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Elective Paper (EC-IC)
Environmental Science

Topic-Threats to Biodiversity

BIODIVERSITY

- Biodiversity refers to the diversity among life forms, which encompasses all the species of Plants, Animals and Microorganism along with their ecosystems and ecological processes.
- The term BIODIVERSITY was first used by wildlife scientist Raymond. F. Dasmann, 1968.

THREATS TO BIODIVERSITY

“ Any activity or mismanagement of biological resources, that damages or has the potential to damage biodiversity at genetic, specie or ecosystem level is referred to as THREAT TO BIODIVERSITY ” .

The core threat to biodiversity on the planet and therefore a threat to human welfare, is the combination of human population growth and the resources used by that population. The human population requires resources to survive and grow and many of those resources are being removed unsustainably from the environment.

SPECIES VULNERANLE TO EXTINCTION

- **Rare Species-**population densities, range and habitat specific
  - Species with restricted geographical range
  - Species with only 1 or few populations
  - Species with small population sizes
- **Declining Species**

- Occur at Sites of High Human Exploitation (poverty, resource extraction, hunting, urbanization, pollution)

Other Predictors of Extinction Vulnerability

- **Large Space (Home range) Requirements-** wolverine, grizzly bear, tiger
- **Large-bodied Animals-** bison, elephants, rhinoceros
- **Ineffective Dispersers-**plants with heavy, unpalatable seed pods, those that are heavily predated
- **Seasonal Migrants-** pronghorn, neotropical migrant songbirds

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. One Horned Rhinoceros

- **Species with Little Genetic Variability-** cheetah
- **Species with Specialized Niche Requirements** – desert pup fish, Kirtland's warbler
- **Species that form permanent or temporary aggregations-** schooling fish, herding animals
- **"Naïve" species with no prior contact with humans-** dodo birds
- **Species closely related to other extinct or near extinct/ threatened species-** rhinoceros, oryx, whales

MAJOR THREATS TO BIODIVERSITY

There are two most important threat to biodiversity, they are

1. Habitat destruction
2. Over exploitation

However, apart from these there are several other threats that has mentioned below :-

A. Pollution

B. Climate change

C. Introduction of invasive species..

D. Man-animal conflict

E. Poaching

HABITAT DESTRUCTION

Habitat destruction is the process by which a natural habitat, such as a forest or wetland, is altered so dramatically that it no longer supports the species it originally sustained. The organisms that previously inhabited the site are displaced or die, thereby reducing biodiversity and species abundance. Habitat destruction is currently ranked as the primary causes of species extinction worldwide.

HABITAT FRAGMENTATION

It is a secondary affect of habitat destruction, occurs when remaining populations are isolated because the links between habitat patches have been destroyed.

HABITAT	FACTORS RESPONSIBLE FOR DESTRUCTION
1. Forest and Woodland	Mainly due to deforestation , Shifting cultivation
2. Grassland	Cultivation, Excessive burning, Over grazing
3. Wetland	Draining or Reclaiming

A. FOREST AND WOODLAND

- Forest is home to million of animal and providing them food, shelter, fuel, cloth, medicine, building material and variety of other resources.
- Forest and woodland are destructed mainly due to collection of timber wood, fuel, and shifting cultivation that lead to following consequences:-

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1. Deforestation
2. Loss of endemism
3. Loss of plant, animal or many other inter-dependent organism.

- Interestingly shifting cultivation has been identified as a principle cause of deforestation in three tropical forest accounting for 70% in Africa, 50% in Asia, 35% in America.
- Some of the species that are in threat due to deforestation include-

GROUP	EXAMPLE
Large Mammal	Golden Lion Tamarin, Woodland caribur of N.America.
Small Mammal	Flying Squirrel
Bird	Owlet, Pipet, Sunbird, weaver of South Africa .
Lower vertebrate	Mountain toad
Invertebrates	Monarch butterfly in South Mexico, Queen Alexander birdwing in New Guinea

2. GRASSLAND

Grassland are habitat of many grazing and browsing animals that are destructed mainly due to:


Cultivated Grassland


Burning of Grassland


Overgrazing

Destruction of grassland ultimately lead to Desertification, Local extinction, Extensive competition.

Some of the remarkable examples are mentioned below:-

CAUSE	THREATENED SPECIES
Over grazing Cultivation	Nilgai, Chinkara, Blackbuck, Red deer Buckwheat in US, Lesser florican in India.
Excessive burning	Pigmi, Hispid in Bhramputra valley.

3. WETLAND

- Wetland are most productive ecosystem and are considered as the "KIDNEY OF NATURE".
- It has been destroyed mainly due to Draining or Reclaiming by mud filling the landfill.
- Draining and reclaiming of wetland lead to destruction of entire ecosystem including about 98% of the total genetic diversity as most specie are unable to migrate to other wetland.

Draining of wetland

- Examples of organism under threat due to destruction of wetland are

EXAMPLE	MAINLY FOUND IN
1.Siberian white crane	Asia
2.Painted frog	Israel
3.Short neck tortoise	West America
4.Aquatic fox turtle	North Mexico
5.Garter snake	Bay of Sanfransisco
6.Copper butterfly	Egypt

Habitat Loss, Degradation, and Fragmentation

HABITAT FRAGMENTATION

Habitat fragmentation is the secondary affect of habitat destruction. It is a process where by and large, continuous area of habitat is both reduced in area and divided into or more fragments.

Conditions of habitat fragmentation

- These fragmentation are often isolated from one another by highly modified or degraded landscape.
- Fragmentation occurs mainly due to severe reduction in habitat area. It can also occur when habitat area is reduced to only a minor degree as and when the original habitat is divided by roads, railways. Canals, power lines, fences, oil pipelines or other barriers to free movement of species.

Threats:

- Fragmentation may limit a species potential for dispersal and colonization.
- Fragmentation may reduce the foraging ability of native animals.

Edge effects

Habitat fragmentation increases the amount of edge relative to the amount of interior habitat. The microenvironment at fragment edge is different from that of the forest interior. Some of these edge effects are more important as-

a. Fluctuations in levels of light
b. Temperature
c. Humidity
d. Wind

These edge effects are often evident up to 500 meters into the forest because plant and animal species are often precisely adapted to certain temperature, humidity and light levels, these changes will eliminate many species from forest fragments.

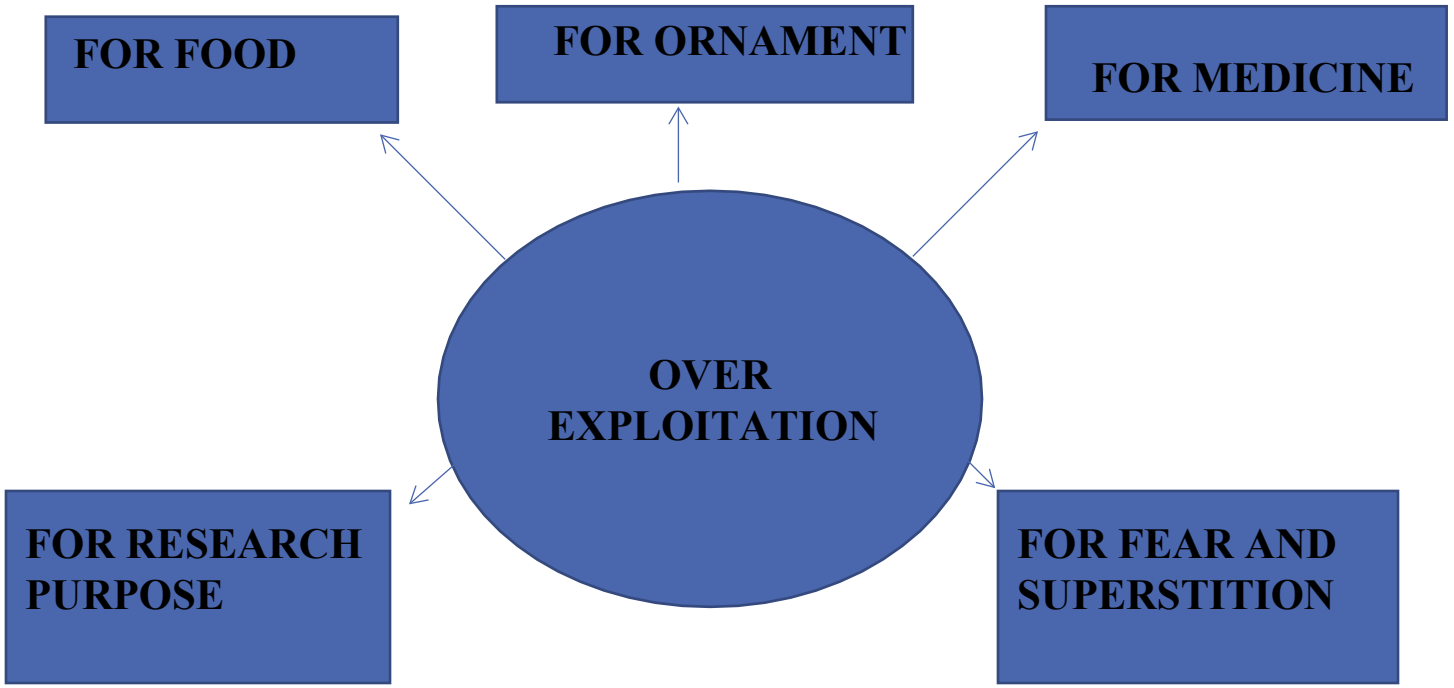
There are natural causes too…

Habitat destruction through natural processes such as volcanism, fire and climate change is well documented in the fossil record. One study shows that fragmentation of tropical rainforest 3000 years ago lead to a great loss of amphibian diversity.

Overexploitation

"Harvesting of animal and natural resources at a rate higher than the nature can recover, is referred to as Over exploitation or Over harvesting."
At present 1/3rd of endangered vertebrates are threatened by over exploitation

Cause of Overexploitation



1. FOR FOOD

- Food has been one of the major reason behind the extinction of many specie of plant and animal in the recent past.
- Species that are extinct due to overexploitation for food- American Bison, Quagga, Dodo, The Great Auk, Passenger pigeon etc.
- Many specie are endangered due to this reason. RED LIST has listed those species some of them are mentioned below.

GROUP	EXAMPLES
Mammal	Black bear, Antelope, Black rhino
Bird	Quail, Skylar, Turtle dove
Reptile	Green turtle, Ridley turtle
Amphibian	Large bull frog, Indian bull frog
Pisces	Salmon, Haddock, Cod, Blue fin tuna.

2. FOR ORNAMENTS

- More species are at risk today because of the demand for their skin, tooth, horn or other part for ornamenting and adoring purposes.
- In Columbia most of the large animal whose skin is in great demand are now endangered.
- An estimate of 60 billion dollar worth of snake's skin has been smuggled out of the India every year, as a result 16 species including cobra, karait and 3 species of viper are declared as endangered.
- Other examples is listed below

PURPOSE	SPECIE EXPLOITED	PLACE
For Ivory	Walrus, Elephant	Asia, Africa
For Perfume	Musk deer, Sperm whale, lavender, Damask rose	Himalaya
For Skin	Ghariyal, Snake, Crocodile	India, Nepal
	Spotted cat	Columbia
For Jwellery	Monarch butterfly	Tropical forest

3. FOR MEDICINE

- From the ancient time many species of plant and animal are used for their medicinal values which nowadays have been exploited beyond needs.
- A data suggest each year more than 2/5th of the prescription in U.S. contain drug using higher plant 25%, bacteria 13%, animal 3% as active ingredient.
- 70% of all plant is known to have anticancerous property grown in Tropical forest.

EXAMPLE	MEDICINAL VALUE
Fox gloves	Digitoxin
Deadly night shell	Atropine
Opium	Morphine
Penicillium notatum	Penicillin
Leech	For its anticoagulant property
Long giant salamander	Traditional Japanese medicine

4. FOR RESEARCH PURPOSES

- Scientific research is supposed to be beneficial for mankind, however from 1950-70 biomedical research causes some serious damage leading to reduction in number of rare species or even sometimes it drag some of them to their extinction.
- Examples

i. Over collection of Panama golden poison frog by scientist.
ii. Nearly 2 lakh Rhesus monkey exported from India during 1960s.
iii. Chimpanzee in Sierra leone.
iv. Large metallic green and brown beetle in East U.S.
v. Rare plant such as Orchid is subjected to some similar hazard

5. DUE TO FEAR/SUPERSTITION

- Fear is still understood but superstition tend to arose irritation, many of such species had become a victim of this superstition.
- Example

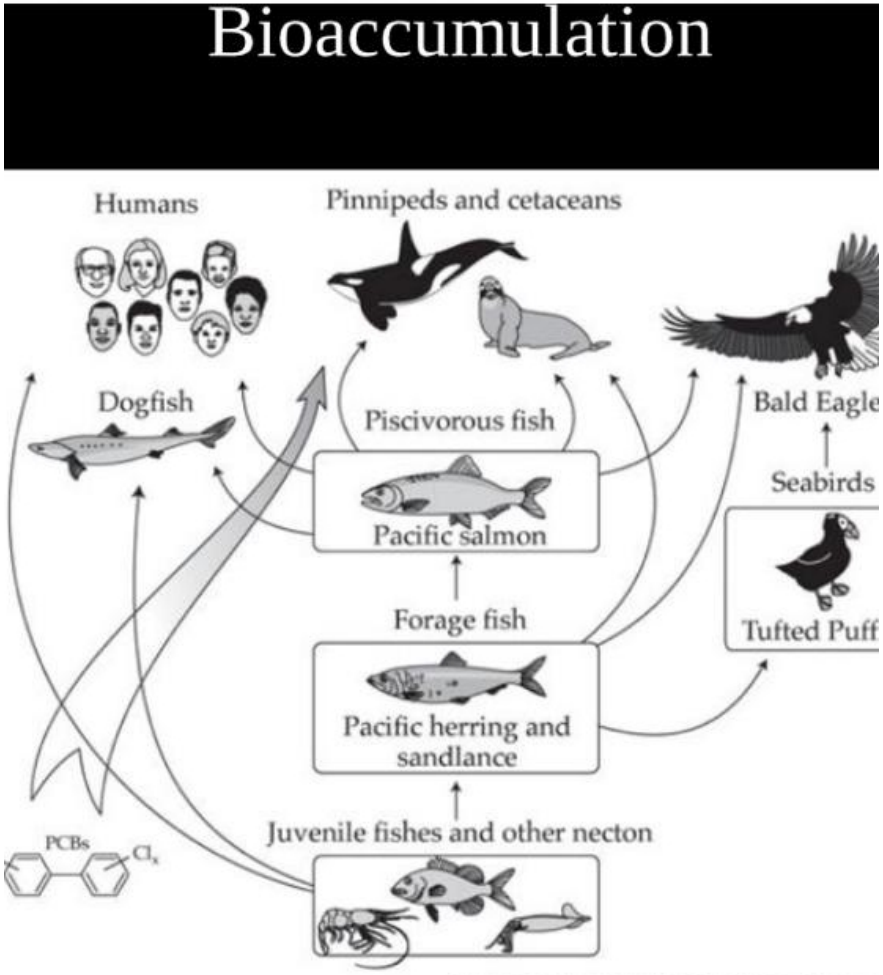
EXAMPLE	PLACE	SUPERSTITION
Lemur	North East	Some tribe people believe them as signal of coming death.
Pygmy chimpanzee	Zaire	Believe to provide superhuman strength.
Bluefin tuna	Japan	Believe to contribute to financial success and longevity.

Beside Habitat destruction and Over exploitation, Pollution, Climate change, Invasion of exotic species are some other important threat to biodiversity.

POLLUTANT	EFFECT
1. Nitrate, Sulphate in lentic ecosystem.	Dead zone formation
2. Cadmium, Mercury, other heavy metals	Bio-magnification
3. NO2, SO2 (large scale)	Affects regional vegetation pattern

A. POLLUTION

- Discharge of toxic synthetic chemical and heavy metal into the environment has a huge impact on species abundance and can lead to extinction.
- Human activities, especially agriculture, have led to increases in the levels of nitrogen and phosphorus in the environment. In water, this overabundance of nutrients, a process called eutrophication, can fuel the excessive growth of phytoplankton and algae. Harmful algal blooms-bloom of specie that produce deadly toxins and sometimes known as “red tides” or “brown tides” for their appearance in the water- can kill fish, marine mammals, seabirds and harm humans.



- When toxic chemicals and metals enter the environment, organisms may absorb them through their skin or ingest them in their food or water. Animals higher in the food chain accumulate these toxins in higher and higher concentrations, a process called biomagnification.
- Top predators-including fish, birds and mammals-can have much higher levels of these toxins in their bodies, making them more likely to experience the diseases, birth defects, genetic mutations and other deleterious effect of these Poisons.

B. CLIMATE CHANGE

The Millennium Ecosystem Assessment ranks climate change among the main direct drivers affecting ecosystems.

Consequences of climate change on the species component of biodiversity include:

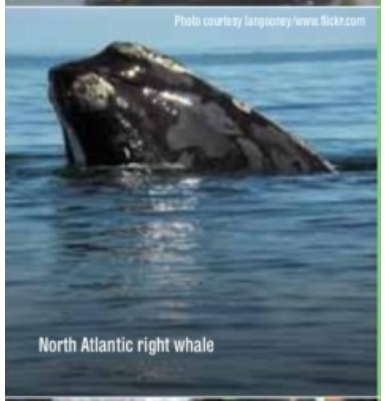
- Changes in distribution
- Increased extinction rates
- Changes in reproduction timings and
- Changes in length of growing seasons for plants.

The links between biodiversity and climate change run both ways: biodiversity is threatened by climate change, but proper management of biodiversity can reduce the impacts of climate change.

Some species that are already threatened are particularly vulnerable to the impacts of climate change.

The following are examples of species and of their vulnerabilities.

In the Arctic, shorter periods of sea ice coverage endanger the polar bear's habitat and existence by giving them less time to hunt.



Climatic fluctuations in North America reduce plankton populations, the main source of food of North Atlantic right whale. Only about 300 individuals remain at present and the availability of food due to climate change is becoming an increasing cause of mortality.

Warmer temperatures in the Pacific regions could reduce the number of male sea turtle offspring and threaten turtle populations. The sex of sea turtle hatchlings is dependent on temperature, with warmer temperatures increasing the number of sea turtles.

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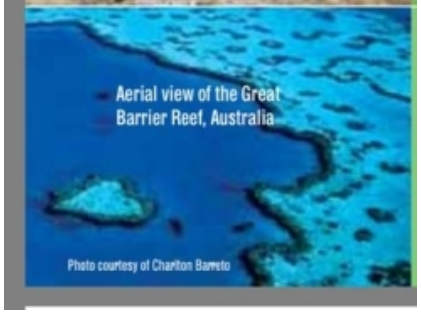
Since frogs rely on water to breed, any reduction or change in rainfall could reduce frog reproduction. Moreover, rising temperatures are closely linked to outbreaks of a fungal disease that contributes to the decline of amphibian populations, especially in Latin America.

Some of the largest remaining areas where tigers occur are the mangrove forests of Asia. The projected rise in sea levels could cause the disappearance of the tigers' habitat, threatening the survival of the species.

In Africa, pressures from longer dry periods and shrinking living spaces are making elephants highly vulnerable to climate change.



Australia's Great Barrier Reef could lose up to 95% of its living coral by 2050 due to changes in ocean temperature .

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Island species are especially vulnerable to climate change because population of these species are small, localized and highly specialized and thus can easily be driven to extinction.

Rise in sea level threaten many coastal ecosystem, mangrove forest and low-lying freshwater wetland biotic life.

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Increase in extreme events such as fire, cyclone, drought, flood. In many cases these results in spreading of alien species and major changes in the distribution and abundance of many indigenous species

Changes in rainfall patterns could have serious impacts on drylands biodiversity


Flood

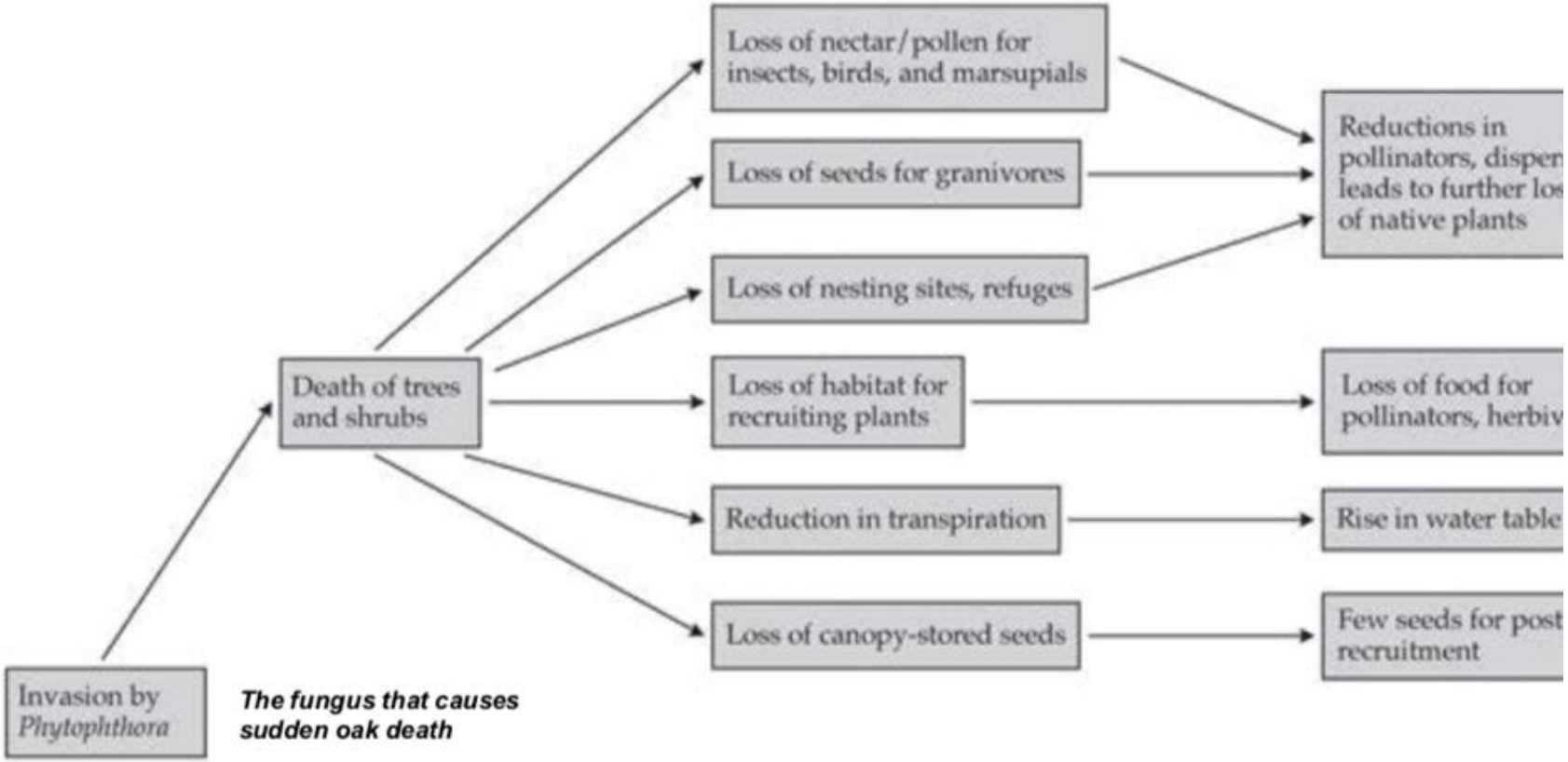

Changes in rainfall patterns can damage land


Drought

EXOTIC SPECIES

- Exotic species are those that have been intentionally or unintentionally introduced by humans into an ecosystem in which they did not evolve. Such introductions probably occur frequently as natural phenomenon.
- These species introduced to new environment often reset the ecological conditions in that new habitat, threatening the species that exist there through competition for resources; this is the reason that they are also termed invasive species.
- Invasive species that are closely related to rare native species have the potential to hybridize with the native species; harmful effects of hybridization have led to a decline and even extinction of native species. e.g. hybridization with introduced cordgrass, *Spartina alterniflora*, threatens the existence of California cordgrass in San Francisco Bay.
- Lakes and islands are particularly vulnerable to extinction threats from introduced species. e.g. in Lake Victoria, the introduction of the Nile perch was largely responsible for the extinction of about 200 species of cichlids. The accidental introduction of the brown tree snake via aircraft from the Solomon Islands to Guam in 1950 has led to the extinction of three species of birds and three to five species of reptiles endemic to the island.

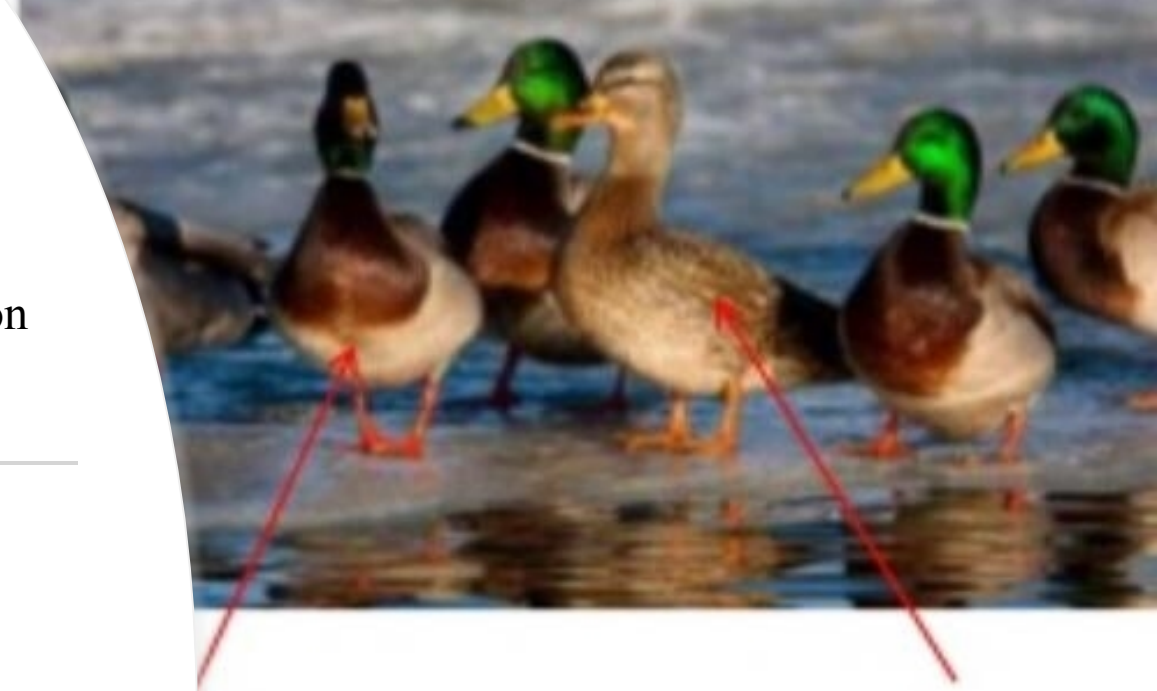
Cascade Effects *One factor can create a trophic cascading domino-like effec within an ecosystem that leads to secondary losses of other species*



Secondary Species Loss and Extinctions

Exotic Species

Introduced mallards, for instance, are driving the native Hawaiian duck to a sort of genetic extinction by breeding with them



Mallards

Hawaiian duck

Prominent examples are the spread of the Peruvian thorny *prosopis juliflorain* in the dry parts of northern India where it replaced native species such as *Acacia nilotica* and the spread of the South American flowering bush *Lantana camara* in the sub-Himalayan belt.

POACHING

- Poaching, in the law, the illegal shooting, trapping, or taking of game, fish or plants from private property or from a place where such practices are specially reserved or forbidden.
- Poaching is a major threat to numerous wild organisms worldwide and is an important contributor to biodiversity loss.

History

Until the 20th century most poaching was subsistence poaching i.e., the taking of game or fish by impoverished peasants to augment a scanty diet.

Modern Poaching

Poaching is now usually done for sport or commercial profit, both in legal and black markets.

Confiscated black –market elephant tusks

Poaching is not limited to animals its also for Plants too……
Three of the most often poached species are galax, black cohosh and ginseng.

Poaching : Specific threats to certain animals are related to large economic benefits.

- Skin and bones from tigers
- Ivory from elephants
- Horns from rhinoceros
- Perfume from the musk deer

MAN-ANIMAL CONFLICT

- It refers to the interaction between wild animals and people and the resultant negative impact on people or their resources, wild animals or their habitat.
- It occurs when wildlife needs overlap with those of human populations, creating costs to residents and wild animals.

Causes

- Human population growth and encroachment into forest lands.
- Land use transformation-industrialization, infrastructure development, commercial farming etc.
- Species habitat loss, degradation and fragmentation due to above mentioned reasons.
- Increasing livestock populations and competitive exclusion of wild herbivores.
- Growing interest in ecotourism and increasing access to nature reserves.

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- Increasing wildlife population as a result of conservation programmes.
- Stochastic events e.g. fire, floods etc.

Impacts

- **Crop damage and damage to property-** elephants damage crops and villages.
- **Livestock depredation-** Himalayan snow leopard preys on goats in the Himalayan region. Farmers trap and kill snow leopards to save their livestock.
- **Injuries and deaths-** Man eater tigers, are reported to have injured and killed villagers living on the periphery.
- **Injuries to wildlife-** Leopards and other wild animals are hacked to death by mobs.

THANKS