Lecture 6
Environment and Resources (III): The Population-Resource Relationship

KEY QUESTION:

Are there adequate provisioning services to support population growth?

With the completion of this lecture, attached readings and tutorial, you should be able to discuss:
- Thomas Malthus' views on limit imposed by the natural environment on population numbers
- Ester Boserup's views on role of technology in expanding resource base
- Limitations to Thomas Malthus' and Ester Boserup's views
- Malthus' and Boserup's lack of consideration of unevenness in access to resources across the population

Lecture Outline

6.1 The Population-Resource Relationship

6.2 Thomas Malthus

6.2.1 Malthus' views on the population-resource relationship

6.2.2 Limitations to Malthus' views

(a) Lack of credit to human inventiveness

(b) Lack of consideration of unevenness in access to resources across the population (see **Section 6.4**)

6.3 Ester Boserup

6.3.1 Boserup's views on the population-resource relationship

Box 1: Technology and resources

6.3.2 Limitations to Boserup's views

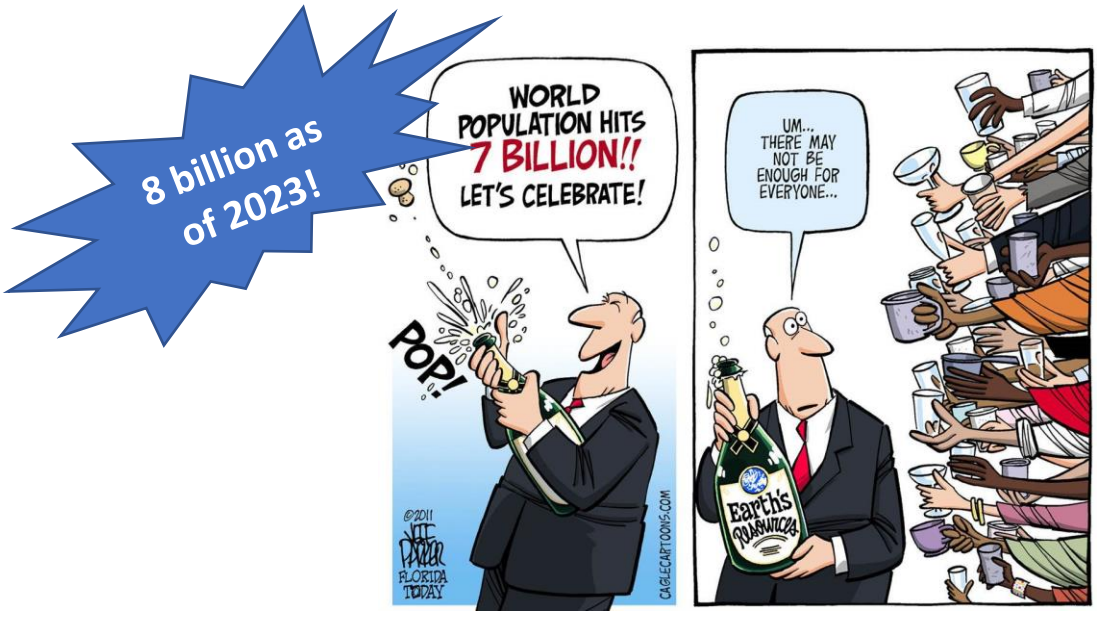
(a) Lack of consideration of degradation of the resource base as a result of technological innovations

Box 2: The Green Revolution

(b) Lack of consideration of unevenness in access to resources across the population (see **Section 6.4**)

6.4 More than meets the eye? Unevenness in access to resources

6.5 Summary: Comparisons between Malthus and Boserup



6.1 The Population-Resource Relationship

- We all need resources to survive. But with 8 billion people in the world today, and continuing to increase in the future, will we have sufficient resources to support our needs? Will there be sufficient resources to support our population growth? What could happen if not?
- The concern over whether there will come a point in time when population will not be sustained by resources available on Earth has been raised for centuries, with the earliest modern theories dated as far back as the late 1700s. The interest over this concern remains today.
- In this lecture, we consider the perspectives of two different thought leaders to help us examine the relationship between population and resources – Thomas Malthus (**Section 6.2**) and Ester Boserup (**Section 6.3**).

6.2 Thomas Malthus

6.2.1 Malthus' views on the population-resource relationship

- Reverend Thomas Malthus (1766 – 1834) had a very enquiring mind and his concerns about the world's capacity to sustain continued growth led him to publish his *Essay on the Principle of Population* in **1798**. Through this work, he was the first to draw a picture that links the consequences of population growth to its causes in a systematic way.
- He theorised that **population growth would ultimately be constrained by the amount of land available for food production.** He believed that:
  - There was **a finite population size** *in relation to* **food supply;** and
  - **Any increases in population beyond this point** would lead to **a decline in the standard of living** and to **war, famine and disease** which will then **reduce population size**.
- There are two main components to his theory we must be familiar with.
  - First, he based his argument on the following principles:
    - **Human population** tends to **increase in a geometric** sequence (i.e. 1, 2, 4, 8, 16, 32, etc.) (Think**:** two parents could have four children, sixteen grandchildren, and so on)
    - **Food production rises** are much more likely to take place in an **arithmetic sequence** (i.e. 1, 2, 3, 4, 5, etc.)(Think: by adding one acre at a time)
    - Thus, in the natural order, at some point, **population growth will outstrip the food supply**, and **the lack of food will ultimately put a stop to the increase of people.** (See **Fig. 1**)

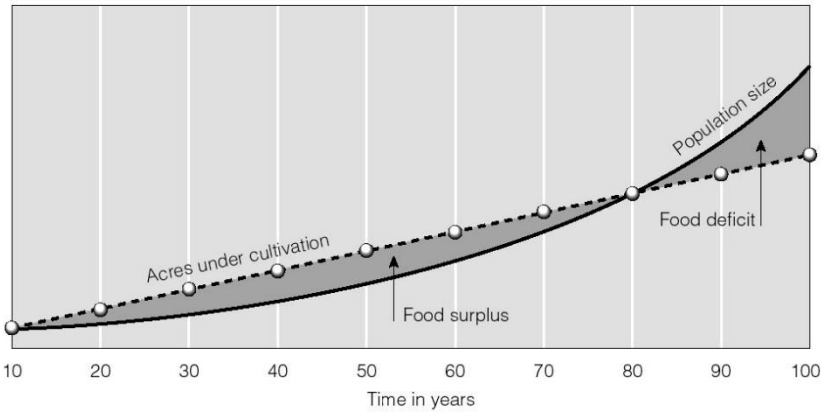


Fig. 1 Over Time, Geometric Growth Overtakes Arithmetic Growth

Note: If we start with 100 acres supporting a population of 100 people and then add 100 acres of cultivated land per decade (arithmetic growth) while the population is increasing by 3 percent per year (geometric growth), the result is a few decades of food surplus before population growth overtakes the increase in the acres under cultivation, producing a food deficit, or "misery," as Malthus called it.

- Second, he maintained that when such a point is reached, **positive** and **preventive** checks would set in to help achieve the equilibrium between population and food production.
  - **Positive checks** are primarily those measures "whether of a moral or physical nature, which tend prematurely to weaken and destroy the human frame". These may take the form of **war** (over food, which is necessary to the existence of man), **famine** (due to lack of food), and **pestilence** (disease). Today we would call these ***the causes of mortality***.
  - There are also **preventive checks** – ***limits to fertility***. In theory, the preventive checks would include all possible means of birth control, including abstinence, contraception, and abortion. However, to Malthus the *only* acceptable means of preventing a birth was to **exercise moral restraint**; that is, to **postpone marriage**, and **abstain from sex** in the meantime, until a man feels secure that he can have a large family.

6.2.2 Limitations to Malthus' views

(a) Lack of credit to human inventiveness

(1) Malthus either failed to see or refused to acknowledge that technological progress was possible, and that its end result was a higher standard of living, not a lower one.

- The crucial part of Malthus's ratio of population growth to food increase was that food (including both plants and animals) **would not grow exponentially**. But this is possible in reality, especially with the aid of **technology**. Technological and industrial development had an effect on agricultural production through **intensification** (e.g. labour and capital) and **extension** (e.g. more land)(See **Box 1** later). ***The world's supply of food is expanding, rather than fixed.***
- Great improvements have been made in increasing food production through means such as better farm management and farm machinery, increased use of artificial fertilisers and pesticides, use of high yielding varieties of plants, adoption of more sophisticated irrigation techniques, fish farming, etc. (Again, see **Box 1** later)

(2) Malthus believed that moral restraint was the only acceptable preventive check, but methods of birth control broke the connection between intercourse and fertility.

- During his lifetime, Malthus was constantly defending against critics who encouraged him to deal more favorably with other means of birth control. To Malthus, these "other means" to prevent births, including contraception (either before or after marriage), abortion, sterilisation, etc were **viewed as a vice** that would "lower… the dignity of human nature."
- However, Malthus never fully embraced the suggestion, nor did he ever bow to pressure to accept anything but moral restraint as a viable preventive check.
- Modern records show that human populations did not inevitably grow geometrically. In fact, it is now recognised that as we develop economically and socially, the trends tend towards lowered birth rates. The access to family planning methods had played a crucial part.

(3) Positive checks did not occur as naturally as Malthus had expected with the advancement of medical technology.

- Malthus did not foresee the introduction of massive death control measures. Immunisation, purification of drinking water, control of disease-carrying organisms, improved sanitation etc. have removed many of the checks which Malthus assumed as 'natural'.

(b) Lack of consideration of unevenness in access to resources across the population
Please see <u>Section 6.4</u> for this. Remember to cite the ideas there when asked to critique Malthus.

6.3 Ester Boserup

6.3.1 Boserup's views on the population-resource relationship

- An early proponent of the idea that population growth could be the trigger of economic development, rather than poverty, was the Danish economist **Ester Boserup**.
- In a set of extremely influential writings, especially the one published in **1965**, she advanced the idea that, **in the long run, a growing population is more likely than either a non-growing or a declining population to lead to economic development**.
- Boserup's argument is that **population growth is the motivating force that brings about the clearing of uncultivated land, the draining of swamps, and the development of new crops, fertilisers, and irrigation techniques, all of which are linked to revolutions in agriculture.**
- Essentially, **she argues that population growth is the prime cause of agricultural change**.
- Boserup's philosophy was based on her observations of communities at different levels of development. She believed that people had an *intuitive* awareness of more effective intensive farming methods that could put into practice in times of need. For Boserup, *all* people have the **will-power and potential resources of knowledge and technology** to achieve **adequate increases in food production** – through use of technology and management strategies (study **Box 1** carefully). The proverb, "**necessity is the mother of invention**" neatly sums this up.
- Indeed, the history of Europe shows that the Industrial Revolution and the increase in agricultural production were accompanied almost universally by population growth (**Fig. 4**).

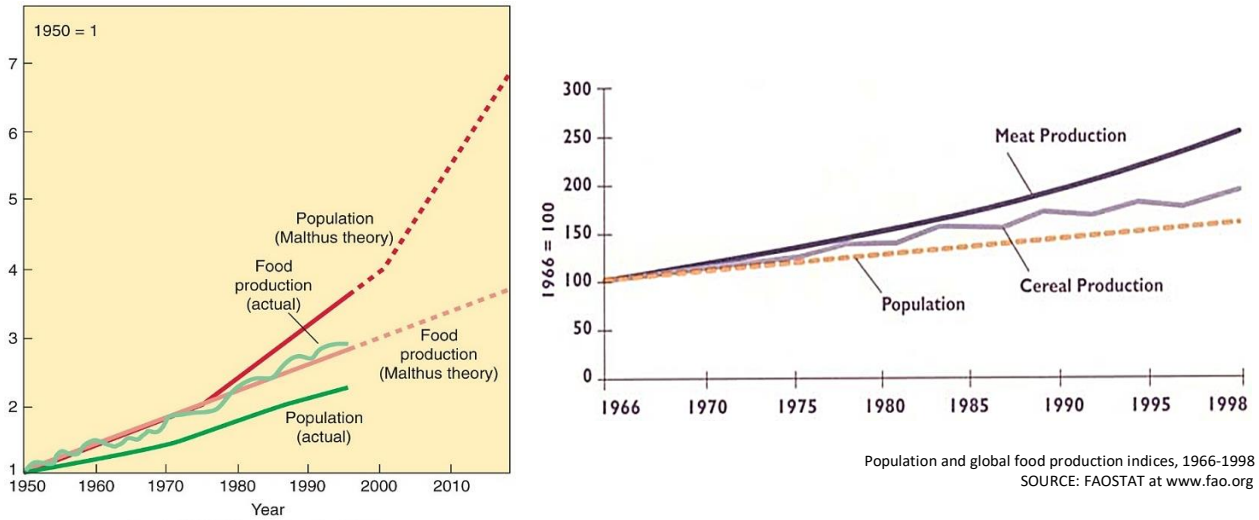


Fig. 4 Malthusian predictions vs actual trends

Box 1: **Technology and resources** *(cross-reference to Lect 5, resource classification)*

Technology can increase the resource base to limit the pressure on existing stock by:

- **finding alternative supplies of resources**. Hydraulic fracturing, or fracking, is the process of extracting oil and gas from rock layers within the ground. This is a good example because these supplies did not use to be able to be reached in the past, and only in recent times did the technology to do so evolve and to the extent that it is economically viable to adopt them at a large scale.
- **finding alternative resources**. A good example of this is the search for alternative sources of energy, such as biofuels. The intensive use of fossil fuels to power economic growth has sounded the alarm bells for the need for other energy sources when fossil fuels are exhausted. Biofuels such as ethanol extracted from crops like sugarcane and corn is possible because of technological knowledge that wasn't available in the past, and the push for the search of alternative energy wasn't so strong some decades ago when fossil fuels seem to be in abundant supplies.
- **increasing the supply of existing resources** such as food crops on agricultural land through *intensification* (e.g. using high-yielding varieties and fertilisers to *produce more with less*) and *extension* (e.g. reclaiming land or draining marshland)
- **renewing used resources** to be suitable for use again through recycling. Technology has allowed us to turn non-renewables into renewables through *recycling*. Used water for example can now be put through processes such as reverse osmosis to be suitable for human consumption, as is the case in Singapore.

6.3.2 Limitations to Boserup's views

(a) Lack of consideration of degradation of the resource base as a result of technological innovations

- Boserup's views are optimistic (contrasting Malthus' pessimism), and have given much credit to human invention such as technology to expand resource base, but may have ignored associated negative environmental consequences.
- Technologies such as those used in hydraulic fracturing can lead to serious environmental impacts such as pollution of groundwater supplies and emissions to air that has the potential to affect health. Technologies for alternative energy such as nuclear energy, biomass and hydroelectric power too have well-known negative impacts (see **Lect 7**). Innovations such as GM foods have caused some concerns on health and the environment (see **Box 2**).
- The ***Limits to Growth*** report published in 1972 (and revised in 2004) by **neo-Malthusians** described how human population interacts with the environment and economy. It drew on a series of computer models which simulated the global interaction of five basic factors that are seen to determine and ultimately limit growth on Earth. **Fig. 5** shows the 2004 version.
    - In the model, population is expected to peak in 2040, and decline thereafter. This may happen not only due to lack of resources, but also high pollution levels. In fact, the model suggested that pollution levels will soar (outside the graph!).
    - This could have depressed land yields and requiring huge investments in agricultural recovery. The population finally declines because of food shortages and negative health effects from pollution.

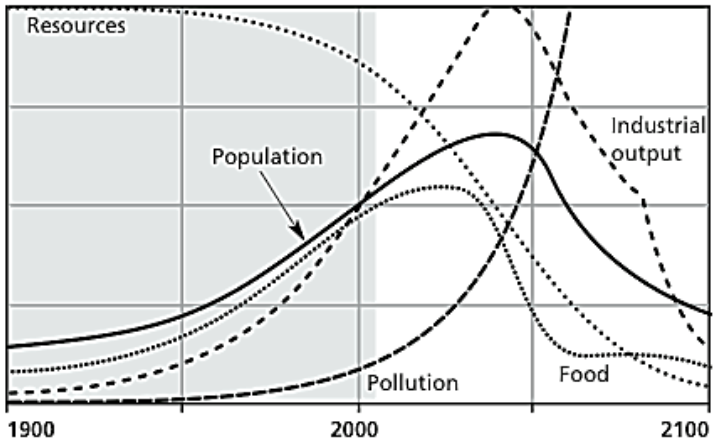


Fig. 5 The Limits to Growth model (2004 version)

Box 2: **The Green Revolution**

- The 'Green Revolution' and the arrival of new, intensive farming techniques and 'high yielding variety' crops is believed by many to have reduced the amount of famine and malnutrition which might have otherwise occurred; although this cannot be proven. Genetically modified (GM) crops, another scientific feat, have also become important in food production in the last few decades.
- However, Green Revolution developments were criticised for shifting production away from traditional subsistence farming in some parts of the developing world, towards export-oriented production, causing the poorest farmers to lose out as land was given over to agri-business and they could not afford to invest in the new technologies and techniques available.
- Also, although GM crops are considered to be presently contributing towards meeting food demands for many, they are also criticised for the unknown long-term impacts they may have on human health and the environment. Boserup's ideas are therefore criticised, as she failed to acknowledge that the Earth's land can become degraded when farmed too intensively with unsuitable techniques, limiting its productive capacity.

(b) Lack of consideration of unevenness in access to resources across the population
(Please see **Section 6.4** for this)

6.4 More than meets the eye? Unevenness in access to resources

- Malthus has predicted with population growth there will be widespread starvation. Based on numbers we know, population growth has occurred, but while there remain many people who are hungry, it is not as widespread as feared.
  - A 2016 study published in *The Lancet* found that by 2025, global obesity prevalence will reach 18% in men and surpass 21% in women; severe obesity will surpass 6% in men and 9% in women.
  - More obese men and women now live in China and the US than in any other country.
- Along the beliefs of Boserup, **Fig. 4** suggests that food production has been growing in excess of population growth rate. Yet:
  - In the same 2016 Lancet study, it is reported that excessively low body weight remains prevalent in the world's poorest regions, especially in South Asia, Central and East Africa.
  - The SDG Report (see **Fig. 6**) stated that up to 811 million persons were still suffering from hunger in 2020.

So, neither Malthus or Boserup were fully accurate in their predictions. What could they have missed?

Fig. 6 Progress on SDG 2

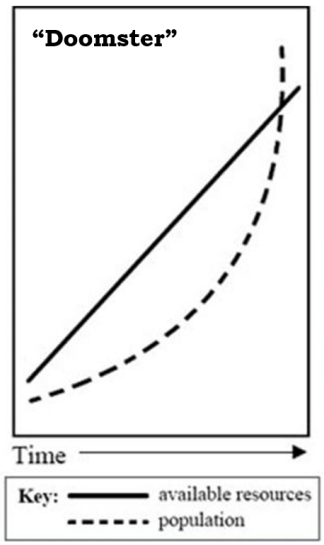
Facts and Figures

- In 2020, between 720 million and 811 million persons worldwide were suffering from hunger, roughly 161 million more than in 2019.
- Also in 2020, a staggering 2.4 billion people, or above 30 per cent of the world's population, were moderately or severely food-insecure, lacking regular access to adequate food.
- Globally, 149.2 million children under 5 years of age, or 22.0 per cent, were suffering from stunting (low height for their age) in 2020, down from 24.4 per cent in 2015.
- To achieve the target of a 5 per cent reduction in the number of stunted children by 2025, the current rate of yearly decline – 2.1 per cent – must double to 3.9 per cent.
- In 2020, wasting (low weight for height) affected 45.4 million or 6.7 per cent of children under 5 years of age.
- The share of countries burdened by high food prices, which had been relatively stable since 2016, rose sharply from 16 per cent in 2019 to 47 per cent in 2020.

Source: **The Sustainable Development Goals Report 2022**

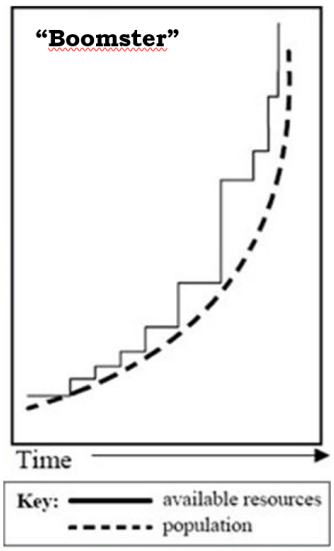
- Some contemporary scholars have pointed out that the population-resource relationship is not entirely based on how many people *versus* how much resources there are or can be. They instead point to **how a largely capitalist society in which we live in helps explain the seemingly lack of resources faced by some groups of people as they do not have the access to, or control of, them.**
- This deprivation does not result from insufficient food on Earth. **People are hungry because the food is not priced within their reach and distributed to all**. The problems are economic and political in nature, not technical.
- Scholars, such as well-known geographer David Harvey, are skeptical of the eternal or natural laws of nature as stated by Malthus (that population tends to outstrip resources), preferring instead to view **human activity as the product of a particular social and economic environment**.
- In particular, Harvey holds strong views against the operations of capitalism, arguing that **capitalism is the cause of uneven access to resources**. Lack of access to resources is the result of a poorly organised society, especially a capitalist society.
    - In a capitalist society, capitalists could acquire more wealth by skimming off some of the workers' wages as profits for themselves. By **underpaying labour** to produce a profit, capitalists accrue surplus value.
    - When capital becomes concentrated in this manner in the hands of a few, wages of the workers remain low and they cannot afford food. So, the workers experience **relative resource scarcity**.

6.5 Summary: Comparisons between Malthus and Boserup



Population growth
⇩
Increased food demand
⇩
Less food per capita
⇩
Positive checks (increase mortality) & preventive checks (decrease fertility)
⇩
Reduction in population growth

Population growth
⇩
Increased food demand
⇩
Technological development and economic advancement
⇩
Population growth continues



	Malthus	Boserup
Main Ideas	There is a **finite population size in relation to food supply** and that any increases in population beyond this point would lead to a **decline in the standard of living** and to **war**, **famine** and **disease** which will then reduce population size. Food supplies grow in an **arithmetic sequence**, yet population grows **geometrically**. **Positive** (war, famine, disease) and **preventive checks** (delay marriage, abstinence from sex) will set us back to equilibrium.	**"Necessity is the mother of invention"** Observed that **people have the will-power and potential resources of knowledge and technology to innovate and to survive.** **Technology** can produce alternative resources (e.g. solar energy); turning non-renewables into renewables (e.g. reused water), increase the supply of existing resource (e.g. food) through intensification (e.g. using HYVs) and extension (e.g. reclaiming land)
Limitations	**Neglected the role of tech** in raising food supply; **birth control** can be preventive check; did not forsee **medical advances** to bring down death rates	Tech innovation may bring **negative impacts to environment** and society
	Lack of consideration of **unevenness in access to resources** across the population due to factors such as capitalism.	