Economic Resources and Economic Thoughts

Economic Resources

Chapter 1

The origins of the sustainability problem

Chapter 2 The origins of the sustainability problem

2.1 Economy-environment interdependence

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'The global challenge can be simply stated:To reach sustainability, humanity must increase the consumption levels of the world's poor, while at the same time reducing humanity's ecological footprint.' (Meadows et al 2005)

Economy–environment interdependence

- Economic activity takes place within, and is part of, the system which is the earth and its atmosphere.
- This system we call ‘the natural environment’, or more briefly ‘the environment’.
- This system itself has an environment, which is the rest of the universe.

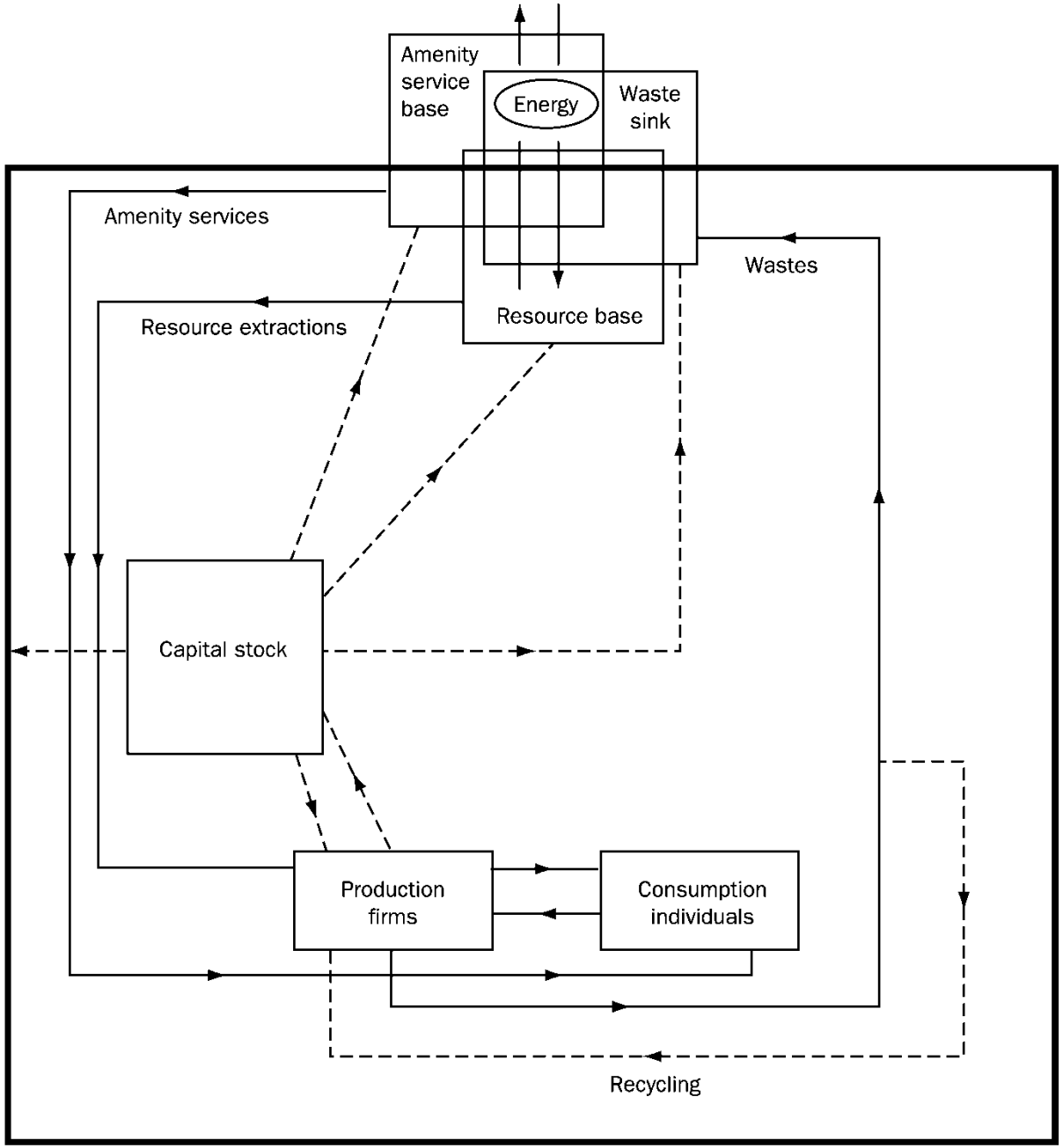


Figure 2.1 Economic activity in the natural environment

The economy in the environment

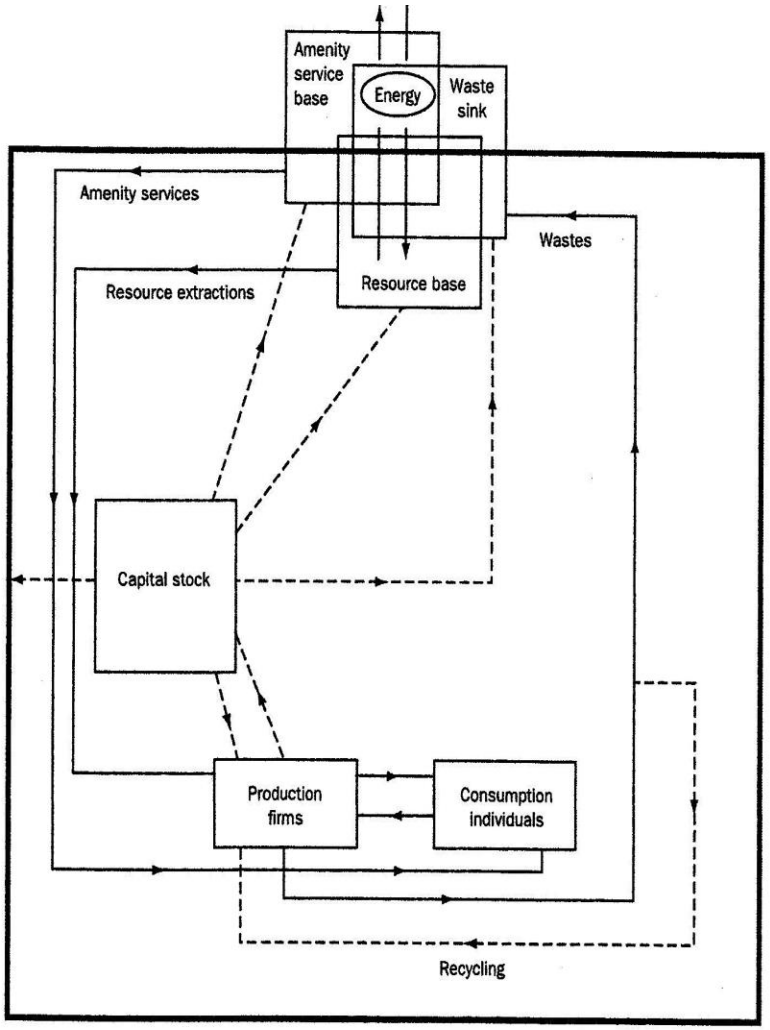


Figure 2.1 Economic activity in the natural environment

The **environment** is a thermodynamically closed system, exchanging energy (but not matter) with its environment.

The economy is located within the environment.

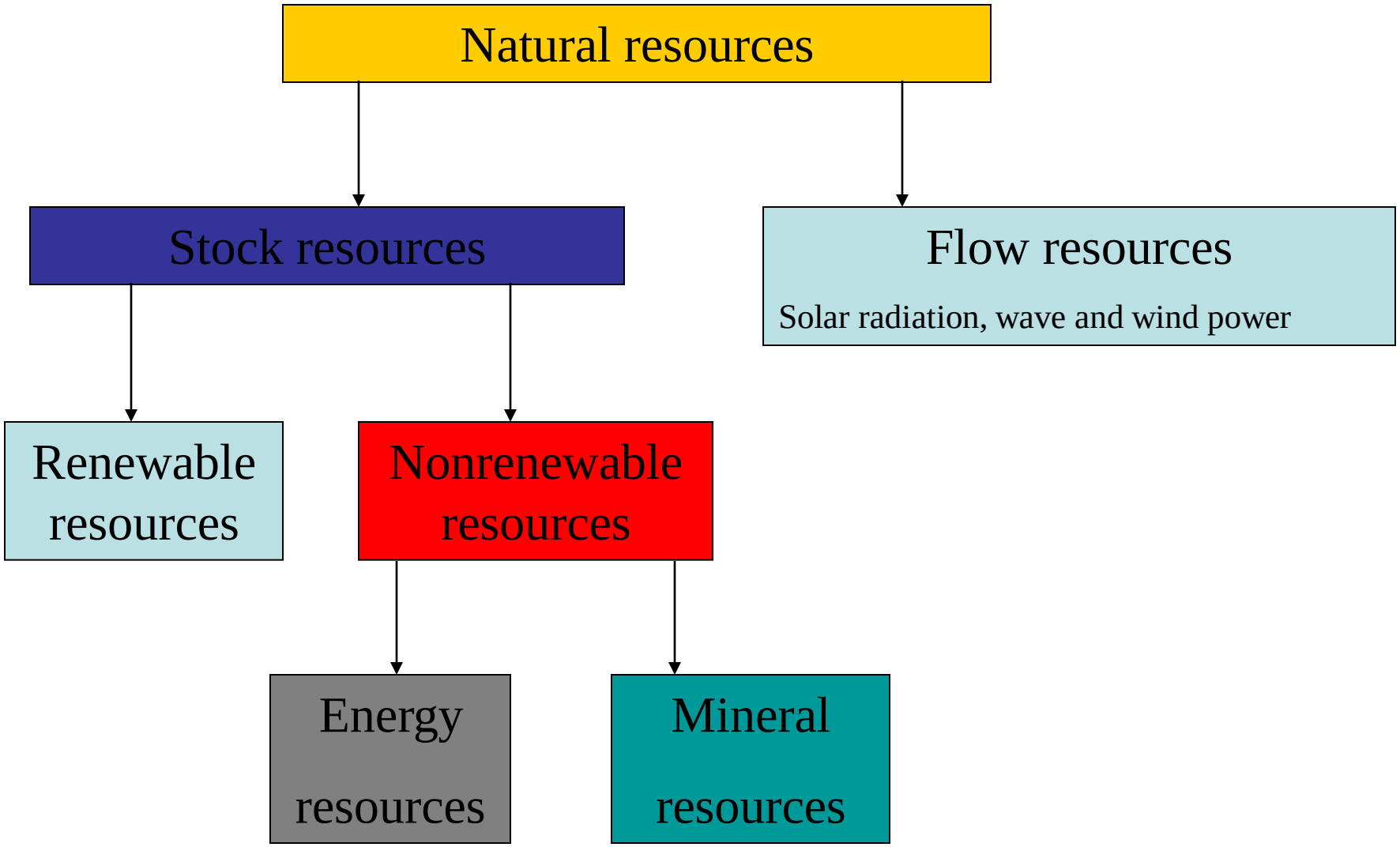
The environment provides four functions to the economy

1. source of resource inputs
2. source of amenity (entertainment) services
3. receptacle (container) for wastes
4. provides life support services

These environmental functions interact with one another in various ways, and may be mutually exclusive

There exist possibilities to substitute reproducible capital for ‘natural capital’

Classification of natural resources



Productive resource services

- Natural resources used in production are of several types.
- One characteristic: does the resource exists as a **stock or a flow**.
- The difference lies in whether the level of current use affects future availability.
  - Flow resources: no link between current use and future availability.
  - Stock resources: level of current use does affect future availability.

Stock resources

Stock resources: a second standard distinction concerns the nature of the link between current use and future availability.

- Renewable resources are biotic populations – flora and fauna: have potential to grow by natural reproduction.

- Non-renewable resources are minerals, including the fossil fuels: no natural reproduction, except on geological timescales.

Distinction between fossil fuels and the other minerals is important.

1. The use of fossil fuels is pervasive in industrial economies, and is one of their essential distinguishing characteristics.
2. Fossil fuel combustion is an irreversible process :
   - In so far as coal, oil and gas are used to produce heat, rather than as inputs to chemical processes, they cannot be recycled.
   - Minerals used as inputs to production can be recycled.
3. This means that whereas in the case of minerals there exists the possibility of delaying, for a given use rate, the date of exhaustion of a given initial stock, in the case of fossil fuels there does not.
4. Third, fossil fuel combustion (burning) is a major source of a number of waste emissions, especially into the atmosphere. e.g. CO_2.

Sustainability

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- **Material transformations involve work, and thus require energy.**
- **Given a fixed rate of receipt of solar energy, there is an upper limit to the amount of work that can be done on the basis of it.**
- **The fossil fuels are accumulated past solar energy receipts, initially transformed into living tissue, and stored by geological processes. Given this origin, there is necessarily a finite amount of the fossil fuels in existence.**
- **It follows that in the absence of an abundant substitute energy source with similar qualities to the fossil fuels, such as nuclear fusion, there would eventually be a reversion to the energetic situation of the pre-industrial phase of human history, which involved total reliance on solar radiation and other flow sources of energy.**

Recycling

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- **The laws of thermodynamics are generally taken to mean that, given enough available energy, all transformations of matter are possible, at least in principle.**
- **On the basis of that understanding it has generally been further understood that, at least in principle, complete material recycling is possible. On this basis, given the energy, there is no necessity that shortage of minerals constrain economic activity. Past extractions could be recovered by recycling.**
- **It is in this sense that the second law of thermodynamics is the ultimate source of scarcity. Given available energy, there need be no scarcity of minerals.**
- **This is what drives the interest in nuclear power, and especially nuclear fusion, which might offer the prospect of a clean and effectively infinite energy resource.**

The materials balance principle

- ‘The materials balance principle’ : also known as the law of conservation of mass; matter can neither be created nor destroyed.

- Economic activity essentially involves transforming matter extracted from the environment.

- Economic activity cannot, in a material sense, create anything. It involves transforming material extracted from the environment so that it is more valuable to humans.

- All material extracted from the environment must, **eventually**, be returned to it, albeit in a transformed state.

- **Figure 2.2:** A materials balance model of economy–environment interactions

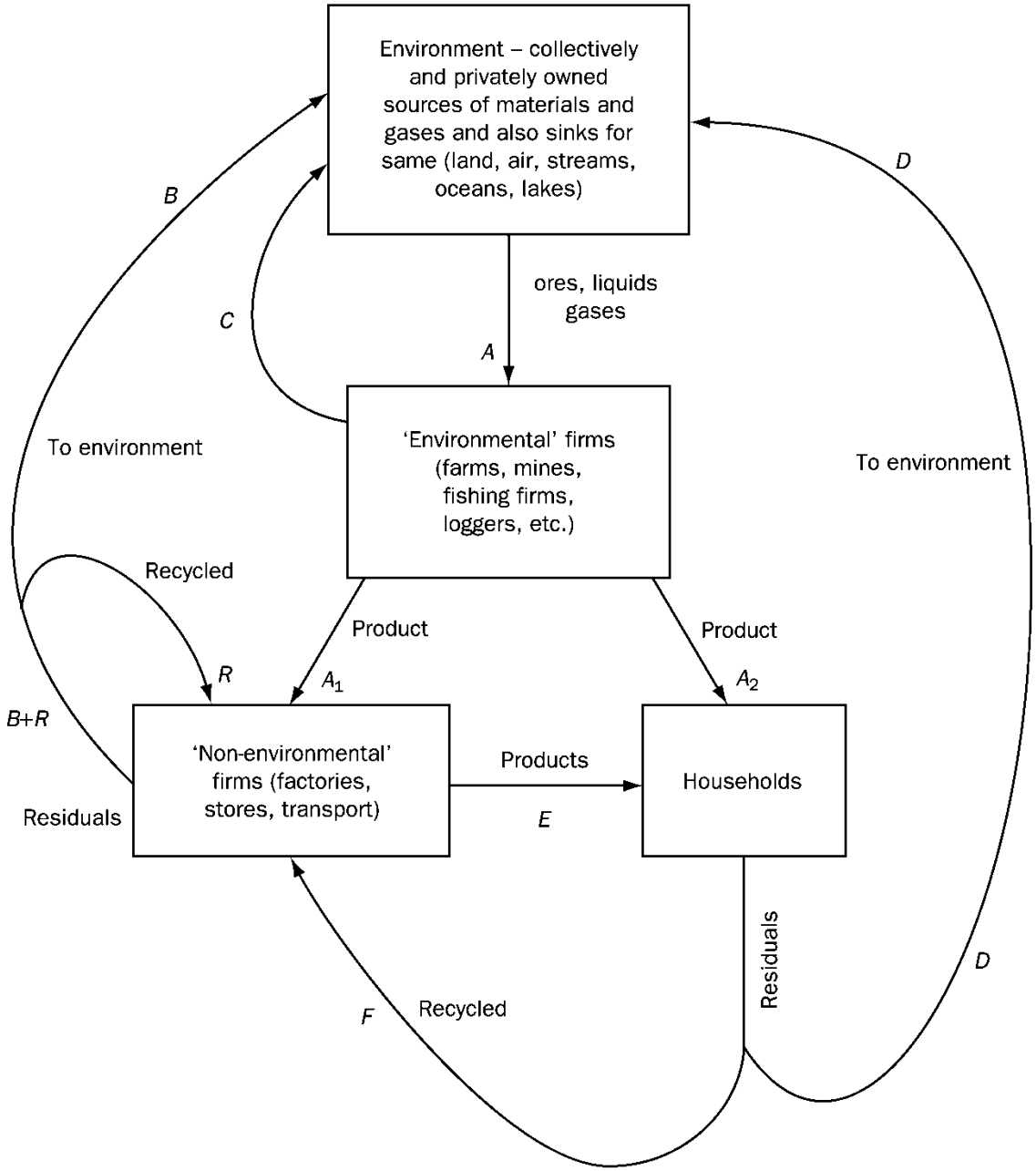


Figure 2.2 A materials balance model of economy–environment interactions
Source: Adapted from Herfindahl & Kneese (1974)

The materials balance principle

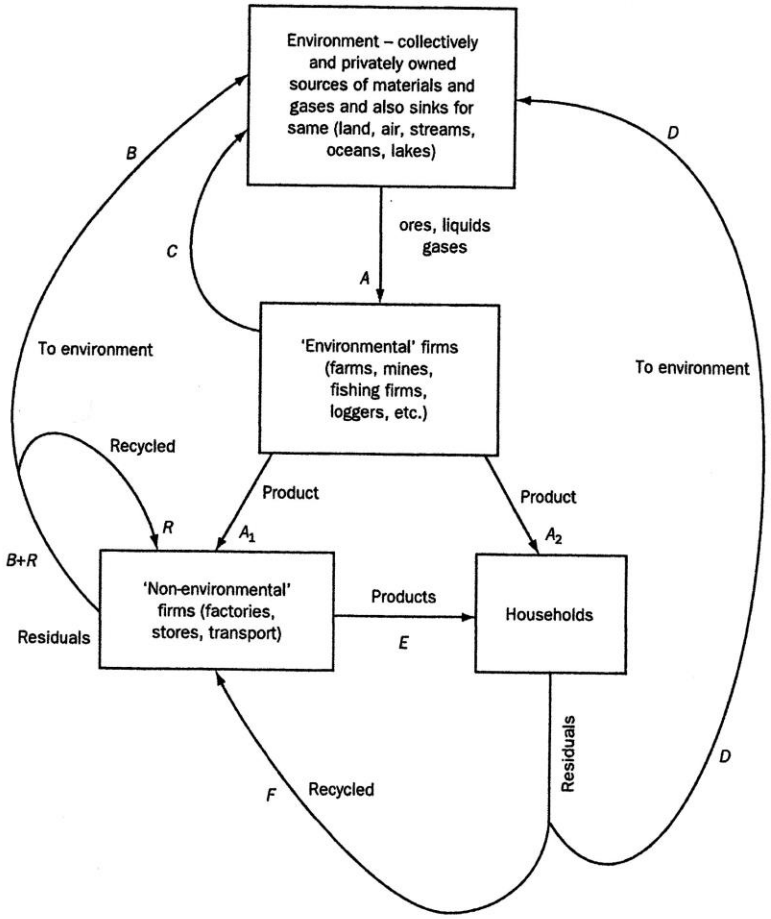


Figure 2.2 A materials balance model of economy–environment interactions
Source: Adapted from Herfindahl & Kneese (1974)

The materials balance principle is the term that economists often use to refer to the **Law of Conservation of Mass**, and its implications. This law says that matter can be neither created nor destroyed, just transformed from one state to another.

The environment	$A \equiv B+C+D$
Environmental firms	$A \equiv A_1+A_2+C$
Non-environmental firms	$B+R+E \equiv R+A_1+F$
Households	$A_2+E \equiv D+F$

In terms of mass, and ignoring lags due to accumulation in the economy, environmental extractions equal insertions, resource input equals waste flow

Ecology

- Ecology is the study of the distribution and abundance of plants and animals.

- A fundamental concept: the ecosystem, an interacting set of plant and animal populations, together with their abiotic (non-living) environment.

- An ecosystem can be defined at various scales from the small and local – a pond or field – through to the large and global – the biosphere as a whole.

Biodiversity

- *Biodiversity:* the number, variety and variability of all living organisms in terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are parts.

- Biodiversity is intended to capture two dimensions:

1. the number of biological organisms
2. their variability.

Levels of Biodiversity

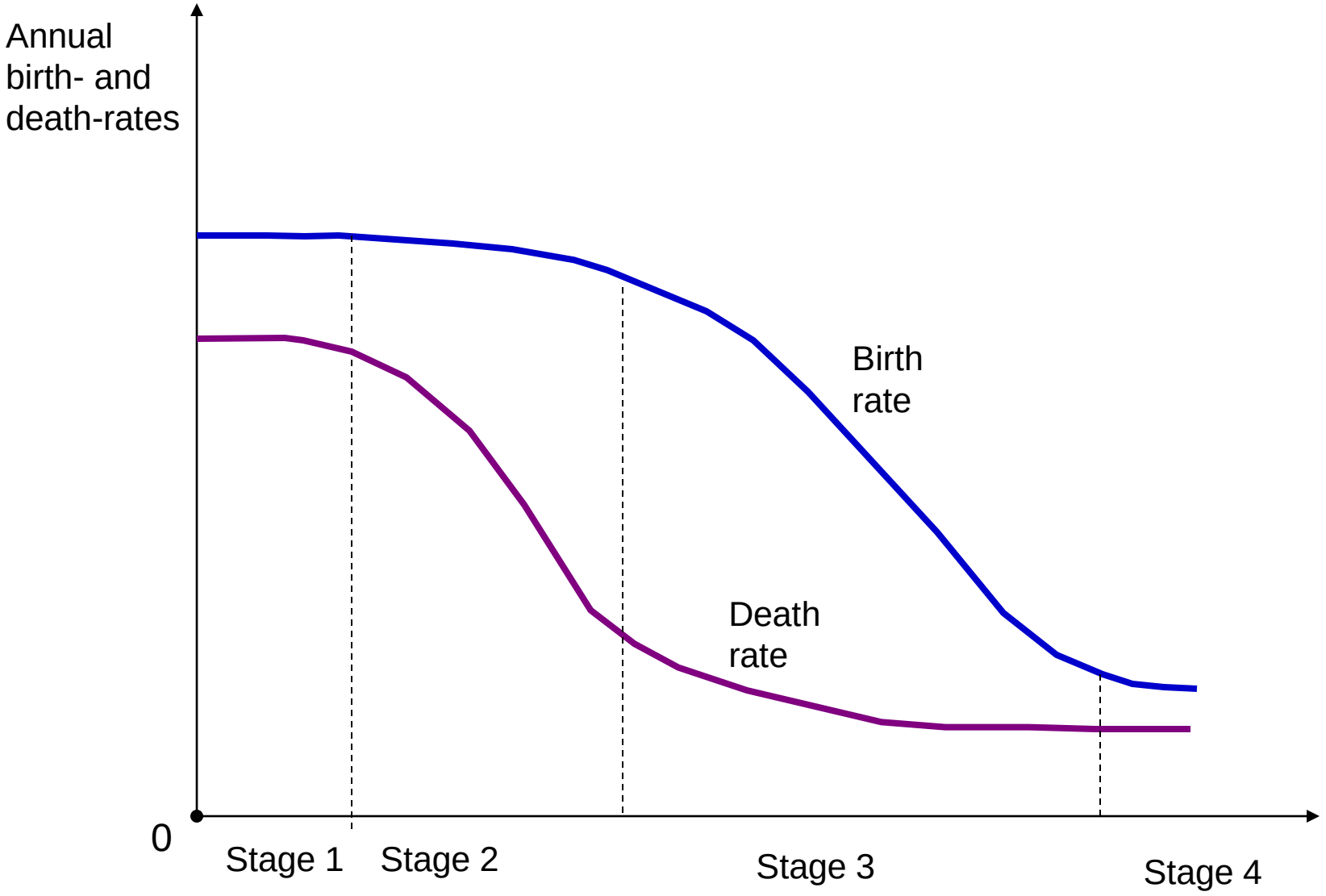
There are three levels at which biodiversity can be considered:

- Population: genetic diversity within the populations that constitute a species is important as it affects evolutionary and adaptive potential of the species, and so we might measure biodiversity in terms of the number of populations.
- Species: we might wish to measure biodiversity in terms of the numbers of distinct species in particular locations, the extent to which a species is endemic (unique to a specific location), or in terms of the diversity (rather than the number) of species.
- Ecosystems: in many ways, the diversity of ecosystems is the most important measure of biodiversity; unfortunately, there is no universally agreed criterion for either defining or measuring biodiversity at this level.

Population

- In 2005 the estimated global human population was 6.5148 billion.
- The estimated growth rate for 1975–2005 was 1.6% per year.
- The staggering increase in human population in the second half of the twentieth century: in 1950 world population was 2.5 billion - it more than doubled over 50 years to 6 billion in 2000.
- At the beginning of the nineteenth century the world's population is estimated to have been about 0.9 billion.
- The projections for the global human population shown in Figure 2.4 are taken from UN Population Division 2000. They differ according to the assumptions made about fertility.
- The medium projection assumes that fertility in all major areas of the world stabilises at the replacement level around 2050.
- The low projection assumes that fertility is half a child lower than for medium, and the high projection half a child higher.
- The long run prospects for the size of the human population are very sensitive to what is assumed about future fertility.

Figure 2.6 The theory of demographic transition



The demographic transition

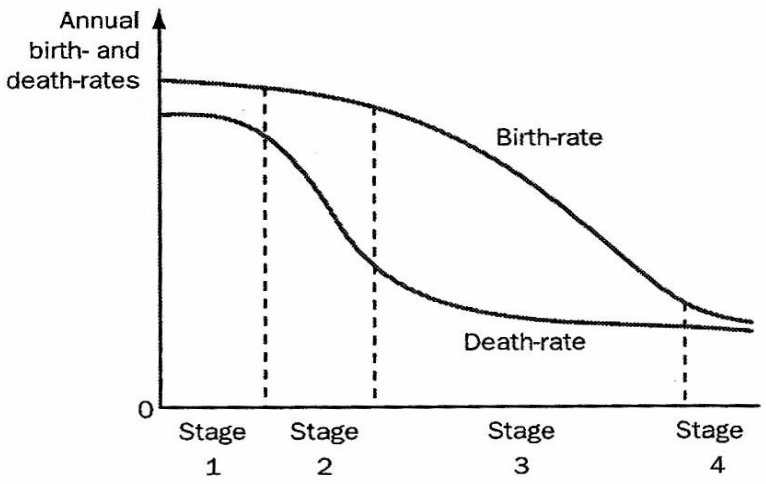


Figure 2.6 The theory of demographic transition

The theory of demographic transition is an attempt to explain the observed negative correlation between income level and population growth rate.

Stage 1. Low income economy with high birth and death rates

Stage 2. With rising real incomes, nutrition and public health measures improve, leading to a falling death rate and rapid population growth.

Stage 3. Due to some or all of

increasing costs of child rearing

reduced benefits of large family size

increasing opportunity costs of home employment

improved economic and social status of women

the birth rate falls and the rate of population growth declines

Stage 4. High income economy with equal and low birth and death rates, and constant population size

Growth as the solution

- Economists have a very strong attachment to economic growth as a major policy objective.
  - A major reason for this is that they see it as the only feasible way to solve the problem of poverty.
  - Generally the better-off will resist attempts to redistribute from them to the poor, so that this route to poverty alleviation will involve social tension and possibly violent conflict.
  - Poverty alleviation via redistribution may not work even if it is politically and socially feasible. The poor are much more numerous than the rich, so that there is simply not enough to take from the rich to raise the poor above the poverty line.
- After WW2, economists thought that they understood how to bring about economic growth and that this could solve the problem of poverty
- Most economists thought that Keynesian macroeconomics was the means to achieving full employment and sustained growth throughout the world.
- The arithmetic of compound growth – growth at a constant proportional rate – is indeed striking.
- Historically economic growth has raised the consumption levels of the mass of the population in the rich industrial world to levels that could scarcely have been conceived 200 years ago.
- For the developing world as a whole, economic growth in the latter part of the twentieth century reduced the extent of poverty.
- The arithmetic of economic growth does not necessarily imply any reduction in economic inequality.
  - The evidence on this hypothesis is mixed.
  - Global income inequalities have not generally decreased in recent years. Within some advanced economies inequality has increased.

The World Commission on Environment and Development

The World Commission on Environment and Development, WCED, was established in 1983 by the United Nations. Its mandate was:

- *to re-examine the critical environment and development issues and to formulate realistic proposals for dealing with them;*
- *to propose new forms of international cooperation on these issues that will influence policies and events in the direction of needed changes;*
- *to raise the levels of understanding and commitment to action of individuals, voluntary organisations, businesses, institutes and governments.*

- Over a period of two years, the commissioners held public meetings in eight countries, at which people could submit their views on WCED's work.
- In regard to analysis and awareness-raising, WCED focused on population growth, food security, biodiversity loss, energy, resource depletion and pollution, and urbanisation.

The Millennium Development Goals

In September 2000 the UN convened the Millennium Summit, attended by representatives of 189 UN members, mostly heads of government. It adopted the Millennium Declaration, the 8 chapters of which were subsequently developed into 8 Millennium Development Goals to be achieved by 2015. The goals are:

1. Eradicate extreme poverty and hunger
2. Achieve universal primary education
3. Promote gender equality and empower women
4. Reduce child mortality
5. Improve maternal health
6. Combat HIV/AIDS, malaria, and other diseases
7. Ensure environmental sustainability
8. Develop a global partnership for development

Each goal is related to more specific targets, of which there are 21 in total. Progress toward goals and targets is mixed and widely seen as disappointing. Progress is reported on the website of the United Nations Development Programme.