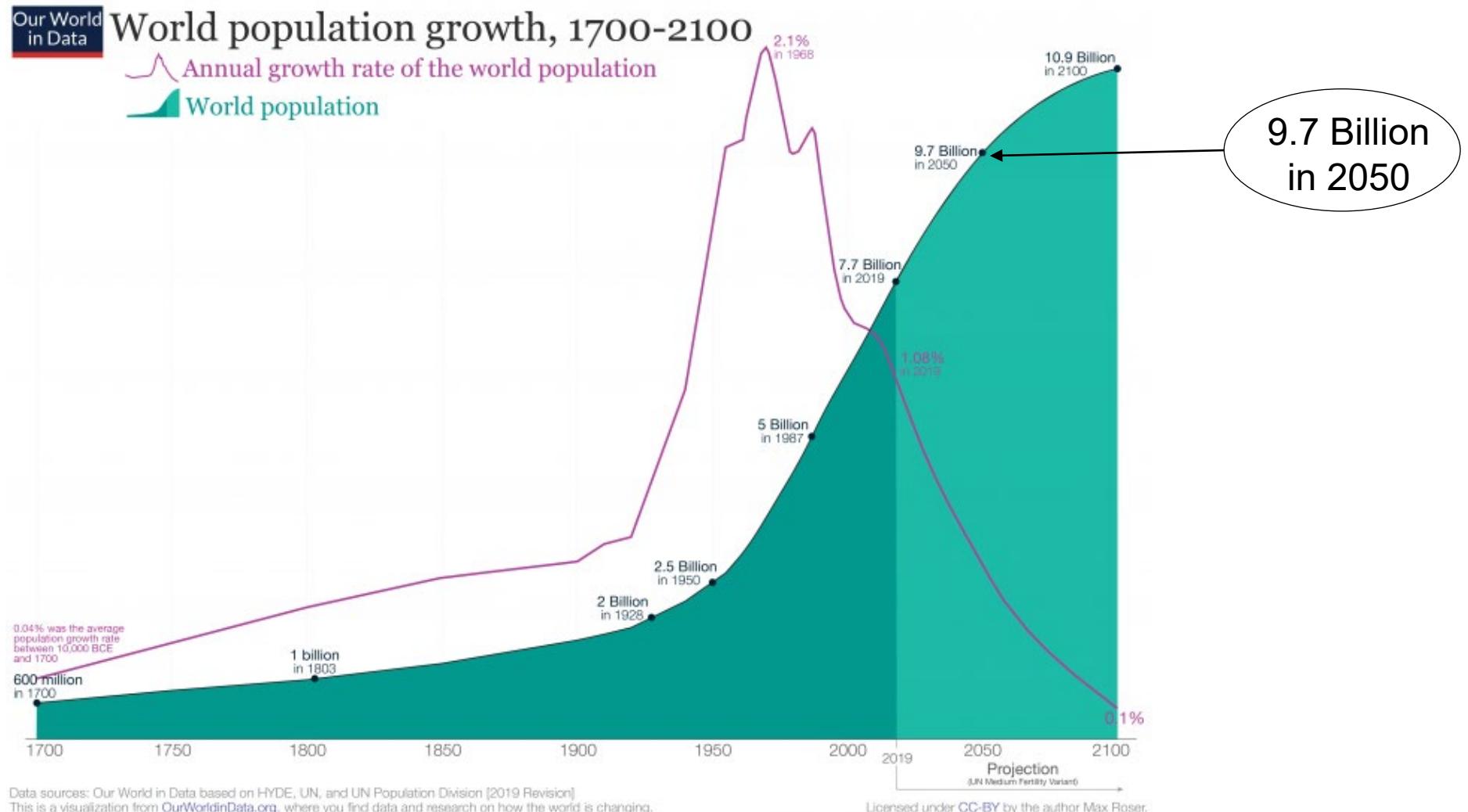
- World's largest economic sector
- Employs half the global work force
- Directly and indirectly responsible for about a quarter of global greenhouse gas emissions (UN)
- Creates economic profit at the expense of the natural environment
- Generates social injustices between countries and among actors in the chain from production to consumption and waste

Global Greenhouse Gas Emissions by Economic Sector



Adapted from United States Environmental Protection Agency. (2014). *Global greenhouse gas emissions data*. <https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data>

How Much Food Will We Need in the Future?

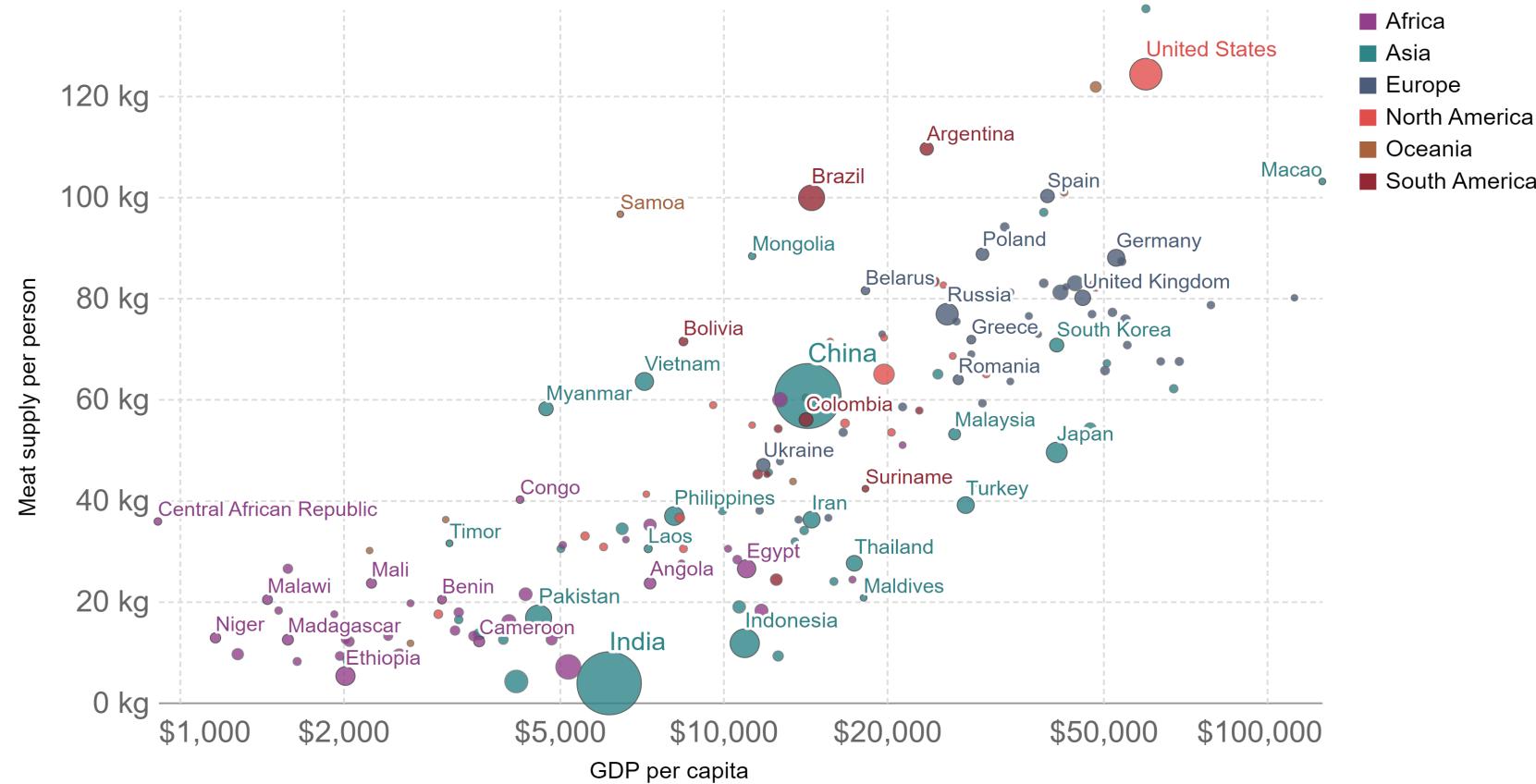


As People Get Richer, They Consume More Food

- By 2050 we will be 9.7 billion people.
- Over 2 billion people worldwide already suffer from hunger today.
- Per capita consumption is also increasing, as incomes go up - 50% more food per person is produced today compared 1961 (according to FAO).

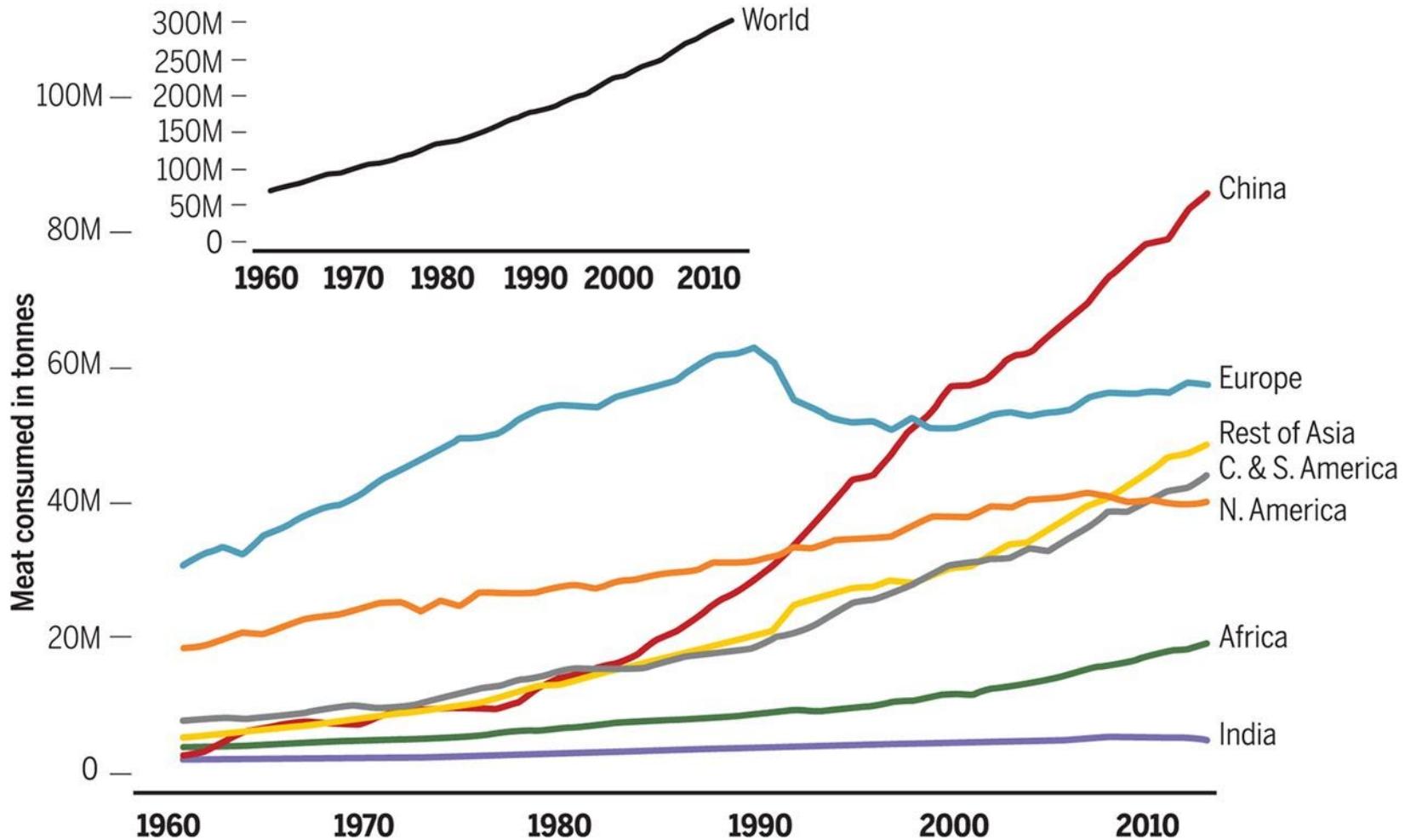
Meat consumption vs. GDP per capita, 2017

Average meat consumption per capita, measured in kilograms per year versus gross domestic product (GDP) per capita measured in constant international-\$. International-\$ corrects for price differences across countries. Figures do not include fish or seafood.

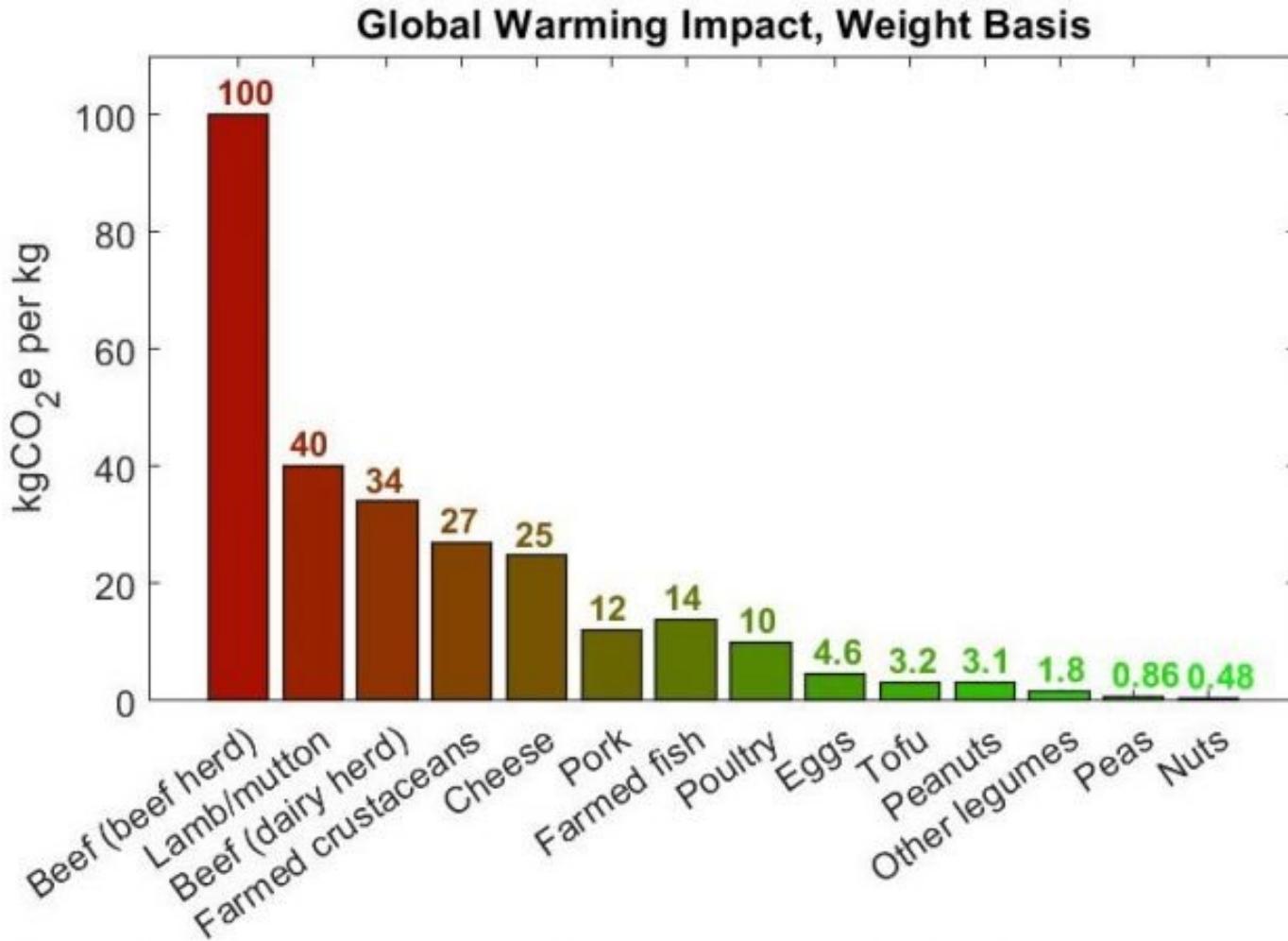


Source: Food and Agriculture Organization of the United Nations, Data compiled from multiple sources by World Bank
OurWorldInData.org/meat-production • CC BY

Meat Consumption (Per Capita) Timeline



Food's Environmental Impact



Agricultural Land Use Impacts the Environment in Multiple Ways

- Single largest cause of biodiversity loss
- 25–30% of greenhouse gas emissions
- Consumptive use of freshwater
- Loading of nutrients
- Pollution due to pesticides
 - Soil erosion and degradation
 - Water pollution
 - Climate change and global warming
 - Depletion of freshwater resources



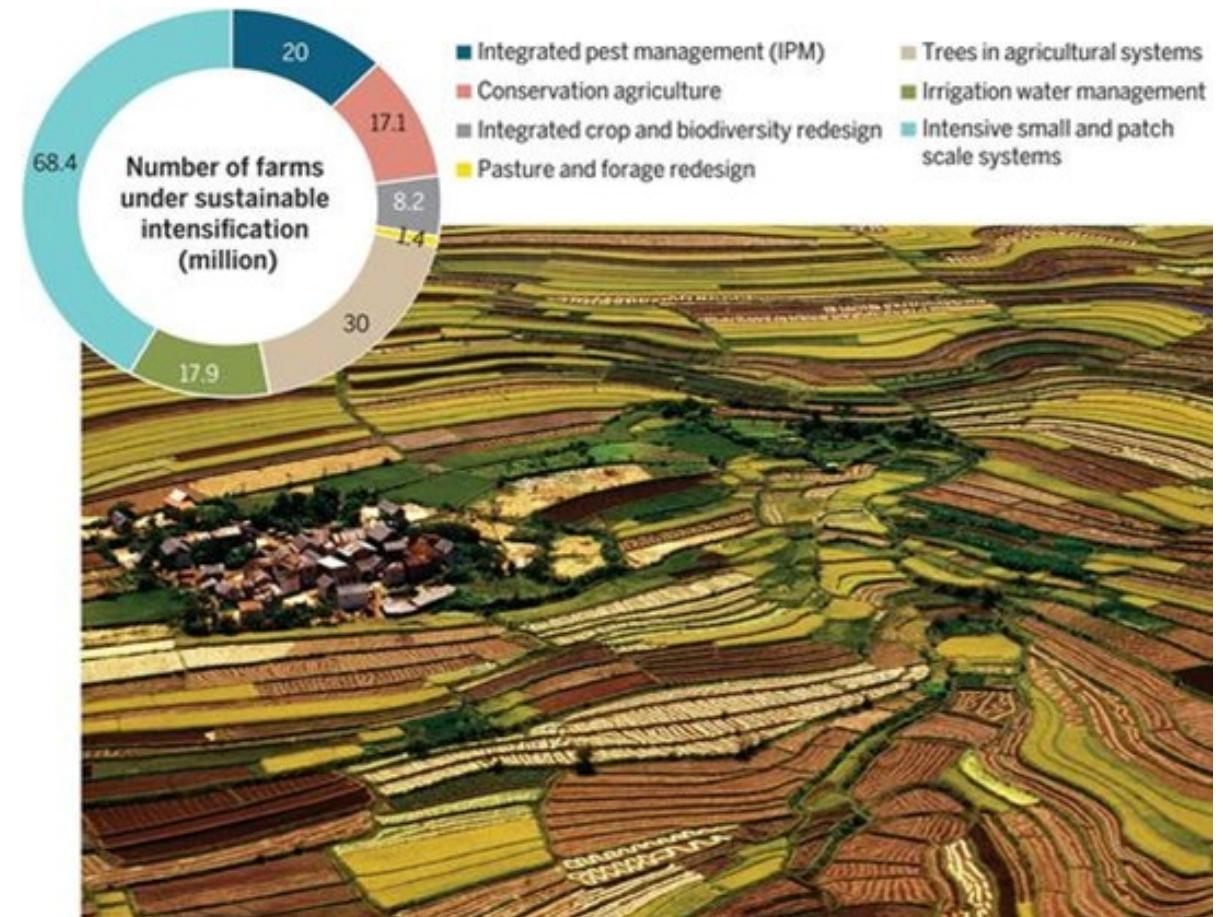
Stop and Think

- Should the food industry pay for environmental degradation caused by industrial food production?
- Should rich countries pay for climate change effects that hit developing countries harder?



Strategies for Producing More Food Sustainably

- More sustainable agricultural practices
- Reducing food waste
- Shifting diets
- Food technology



Food Waste

- According to FAO, one third of all produced food were globally wasted in 2020.
- Great losses during the production line, in shops, and where food is consumed.
- Reducing waste is a way to increase food availability without increasing production!



Food Waste

You are required to watch this supplementary video, by visiting the external link to abide by copyright protection requirements. You would have completed the lesson after watching the video.

https://www.youtube.com/watch?v=bCpPEZ6S8ZY&feature=emb_logo

(If required: Please complete any other additional learning activities within the course site.)



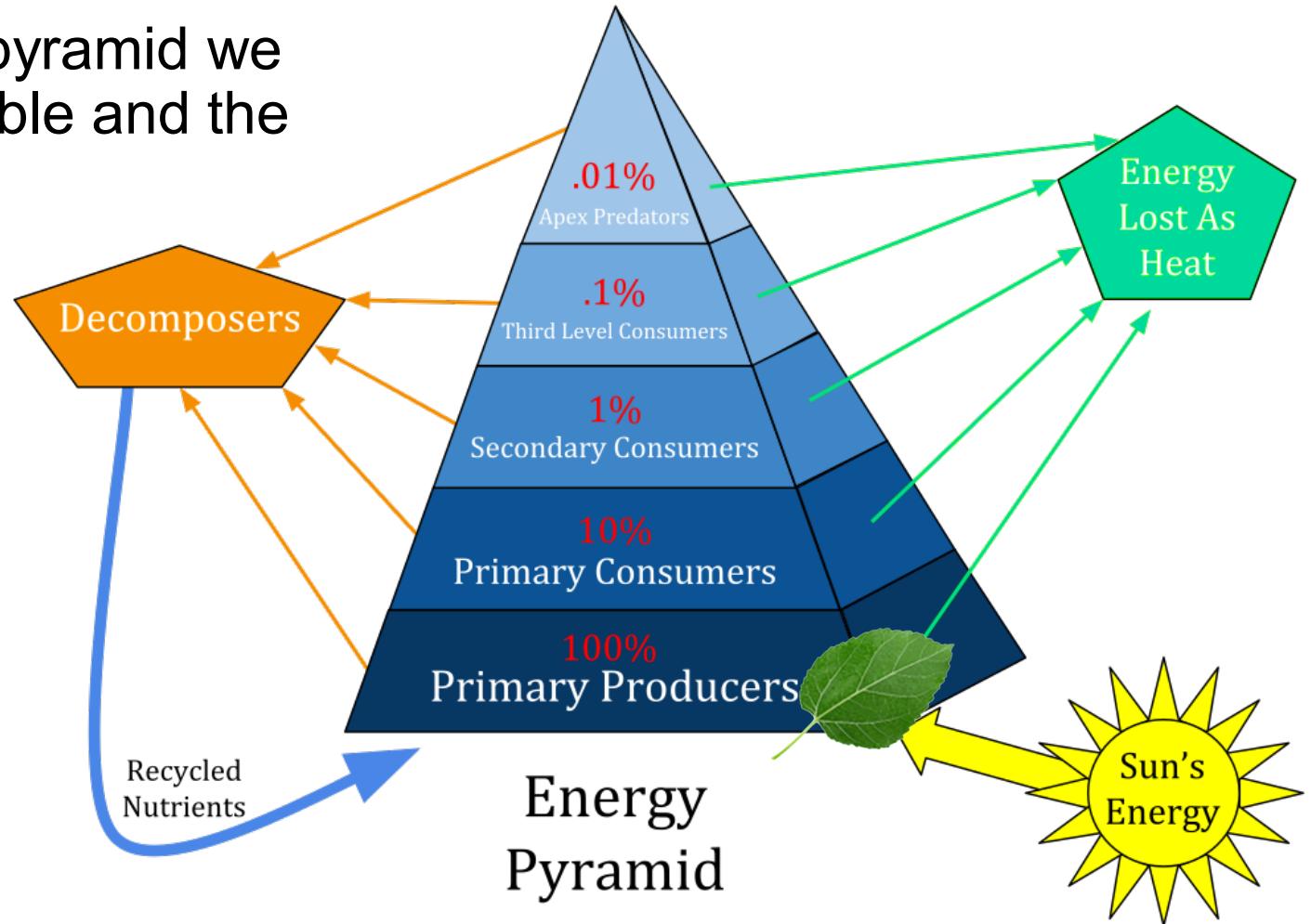
Black Soldier Fly Larvae Turn Food Waste Into Nutrients in Singapore

- Food waste converted into nutritious compost which can then be used to grow local food, or even as animal feed.
- It is a closed food loop.
- Circular economy—no end of product life, just the next stage in the circle.



Why Veggies Feed More People

The lower down in the energy pyramid we feed, the more energy is available and the more people we can feed.



How the world's land is used: Total area sizes by type of use & land cover

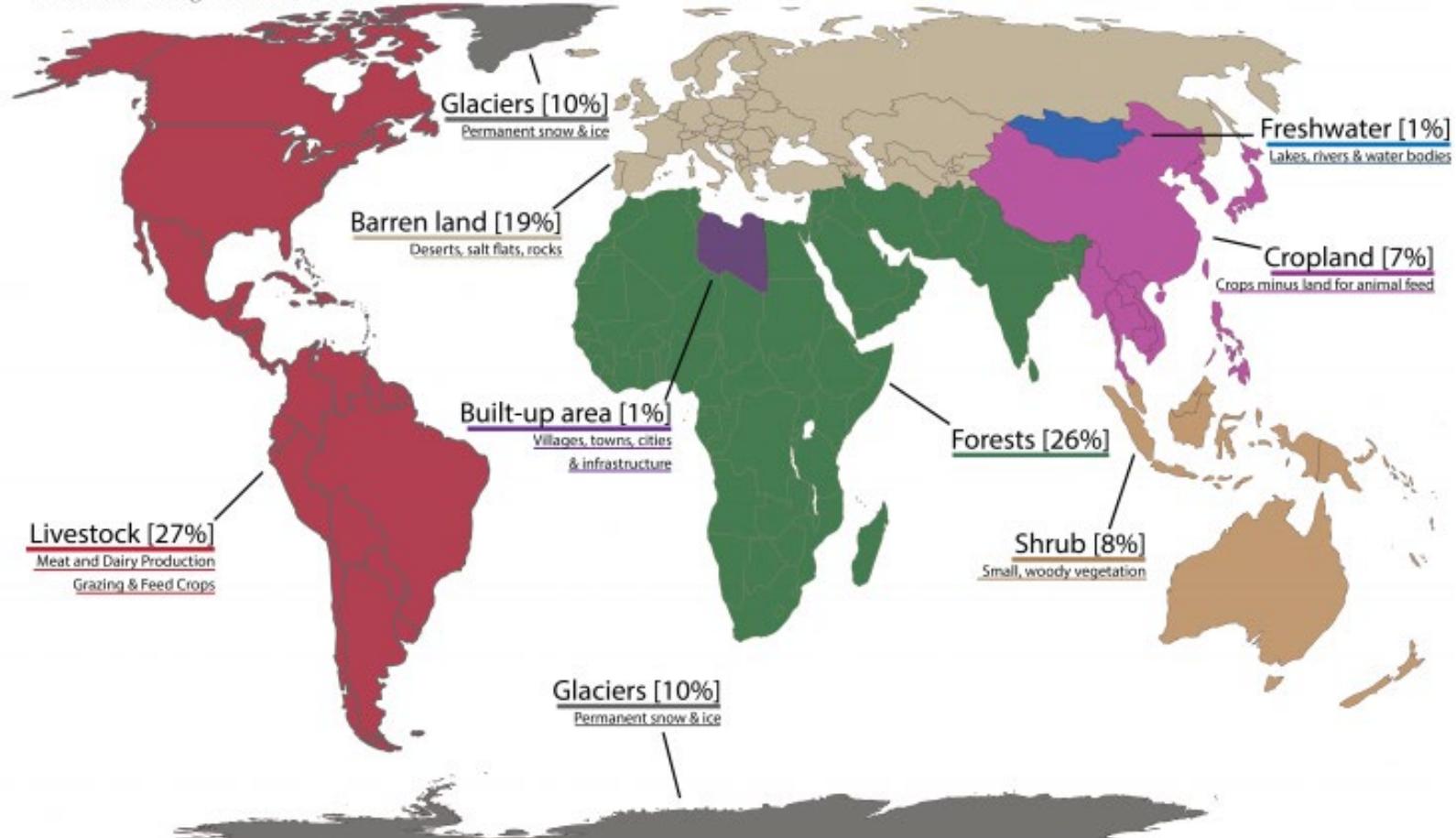
OurWorld
in Data

Global surface area if land was aggregated by usage or terrain cover. Land categories are not shown by their distribution around the world but are representative of the total area that they cover.

Land uses as a percentage of global land area are shown in square brackets.

– Cropland is shown as land area used for crop production minus area used for production of animal feed.

– Livestock area is inclusive of both grazing land and cropland for animal feed. ‘Barren land’ refers to land cover in which less than one-third of the area has vegetation or other cover.



Based on data by the UN Food and Agricultural Organization (FAO) and World Bank Statistics. This map is based on the equal-area Eckert IV map projection.

The data visualization is available at [OurWorldInData.org](https://ourworldindata.org/crop-yields). There you find research and more visualizations on this topic.

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Lab-Grown Meat

- Singapore was first in the world to approve the sale of lab-grown meat to consumers in December 2020.
- Multiple alternative protein start-ups set up in Singapore—growing industry.
- Affordable food for everyone?
- Singapore's traditional food culture?



Stop and Think

Will lab-grown meat help us:

- feed the growing population more sustainably?
- eradicate hunger in the world?
- promote economic growth and livelihoods, in Singapore vs. Indonesia?
- be healthy?
- mitigate climate change and reduce environmental destruction?
- reduce social injustice between countries in the global food system?



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