Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and informational value

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Ecology, Ecosystem and Biodiversity

- **Ecology** is defined as the study of interrelationship of different organisms with each other and with their environment.
- **Ecosystem** refers to the system resulting from the interaction of all the living and non living factors of the Environment. There are many examples of ecosystems - a pond, a forest, an estuary, a grassland. Various types of Ecosystem
- **Biodiversity** is the biological variety and variability of life on Earth. It includes **diversity within and among species and ecosystems**. Biodiversity is a measure of variation at the **genetic**, **species**, and **ecosystem level**.

Ecosystem Service

- Ecosystem services are the many and **varied benefits to humans provided by the natural environment and from healthy ecosystems**

Ecosystem Services

- **Ecosystems and human well-being: a framework for assessment. Millennium Ecosystem Assessment 2003,** World Resources Institute, identified four major categories of ecosystem services:
  1. **Provisioning services**
  2. **Regulating services**
  3. **Cultural services**
  4. **Supporting services**

- Changes in biodiversity can influence the supply of ecosystem services.
- Biodiversity, as with ecosystem services, must be protected and sustainably managed.

1. Provisioning Services

- **Provisioning services** are the material benefits people get from ecosystems and nature
- Fruits, vegetables, trees, fish, and livestock are available to us as direct products of ecosystems.
- Along with food, other types of provisioning services include drinking water, timber, wood fuel, natural gas, oils, plants that can be made into clothes and other materials, biochemicals, genetic resources and medicinal benefits.

2. Regulating Services

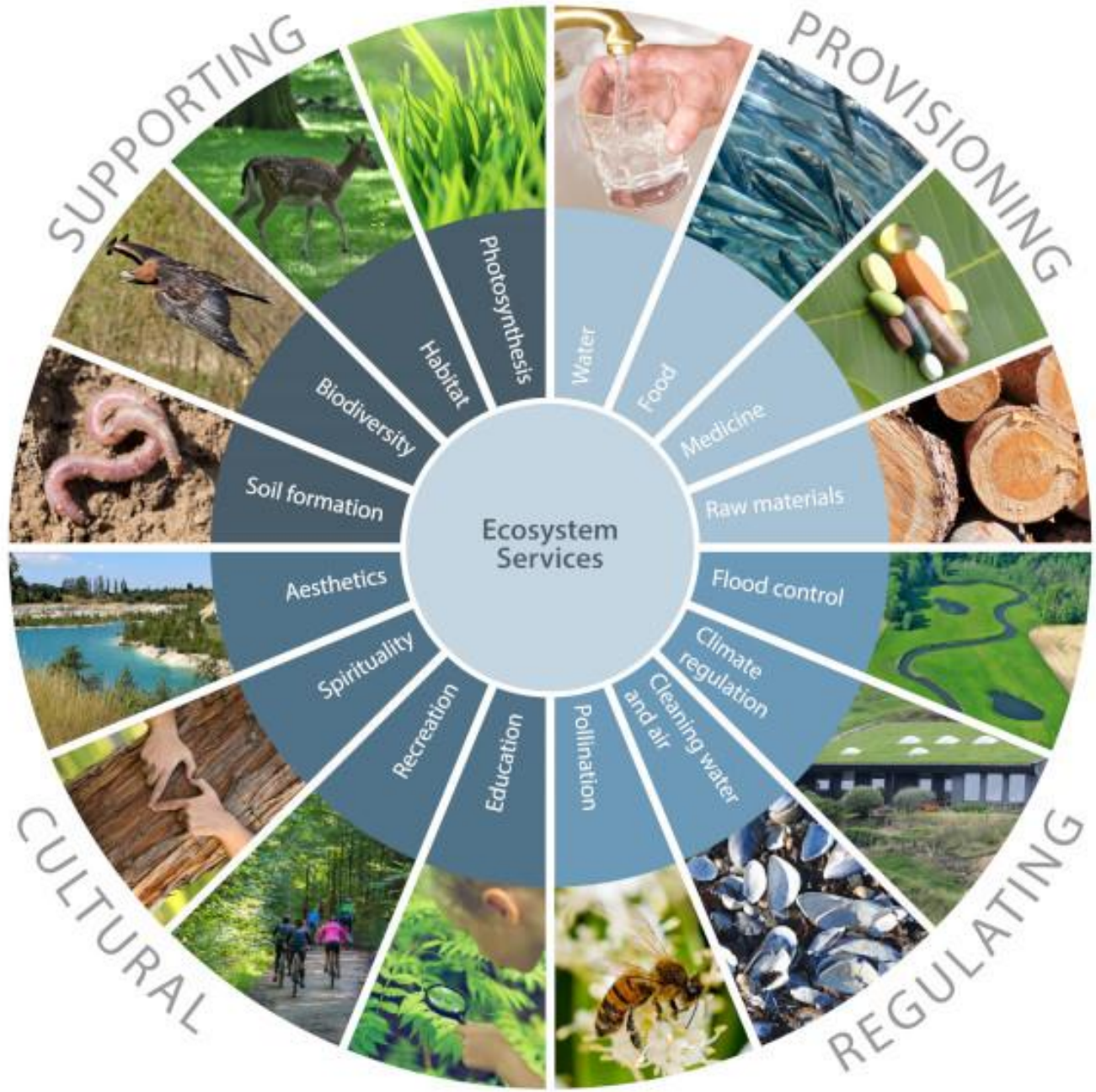
- **Regulating services are** the benefits provided by ecosystem processes that moderate natural phenomena that make life possible for people.
- Regulating services include **decomposition**, **air** and **water purification**, **erosion and flood control**, and **carbon storage**, **pollination climate regulation,** and **disease regulation**.
- Plants clean air and filter water, bacteria decompose wastes, bees pollinate flowers, and tree roots hold soil in place to prevent erosion.
- All these processes **work together to make ecosystems clean, sustainable, functional,** and **resilient to change**.

3. Cultural Services

- **Cultural services** are non-material benefits people gain from ecosystems
- contributes to the **development** and **cultural advancement** of people, including how ecosystems play a role in **local, national, and global cultures**;
- They include recreation, aesthetic enjoyment, physical and mental health benefits, spiritual experiences, educational, sense of place, cultural heritage.
- It has guided our **cultural, intellectual,** and **social development** by being a constant force present in our lives.

4. Supporting Services

- **Supporting services** are necessary for the production of all other ecosystem services
- Ecosystems themselves couldn't be sustained without the **consistency of underlying natural processes** (e.g. **Photosynthesis**, **soil formation, nutrient cycling, water cycle, primary production**)
- These processes allow the Earth to sustain basic life forms, let alone whole ecosystems and people.
- Without supporting services, provisional, regulating, and cultural services wouldn't exist


SUPPORTING
PROVISIONING
CULTURAL
REGULATING
Ecosystem Services
Photosynthesis
Habitat
Biodiversity
Soil formation
Water
Food
Medicine
Raw materials
Aesthetics
Spirituality
Recreation
Education
Pollination
Cleaning water and air
Climate regulation
Flood control

Values of Biodiversity

The values **of Biodiversity** can be divided as:

- Direct values
- Indirect values

Direct values

- Direct values, also known as **use values and commodity values**, are assigned to the products harvested by people.
- These values can be further sub-divided as:

  a) **Consumptive use value**: It can be **assigned to goods** such as **fuel wood** and **goods that are consumed locally** and do not figure in national and international market

  b) **Productive use value**: It is assigned to products that are derived from the wild and sold in commercial markets, both national as well as international markets.

Indirect values

- Indirect values are assigned to benefits provided by biodiversity that **do not involve harvesting or destroying the natural resource**.
- Such benefits include **ecological benefits such as soil formation, nutrient cycling, waste disposal, air** and **water purification, education, recreation,** etc. Indirect value can be further sub-divided as:
  a) Non-consumptive use value
  b) Aesthetic, social and cultural value
  d) Ethical value

a) **Non-consumptive use value**: It is assigned to benefits such as soil formation/ protection, climate regulation, waste disposal, water and air purification, eco-tourism, medical research, etc.

b) **Aesthetic, social and cultural value**: The diversity of life on Earth brings us many aesthetic and cultural benefits. It adds to the quality of life, providing some of the most beautiful and appealing aspects of our existence.

   a) Biodiversity is an important quality of landscape beauty.
   b) Many species of birds, large land mammals, sea animals and flowering plants are appreciated for their beauty.
   c) Contact with nature can also be psychologically and emotionally restorative.
   d) In many cultures, nature carries spiritual connotations, and a particular plant or animal species or landscape may be inextricably linked to a sense of identity and meaning.
   e) Today we continue to imbue certain animals and plants with cultural significance; for instance, in India tiger and peacock, which are endangered, are especially valued because they have been adopted as national animal and bird respectively.

Ecosystem and Biodiversity Services

- Ecological values
- Economic values
- Consumptive values
- Aesthetic values
- Scientific values
- Social values

Ecological Services

- **Ecological life support**—biodiversity provides functioning ecosystems that **supply oxygen**, **clean air** and **water, pollination of plants**, **pest control**, **wastewater treatment** and many ecosystem services.
- Ecosystem services, such as
  - Protection of water resources (Hydrological cycle)
  - Soils formation and protection (soil conservation)
  - Nutrient storage and recycling (biogeochemical cycle)
  - Pollution breakdown and absorption (purifying air, water and soil)
  - Contribution to climate stability (regulation of weather and climate)
  - Maintenance of ecosystems stability
  - Anthropogenic carbon shrinkage and carbon sequestration
  - Recovery from unpredictable events

Oxygen

- Through photosynthesis, plants use carbon dioxide, sunlight and water to create energy and release oxygen. In turn plants and animals breathe in oxygen and exhale carbon dioxide.
- One of the biggest sources of oxygen is **phytoplankton living near the ocean's surface**.
- **Trees and other plants absorb ground level ozone, carbon monoxide, sulfur dioxide, and other greenhouse gases**

Decomposition

- Decomposition is the natural process of dead animal or plant material rotting and being broken down.
- **Bacteria, fungi, worms, flying insects, beetles, and other living creatures are decomposers**.
- Decomposers **recycle carbon, nitrogen, and phosphorous** - providing essential nutrients for new plants to grow. Without their work, it is possible that the Earth would be unable to support life.

Drinking Water

- Biodiversity sustains the water cycle (water moving over or under the ground, evaporating and transpiring into the atmosphere, then falling back to Earth as rain or snow) and is sustained by biodiversity.
- **Transpiration** (the movement of water through vegetation and soil) provides 62 percent of annual renewable fresh water on our planet.
- **Groundwater** (water that seeps underground) is the major source of drinking water for many people.
- **Biodiversity cleanses and purify water**. **Wetland, plants**, for instance, help remove heavy metals and excessive levels of nutrients.
- **Vegetation can affect local rainfall patterns**. Large-scale removal of plants changes these patterns.

Healing and Recovery from Natural Disasters

- **A wide variety of species in an ecosystem** provides an ecosystem with greater **resistance to disease and pest outbreaks**.
- **Plants help protect soil from erosion**.
- **Bacteria, insects, plants and other living creatures release nutrients** and help keep soils fertile.
- **Flood control**
- **Cyclone resistance in coastal areas**
- An ecosystem with **rich biodiversity is more resilient** and able to withstand the extinction of an individual species.

Economic Services

Foods:

- Food crops, livestock, forestry, and fish, fruits, honey
- Much of our food exists because of **the ecological services of pollinators**.
- **Fish provide billions of people** with essential animal protein.
- **Thousands of species of plants have been cultivated** for consumption throughout human history
- **Meat** from native wildlife contributes to food and livelihoods in many countries.

Medication:

- Many wild plant species have been used for medicinal purposes from time immemorial.
- For example, **quinine comes from cinchona tree (used to treat malaria**), **digitoxin from the foxglove plant (to treat chronic heart trouble**), and **morphine from the poppy plant (pain relief**), **Aspirin was originally made from willow tree bark**, and **Penicillin and tetracycline**, as well as other **antibiotics**, are derived from microorganisms.
- Over 70 % of the promising **anti-cancer drugs come from plants in the tropical rainforests.**
- Animals may also play a role,
- It is estimated that of the **250,000 known plant species, only 5,000 have been researched for possible** medical applications.

Industry:

- **Wood**: For shelter, warmth, furniture and infrastructures
- **Paper**: from soft woods and grass
- **Textile**: Cotton and fibres for clothing
- **Energy**: Biodiversity may be a source of energy (such as biomass)
- **Agro-based industry**: Supplies from animal origin are wool, silk, fur, leather, lubricants and waxes.
- **Animal husbandry**: Animals may also be used as a mode of transportation.
- **Tourism and recreation**: Biodiversity is a source of economical wealth for many areas, such as many parks and forests, where wild plants and animals are a source of beauty and joy for many people. Ecotourism in particular, is a growing outdoor recreational activity.
- Other industrial products are oils, lubricants, perfumes, fragrances, dyes, paper, waxes, rubber, latex, resins, poisons and cork can all be derived from various plant species.

Aesthetic Value

- Stretches of barren lands with no signs of visible life is not a pleasant sight
- The pleasure of enjoying wildlife’s beauty
- Scenic beauty
- Eco-tourism is based on the aesthetic value of biodiversity
- Eco-tourism is estimated to generate about 12 billion dollars of revenue annually

Ethical role

- Ethical values is also sometimes known as existence value.
- It involves ethical issues like “all life must be preserved” and the concept of “Live and let live”
- If humans consider species have a right to exist, they cannot cause voluntarily their extinction. Besides, biodiversity is also part of many cultures of spiritual heritage.

Scientific Values

- Studying and research on plants and animals
- each species can give scientists some clue as to how life evolved and will continue to evolve on Earth
- biodiversity helps scientists understand how life functions and the role of each species in sustaining ecosystems.
- Search for their possible use of medication
- Integrated pest management

Social value

- Values associated with the social life, customs, religion and psycho-spiritual aspects of people
- Many of the plants are considered holy and sacred in our country (Tulsi, Peepal, Mango)
- Many animals like cow, snake, bull, peacock also have significant place in our psycho-spiritual arena and thus hold special social importance

Thank you