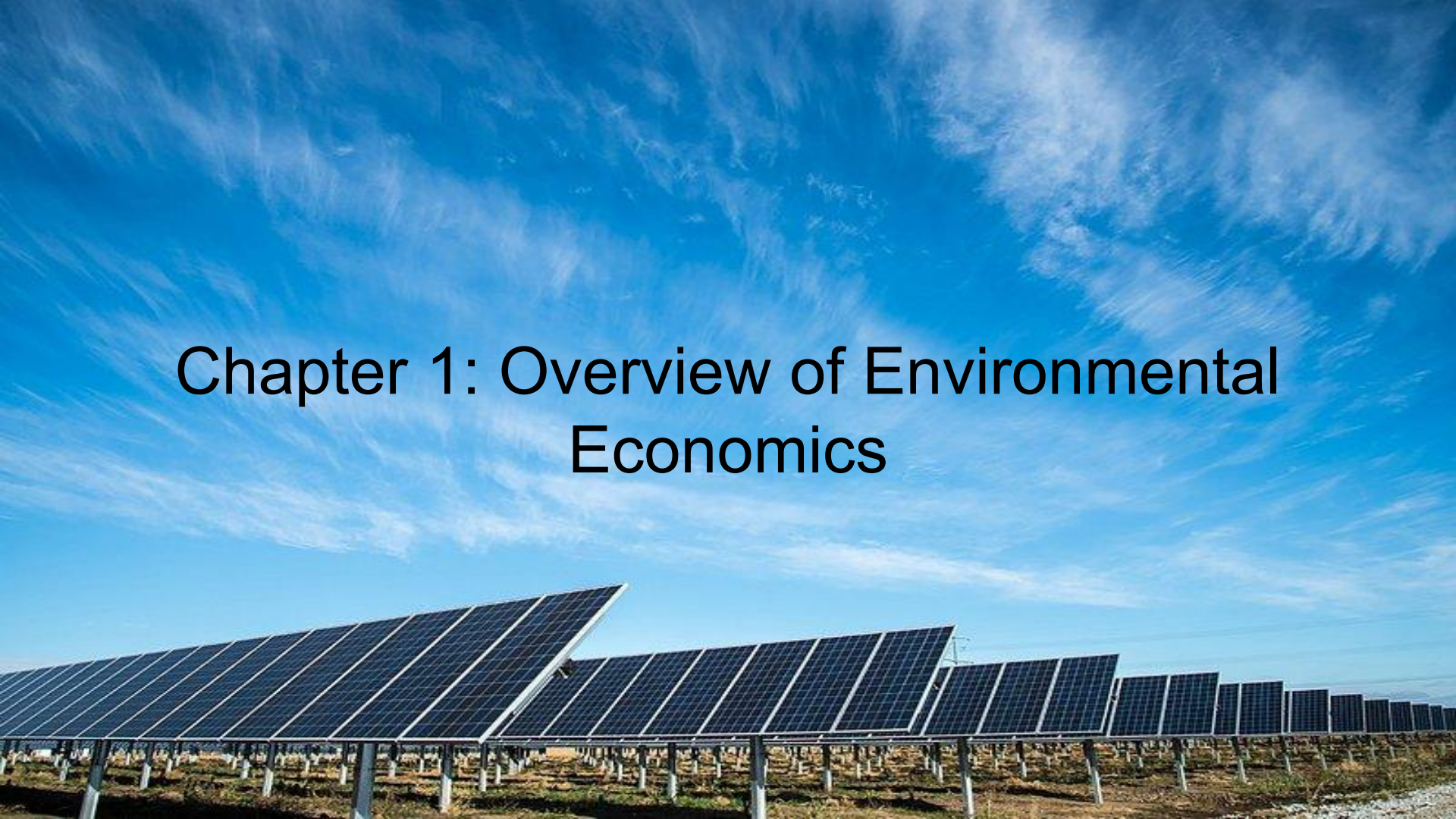
Environment economics and policies

EC 506

Chapter 1: Overview of Environmental Economics



Learning objectives

- Understand the relationship between the economy and the environment: you should grasp how economic activities impact the environment and how environmental changes can affect economic outcomes.
- understand the concept of scarcity as it applies to natural resources and how societies allocate these scarce resources among competing uses.
- Differentiate between renewable and nonrenewable resources, understand the economic implications of sustainable management practices for renewable resources and the challenges associated with the depletion of nonrenewable resources.

Environmental economics

Environmental economics is the application of the principles of economics to the study of how environmental resources are managed.

Environmental economics draws from both Microeconomics and Macroeconomics, although more from microeconomics than from macroeconomics.

It focuses primarily on how and why people make decisions that have consequences for the natural environment. It is concerned also with how economic institutions and policies can be changed to bring these environmental impacts more into balance with human desires and the needs of the ecosystem itself.

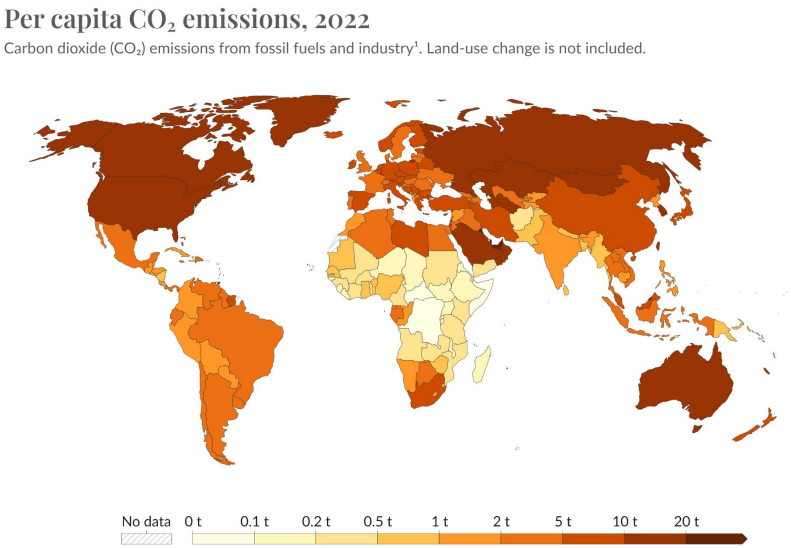
Environmental economics **at individual level**

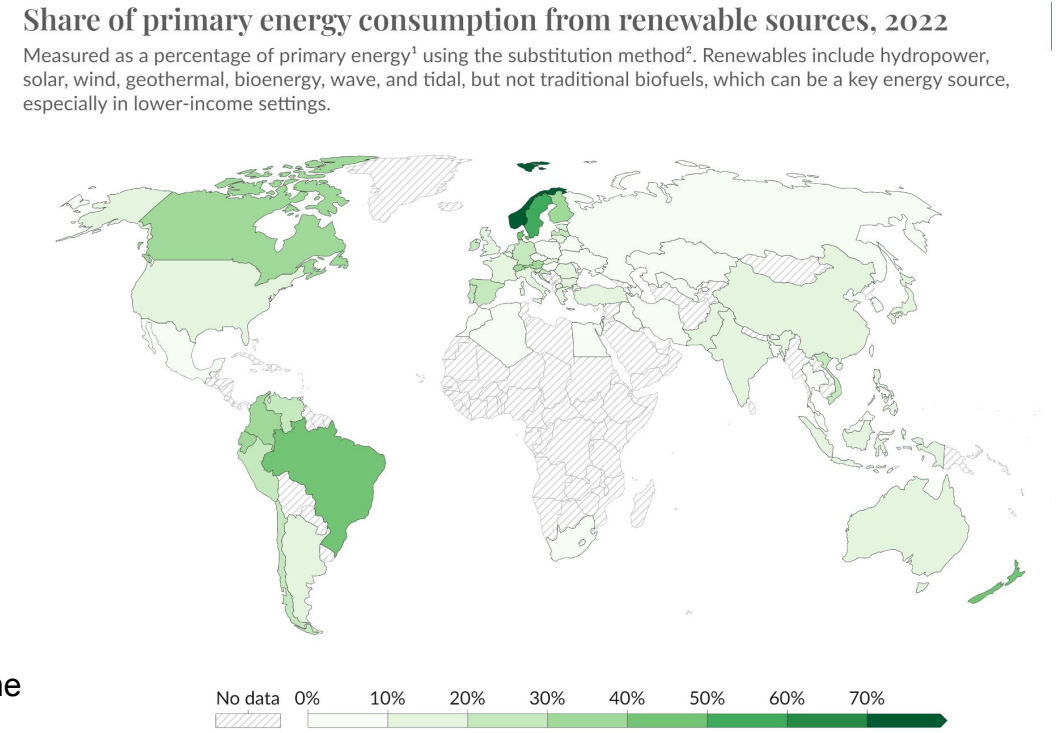
Diesel irrigation

Solar irrigation

What is the motive (economic/environmental)?
What is the incentive to modify individual behaviour (economic/environmental/both)?

Environmental economics **at the world level**





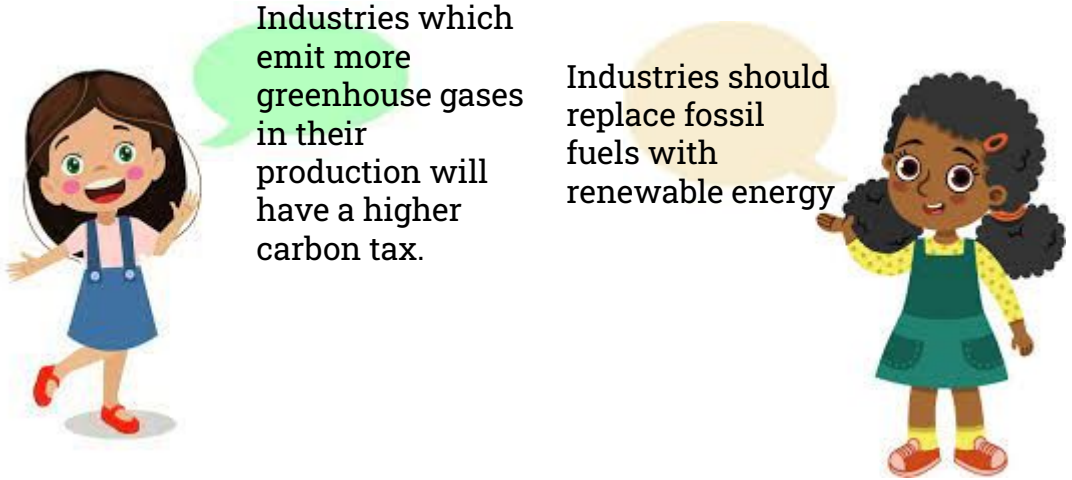
Environmental economics has a major role to play in the design of public policies for environmental quality improvement.

Environmental economics: Main principles

- The theory of environmental externalities
- The optimal management of common property and public goods
- The optimal management of natural resources over time
- The economic valuation of environmental goods and services

Scope of EE: Positive and Normative Environmental Economics

- The PEE draws upon microeconomic theories and macroeconomic theories to describe and explain the ways in which economic factors influence the consumption and production of environmental goods and services.
- The NEE attempts to prescribe what ought to be done to protect and conserve the environment. It applies the principles of welfare economics to determine the optimal level of pollution.



Who is making a positive statement and who a normative one?

Scope of EE: Positive and Normative Environmental Economics

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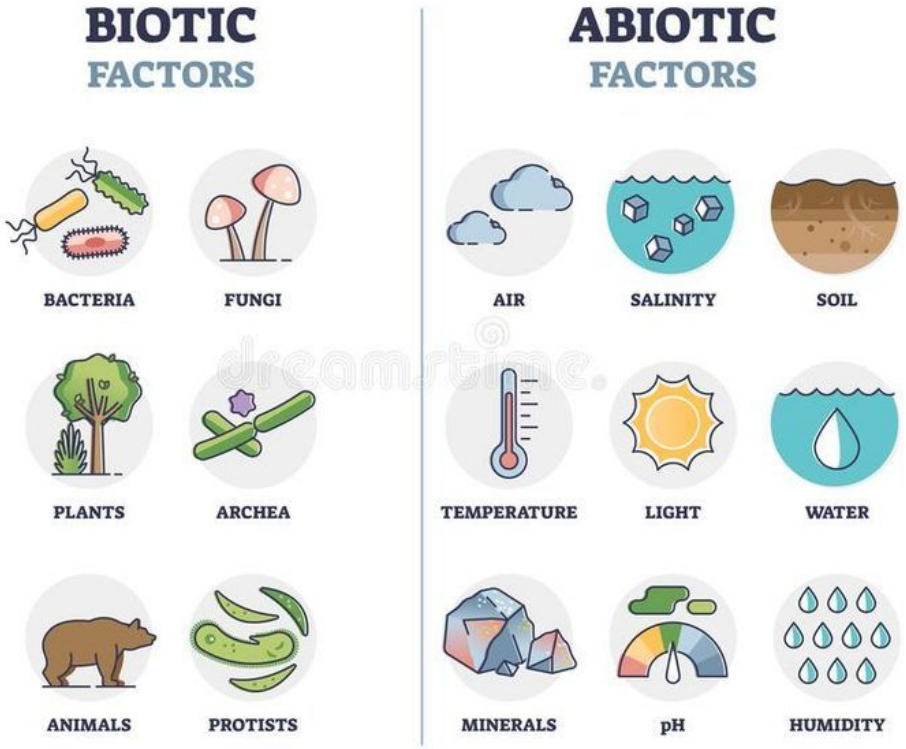
In 2021, around 6% of emissions were in countries or sectors that had a carbon tax.

If we want the climate cost of fuels and products to be reflected in their market price we would want a carbon pricing mechanism everywhere.

Who is making a positive statement and who a normative one?

Environmental economics: the environment

By the term **‘environment’** we mean the natural environment which includes all biotic/living (renewable resources) and abiotic (fossil fuels, mineral resource, water, solar energy etc.) elements that form our surroundings.



Environmental economics: functions of the environment

Any economic system exists within, and is encompassed by, the natural world. Its processes and changes are of course governed by the laws of nature. In addition, economies make use directly of natural assets of all types.

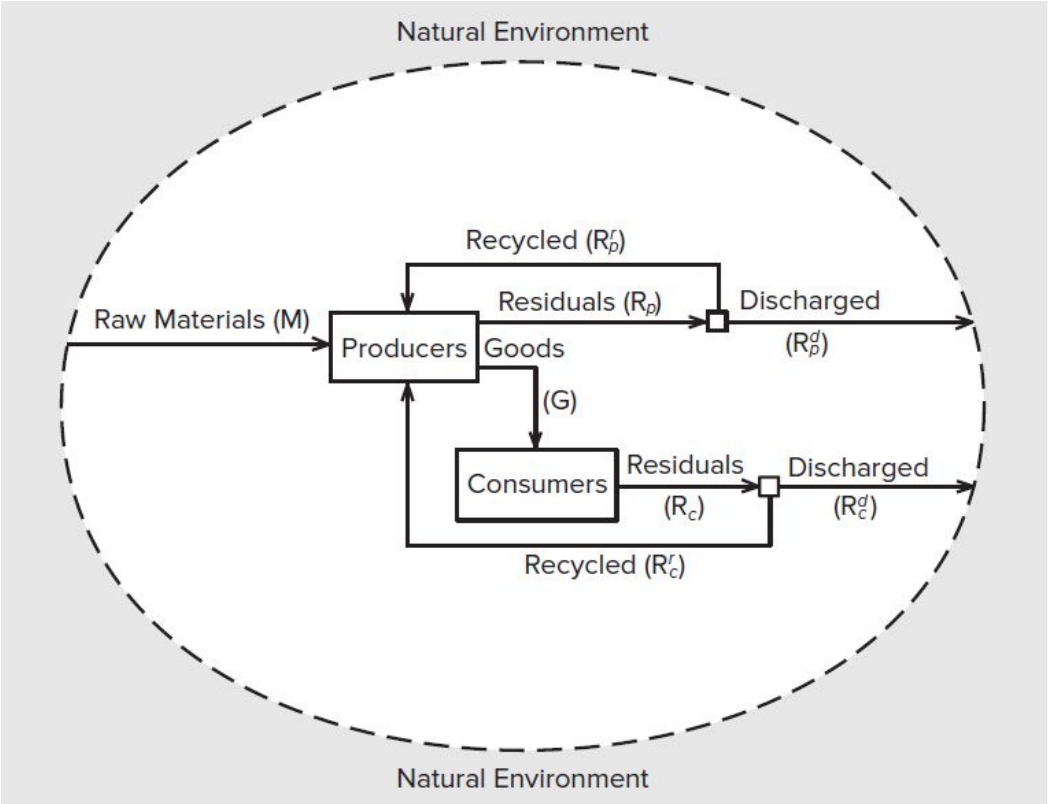
Functions of the natural environment:

- **Provider of raw materials and energy inputs**, without which production and consumption would be impossible (e.g., land, water, crude oil)
- **Provider of amenities** to consumers (e.g. recreation, biodiversity)
- **Waste sink** to assimilate the waste products of production and consumption and convert them into harmless or ecologically useful products (e.g., micro-organisms in oceans break down oil spills, bacteria in the soil breaks down human waste)

Environmental economics: economy and environment

The elements within the circle are parts of the economic system, the whole of which is basically encapsulated within the natural environment.

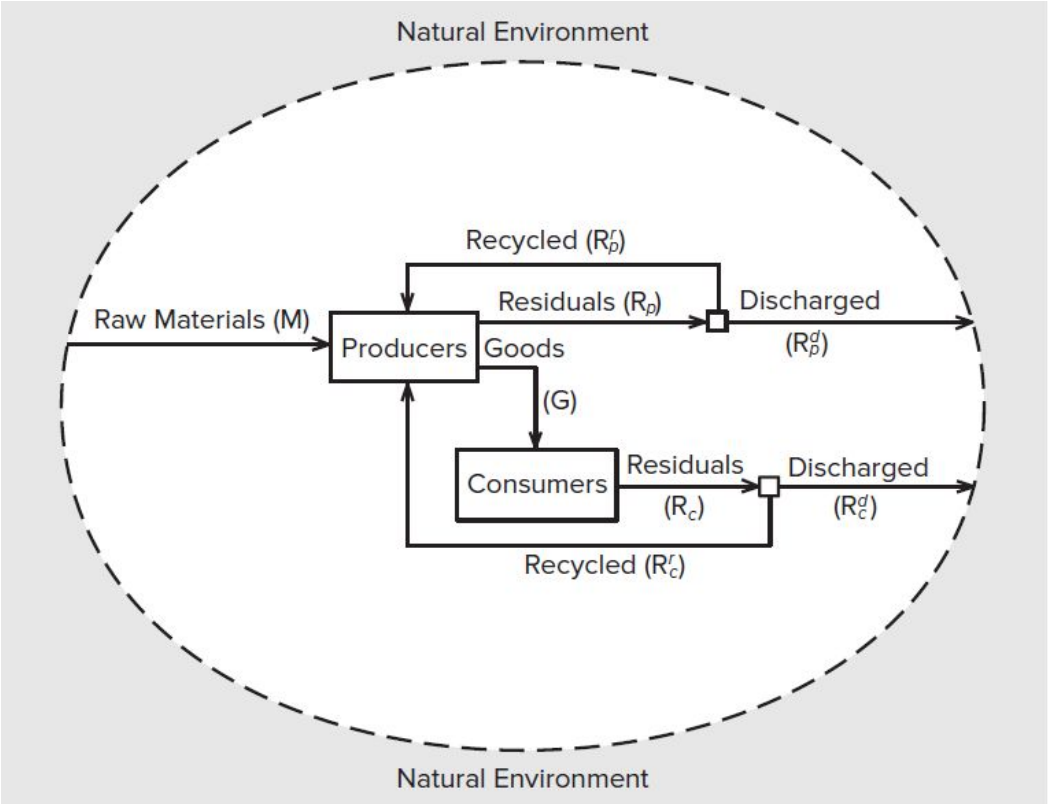
The economy has been divided into two broad segments, producers and consumers.



Environmental economics: economy and environment

The producers category includes all private firms that take inputs and convert them to outputs; it also includes units such as public agencies; nonprofit organizations; and firms producing services, such as transportation.

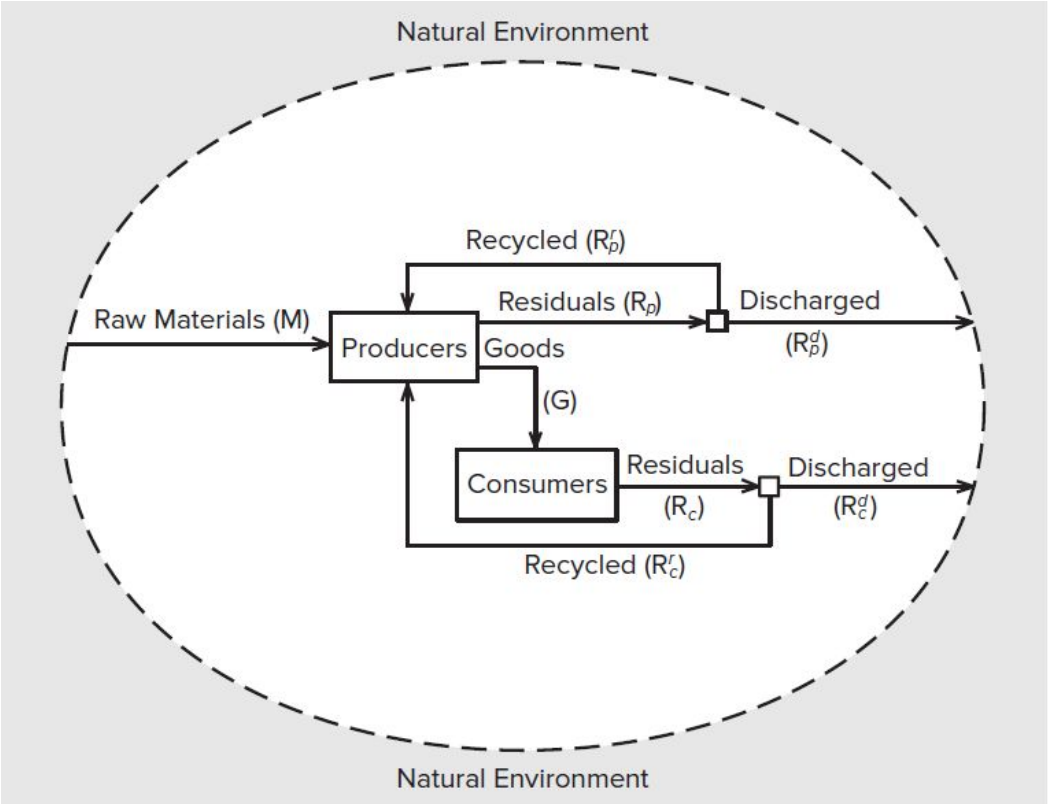
The primary inputs from the natural environment to the producing sector are materials, in the form of fuels, nonfuel minerals, and wood; fluids (e.g., water and petroleum); and gases of various types (e.g., natural gas and oxygen).



Environmental economics: economy and environment

The consumers category includes all of the private households to whom the vast collections of final goods and services are distributed.

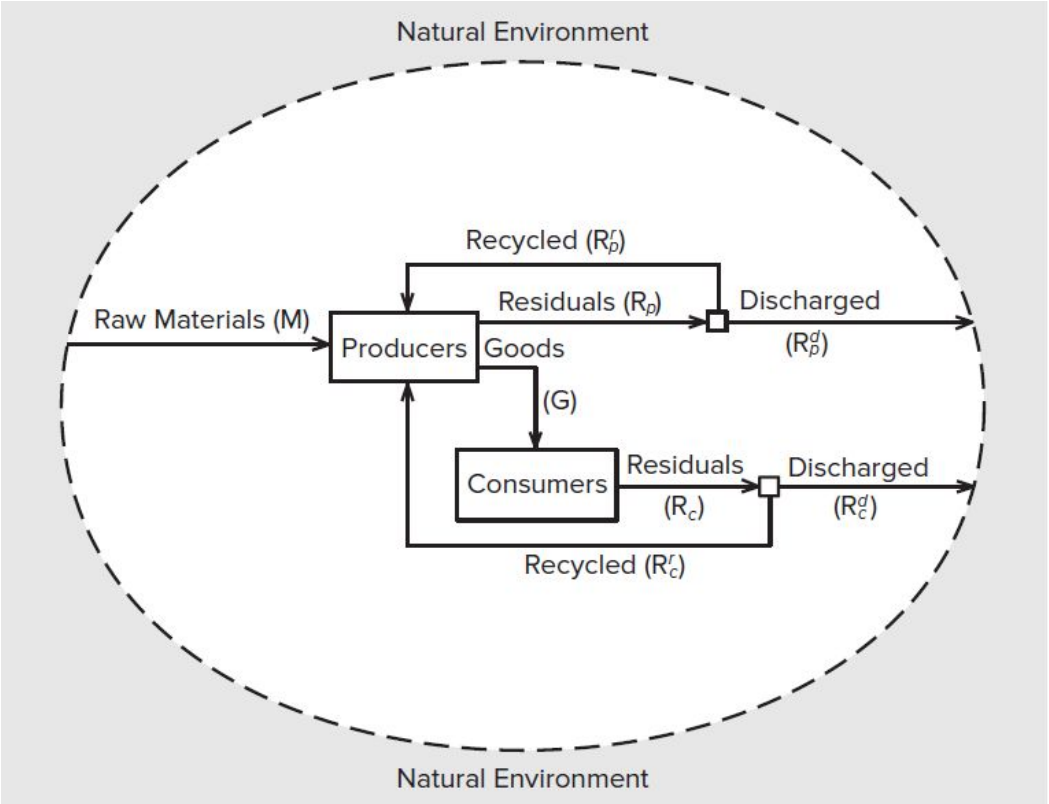
One could argue that consumers sometimes use inputs directly from nature, like producers; many households, for example, get their water supplies directly from groundwater aquifers rather than water distribution companies.



Environmental economics: economy and environment

Production and consumption create residuals, which is another way of saying leftovers. They include all types of material residuals that may be emitted into the air or water or disposed of on land.

Consumers are also responsible for enormous quantities of residuals, chief among which are domestic sewage and automobile emissions.

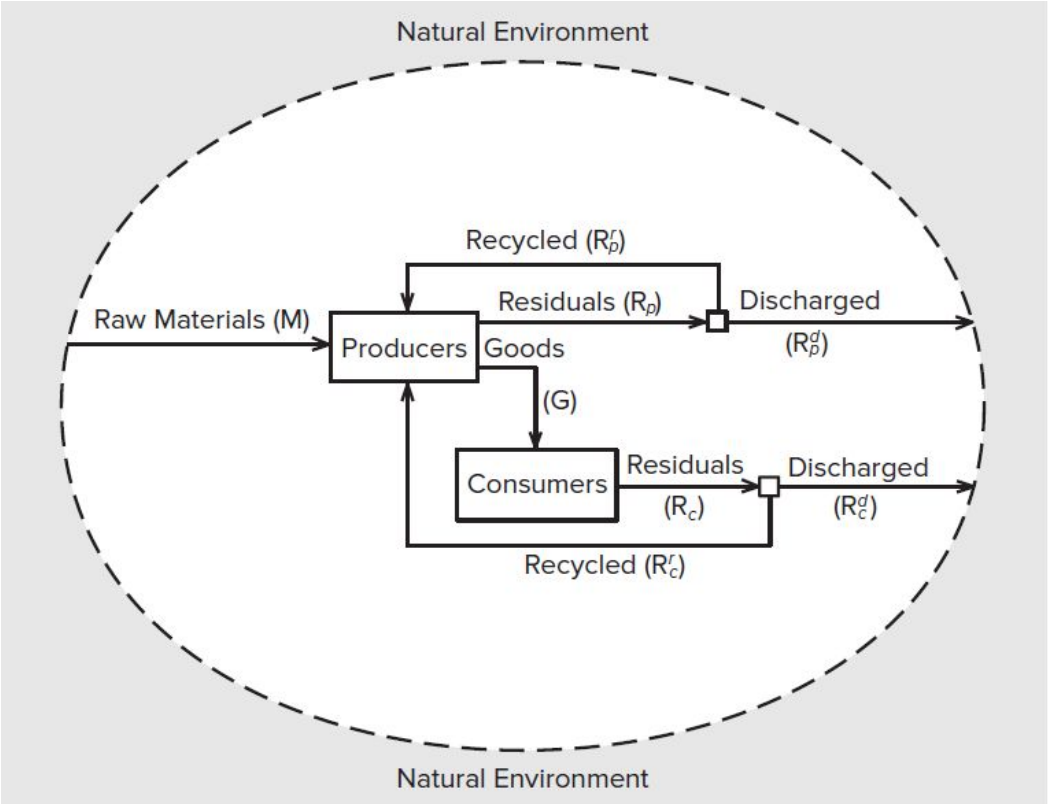


Environmental economics: economy and environment

Environmental management and materials/energy balance approach:

$$R_p^d + R_c^d = M = G + R_p - R_p^r - R_c^r$$

The fundamental materials/energy balance equation must hold in the long run. This shows us something very fundamental: **to reduce the mass of residuals disposed of in the natural environment, it is necessary to reduce the quantity of raw materials taken into the system.**



Natural resource economics

The study of nature in its role as provider of raw materials is called natural resource economics.

In modern industrial/urban societies, it is sometimes easy to overlook the fact that a large part of total economic activity still relies on the extraction and utilization of natural resources.

Natural resource economics is the application of economic principles to the study of these activities.

Mineral economics

Forest economics

Marine economics

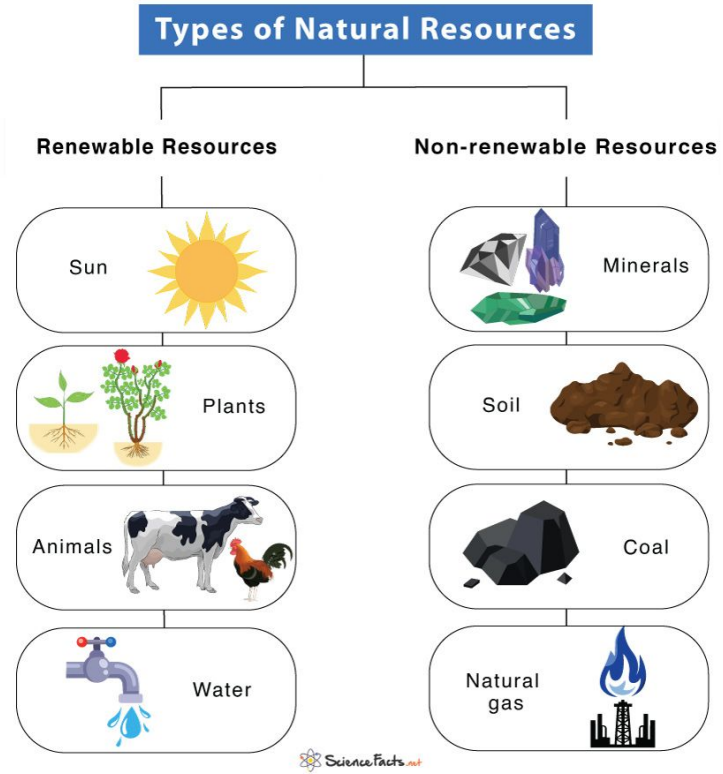
Land economics

Energy economics

Water economics

Agricultural economics

Natural resource economics: **types of resources**



Resource scarcity

Scarcity is the universal economic problem. Resource scarcity refers to the limited availability of essential goods and services relative to the demand for them.

This scarcity can arise due to various factors, including natural limitations, such as finite reserves of minerals or water, environmental degradation, population growth, and inefficient resource allocation.

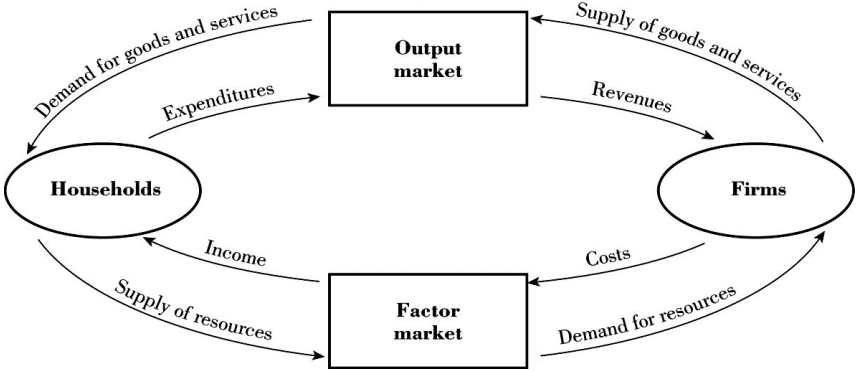
Choice: in a world of scarcity, we cannot attain the satisfaction of all our material needs completely. Hence, we need to make choices and set priorities.

Opportunity cost: Every choice we make has a cost associated with it; one cannot get more of something without giving up something else.

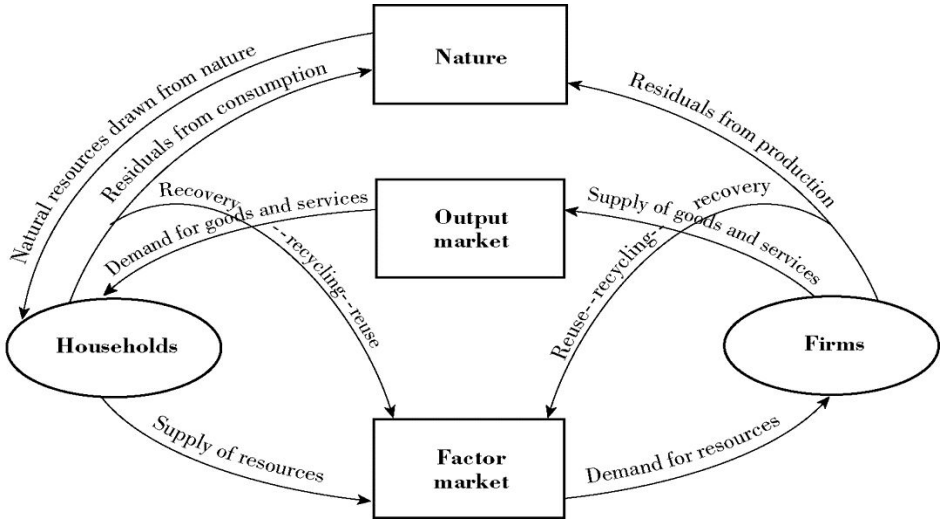
Efficiency: In the presence of scarcity, no individual or society can afford to be wasteful or inefficient. The objective is, therefore, to maximize the desired goods and services that can be obtained from a given set of resources.

Social institutions: In the presence of scarcity, therefore, the allocation and distribution of resources always cause conflicts. To resolve these conflicts in a systematic fashion, some kind of institutional mechanism(s) needs to be established.

Traditional economics versus environmental economics



Circular flow model (TE)



Material balance model (EE)

Traditional economics (TE) versus environmental economics (EE)

- TE does not deal with the interaction between environment and economic activities which **EE does**.
- TE deals with private goods that are bought and sold in markets. **EE deals with public or collective goods with no or imperfect markets.**
- TE is not concerned with externalities but **EE does deal with externalities.**

The neoclassical economic perspective

In early neoclassical growth models is the absence of land, or any natural resources, from the production function used in such models.

Classical limits-to-growth arguments, based on a fixed land input, did not have any place in early neoclassical growth modelling. **The introduction of natural resources into neoclassical models of economic growth occurred in the 1970s, when some neoclassical economists first systematically investigated the efficient and optimal depletion of resources.**

For example: The efficient and optimal use of natural resources, The theory of optimal resource extraction: non-renewable resources, renewable resources, forest resources.

In 1931, Hotelling published a seminal paper titled "The Economics of Exhaustible Resources," in which he analyzed the optimal extraction of non-renewable resources such as minerals, oil, and gas.

Martin L. Weitzman, an American economist, in 1970s, In his paper titled "Optimal depletion of an exhaustible resource under uncertainty" extended Hotelling's framework to analyze optimal extraction paths for non-renewable resources under conditions of uncertainty.

Fundamental concepts

Ambient quality: Ambient refers to the surrounding environment, so ambient quality refers to the quantity of pollutants in the environment, for example, the concentration of SO2 in the air over a city or the concentration of a particular chemical in the waters of a lake.

Which lake has a better ambient?

Fundamental concepts

Environmental medium: Broad dimensions of the natural world that collectively constitute the environment, usually classified as land, water, and air.
Environmental quality: A term used to refer broadly to the state of the natural environment. This includes the notion of ambient quality and such things as the visual and aesthetic quality of the environment.

Which lake has a better environment?

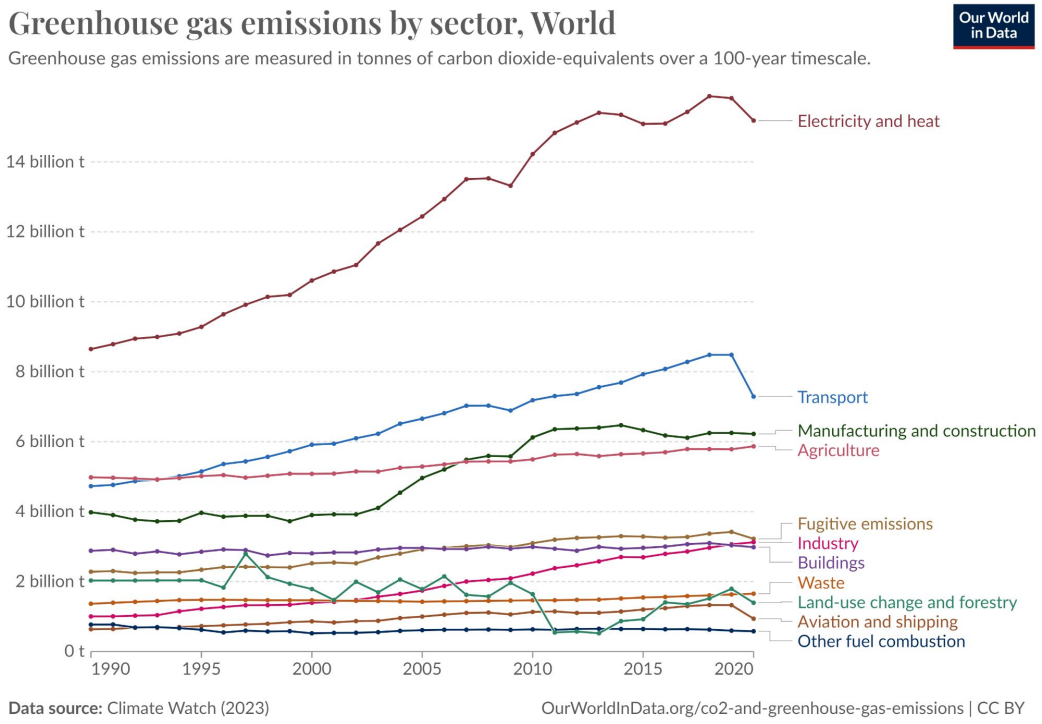
Fundamental concepts

Residuals: Material that is left over after something has been produced. A plant, for example, takes in a variety of raw materials and converts these into some product. Materials and energy left after the product has been produced are production residuals. Consumption residuals are whatever is left over after consumers have finished using the products that contained or otherwise used these materials.

Fundamental concepts

Emissions: The portion of production or consumption residuals that is placed in the environment, sometimes directly, sometimes after treatment.

Source: The location at which emissions occur, such as a factory, an automobile, or a leaking landfill.



Fundamental concepts

Recycling: The process of returning some or all of the production or consumption residuals to be used again in production or consumption.

Fundamental concepts

Pollutant: A substance, energy form, or action that, when introduced into the natural environment, results in a lowering of the ambient quality level. We want to think of this as including not only the traditional things, such as oil spilled into oceans or chemicals placed in the air, but also activities, such as certain building developments, that result in “visual pollution.”

Fertilizer runoff

Oil spill in the ocean

Polluted city

Fundamental concepts

non cumulative pollutant is noise; as long as the source operates, noise is emitted into the surrounding air, but as soon as the source is shut down, the noise stops.
cumulative pollutant is plastics that accumulate in the environment in nearly the same amounts as they are emitted.

Noise pollution and the degradation of the visual environment are **local** in their impacts; the damages from any particular source are usually limited to relatively small groups of people in a circumscribed region.
Acid rain is a **regional** problem; emissions in one region of the United States (and of Europe)
affect people in other parts of the country or region. The ozone-depleting effects of chlorofluorocarbon emissions from various countries work through chemical changes in the earth's stratosphere, which means that the impacts are truly **global**.

Pollution sources differ in terms of the ease with which actual points of discharge may be identified. Municipal waste treatment plants normally have a single outfall from which all of the wastewater is discharged. These are called **point-source pollutants**.
There are many pollutants for which there are no well defined points of discharge. Agricultural chemicals, for example, usually run off the land in a dispersed or diffused pattern, there is no single pipe or stack from which these chemicals are emitted. This is a **nonpoint-source type of pollutant**.

Emissions from electric power plants or municipal waste treatment plants are more or less **continuous**. Many pollutants are emitted on an **episodic** basis, however. The classic example is accidental oil or chemical spills.

Fundamental concepts

Pollution: Some people might say that pollution results when any amount, no matter how small, of a residual has been introduced into the environment. Others hold that pollution is something that happens only when the ambient quality of the environment has been degraded enough to cause some damage.
Damages: The negative impacts produced by environmental pollution on people in the form of health effects, visual degradation, and so on, and on elements of the ecosystem through disruption of ecological linkages, species extinctions, and so forth.



End of Chapter 1