HS 229: Environmental Economics

Mrinal Kanti Dutta (**mkdutta@iitg.ac.in**)
Dept. of Humanities and Social Sciences, IIT Guwhati

The Economy and the Environment

Environmental Economics

- Concerned with the impact of economy on environment, significance of the environment to the economy, and the appropriate way of regulating economic activity for achieving balance among environmental, economic and other social goals

- Essence of environmental problem is the economy -producer behaviour and consumer desires

The Economy and the Environment

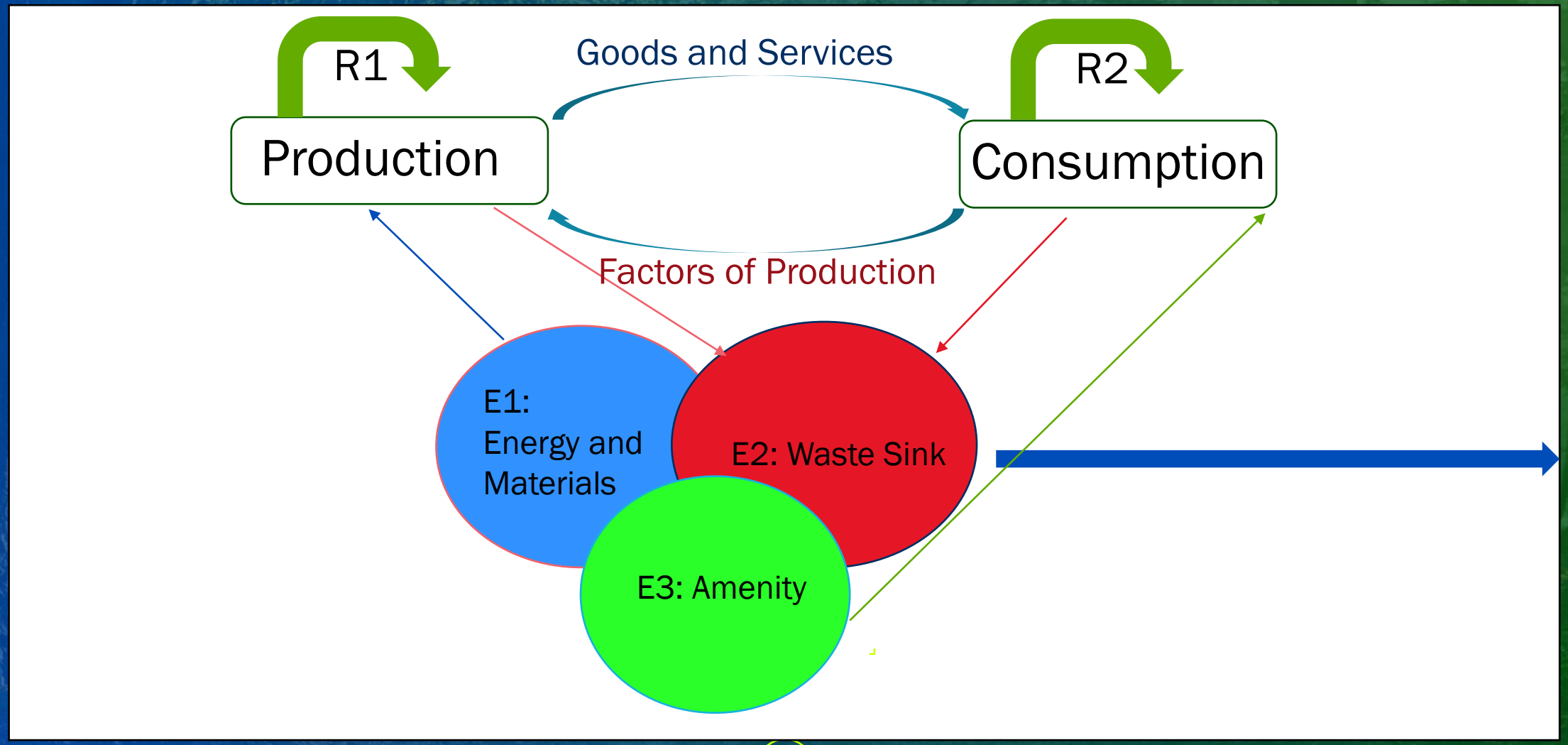
- Economy: Population of economic agents, the institutions they form (firms, government) and the interlinkages between agents and institutions (markets)
  - All the firms that make up industry
- Environment: the biosphere, the atmosphere, all flora and fauna
  - Includes life forms, energy and material resources, the stratosphere and troposphere
  - All natural resources, including land, land cover and ecosystems

The Economy and the Environment

- The constituent parts of environment interact with each other
- Effects of human activity on the environment, and the consequences of these affects on human well being
  - Generation of electricity
  - Agricultural support policy

- The economy operates from inside the environmental system, with conditions in the two systems being simultaneously determined
- Many links between the two systems

Economy-Environment Interaction



Linkage between the Economy and the Environment

- Environment provides inputs of raw materials and energy sources
- Waste sink for the economy
- Direct source of amenity to the environment
- Basic life support services
  - Climate regulation, operation of water cycle, regulation of atmospheric composition and nutrient cycling

Role of Environment as a Waste Sink

- May result from production or consumption
- In some cases, wastes are biologically or chemically processed
- ‘Assimilative capacity’ for the wastes
- For some inputs, no natural process to transform them into harmless substances
- Cumulative and conservative pollutants
  - Examples- Metals, DDTs, PCBs

Role of Environment as a Waste Sink

- For cumulative pollutants, the stock in any period t* is-

$$S_{t^*}^{c} = \sum_{t_o}^{t=t^*} F_t \text{----------} \rightarrow (2)$$

F_t= Flow of pollutants

- For degradable pollutants, the stock in any time period *'t'* is given by-

$$S_t^{a} = F_t - A_t \text{----------} \rightarrow (1)$$

A=Amount assimilated in any period

Role of Environment as Amenity Provider

- Amenities - the economic value
- Economic value dependent on social well-being
- Social welfare is the sum total of individual utilities

  $U_j = U(X_1, X_2, \ldots, X_n; Q_1, Q_2, \ldots, Q_m)$

  U_j=Utility; X=Goods and services; Q= Env. Assets
- Trade off between different uses of the environment

Role of Environment as Amenity Provider

- If $U_j = U(X_1, X_2, ..., X_n; Q_1, Q_2, ..., Q_m)$
  U_j=Utility; X=Goods and services; Q= Env. Assets
- Let Q1 be local air quality, Q2: Water Quality,.....
- X1: consumption of services provided by owning a car
- An increase in consumption of car services increases utility ($\delta Uj/\delta X1>0$)
- But this increase in car use decreases air quality ($\delta Q1/\delta X1<0$)
- This fall in air quality reduces utility by an amount ($\delta Uj/\delta Q1 * \delta Q1/\delta X1$)
- The net effect is thus ambiguous

Conflicts in Resource Use/Trade-offs

- Using a mountain region for extracting minerals versus using for amenities
- Using a river as a waste-disposal unit and provider of amenity
- Felling a forest for timber and electricity generating capacity of a dam
- Preserving a wetland for its aesthetic qualities and availability of drained land for agriculture
- An increase in the use of environment as a waste sink may reduce the ability to supply basic life support

Conflicts in Resource Use/Trade-offs

- Environment is a scarce resource- many conflicting demands placed on it
  - Relative vs. absolute scarcity
  - Absolute scarcity from economic growth

- Role of economics and price system
  - Market (Success/Failure)

Global Life Support Services

- Maintenance of an atmospheric composition suitable for life
- Maintenance of temperature and climate
- Recycling of water and nutrients
  - Hydrological, carbon and oxygen cycles

The First Law of Thermodynamics: Materials Balance Principle

"Matter, like energy, can neither be created nor be destroyed"

Implications:

- As more matter is extracted by the production process, more waste is generated
- Puts limits on the degree to which resources can be substituted

The Second Law of Thermodynamics: Entropy Law

"In a closed system, the use of matter-energy causes a one way flow from low entropy resources to high entropy resources; from order to disorder."

Implications:

- Energy can not be recycled in such a way that we get back all the capacity of the original energy source
- Helps in understanding the limits of matter-energy recycling

Texts:

N. Hanley, J. F. Shogren and B. White, *An Introduction to Environmental Economics,* Oxford University Press, 2001

N. Hanley, J. F. Shogren and B. White, *Environmental Economics: In Theory & Practice,* 2nd Revised edition, Palgrave MacMillan, 2006

THANK YOU!