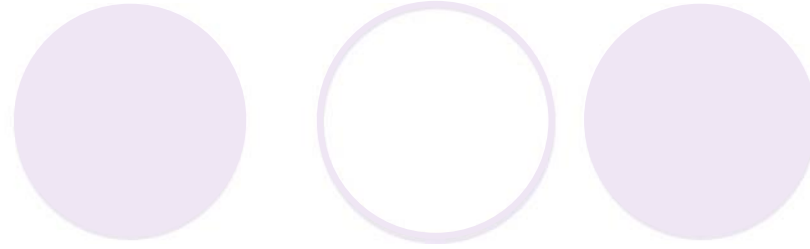


Impacts of Climate Change on Already Stressed Biodiversity, Ecosystems, and Ecosystem Services

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(S20170010016)



Topics discussed



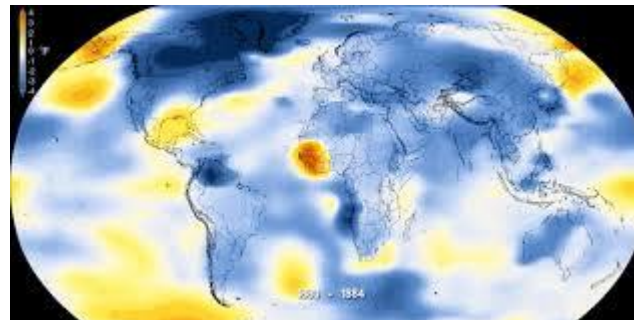
- ◉ What is climate change?
- ◉ Causes of climate change.
- ◉ What are biodiversity, ecosystem and ecosystem services?
- ◉ Impact of climate change on biodiversity, ecosystem and ecosystem services.

Climate change

Climate change is a change in the pattern of weather, and related changes in oceans, land surfaces and ice sheets, occurring over time scales of decades or longer.

For example:

- ◉ Increase in the global temperature (Global warming)
- ◉ Irregular rain pattern
- ◉ Irregular amount of rain at any place



Global warming

Biodiversity



- ◉ Biodiversity is the variability among living organisms from all sources, including terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part
- ◉ This includes diversity within species, between species, and of ecosystems.
- ◉ Biodiversity forms the foundation of the vast array of ecosystem services that critically contribute to human well-being.
- ◉ Biodiversity is important in human-managed as well as natural ecosystems. Decisions humans make that influence biodiversity affect the well-being of themselves and others.

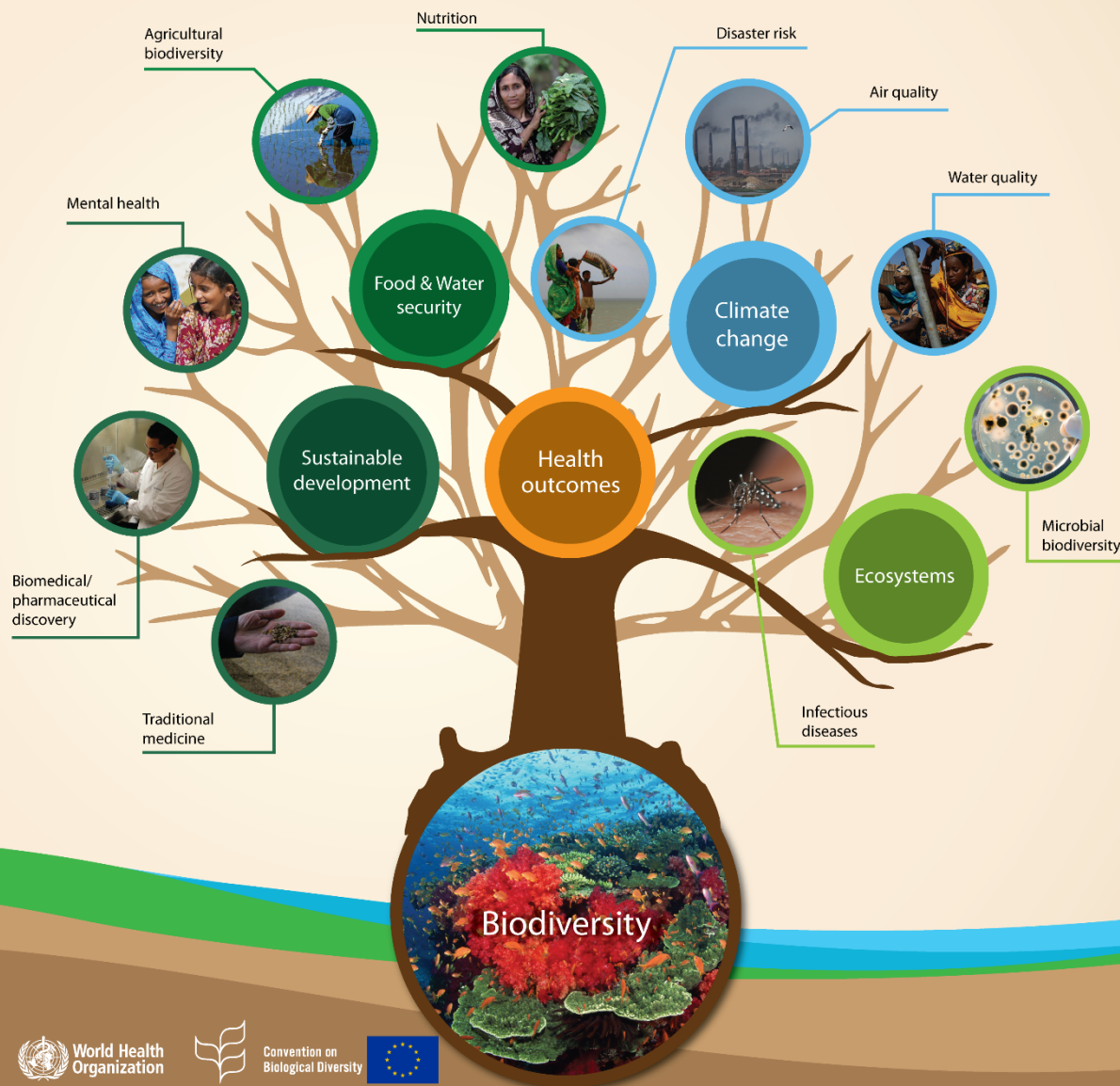
Biodiversity and human health

Health "is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity".

Biological diversity (biodiversity) is "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems."

Biodiversity underpins ecosystem functioning and the provision of goods and services that are essential to human health and well being.

The links between **biodiversity and health** are manifested at various spatial and temporal scales. Biodiversity and human health, and the respective policies and activities, are interlinked in various ways.



Direct drivers of biodiversity loss include land-use change, habitat loss, over-exploitation, pollution, invasive species and climate change. Many of these drivers affect human health directly and through their impacts on biodiversity.

Women and men have different roles in the conservation and use of biodiversity and varying health impacts.

Human population health is determined, to a large extent, by social, economic and environmental factors.

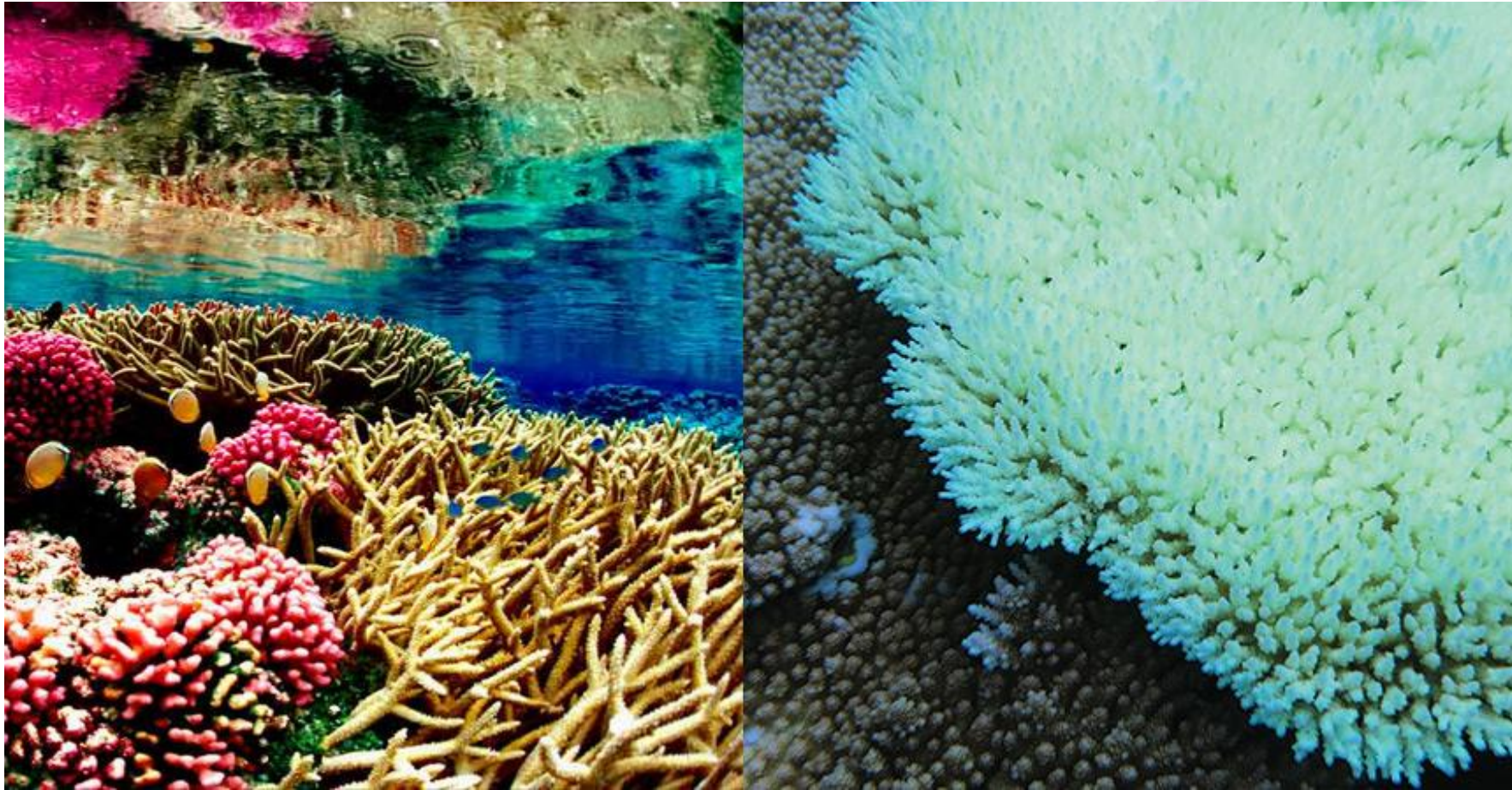
The social and natural sciences are important contributors to biodiversity and health research and policy. Integrative approaches such as the Ecosystem Approach, Ecohealth and One Health unite different fields and require the development of mutual understanding and cooperation across disciplines.

Impact of climate change on Biodiversity

- ◉ Temperature spikes - There is evidence that some species are physiologically vulnerable to temperature spikes. For example, the green ringtail possum, an endemic species of Queensland's tropical rainforests, cannot control its body temperature when the ambient temperature rises above 30°C.
- ◉ Coral Bleaching - This is a whitening of coral caused when the coral expels their zooxanthellae, a symbiotic photosynthesising algae that lives within the coral tissues and provides it with essential nutrients. Warmer sea surface temperatures are blamed for an increase in this phenomenon. Since the zooxanthellae help coral in nutrient production, their loss can affect coral growth and make coral more vulnerable to disease.

Impact of climate change on Biodiversity

- ◉ Sea-level rise - According to the most recent IPCC report, sea level is predicted to rise by 26–98 cm by 2100. This increase in sea level could threaten many coastal ecosystems. At risk are mangrove forests and low-lying freshwater wetlands in Kakadu National Park.
- ◉ Effects of CO₂ - The basic ingredients for photosynthesis include carbon dioxide and water. Increased carbon dioxide in the atmosphere causes increased growth rates in many plant species. This is good news for farmers, but only if this carbon dioxide 'fertilisation' effect is matched by adequate soil moisture and other nutrients. Leaf-eating animals like koalas may not be so lucky: increased concentrations of carbon dioxide could diminish the nutritional value of foliage.



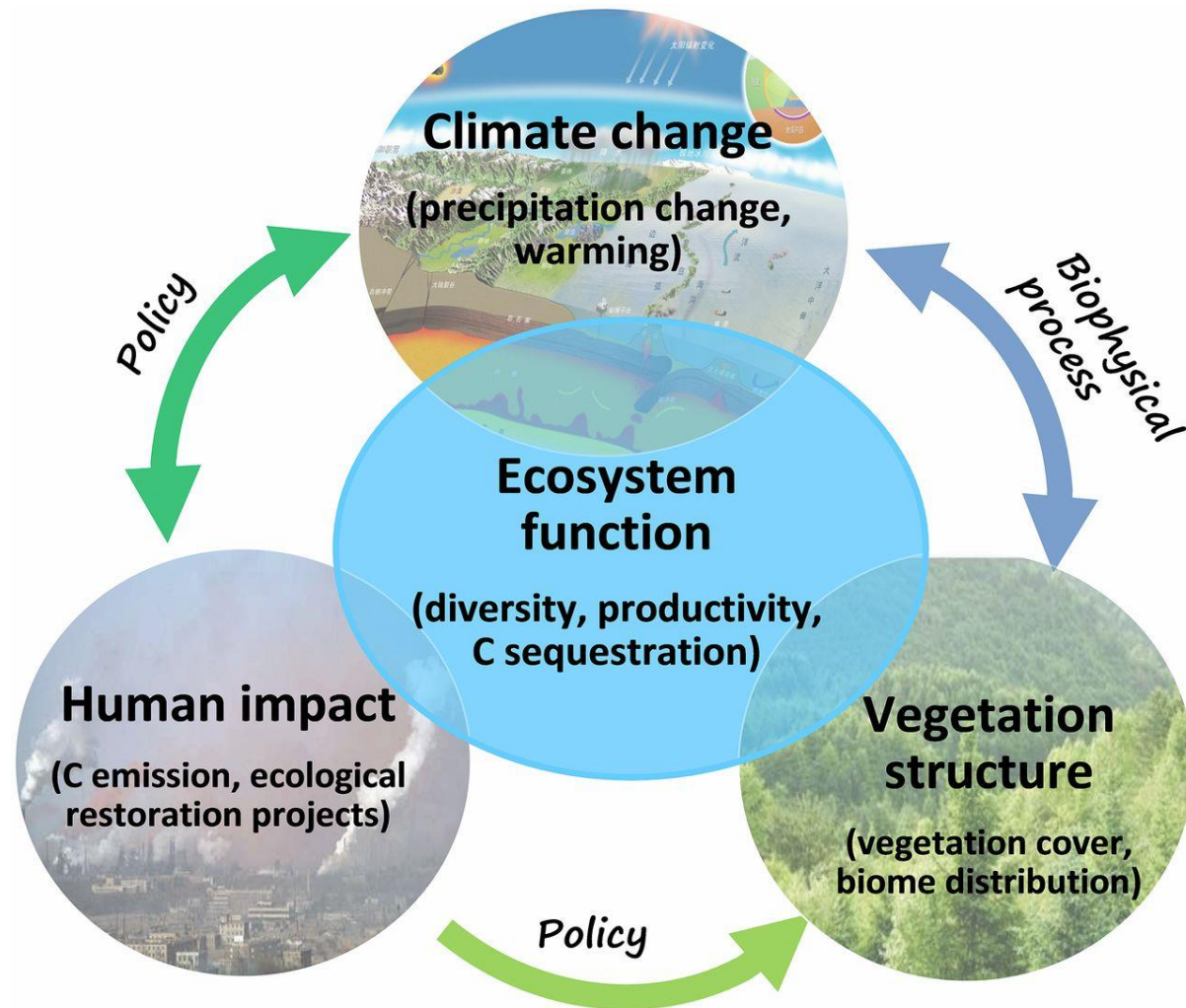
Coral Bleaching

Ecosystem



- ◉ An ecosystem is a community of living organisms in conjunction with the nonliving components of their environment, interacting as a system.
- ◉ These biotic and abiotic components are linked together through nutrient cycles and energy flows. Energy enters the system through photosynthesis and is incorporated into plant tissue. By feeding on plants and on one-another, animals play an important role in the movement of matter and energy through the system.
- ◉ They also influence the quantity of plant and microbial biomass present.
- ◉ By breaking down dead organic matter, decomposers release carbon back to the atmosphere and facilitate nutrient cycling by converting nutrients stored in dead biomass back to a form that can be readily used by plants and other microbes.

Ecosystem

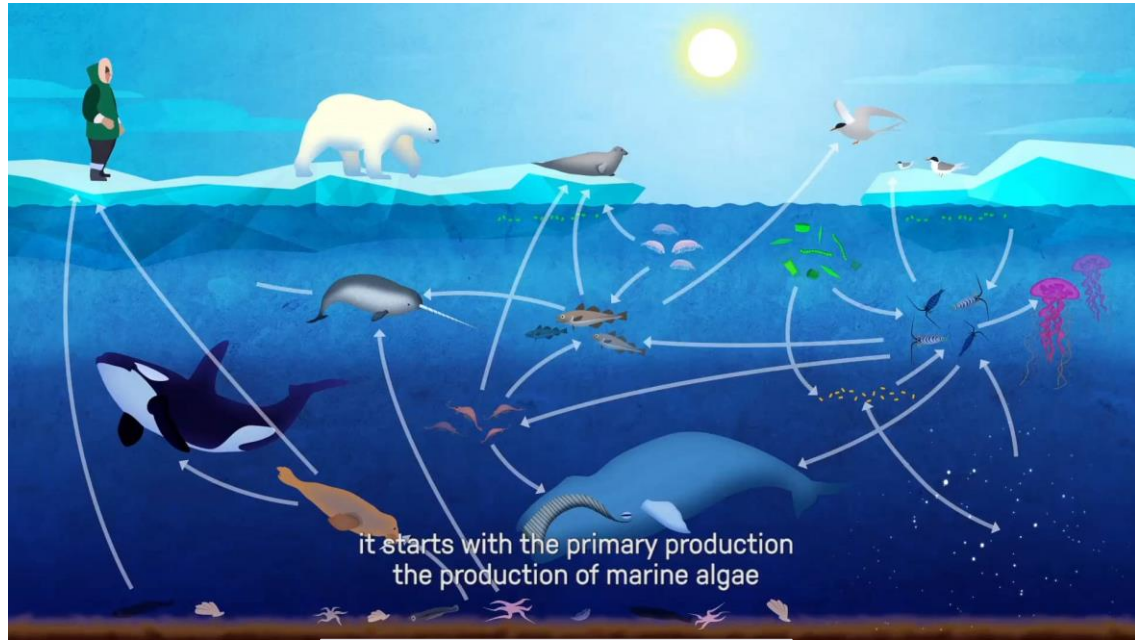


Impact of climate change on Ecosystem

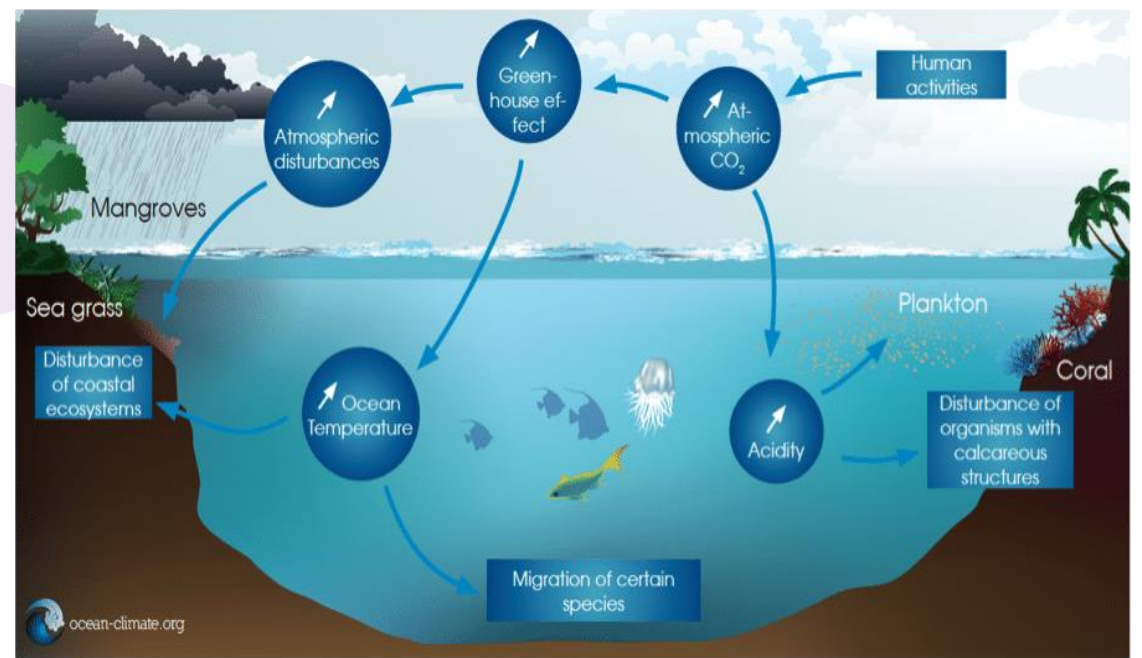
- ◉ Arctic ecosystem - Average air temperatures in the region have increased by about 5°C over the last 100 years. Recent data shows that there'll be almost no summer sea ice cover left in the Arctic in the next few decades. The effects won't just be felt by the habitats and species such that rely upon this area - they'll be dramatic in the entire northern hemisphere.
- ◉ Mountains - Mountains cover approximately 25 percent of earth's surface and provide a home to more than one-tenth of global human population. Changes in global climate pose a number of potential risks to mountain habitats.[42]
Researchers expect that over time, climate change will affect mountain and lowland ecosystems, the frequency and intensity of forest fires, the diversity of wildlife, and the distribution of fresh water.

Impact of climate change on Ecosystem

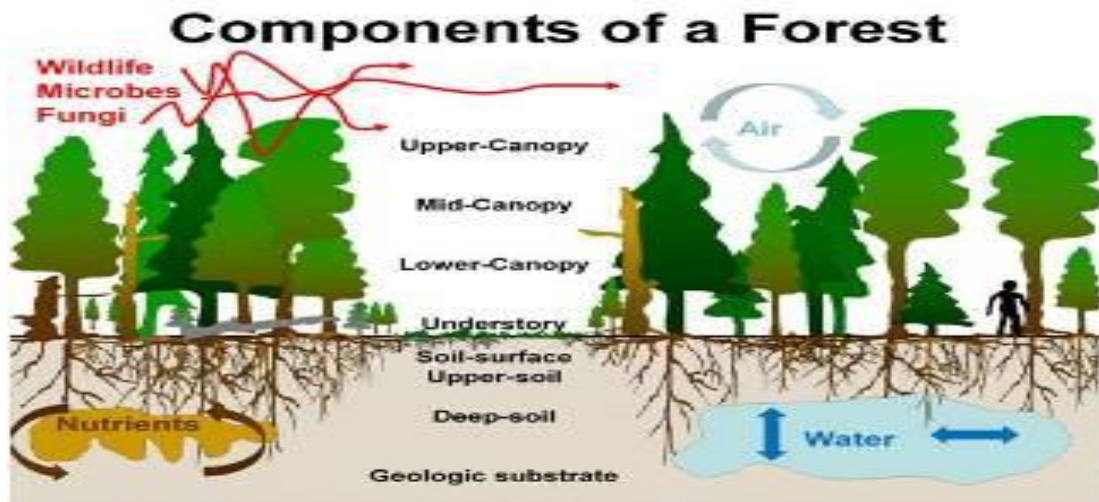
- ◉ Forests - Impacts vary in different kinds of forests. Sub-Arctic boreal forests are likely to be particularly badly affected, with tree lines gradually retreating north as temperatures rise. In tropical forests such as the Amazon, where there's abundant biodiversity, even modest levels of climate change can cause high levels of extinction.
- ◉ Oceans - Impacts vary in different kinds of forests. Sub-Arctic boreal forests are likely to be particularly badly affected, with tree lines gradually retreating north as temperatures rise. In tropical forests such as the Amazon, where there's abundant biodiversity, even modest levels of climate change can cause high levels of extinction.



Arctic Ecosystem



Ocean Ecosystem



Forest Ecosystem



Mountain Ecosystem

Ecosystem services



- ◉ Ecosystem services are the many and varied benefits that humans freely gain from the natural environment and from properly-functioning ecosystems.
- ◉ Such ecosystems include, for example, agroecosystems, forest ecosystems, grassland ecosystems and aquatic ecosystems.
- ◉ These ecosystems functioning properly provides such things like agricultural produce, timber, and aquatic organisms such as fishes and crabs.
- ◉ Collectively, these benefits are becoming known as 'ecosystem services', and are often integral to the provisioning of clean drinking water, the decomposition of wastes, and the natural pollination of crops and other plants.

Ecosystem Services



Supporting services

- ◉ These include services such as nutrient cycling, primary production, soil formation, habitat provision and pollination.
- ◉ These services make it possible for the ecosystems to continue providing services such as food supply, flood regulation, and water purification.

Provisioning services

- ◉ food (including seafood and game), crops, wild foods, and spices
- ◉ raw materials (including lumber, skins, fuel wood, organic matter, fodder, and fertilizer)
- ◉ genetic resources (including crop improvement genes, and health care)\
- ◉ water purity
- ◉ biogenic minerals
- ◉ medicinal resources (including pharmaceuticals, chemical models, and test and assay organisms)
- ◉ energy (hydropower, biomass fuels)
- ◉ ornamental resources (including fashion, handicraft, jewelry, pets, worship, decoration and souvenirs like furs, feathers, ivory, orchids, butterflies, aquarium fish, shells, etc.)

Ecosystem Services



Regulating services

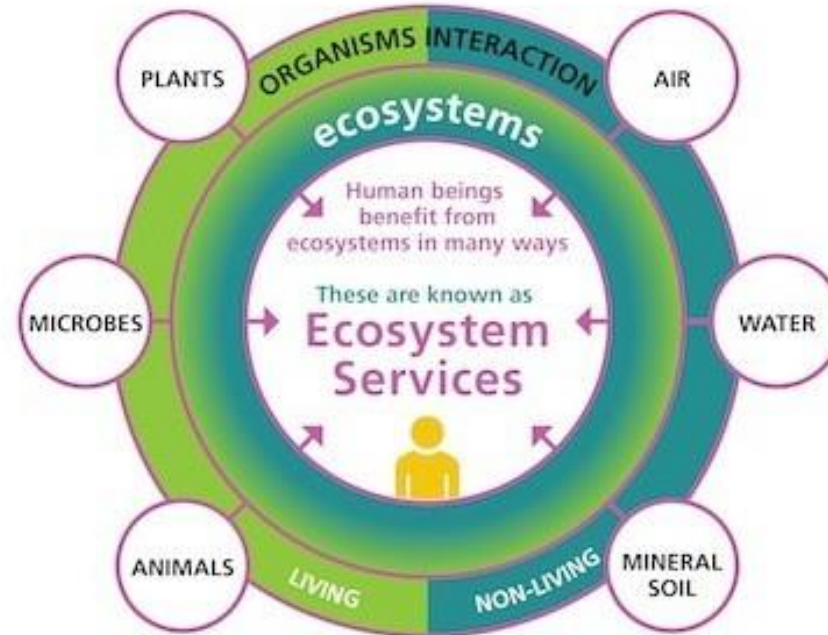
- ◉ Carbon sequestration and climate regulation
- ◉ Predation regulates prey populations
- ◉ Waste decomposition and detoxification
- ◉ Purification of water and air pest and disease control

Cultural services

- ◉ cultural (including use of nature as motif in books, film, painting, folklore, national symbols, architect, advertising, etc.)
- ◉ spiritual and historical (including use of nature for religious or heritage value or natural)
- ◉ recreational experiences (including ecotourism, outdoor sports, and recreation)
- ◉ science and education (including use of natural systems for school excursions, and scientific discovery)
- ◉ Therapeutic (including Ecotherapy, social forestry and animal assisted therapy)

Ecosystem services

- ◀ Pollination
- ◀ Pest and disease management
- ◀ Fresh water, food, fibre, habitat and genetic resources
- ◀ Recreation and tourism
- ◀ Spiritual health, cultural identity



- ▶ Erosion prevention
- ▶ Protection from natural disasters
- ▶ Carbon sequestration and storage
- ▶ Air and water pollution control
- ▶ Nutrient cycling and soil fertility

Impact of climate change on ecosystem Services

Impacts on food and feed

- ◉ In the harsh environment of high mountain regions, climate change can profoundly affect food systems.
- ◉ Diminished snow cover and changing precipitation patterns affect subsistence agriculture in high-elevation villages in India and Nepal.
- ◉ In the meadows of Nagqu Prefecture in Tibet, climate change has contributed to a reduction of plant density, affecting yak and sheep herders, and in the Tibetan steppe in Sunan Yugur Autonomous County, climate change seems to be contributing, together with increased grazing intensity, to the reduction of soil organic carbon.
- ◉ In dry high-mountain environments such as the Moroccan High Atlas, climate change could have negative consequences for livestock management.
- ◉ All these changes lead to continuing multidimensional poverty in rural mountain communities. On the other hand, increased temperature can also enable the cultivation of new crops that could not previously be grown in high mountain areas and that could diversify local diets

Impact of climate change on ecosystem Services

Impacts on water availability-

- ◉ Mountains have been called the world's water towers. The provision of water is one of the major ecosystem services affected by climate change in high mountain areas, with severe consequences for downstream populations as well as high mountain areas.
- ◉ Local communities in Peru have experienced a decline in water resources in the dry season.
- ◉ In the Khumbu region of Nepal, decreased stream flow due to climate change is affecting the availability of water to meet the high water demands of tourists.
- ◉ In Austrian mountains, exceptionally hot and dry summers have been shown to diminish the amount of water recharging the aquifers, decreasing water availability.
- ◉ In arid mountain regions, such as the Jabal Al Akhdar mountains in Oman, groundwater decline has led to water shortages for domestic supply and increased demand for bottled water.

Impact of climate change on ecosystem Services

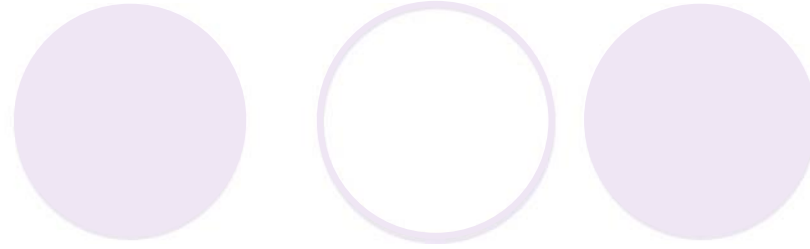
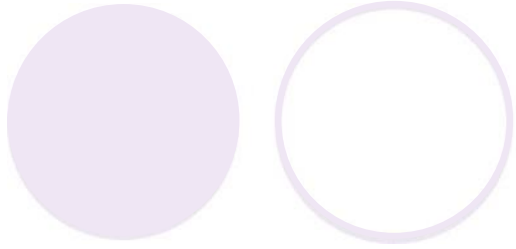
Impacts on natural hazards regulation-

- ◉ As glaciers retreat, the decreased land-surface stability affects the frequency and location of natural hazards.
- ◉ Hazards are mainly caused by permafrost melting (producing landslides and rockfall), glacial lake outburst floods (GLOFs), and extreme weather events (virulent storms).
- ◉ Recent evidence seems to indicate that permafrost degradation increases the risks in high mountain areas due to a higher probability of rockfalls.
- ◉ Climate change has increased the number and size of high-mountain lakes. This increases the likelihood of GLOFs, which have been documented as a major threat to local communities and tourists.
- ◉ Climate change-related extreme weather events might also make high mountain areas a riskier environment. Examples include the precipitation that peaked at 300 mm in a day on the Cévennes mountains in France and the virulent storm that trapped local mountain guides and mountain tourists on the Annapurna trail in the Himalaya in 2014.
- ◉ Certain ice-climbing routes, such as the northeast face of the Eiger in Switzerland or the Diamond Corridor on Mount Kenya, are now often bare of snow, making climbing more exposed. Other classic ice climbing routes in the Eastern Alps have also been affected by increased rockfall.

Impact of climate change on ecosystem Services

Impacts on aesthetics

- ◉ High mountain areas are highly appreciated for their aesthetic value and preferred visually over lower elevations in mountain areas.
- ◉ Snow-covered areas seem to be visually preferred as well. Although there has been little research on the effect of climate change on the aesthetics of high mountain areas, this effect is unquestionable, mainly associated with the retreat of glaciers, which is relatively well monitored worldwide.
- ◉ The glacier on Mount Kilimanjaro has lost 85% of its area over the last 100 years, and it is unlikely that any ice will remain in the year 2060 (Cullen et al 2013). Also in the tropics, the Cordillera Blanca in Peru has lost more than 30% of its glacial area since 1930.
- ◉ Climate change impacts reduced snow cover in June in the northern hemisphere by 11.7% every decade between 1967 and 2012, and the upward retreat of the glacier tongues of 43 glaciers in the western Alps between 1984 and 2010 has been 170 meters on average. Snow cover in the Alps is predicted to drop significantly due to climate change.



Thank You



Care for earth, care for the coming birth.