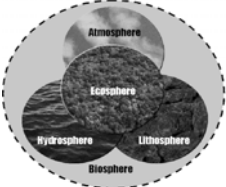


3.2.1-3.2.7 Natural Capital

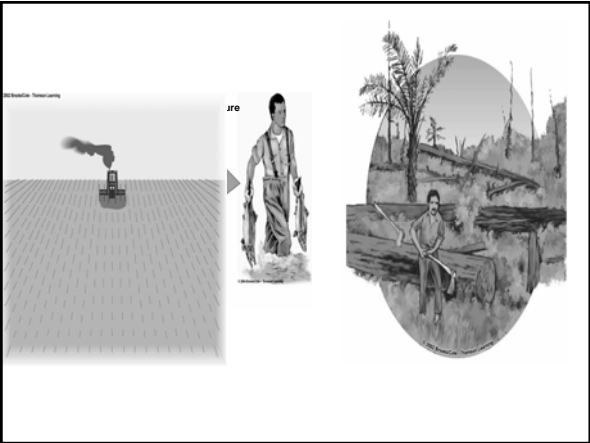
Natural Capital

includes the core and crust of the earth, the biosphere itself - teeming with forests, grasslands, wetlands, tundra, kelp forests, deserts, and other ecosystems - and the upper layers of the atmosphere.



NATURAL CAPITAL and INCOME


- What are some resources that can be considered Natural Capital?

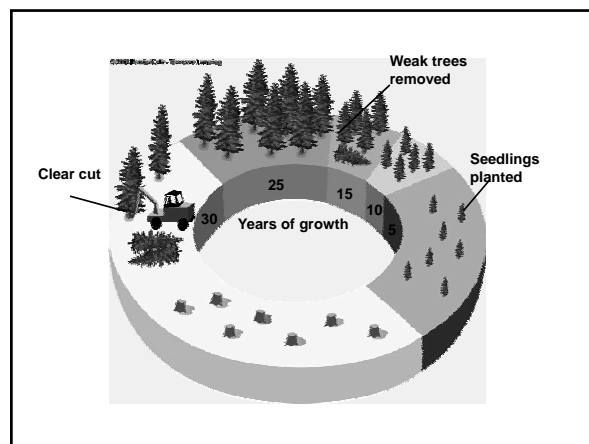
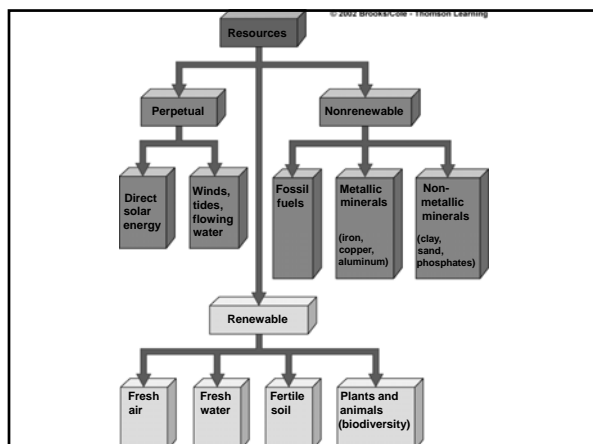


3 categories of Natural Capital

1. **Renewable** - *living* species and ecosystems which can be replaced by natural productivity (photosynthesis!) as fast as they are used (e.g. food crops, timber).
2. **Replenishable** - *non-living* resources which are can be continuously restored by natural processes as fast as they are used (e.g stratospheric ozone layer, groundwater).

3. **Non-renewable** - Resources which cannot be replenished at the same rate at which they were used.
 - Any use of these resources implies depletion of the stock.
 - e.g. fossil fuels, minerals.
 - If these resources are being depleted we must:
 - 1) improve efficiency of use
 - 2) develop substitutes or
 - 3) recycle





Through out this course you have seen that human's are not managing the world's resources sustainably:

- World's population has grown to over 6.4 billion.
- We've lost about ¼ of the world's topsoil.
- We are feeding well over twice as many people on only 80% of the agricultural fields than were being cultivated in 1950.
- Global warming is underway.
- Depletion of the stratospheric ozone layer.
- Since 1950 we have cut down about 1/3 of the forests without replacing them.
- We are driving the world's species to extinction.

SUSTAINABILITY

Development that meets the needs of the present without compromising the ability of future generations to meet their needs.



- Sustainability is the extent to which a given interaction with the environment exploits and uses the **NATURAL INCOME** without causing long term deterioration of **NATURAL CAPITAL**.
- Harvesting renewable or replenishable resources at a rate that will be replaced by natural growth.
- Long term harvest (or pollution or destruction) rate must not exceed rate of natural capital renewal.
- "Living within the means of nature"
- The depletion of essential forms of natural capital is unsustainable.

SUSTAINABLE YIELD

- Rate of increase in **NATURAL CAPITAL**.
- Amount which can be exploited without depleting the original stock or its potential to be replenished.
- Exploitation must not affect long term productivity.



CALCULATION OF SY

$$SY = \frac{\text{total biomass at time } t + 1 - \text{total biomass at time } t}{\text{energy at time } t + 1 - \text{energy at time } t}$$

or

- Gain in biomass over time through growth and recruitment (addition of individuals to the population).
- Can express as energy rather than biomass.

OR...

$$SY = \frac{(\text{annual growth} + \text{recruitment}) - (\text{annual death} + \text{emigration})}{\text{energy at time } t + 1 - \text{energy at time } t}$$

- Even with the use of the best technologies we could imagine, the productivity of Earth still has its limits, and the extent of our use of it cannot be expanded indefinitely.
- The world does not contain nearly enough resources to sustain everyone at the level of consumption that is enjoyed in the U.S., Europe and Japan.

RECYCLE



REDUCE

REUSE

REDUCE resource used.

- Consume less.
- Redesign manufacturing processes and products to use less materials and energy.
- Redesign manufacturing processes to produce less waste and pollution.
- Develop products that are easy to repair, reuse, remanufacture, compost, or recycle.
- Design products that last longer.
- Eliminate or reduce unnecessary packaging.
- Use trash taxes.

REUSE is a form of waste reduction.

- Extends resource supplies.
- Keeps high-quality matter resources from being reduced to low-quality matter waste
- Reduced energy use and pollution even more than recycling.
- Bad news is we have increasingly substituted reusable items with disposable items.

RECYCLING waste items are made into new products.

Two types of recycling

- *Primary or closed-looped:* in which waste discarded by consumers are recycled to produce new products of the same type.
- *Secondary or downcycling:* in which waste materials are converted into different and usually lower-quality products.

