ENVIRONMENTAL ECONOMICS

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Economics of Natural Resources

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- Resources are broadly classified under two categories:

  Renewable and Non- Renewable (depletable) Resources

- Non-renewable resources are those which remain on the earth in different form after use and can not be reconstituted in to their original form after use

- These resources, after use if not recycled properly become a waste material

Economics of Natural Resources

- On the other hand, resources are renewable when they can be replenished after use and can be sustained if natural flow of the resources is maintained

- Discussion of resources and their use is important because in the pursuit of development available resources are nearly over exploited

- Therefore, their efficient use and allocation is highly significant for attaining sustainable development

- However, understanding the conditions of efficient allocation of both the types of resources requires understanding of resource taxonomy and the distinction between categories of resources - depletable and renewable and issues emerging from these distinction

Resource Taxonomy:

- Three separate concepts are used to classify the stock of depletable resources:
  - current reserves,
  - potential reserves, and
  - resource endowment

- The US Geological Survey (USGS) has developed a classification system of resources which has two dimensions, namely, economic and geological.

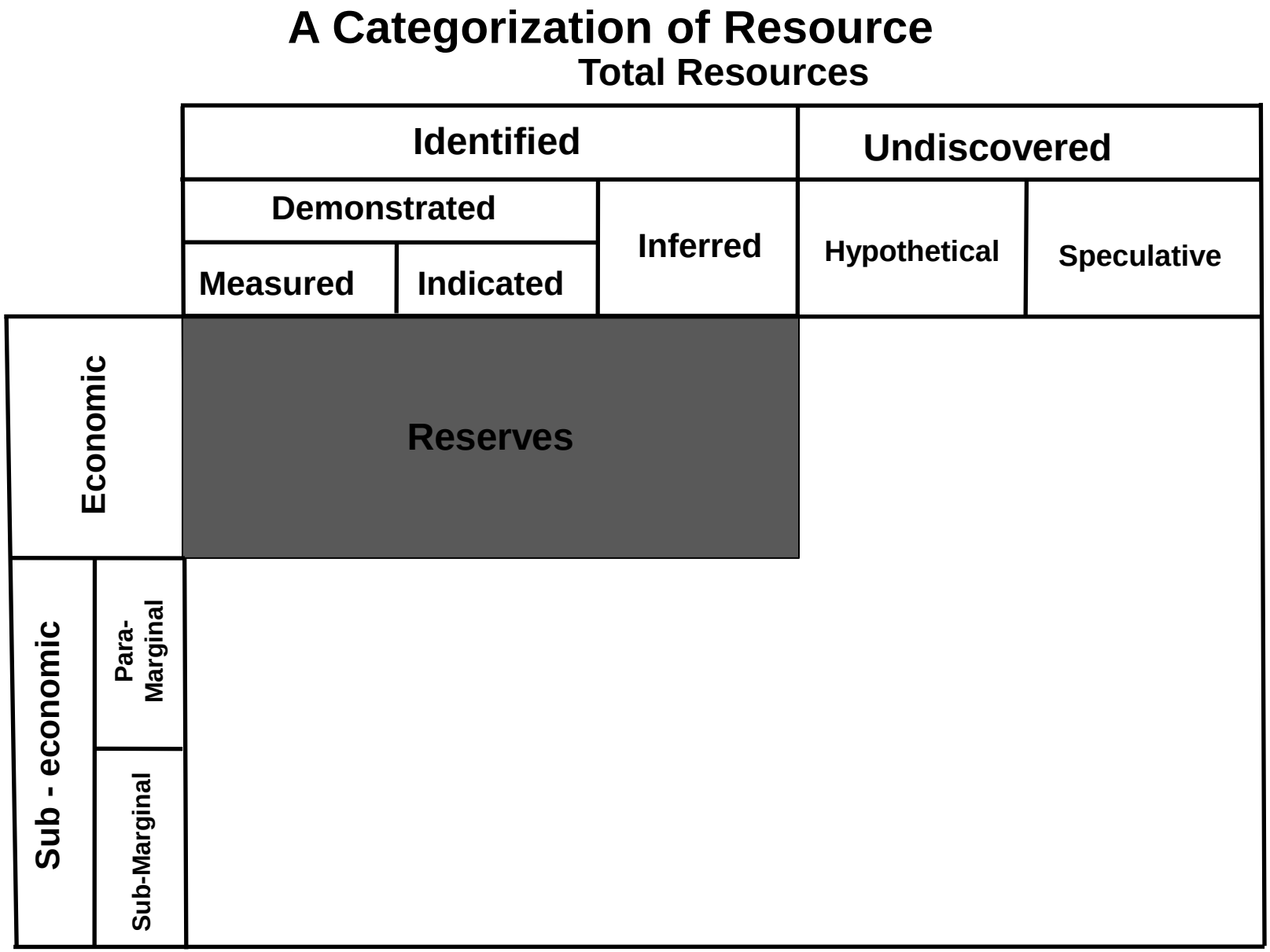
A Categorization of Resource
Total Resources
Identified
Undiscovered
Demonstrated
Inferred
Hypothetical
Speculative
Measured
Indicated
Economic
Reserves
Sub - economic
Para-Marginal
Sub-Marginal

Figure 1

Resource Taxonomy

- A movement, in the figure 1 from top to bottom represents movement from cheaply extractable resources to those extracted at substantially higher prices

- By contrast, a movement from left to right represents increasing geological uncertainty about the size of the resource base

Resource Taxonomy

- ***Current reserves:*** (shaded area in the figure - 1) known resources that can profitably be extracted at current prices. Magnitude of current reserve can be expressed as a number

- ***Potential reserves:*** resources that can be extracted at the prices people are willing to pay for these resources – the higher the price higher is the potential reserves

Resource endowment: represents the natural occurrence of resources in the earth's crust and independent of prices.

- This concept is more geological rather than the economic

- This concept is important because it places an upper limit on the availability of terrestrial resources.

Meaning the terms used in the Figure-1:

- *Identified resources*:
  specific bodies of mineral–bearing material whose location, quality and quantity are known from geological evidence and supported by engineering measurements

- *Measured resources*:
  material for which quantity and quality estimated are within a margin of error less than 20 percent, from geologically well known sample sites

- *Indicated resources*: material of which quantity and quality have been estimated partly from sample analyses and partly from reasonable geological projections

- *Inferred resources*: material in unexplored extensions of demonstrated resources based on geological projections

- *Undiscovered resources*: unspecified bodies of mineral bearing material surmised to exist on the basis of broad geological knowledge and theory

- *Hypothetical resources*: undiscovered materials reasonably expected to exist in a known mining district under known geological conditions.

- *Speculative resources*: undiscovered materials that may occur in either known types of deposits in favorable geological settings where no discoveries have been made or in yet unknown types of deposits that remain to be recognized

Distinction between two categories of resources:

- The first category of resources includes all depletable, recyclable resources, such as copper
- A depletable resource is one for which the natural replenishment feedback loop can be safely ignored
- The rate of replenishment for these resources is so low that it does not offer a potential for augmenting the stock in any reasonable time frame

Distinction between two categories of resources:

- A recyclable resource is one which although currently being used for some particular purpose, exists in a form allowing its mass to be recovered once that purpose is no longer necessary or desirable

- The current reserves of a depletable, recyclable resource can be augmented by economic replenishment as well as by recycling

- Stimulant of economic replenishment includes: price and technological progress.

Distinction between two categories of resources:

- Another side of the depletable resources is that their potential reserves can be exhausted owing to demand for and durability of the products built with the resource, and the ability to reuse the products
- Higher prices tend to reduce demand for the product (except for price inelastic products)
- Durable products last longer, reducing the need for newer ones
- Reusable products provide a substitute for new products

Distinction between two categories of resources:

- For some resources, the size of potential reserve depends explicitly on our ability to store the resource.
  - e.g. helium.

- Not all depletable resources permit recycling or reuse
  - e.g. coal, oil and gas are consumed as they are used
  - Once combusted and turned into heat energy, the heat dissipates in to the atmosphere and becomes non-recoverable

- Endowment of depletable resource is of finite size
- Current use of depletable, non-recyclable resources preclude future use
- Recycling and reuse make the useful stock last longer, all other things being equal
- 100% recycling of recyclable resources is not possible
- Even if most of them are recyclable (e.g. copper) the theoretical upper limit on recycling is less than 100 percent

- **Renewable Resources** are differentiated from depletable resources primarily by the fact that natural replenishment augments the flow of renewable resources at a non-negligible rate

- Examples: solar energy, water, cereal grains, forest, fish, animals etc.

- Flow of these resources can be maintained perpetually

- For some renewable resources, the continuation and volume of their flow depend crucially on humans
- For example: soil erosion and nutrient depletion reduce the flow of food
- Excessive fishing reduces the stock of fish which in turn reduces the rate of natural increase of the fish population

- For other renewable resources, the flow is independent of humans

- For example: solar energy
  - Same amount is available across generations
  - The amount consumed by one generation does not reduce the amount that can be consumed by subsequent generations

- **Some renewable resources can be stored** and hence provides a valuable way to manage the allocation the resource over time.
- For example, food with proper storage can help overcome the problem of hunger (cold storage)

- Unstored solar energy

- Storage of renewable resources usually performs a different service from storage of depletable resources

- Storing depletable resources extends their economic life, on the other hand storing renewable resources can serve as a means of smoothing out the cyclical imbalances of supply and demand
- Surpluses are stored for periods when deficits may occur
  - e.g. food stockpiles, use of dams to store hydro-power

- The challenge for management of renewable resources is different from the challenge for managing depletable resources

- ***The challenge for depletable resources involves allocation of dwindling stock among generations while meeting the ultimate transition to renewable resources. In contrast, the challenge for managing renewable resources involves the maintenance of an efficient sustainable flow.***