

EE475: Natural Resource Economics

## Introduction (2)

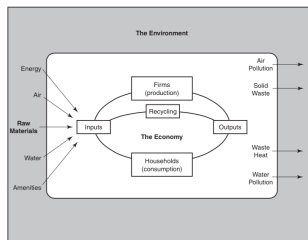
16th January 2015  
by  
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## Outline

- Range of services from natural resources
- Role of Economics
  - Differences between Natural Resource Economics, Ecological Economics, and Common-pool resource studies
- Sustainability and Scarcity
- Bonus slides

## Range of services from natural resources

- From last time, we see how natural resource contributes to the economy through the framework Environment as an asset.



How can we systematically  
classify services from  
natural resources?

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### Range of services from natural resources

- One way to classify is through values of the natural resources that human perceive.
- 2 Types of Value (Field 2008)
  - **Use Value:** implying that some attributes of nature are being utilized in some sense.
  - **Nonuse Value:** values expressed by human being simply for the existence of natural resources.

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### Range of services from natural resources

- With use values, natural resources can be classified into 2 types (Field 2008)
  - **Extractive resources:** Natural resources that are subject to some process of physical removal from their natural surrounding and perhaps physical transformation during their use.
  - **Non extractive resources:** Natural resources that yield valuable services without being removed from their natural setting.

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### Range of services from natural resources

|                         | Natural resource products and services |                |
|-------------------------|----------------------------------------|----------------|
| Natural resource        | Extractive                             | Non extractive |
| Minerals                |                                        |                |
| Forests                 |                                        |                |
| Land                    |                                        |                |
| Plants                  |                                        |                |
| Terrestrial animals     |                                        |                |
| Fisheries               |                                        |                |
| Water                   |                                        |                |
| Meteorological Services |                                        |                |

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### Range of services from natural resources

|                         | Natural resource products and services                      |                                                                                      |
|-------------------------|-------------------------------------------------------------|--------------------------------------------------------------------------------------|
| Natural resource        | Extractive                                                  | Non extractive                                                                       |
| Minerals                | Fuel / nonfuel                                              | Geological service (weathering)                                                      |
| Forests                 | Forest products (timber)                                    | Recreation (Backpacking) Ecosystem protection (flood control, CO2 Sequestration)     |
| Land                    | Fertility                                                   | Space, scenic values                                                                 |
| Plants                  | Food and Fiber, Biodiversity products (medicinal plants)    |                                                                                      |
| Terrestrial animals     | Food and Fiber, Biodiversity products (Genetic Variability) | Recreational services(bird watching, ecotourism)                                     |
| Fisheries               | Food                                                        | Recreational services (recreational fishing, whale watching)                         |
| Water                   | Municipal and industrial supplies, irrigation               | Recreation (boating)                                                                 |
| Meteorological Services | Energy source (geothermal)                                  | Energy sources (solar), Global Radiation Balances, Radio spectrum, Natural Disasters |

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### Can you classify these use goods and services using economics framework?

|                              | Excludable              | Non-Excludable (or difficult to exclude) |
|------------------------------|-------------------------|------------------------------------------|
| Rival (Subtractable)         | Private Goods           | Common-pool resources                    |
| Non-rival (Non-subtractable) | Club goods (Toll goods) | Public goods                             |

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## Range of services from natural resources

- 2 types of nonuse values
  - **Option value** - The existence of the natural resource is valuable because of its prospect for future use.
  - **Bequest value** - The existence is valuable because people want to leave a healthy ecosystem to future generation.

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## Modeling resource services

- Natural resource management decisions are complex because they involve connections and trade-offs between the present and the future.
- In period 0,
  - There is a certain quantity of resource available
  - The resource is "used" in some amount.
  - The resource may replenish or increase in some amount (growth of the resource), which depends on the type of resource.
- These factors contribute to the availability of resource in period 1.

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## Modeling resource services

Amount of resource available in period 1 ( $S_1$ ) = Amount of resource available in period 0 ( $S_0$ ) - Amount of resource used in period 0 ( $Q_0$ ) + Increment to the resource in period 0 ( $\Delta S$ )

$$S_1 = S_0 - Q_0 + \Delta S$$

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## What are the models of these types of resources?

- Nonrenewable Resources ?
- Renewable Resources (nonaccumulating) ?
- Renewable Resources (accumulating) ?
- Recyclable Resources ?

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## Role of Economics

- Economic analysis provides sets of tools to **understand** and **modify** human behavior, especially when facing scarcity.
- Many resource problems fall between **microeconomics** and **macroeconomics**, and make use of both.
- [Review] What is the difference between **Positive** and **Normative** economics?

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## Role of Economics

- Economics uses 'model' to explain reality.
  - Model simplifies real world situation, which means only some variables are included and others are left out.
  - If a model is changed, the conclusion drawn from it will change.
  - It makes sense to be sceptic about the use of economic model.
  - Nonetheless, most economic models are verified by empirical research using tools from "Econometrics" and recently "Experimental Economics".

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## Role of Economics

- When evaluating performance of natural resource-using individuals and firms and of public agencies pursuing natural resource management policies, the followings are the ones of the important criteria.
  - Economic Efficiency
  - Equity
  - Sustainability
- Because natural resource problems and policies may involve several levels of society, it is important to be clear at which level are we talking about.

## Differences between related fields studying natural resource issues

- **Natural resource economics:**
  - Methodology: Neoclassical economics.
  - Tend not to include ecological dynamics into the analysis as endogenous factor.
- **Ecological economics:**
  - Methodology: pluralist
  - Tend to include ecological dynamics into the analysis as endogenous factor.
- **Common-pool resource studies**
  - Methodology: pluralist
  - Proposing that mechanism for managing natural resources is not necessarily market or state. Resource users can formulate an institution, enforce it, and achieve sustainable use of the resource.

## Sustainability and Scarcity

- What is sustainability?
  - The endurance of systems and processes
- Definition of Sustainable Development
  - “*Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs*” – The Brundtland Report (1987)

## Sustainability and Scarcity

- Strong Sustainability
  - The Pigovian doctrine: curtailing the flow of negative by-products from production through the use of charges.
  - Series of activities must be arranged in order to eliminate all negative impacts.
  - The cumulative negative impact is zero in the long run.
  - Once certain practices are corrected, things will remain in a *steady state* into the indefinite future.

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## Sustainability and Scarcity

- Weak sustainability
  - Based on Solow's constant-consumption model
  - Society's consumption remains in a steady state while its pattern of input use is changing.
  - 5 kinds of capital: Natural, Financial, Produced, Human, and Social
  - While stock of one capital (for example, natural capital) is depleted, other kinds must be developed or increased in order to maintain the society's consumption.

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## Sustainability and Scarcity

- What are the pros and cons for each type of sustainability in your opinion?
- Which type of sustainability do you prefer?
- Which type of sustainability do you think possible?

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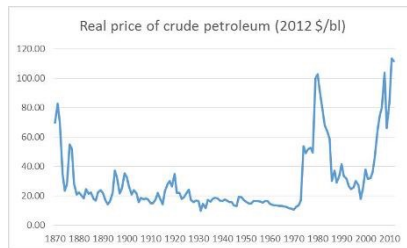
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## Sustainability and Scarcity

- To know whether we are on a sustainable path, we have to monitor the stocks, consumptions and production flows, price of natural resources etc.
- Measurements of **natural resource scarcity** are used as **indicators for sustainability**.
- Indicators
  - Changes in the Real Price of Resources
  - Costs of Discovering New Supplies of Resources

## What do you see?



Price of a barrel of oil measured in 2012 dollars, 1870-2012. Data source: [BP Statistical Review of Energy](#).

Source of the figure: James Hamilton (2014). "Commodity Prices and resource scarcity". [oilprice.com](#), June 2nd 2014. Accessed January 6th, 2015.  
<http://oilprice.com/Energy/Energy-General/Commodity-Prices-and-Resource-Scarcity.html>