

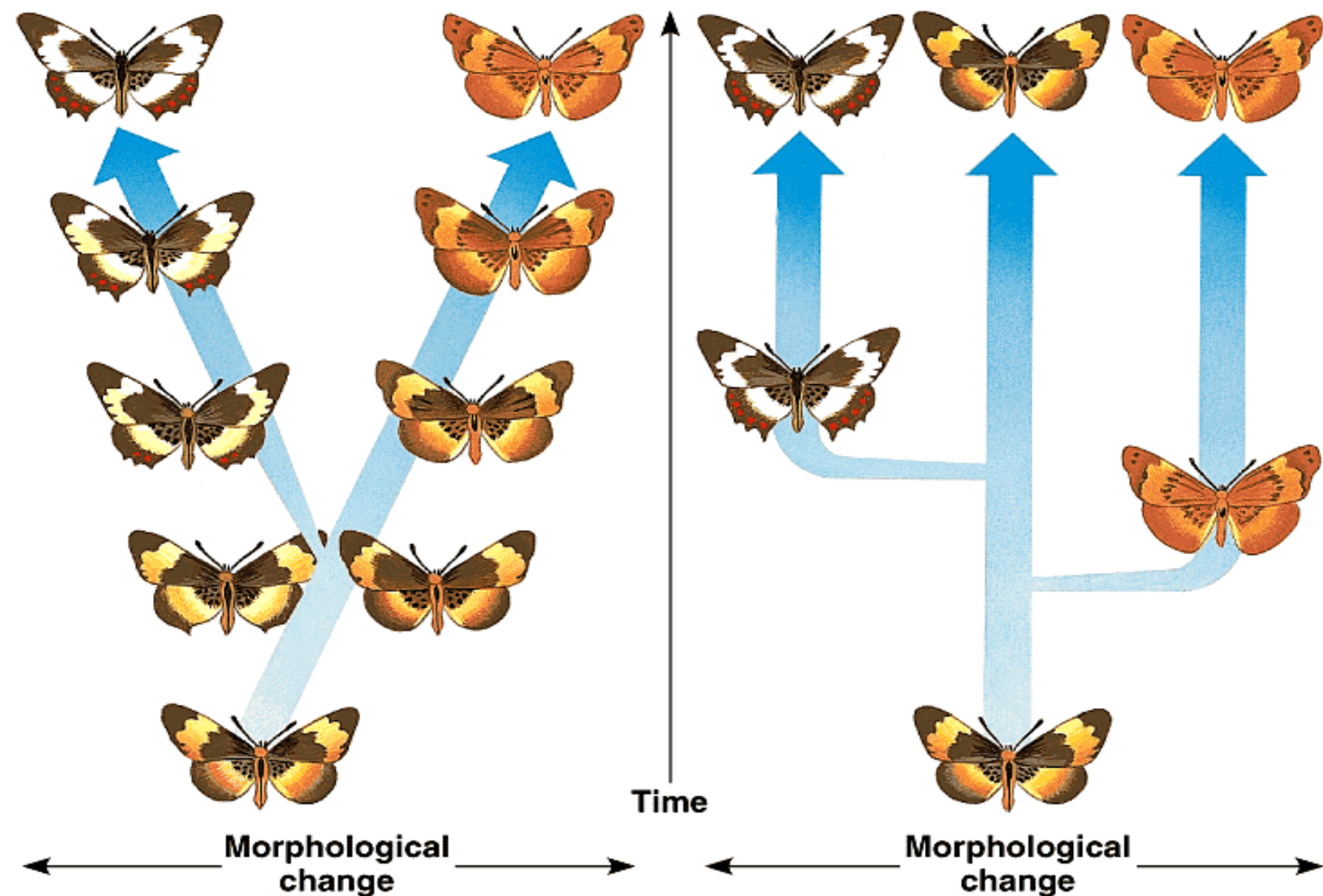
Biodiversity

- **Biodiversity:-** *the extent to which an ecosystem contains different species.*
- *Greater biodiversity makes an ecosystem less vulnerable*
- *Concerned with species richness.*
- *Includes three main hierarchical levels. such as*
 - *Genetic diversity*
 - *species diversity*
 - *Ecological diversity*

Genetic diversity

- **Genetic diversity:- Variations of genes within a species.**
 - Lots of distinct populations within a species (lots of varieties of potatoes-all from same species)
 - Genetic Variation within the population butterfly





(a) Gradualism model

(b) Punctuated equilibrium model

Cont...

- Variation b/n individuals of single population.
- The species with essentially one set of genes (the gene pool) or the presence of different (but related) gene pools.
- 2. Species diversity:- the variety of species in a given region or area.
- Determined by counting the number of different species present.
- 3. Ecosystem diversity- Communities of plants and animals together with the physical characteristics of their environment.

Species diversity

- number of species in a given area.
 - An island with 2 bird species and 1 lizard species is more diverse than an island with 3 bird species.



Ecosystem diversity

- Variety of ecosystems within an area.



Cont...

- **Biodiversity :- is a measure of the overall variability of life on the planet or local area which includes**
 - **the species richness and species diversity of area.**
 - **the ecological variability of each species**
 - **the genetic variability of each species.**

Human Influence on Biodiversity

- ❖ **Biodiversity :- is lost or reduced in many ways. but, the important activities reduced biodiversity more are**
 - deforestation**
 - the impact of agriculture.**

Effect of Deforestation on Biodiversity

- **Deforestation is usually carried out for one of two main reasons:**
- **To clear land for human activities, such as mining, agriculture or house building, or**
- **To obtain timber to make products such as paper, charcoal, furniture, or to use as a building material**

Tropical rainforest

- . One of the most complex and species-rich ecosystems in the world.**
- Rainforest covers about 7% of the Earth's surface and contains 25% of the known species.**
- Although many of the trees are very tall, the root systems are shallow and trees can easily fall.**
- The shallow root systems grow in shallow, nutrient-poor soils.**
- The soils are nutrient poor because many of the minerals from the soil remain 'locked up' in the huge trees.**

Cont...

- **The only recycling of nutrients that occurs on a regular basis takes place when leaves fall.**
- **There is no accumulation of detritus as decomposers rapidly break down the leaves and release the mineral ions they contain.**
- **The roots take these up, leaving few mineral ions in the soil.**
- **As a result, when the forest is cleared for agriculture, crop yields are often poor after the first year and more forest must be cleared.**

Cont...

- ❖ **Felling tropical rainforest has far-reaching effects.**
 - **A serious reduction in species diversity.**
 - **Many ecological niches are destroyed when trees are felled and the species that fill these niches are lost.**
 - **Reduces the biodiversity of the area.**
 - **Reduction in the rate at which carbon dioxide is removed from the atmosphere.**
 - **In addition, if the trees are burned, then carbon dioxide is added to the atmosphere.**
 - **The local and global cycling of carbon and nitrogen is therefore affected.**

Cont...

- ❖ **A secondary succession will take place. If the felled area is allowed to regenerate, then seeds of many species of plant from the shrub layer will germinate. Ordinarily, the shrub layer is limited because**
- **The canopy prevents much of the light from reaching lower levels.**
- **If the shrub layer is allowed to dominate, this could give rise to a less complex ecosystem with a lower biodiversity.**

What are the effects of agriculture on biodiversity

- ❖ **The effects of large-scale agriculture that follow the same pattern large areas of land for the production of only one crop plant, such as maize or another cereal crops.**
- ❖ **This type of agricultural activities causes reduction of biodiversity in many ways:-**
 - **B/c the area is dominated only by one species and reduces number of niches for other organism.**
 - **Organism that live in the area may regarded as pests and to control them pesticides are used.**
 - **To create bigger and productive fields the number of habitat & niches are destroyed.**

Index of Biodiversity

- **Index of diversity:-** is a number indicating an ecosystem's biodiversity.
- **Can be calculated using number of species in given area.**
- **Example :-** there are three ecosystem.

Species	Area1	Area2	Area3
A	86	16	23
B	5	17	25
C	2	16	27
D	3	17	5
E	1	17	12
F	3	17	8

Cont...

- **Low value index of diversity indicates an area dominated by one or few species.**
 - **Could be result of hostile environment with only few organism adapted to the env/t.**

Example:- Area1 dominated by species A ONLY.

If there are more successful species with no species completely dominating the area, the value for index of diversity will be higher.

Example area2.

Cont...

❖ **A higher diversity index shows:-**

- A number of successful species**
- More stable ecosystem**
- More ecological niches are available**
- The env/t is likely to be less hostile.**

➤ **Example;- Tropical rain forest provide stable ecosystem with high species diversity.**

➤ **Environmental change is likely to be less damaging to the ecosystem as whole unless it affects all the plant present.**

What is the status of biodiversity in Africa?

- **Africa is the areas that have high plant species & mammal species richness.**
- **The one important exception is the part of south Africa have high plant species richness but donot have high mammal species.**
- **Example :- Fynbos of south Africa.**
- **B/c the plants grow on a very nutrient poor soils and there is no protein in the plaants to support large number of mammals.**

Cont...

❖ **Africa is endowed with:-**

- **1229 species of the world's mammal species.**
- **About 1000 bird species in Africa of which 1600 are endemic to sub – saharan Africa.**
- **About 950 species of amphibians.**

Biodiversity in Ethiopia

❖ **Ethiopia is an important regional centre of biological diversity, b/C**

- **The wide range in altitude and climate,**
- **the isolation of the highlands of Ethiopia.**
- **there are so many different biomes**

Cont...

- **About 10–12% of these plant species are endemic to Ethiopia (approximately 1150 plant species).**
- **And the story of plant species richness doesn't end with wild plants in Ethiopia.**
- **Ethiopia is one of the 12 centres of origin (Vavilov centres) of cultivated crops.**
- **There are 11 cultivated crops, which have their centre of genetic diversity in Ethiopia.**

Cont...

- These are:
- *Coffea arabica* – Coffee
- *Eragrostis tef* – Tef
- *Ensete ventriculatum* – Ensete
- *Coccinia abyssinica* – Anchote
- *Guizotia abyssinica* – Niger seed (Nug)
- *Brassica carinata* – Ethiopian rape (Gomenzer)
- *Carthamus tinctorius* – Safflower (Suf)
- *Sorghum Spp.* – Sorghum
- *Hordeum Spp.* – Barley
- *Linum usitatissimum* – Linseed (Telba)
- *Ricinus communis* – Castor bean (Gulo)

Cont...

- **Ethiopia is also an important centre of genetic diversity of forage plants.**
- **About 46 legumes are endemic to Ethiopia. They include:-**
- **species of *Trifolium* (clover), *Vigna* (a type of bean) and *Lablab* (all parts of the plant are edible).**
- **These plants, used as animal feed.**
- **Also important because they add nitrogen to the soil in which they grow as they have nitrogen-fixing bacteria living symbiotically in their roots.**

Practices with direct effects on biodiversity

- ❖ **Deforestation – conversion of forests, woodlands and savannas to agricultural lands (for cultivation and grazing) and other land use**
- ❖ **Systems reduce the area available to native species**
- ❖ **Fuelwood collection and illegal logging**
- ❖ **Overgrazing by stock animals – reduces the availability of forage and woody plant species for other animals**
- ❖ **Introduction of improved crop varieties – reduce the genetic diversity of the particular crop plant as only the ‘improved’ variety is used**

Cont ...

- **overhunting (poaching) – directly reduces the numbers of the species hunted.**
- **introduction of alien invasive species – these often outcompete native species for the available resources, sometimes making native species locally extinct**

Practices with indirect effects on biodiversity

- high population growth**
- undervaluation of the biodiversity resources – if biodiversity is not seen as important at all levels of government**
- legal and institutional systems that promote unsustainable exploitation**
- disregard of traditional communal (range) land management systems – traditional methods of land management conserved the species present and used them to support the community**

Cont...

- **In 2005, the Ethiopian Insitute of Biodiversity Conservation in Addis Ababa put forward a National Biodiversity Action Plan.**
- **This action plan reviews the current situation and makes numerous recommendations on:-**
 - Ecological considerations**
 - Socioeconomic considerations**

Ecological consideration

- **Accelerate recovery by enrichment planting of target species in degraded remnant forests.**
- **Establish corridors to enhance the biodiversity and eventually the viability of fragmented forests, particularly in the central and northern highlands.**
- **Establishment of buffer zones (through tree planting) to stop further degradation of isolated forest fragments.**

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- **Planting native woody species may be necessary on sites lacking of vegetation (for example, steep slopes).**
- **Establishment of tree plantations, which can serve as nurse crops, on highly degraded sites.**
- **Establishing area enclosures may be necessary to enhance natural regeneration and diversity of the native flora, particularly in arid and semi-arid regions.**
- **Control or eradicate (where possible) alien invasive species using integrated pest management.**

Socioeconomic consideration

- **Allow meaningful participation by all stakeholders (people who have any interest in a particular course of action), including in decision making and implementation.**
- **Consider local socioeconomic needs in choices of approaches and options in matters impacting on local biodiversity.**
- **Strengthen local organisations.**
- **Make land and tree tenure completely secure.**
- **Formulate policies that promote sustainable utilisation and conservation of biodiversity.**

Importance of Biodiversity

- **Maintains soil quality:** healthy bacteria, algae, fungi, mites, millipedes and worms help cycle nutrients



- **Maintains air quality:** plants purify the air and filter harmful particles out of the air (using or absorbing) nutrients and pollution



Cont...

- **Maintains water quality: variety of vegetation reduces erosion and purifies water by removing (using or absorbing) nutrients and pollution**



Pest control: most crop pests can be controlled by other organisms for a longer period of time – helpful because many pests become resistant to synthetic pesticides



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- **Pollination and crop production:** More than 1/3 of world's crops rely on healthy pollinators



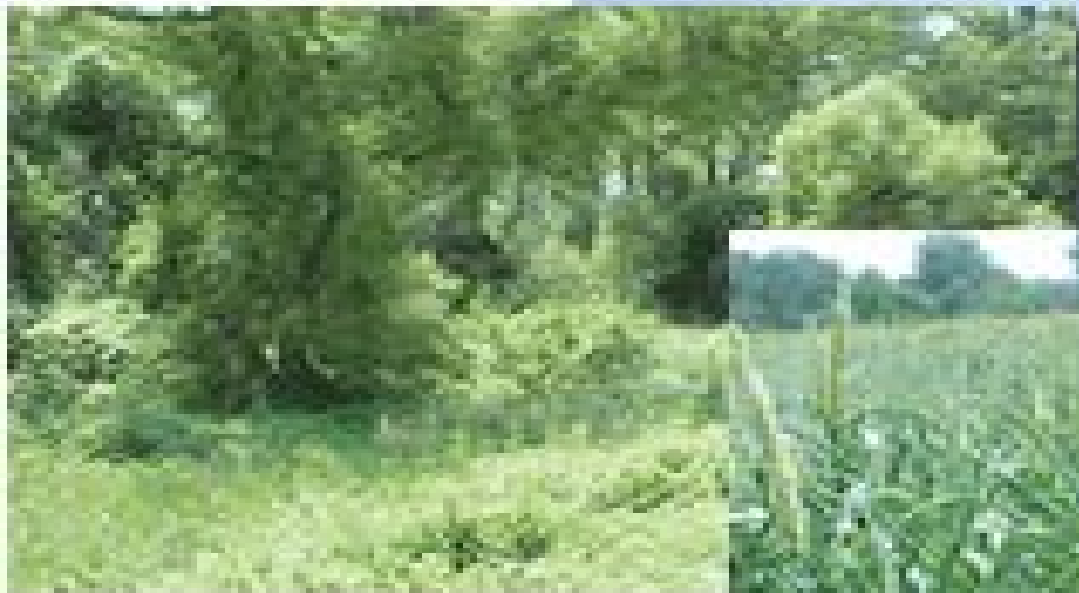
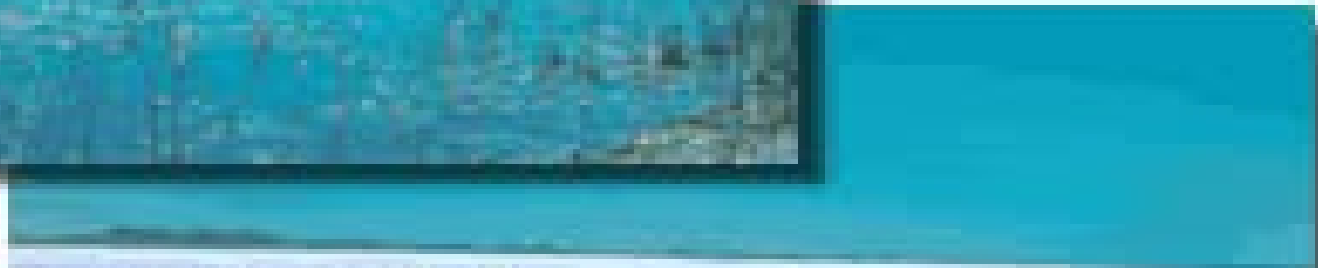
Potential) Medicines: many current and possible future medications found in areas with high biodiversity

Threats of Biodiversity

- **Habitat destruction/fragmentation**
- **Invasive species**
- **Population growth**
- **Pollution**
- **Overconsumption**

Habitat Destruction

- **Changing a habitat to suit human needs...for housing, farming, etc**
- **This displaces animals/plants. As the human population grows, so does habitat destruction!**



Invasive Species

- ❖ Any organism that has been relocated somewhere other than its original habitat.

Population growth of Humans

- **Increasing population means greater demand for food, shelter, fuel and water.**
- **This often leads to habitat loss, pollution, resource scarcity and overconsumption (in areas with enough money)**
- **Humans are coming into greater (more frequent) contact with previously wild areas with high**



Pollution

- Pollution can alter the habitat to the point where some plants and animals will not be able to adapt.**
- Global Climate Change--many species are intolerant to changes in temperature--affects feeding relationships and breeding patterns.**
- Acid rain/Air pollution--these types of issues do not respect borders. US acid rain fell in Canada destroying sugar maple forests which upset the amount/quality of maple syrup produced.**

Overconsumption

- **Individuals consuming way more resources than needed to survive – sometimes more than is needed for a high standard of life**
- **Industrialized nations make up 25% of the world's population, but use 75% of its resources.**
- **US makes up only 5% of world's pop--causes 33% of world's pollution!**





Why is biodiversity loss a concern?

- **The Millennium Assessment (MA) findings suggest that biodiversity loss contributes to:**
 - **worsening health**
 - **increasing insecurity of food supply**
 - **increasing vulnerability**
 - **lower material wealth**
 - **worsening social relations**
 - **less freedom for choice and action**

Cont...

- **Other dangers that result from the loss of biodiversity. The list is huge, but here are some examples:**
- **Continued felling of forests in some countries leads to increased flooding**
- **Many medicines have been derived from plants; the oldest painkiller – aspirin – is derived from the willow tree .**
- **some sheep from South America produce anti-cancer drugs**

Cont...

- ❖ **There are three guiding ideas of conservation:**
 - **Research – we must know what we are doing**
 - **Minimum intervention – the balances within and between**
 - **Ecosystems are delicate and can easily be upset**
 - **Repair rather than replace – it is always better to try to help an ecosystem to repair any damage rather than try to replace it.**

Cont...

- ❖ **The ecological principles that form the basis of conservation of biodiversity are:**
 - **Any protection of species and varieties of species will support biodiversity**
 - **Maintaining habitats is fundamental to conserving species**
 - **Large areas usually contain more species than smaller areas with similar habitats**
 - **Disturbances to habitats shape the characteristics of populations, communities and ecosystems.**
 - **Climate change will increasingly influence all types of ecosystems**

Cont...

❖ **To help conserve our biodiversity, we should also use our resources in a sustainable way. This means that we must not continue to:**

- **Overfish the oceans**
- **Fell rainforest in the current manner; it must be felled sustainably, by strip-felling, for example**
- **Reduce the genetic diversity of stock animals and crop plants**
- **By breeding only those that produce certain desired traits (lean meat, high milk yield, high grain yield)**
- **Grow vast areas of cereals in monoculture.**