# Ekologi dalam Pemanfaatan Sumberdaya Alam dan Lingkungan

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# ECOLOGY

# Ekologi, Ekonomi dan Politik

Are
about
strategic

*Eecology, studying the economy of nature -- the investigation of the total relations of the organisms both to its organic and to its inorganic environment; -- in a word, ecology is the study of all the complex interrelationships referred to by Darwin as the conditions of the struggle for existence.* Ernst Haeckel, 1870.
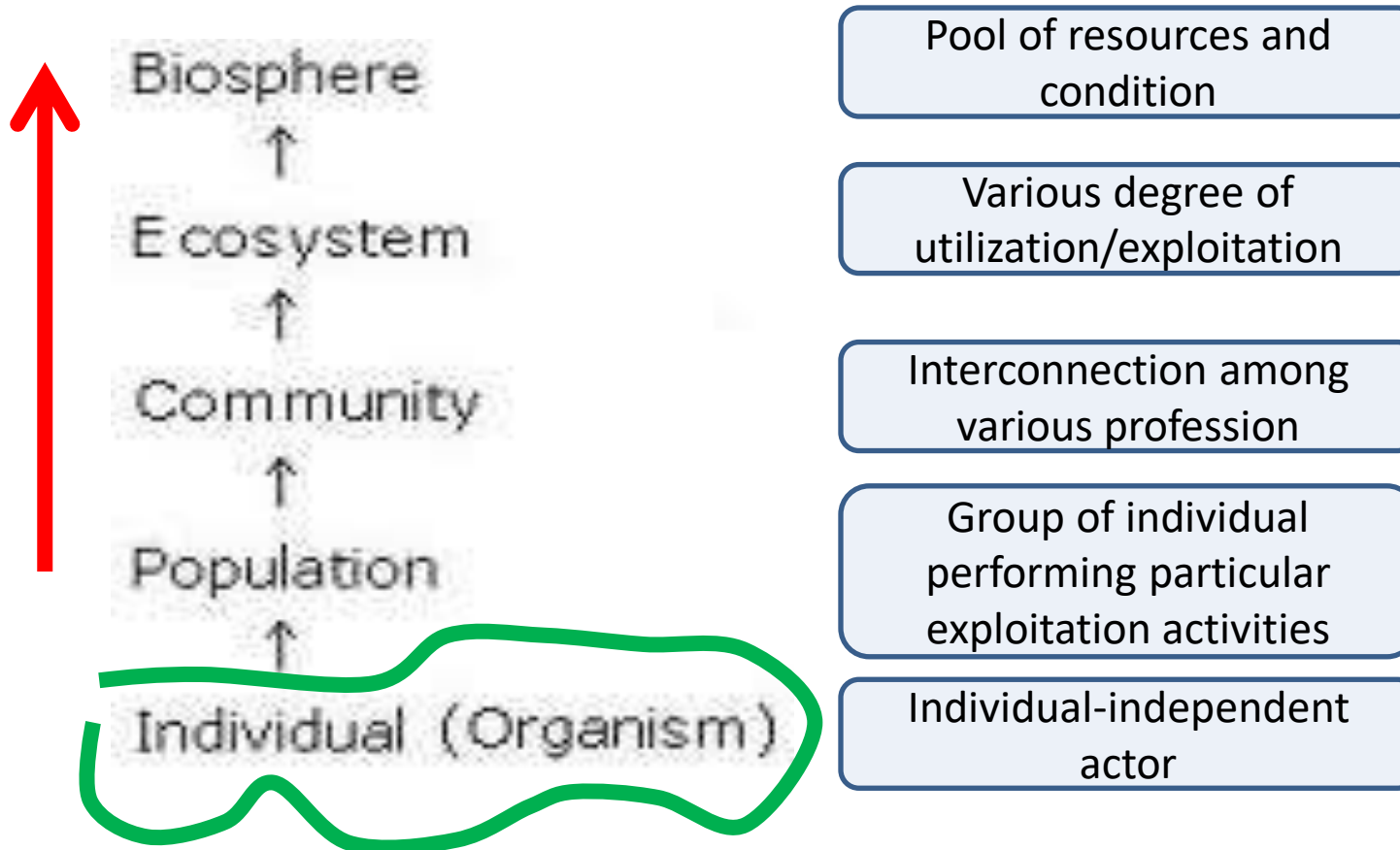
# Hierarchy

Ecology

| Ecology Hierarchy | Description |
|---|---|
| Biosphere | Pool of resources and condition |
| ↑ Ecosystem | Various degree of utilization/exploitation |
| ↑ Community | Interconnection among various profession |
| ↑ Population | Group of individual performing particular exploitation activities |
| ↑ Individual (Organism) | Individual-independent actor |

# Organism: Important Concepts

- **Adaptability**: adaptability refers to ability to change something or oneself to fit to changes.

# Ecology

Biosphere

↑
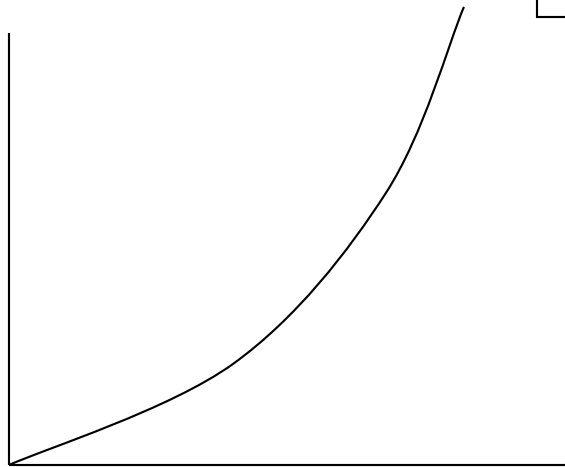
Ecosystem

↑

Community

↑

Population

↑

Individual (Organism)
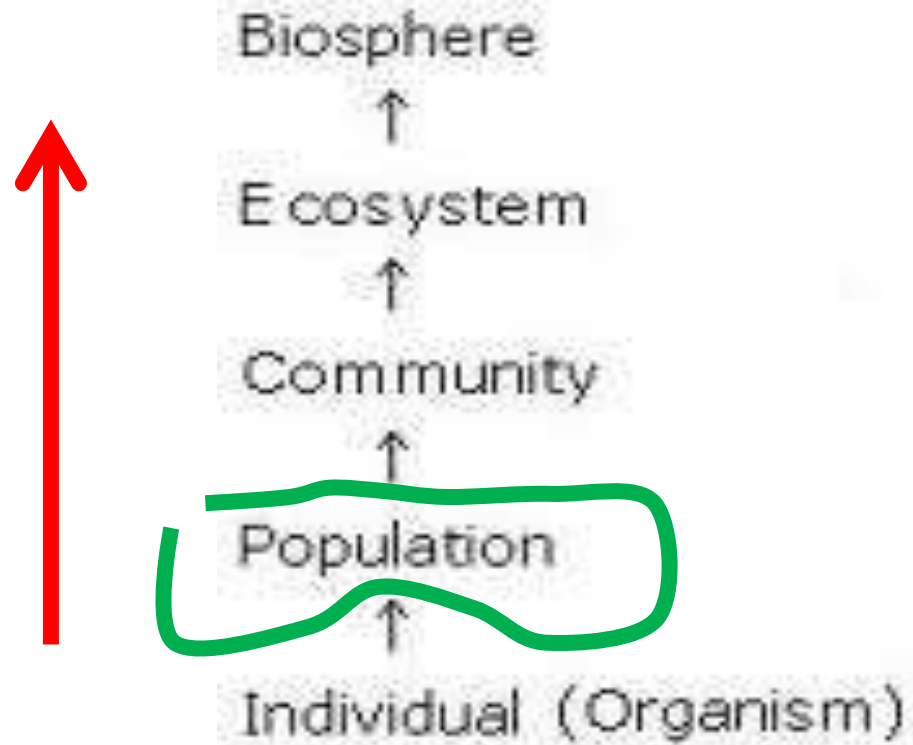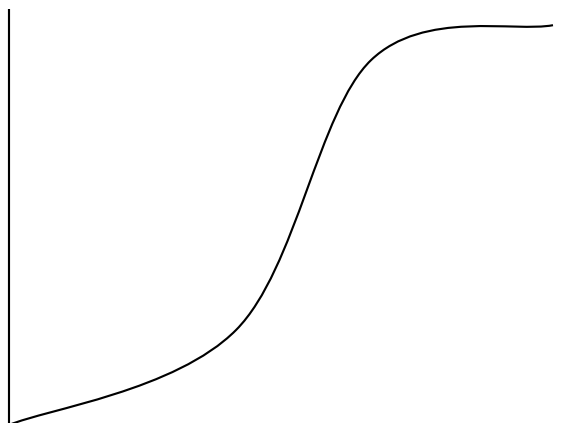
# Important concept: Carrying Capacity

- **Carrying Capacity (k):**
  - The maximum population size that can be supported by the available resources
  - There can only be as many organisms as the environmental resources can support
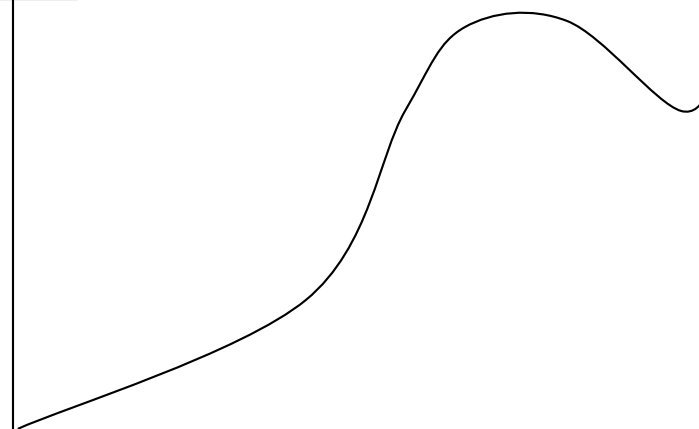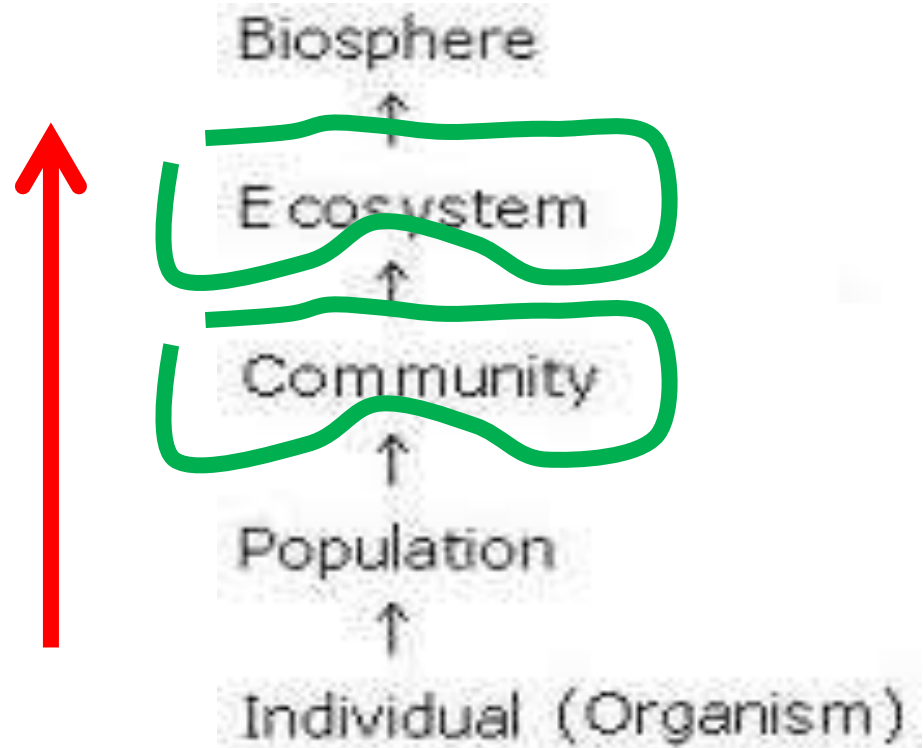
Exponensial

J -Shaped

Irruptive

logistik

# Ecology

Biosphere

↑

Ecosystem

↑

Community

↑

Population

↑

Individual (Organism)

# Principles in Community Ecology:

## Diversity-Stability

- One rationale for maintaining biodiversity is a presumed relationship between the number of species in a community and the stability of the community.

Elton's statements

1. Agricultural monocultures more prone to pest outbreaks than mixed communities

2. pest outbreaks rare in tropical ecosystems (more diverse than temperate)

# Principles in Ecology:

Stability – A system is stable if and only if the variables all return to initial equilibrium state after a perturbation (Pimm 1986) {a mathematical definition of stability}  4 components:

Resilience – speed of return to equilibrium

Persistence – the time a variable lasts before

changing to a new value

Resistance – how large a disturbance is

needed to perturb system

Variability – the normal range of values at

equilibrium

## Productivity

Gross Primary Productivity (GPP) is the rate at which an ecosystem's producers capture and store chemical energy as biomass. Net Primary Productivity (NPP) is GPP minus the rate at which producers use stored chemical energy in their biomass. This is the basic food source for all consumers. It is estimated that humans waste 27% of the world's NPP (Jones, 1997).

# The Environment and Economic

- Environment, resource and condition are assets
- Environmental issues affect, and are affected by, economic development
- Poverty and ignorance may lead to non-sustainable use of environmental resources

**TABLE 11.1**    Principal Health and Productivity Consequences of Environmental Damage

| Environmental Problem | Effect on Health | Effect on Productivity |
|---|---|---|
| Water pollution and water scarcity | More than 2 million deaths and billions of illnesses a year attributable to pollution; poor household hygiene and added health risks caused by water scarcity | Declining fisheries; rural household time and municipal costs of providing safe water; aquifer depletion leading to irreversible compaction; constraint on economic activity because of water shortages |
| Air pollution | Many acute and chronic health impacts: excessive urban particulate matter levels are responsible for 300,000 to 700,000 premature deaths annually and for half of childhood chronic coughing; 400 million to 700 million people, mainly women and children in poor rural areas, affected by smoky indoor air | Restrictions on vehicle and industrial activity during critical episodes; effect of acid rain on forests and water bodies |
| Solid and hazardous wastes | Diseases spread by rotting garbage and blocked drains; risks from hazardous wastes typically local but often acute | Pollution of groundwater resources |
| Soil degradation | Reduced nutrition for poor farmers on depleted soils; greater susceptibility to drought | Field productivity losses in range of 0.5% to 1.5% of gross national product (GNP) common on tropical soils; offsite siltation of reservoirs, river–transport channels, and other hydrologic investments |
| Deforestation | Localized flooding, leading to death and disease | Loss of sustainable logging potential and of erosion prevention, watershed stability, and carbon sequestration provided by forests |
| Loss of biodiversity | Potential loss of new drugs | Reduction of ecosystem adaptability and loss of genetic resources |

**TABLE 11.1**  (*continued*)

| Environmental Problem | Effect on Health | Effect on Productivity |
|---|---|---|
| Atmospheric changes | Possible shifts in vector-borne diseases; risks from climatic natural disasters; diseases attributable to ozone depletion (perhaps 300,000 additional cases of skin cancer a year worldwide; 1.7 million cases of cataracts) | Sea-rise damage to coastal investments; regional changes in agricultural productivity; disruption of marine food chain |

# LAYANAN EKOSISTEM/ECOSYSTEM SERVICE



Source: Millennium Ecosystem Assessment
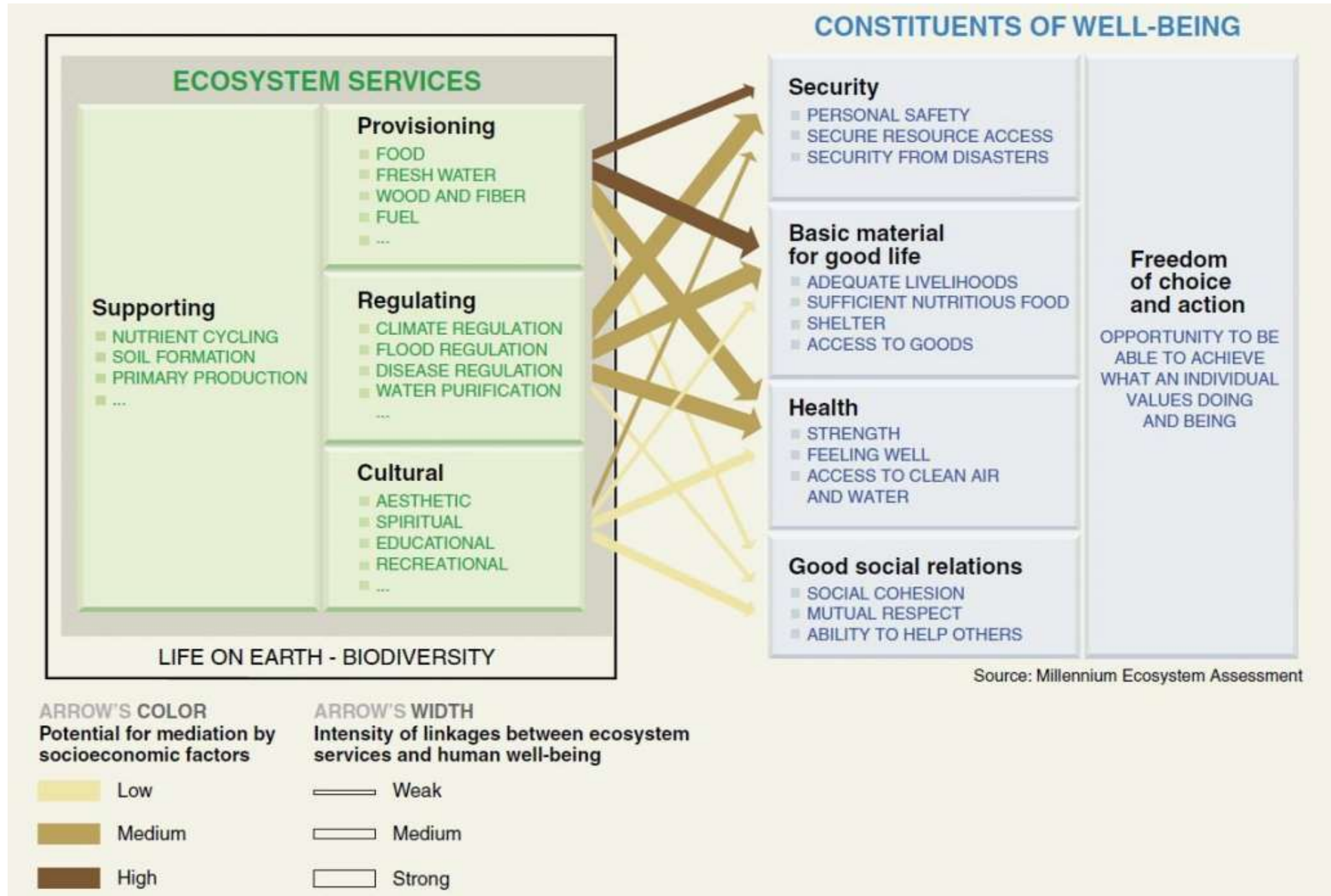
# BIODIVERSITY ECOSERVICES
## Living Planet and Human Well-Being

**PROVISIONING**
Food

**PROVISIONING**
Raw Materials

**REGULATING**
Natural Disasters

**REGULATING**
Pollination

**CULTURE**
Tourism

**PROVISIONING**
Fresh Water

**PROVISIONING**
Medicinal Resources

**REGULATING**
Waste-Water Treatment

**REGULATING**
Biological Control

**CULTURE**
Recreation and Health

**REGULATING**
Local Climate

**REGULATING**
Carbon Storage

**REGULATING**
Erosion and Fertility

**HABITAT**
Species and Ecosystems

**HABITAT**
Genetic Diversity

**CULTURE**
Spiritual Experience

**CULTURE**
Aesthetic Appreciation

Icons: Jan Sasse / TEEB
Design: Globaïa

# Layanan ekosistem

- Ecosystem functions of value to humans known as ecosystem services
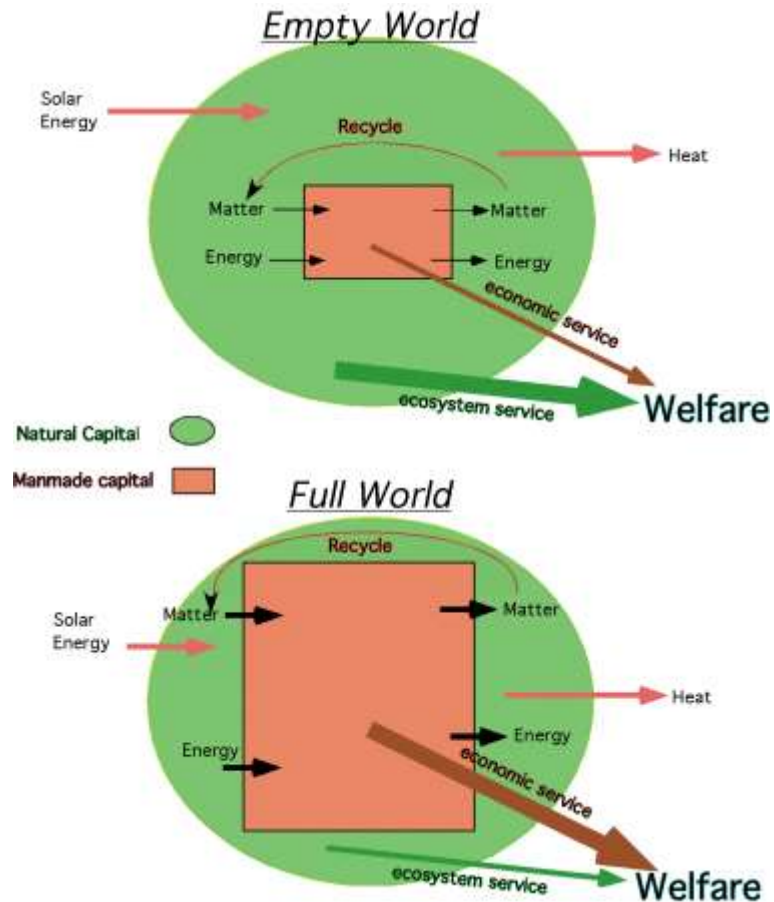- Includes life support functions

# Characteristics of Services

- Resource scarcity
- Non-market
- What risks should we impose on future generations?

# Kendali Politik dan Ekonomi



- All economic production depletes ecosystem structure
- All economic production generates waste
- Resource extraction and waste emissions necessarily degrade ecosystem services
- Ecosystem services have become the scarcest resources

# Prinsip Pengelolaan SDA

*Fokus pada Result Chain dan Causal Chain*

- *Result Chain; Penanganan secara kuratif melalui pemanfaatan IPTEK*

- *Causal chain; penanganan pada wilayah penguatan secara kultural dan antisipatif*

# Pengembangan indikator menjadi penting
# Indicators for A Sustainable Use of Natural Resources

1. Results chain: Indicators of the state of the environment or environmental quality indicators (that indicate the state of the environment--e.g., Diversity indexes, the concentration of heavy metals in soils and pH levels in lakes).

# Indicators for A Sustainable Use of Natural Resources

## 2. Causal chain: eco-sociological indicators

Indicators for ecosystem service
are engaged between both, result
and causal chain

Christian Azar, John Holmberg *,
Kristian Lindgren (1996)

# Indicators for A Sustainable Use of Natural Resources

- Environmental pressure indicators (that Indicate human activities that will directly influence the state of the environment--e.g., emission rates of toxic substances)

- Societal activity indicators (that indicate activities occurring within society--the use of extracted minerals, the production of toxic chemicals, recycling of material),

# Eco-sociological indicators:

*Prinsip 1: Substansi yang diekstrak dari lithosfer, hidrosfer, biosfer, atmosfer tidak secara sistematis terakumulasi dalam ekosfer (substances extracted from the lithosphere must not systematically accumulate in the ecosphere).*

Elements from the lithosphere must not be spread at a rate which will give rise to a systematic increase in the ecosphere. Such an increase will occur if the sum of the anthropogenic emissions and the natural flows from the lithosphere to the ecosphere (weathering processes and volcanic eruptions) exceeds the sedimentation rate and the rate of final disposal in the lithosphere. Because of the complexity and delay mechanisms of processes in the ecosphere, it is extremely hard to say what level of accumulation will cause an effect. In fact, every substance has a limit (often unknown), above which damage occurs in the ecosphere. Increasing amounts of carbon dioxide in the atmosphere, of sulphur dioxide leading to acid rain, of phosphorus in lakes and of heavy metals in soils and in our bodies are all examples of such accumulation. In practice, this principle implies restrictions on the extraction rate of metals and fossil fuels in combination with increased recycling of material and decreased dissipative use of scarce elements. It also implies substitution of abundant elements for scarce elements.
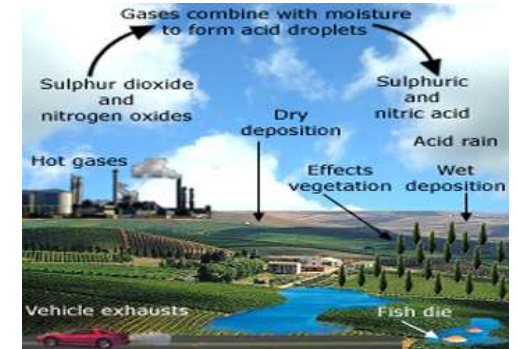
## Principle 2: societal-produced substances in from the technosphere must not systematically accumulate in the ecosphere.

In the technosphere, molecules and atomic nuclei of different kinds are produced, some of them long-lived, in amounts previously unknown to the ecosphere. If they are emitted faster than they are degraded into molecules or nuclides that can be integrated in the ecospheric cycles, and/or faster than they are removed to the lithosphere, such substances will accumulate in the ecosphere. In order to reduce the amount emitted, one can degrade substances within the technosphere or deposit them in final disposals. The principle also implies that persistence is a very important aspect of substances that are foreign to nature, and therefore there should be strong restrictions on the use of persistent substances foreign to nature.

*Principle 2: societal-produced substances must not systematically accumulate in the ecosphere.*

# Principle 3: the physical conditions for production and diversity within the ecosphere must not become systematically deteriorated.

A sustainable society must not systematically reduce the physical conditions for the long-term production capacity in the ecosphere or the diversity of the biosphere. Society must neither take more resources from the ecosphere than are regenerated nor systematically reduce natural productivity or diversity by manipulating natural systems. Deforestation, soil erosion, land degradation with desertification as an extreme form, extinction of species of plants or animals, exploitation of productive land for asphalt roads and refuse dumps, and destruction of freshwater supplies are examples of such reduction, Society is dependent on the long-term functions of the ecosystems. Even if Principle 1 and Principle 2 are fulfilled, society must be careful with its manipulation of the resource base in order to avoid a loss of the productive capacity for the supply of food, raw materials and fuel, This dependence will become more obvious when the use of fossil fuels is reduced (in accordance with Principle 1).

*Principle 4: the use of resources must be efficient and just with respect to meeting human needs.*

The assimilative capacity as well as the available resource flows are limited. In order to fulfil human needs for a growing global population, the resources and services obtained from nature must be used efficiently within the society. Socially, efficiency means that resources should be used where they are needed most. This also leads to the requirement of a just distribution of resources among human societies and human beings.

# DISKUSI

1. Mempelajari semua materi dan jurnal yang disampaikan
2. Membuat resume mengenai Ekologi dalam Pemanfaatan Sumberdaya Alam dan Lingkungan
3. Memberikan review singkat tentang isi jurnal yang disampaikan
4. Dikerjakan dalam 1 file
5. Waktu mengerjakan satu minggu
6. Output diupload di spade (https://spada.uns.ac.id/)
7. Untuk backup, juga diupload ke http://gg.gg/PSDAL_PSAIN2020, untuk backup