



Module -2

Biodiversity

BY

DR. V. SAI SARASWATHI., M. PHARMA., PH. D.,

ENVIRONMENTAL SCIENCE PROFESSOR,

ASST. PROF. (SR.), SAS,

VIT UNIVERSITY, VELLORE- 632014

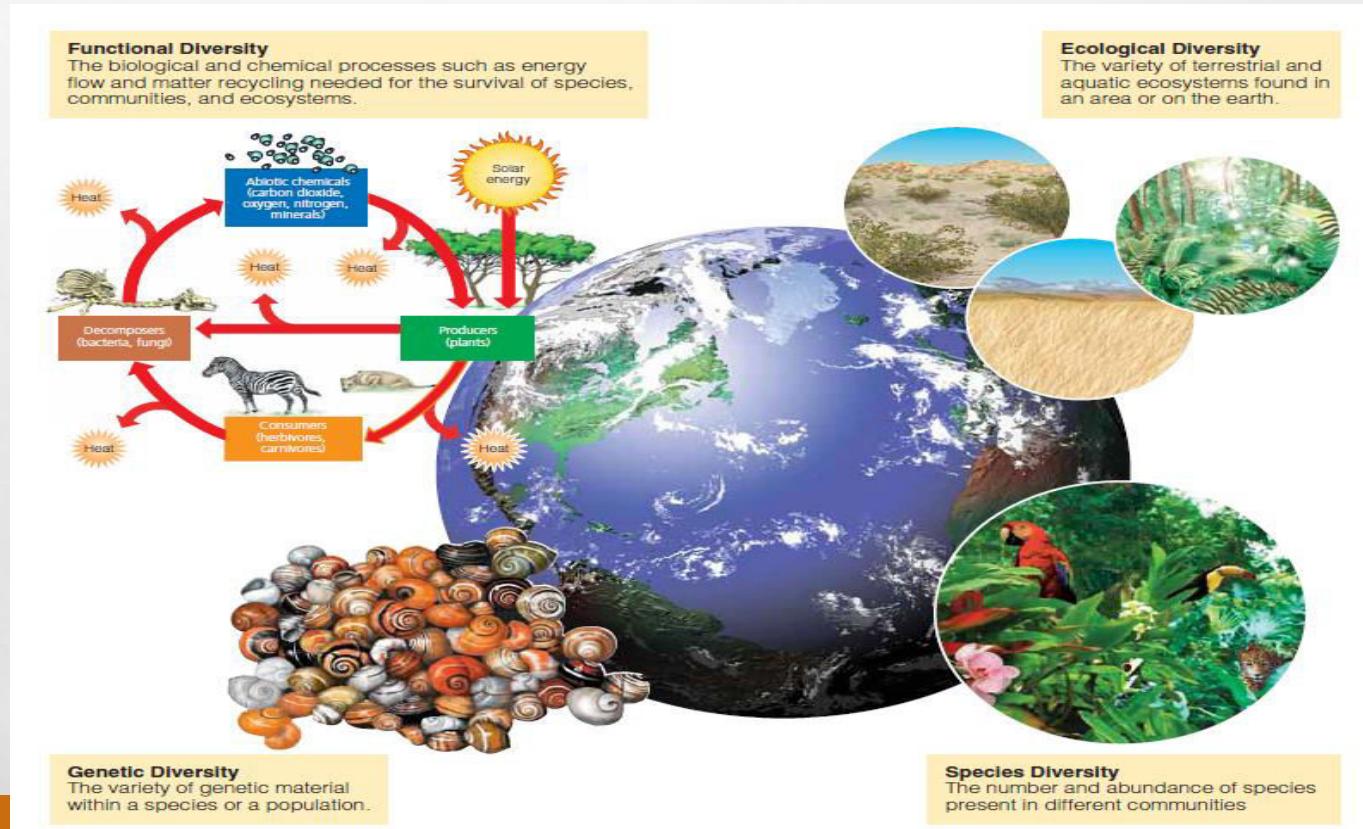


CONTENT

- IMPORTANCE
- TYPES,
- MEGA-BIODIVERSITY
- SPECIES INTERACTION –
 - EXTINCT,
 - ENDEMIC,
 - ENDANGERED AND
 - RARE SPECIES
- HOT-SPOTS
- GM CROPS
- THREATS TO BIODIVERSITY:
- NATURAL AND ANTHROPOGENIC ACTIVITIES
- CONSERVATION: TERRESTRIAL AND AQUATIC BIODIVERSITY.

INTRODUCTION- BIODIVERSITY

- BIODIVERSITY OR BIOLOGICAL DIVERSITY IS THE DIVERSITY OF THE EARTH' S SPECIES, GENES THEY CONTAIN, THE ECOSYSTEM IN WHICH THEY LIVE, AND ECOSYSTEM PROCESSES OF ENERGY FLOW AND NUTRIENT CYCLING THAT SUSTAIN ALL LIFE.



IMPORTANCE OF BIODIVERSITY

- THE EARTH'S BIODIVERSITY IS A VITAL PART OF THE NATURAL CAPITAL THAT HELP TO SURVIVE ALL ECOSYSTEM.
 - FOOD
 - WOOD
 - FIBER
 - ENERGY
 - MEDICINES
 - ECONOMIC WEALTH
 - QUALITY OF WATER
 - AIR
 - FERTILITY OF SOIL
 - DISPOSE OF WASTE
 - CONTROL OF PESTS

TYPES OF BIODIVERSITY

- **GENETIC DIVERSITY:** PROVIDES A VARIETY OF GENES THAT ENABLE LIFE ON THE EARTH TO ADAPT TO AND SURVIVE DRAMATIC ENVIRONMENTAL CHANGES.
- **ECOSYSTEM DIVERSITY:** THE EARTH'S VARIETY OF DESERT, GRASSLANDS , FOREST AND MOUNTAINS, OCEANS, LAKES, RIVERS AND WETLANDS IS THE MAJOR COMPONENTS OF BIODIVERSITY.
- **FUNCTIONAL DIVERSITY:** THE VARIETY OF PROCESSES OF MATTER CYCLING AND ENERGY FLOW WITHIN ECOSYSTEMS AND BIOSPHERE.

INDIA -MEGA BIODIVERSITY

India as a Mega Diversity region

- India is one of 12 mega diversity countries of world.
- It has 47,000 species of plants and 81,000 species of animals.
- Many endemic plants and animals.
- Centre of origin of many flowering and crop plants.
- Great marine diversity due to 7500 km long coastline



***Sapria himalayana*(parasitic angiosperm)**



INDIA- MEGA BIODIVERSITY

- **10TH RANK AMONG PLANT RICHNESS**
- **11TH – ENDEMIC SPECIES OF HIGHER VERTEBRATES**
- **6TH IN CENTRES OF DIVERSITY AND ORIGIN OF FOOD CROPS**
- **INDIA IS ONE OF THE 12 MEGA BIODIVERSITY NATION**
- **5000 SPECIES ARE THERE OF FLOWERING AND 320 SPECIES OF FOOD PLANTS**
- **MARINE BIODIVERSITY IS STILL TO BE EXPLORED**
- **45,000 PLANT SPECIES- 7% WORLD'S CONTRIBUTION**
- **81000 ANIMAL SPECIES- 6.5 % FAUNA**

SPECIES INTERACTION - TERMS

- **EXTINCTION:** THIS AFFECTS THE NUMBER AND TYPES OF SPECIES ON THE EARTH- ENTIRE SPECIES CEASES TO EXIST.
- **ENDEMIC SPECIES:** SPECIES FOUND IN FEW AREAS ONLY.
 - EXIST IN ISLANDS AND TROPICAL RAIN FOREST.
 - EG: GOLDEN TOAD – FOUND IN COSTA RICA'S MOUNTAINOUS REGION. IN 1989 IT BECAME EXTINCT.
 - REASON: WARMER AIR FROM GLOBAL CLIMATE CHANGE CAUSED THE AREA'S MOISTURE BEARING CLOUDS IN CARIBBEAN SEA TO RISE AND DRY OUT THE HABITAT FOR THIS FROG.



Figure 4-7 Depleted natural capital: male golden toad in Costa Rica's high-altitude Monteverde Cloud Forest Reserve. This species has recently become extinct because changes in climate dried up its habitat.

EXTINCTION

- **BACKGROUND EXTINCTION:** SPECIES DISAPPEAR AT A LOW RATE
 - BIOLOGISTS ESTIMATE THE AVERAGE ANNUAL BACKGROUND EXTINCTION RATE IN ONE TO FIVE SPECIES FOR EACH MILLION SPECIES ON THE EARTH.
- **MASS EXTINCTION:** SIGNIFICANT RISE IN EXTINCTION RATE.
- THIS LEADS TO EVOLUTION OF NEW SPECIES.
- AS ENVIRONMENTAL CONDITIONS CHANGE, THE BALANCE BETWEEN FORMATION OF NEW SPECIES AND EXTINCTION OF EXISTING ONES DETERMINES THE EARTH'S BIODIVERSITY.



Passenger pigeon



Great auk



Dodo



Dusky seaside sparrow



Aepyornis
(Madagascar)

TYPES OF SPECIES EXTINCTION

- **LOCAL EXTINCTION:** WHEN A SPECIES IS NO LONGER FOUND IN AN AREA. BUT STILL FOUND ELSEWHERE IN THE WORLD.
- **ECOLOGICAL EXTINCTION:** FEW MEMBERS OF A SPECIES ARE LEFT AND IT CAN NO LONGER PLAY ITS ECOLOGICAL ROLES IN COMMUNITIES.
- **BIOLOGICAL EXTINCTION:** SPECIES IS NO LONGER FOUND ANYWHERE ON THE EARTH.

Characteristic	Examples
Low reproductive rate (K-strategist)	 Blue whale, giant panda, rhinoceros
Specialized niche	 Blue whale, giant panda, Everglades kite
Narrow distribution	 Elephant seal, desert pupfish
Feeds at high trophic level	 Bengal tiger, bald eagle, grizzly bear
Fixed migratory patterns	 Blue whale, whooping crane, sea turtle
Rare	 African violet, some orchids
Commercially valuable	 Snow leopard, tiger, elephant, rhinoceros, rare plants and birds
Large territories	 California condor, grizzly bear, Florida panther

Figure 9-4 Characteristics of species that are prone to ecological and biological extinction.

CAUSE FOR PREMATURE EXTINCTION

- **HIPPCO-**
 - H- HABITAT DESTRUCTION, DEGRADATION AND FRAGMENTATION
 - I- INVASIVE
 - P- POPULATION GROWTH
 - P- POLLUTION
 - C- CLIMATE CHANGE
 - O- OVER EXPLOITAION

HUMAN ACTIVITIES – PREMATURE EXTINCTION OF SPECIES

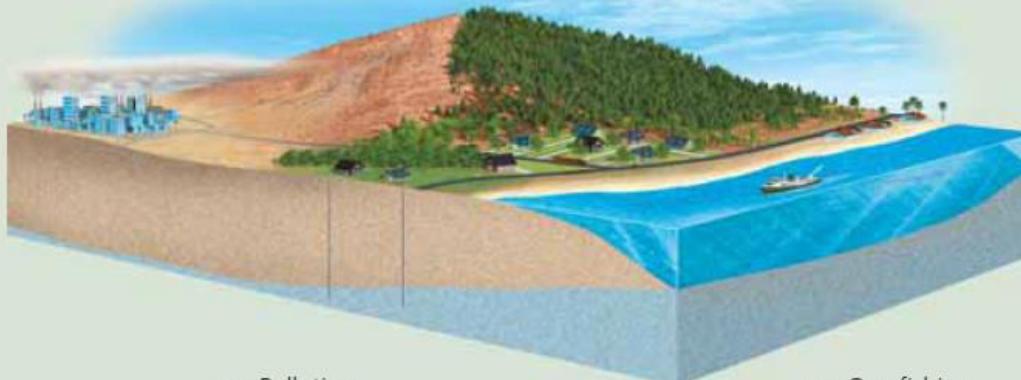
- ACCORDING TO BIOLOGIST: AS POPULATION AND RESOURCES CONSUMPTION INCREASES OVER NEXT 50 YEARS OUR ECOLOGICAL FOOT PRINT WILL EXPAND LIKELY.
- PREMATURE EXTINCTION WILL BE THERE FOR CURRENT SPECIES BY 2050.
- THIS WILL LEAD TO DEGRADE AND DEPLET THE NATURAL CAPITAL THAT SUPPORTS ALL LIFE.
- IT TOOK MILLION'S OF YEARS FOR MASS EXTINCTION.
- WE ARE DEGRADING THE TROPICAL FOREST, CORAL REEFS AND WETLANDS- CENTERS FOR FUTURE SPECIATION.

CAUSES OF DEPLETION-PREMATURE EXTINCTION

Causes of Depletion and Premature Extinction of Wild Species

Basic Causes

- Population growth
- Rising resource use
- Undervaluing natural capital
- Poverty

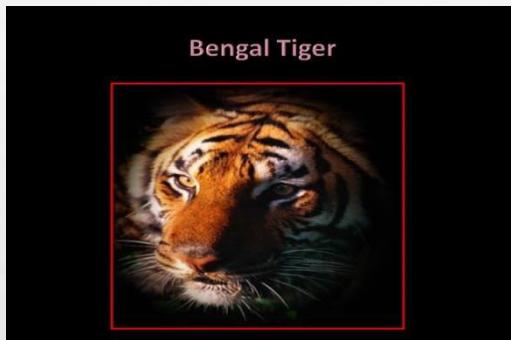


Secondary Causes

- | | | |
|---|---|-----------------------------|
| • Habitat loss | • Pollution | • Overfishing |
| • Habitat degradation and fragmentation | • Commercial hunting and poaching | • Climate change |
| • Introduction of nonnative species | • Sale of exotic pets and decorative plants | • Predator and pest control |

ENDANGERED AND THREATENED SPECIES

- EVEN BIOLOGIST CLASSIFY SPECIES INTO TWO EXTINCTION
 - **ENDANGERED SPECIES:** FEW INDIVIDUALS ARE THERE AND THOSE SPECIES COULD BECOME EXTINCT. (NATURAL RANGE)



- **THREATENED SPECIES:** (KNOWN AS VULNERABLE SPECIES) IS STILL ABUNDANT IN NATURAL RANGE, BUT DECLINE IN NUMBERS AND BECOME ENDANGERED IN NEAR FUTURE.



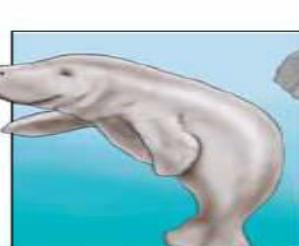
Grizzly bear



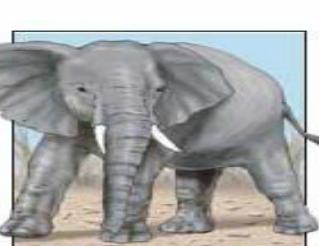
Kirkland's warbler



Knowlton cactus



Florida manatee



African elephant



Utah prairie dog



Swallowtail butterfly



Humpback chub



Golden lion tamarin



Siberian tiger



Giant panda



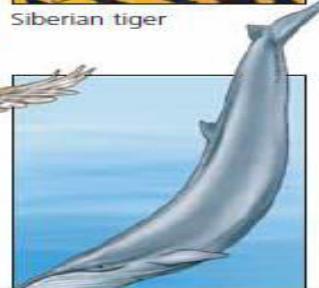
Black-footed ferret



Whooping crane



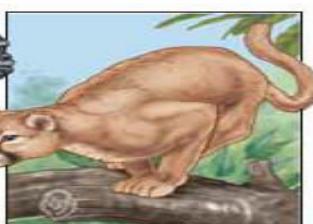
Northern spotted owl



Blue whale



Mountain gorilla



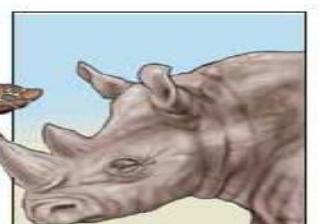
Florida panther



California condor



Hawksbill sea turtle



Black rhinoceros

Figure 9-3 Endangered natural capital: species that are endangered or threatened with premature extinction largely because of human activities. Almost 30,000 of the world's species and 1,260 of those in the United States are officially listed as being in danger of becoming extinct. Most biologists believe the actual number of species at risk is much larger.

WAYS THAT SPECIES BECOME ENDANGERED

- HABITAT LOSS
- UNREGULATED OR ILLEGAL POACHING
- PESTICIDES
- POLLUTION
- COMPETITION WITH OTHER SPECIES
- DISEASE
- PREDATORS IN NATURAL

INVASIVE SPECIES- CASE STUDY

- INTRODUCING THE EXOTIC SPECIES ALSO DISTURB THE ECOSYSTEM.

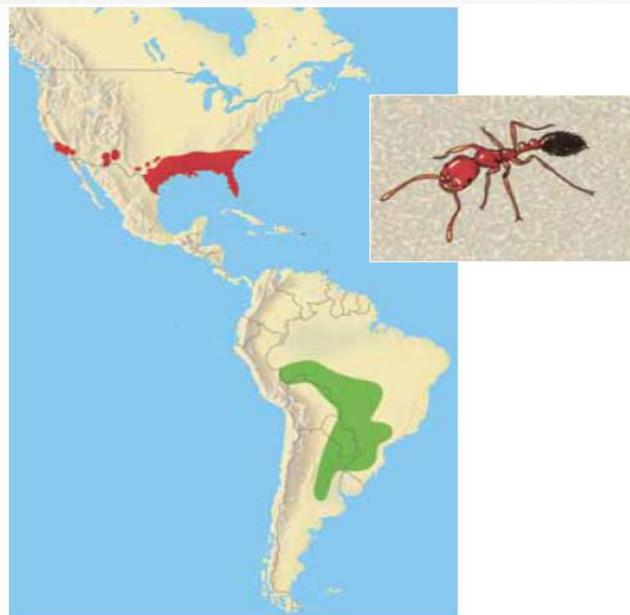


Figure 9-11 Accidentally introduced invasive species: the Argentine fire ant, introduced accidentally into Mobile, Alabama, in 1932 from South America (green area), has spread over much of the southern United States (red area). This invader is also found in Puerto Rico, New Mexico, and California. **Question:** How might this accidental introduction of fire ants have been prevented? (Data from S.D. Porter, Agricultural Research Service, U.S. Department of Agriculture)

- Aggressive argentina fire ant introduced
Into the United states.
- When these ant invade an area, they
wipe off 90% native species.
- They killed the deer fawns, birds, livestock
Pets, 80 % people was allergic to their venom.

WAYS TO REDUCE THREATS FROM INVASIVE SPECIES

- ONCE AN NON-NATIVE SPECIES IS ESTABLISHED IN AN ECOSYSTEM, ITS REMOVAL IS ALMOST IMPOSSIBLE.
- FUND A MASSIVE RESEARCH PROGRAM TO IDENTIFY THE SPECIES TO BECOME SUCCESSFUL INVADERS.
- INCREASE THE GROUND SURVEYS AND MONITOR THE SPECIES AND FIND HOW THEY WILL SPREAD.
- STEP UP FOR IMPORTED GOODS WHICH LIKELY CONTAIN THE INVADER SPECIES.
- IDENTIFY MAJOR HARMFUL INVADER SPECIES AND PASS INTERNATIONAL LAWS BANNING IN TRANSFER FROM ONE TO THE ANOTHER.
- INCREASE RESEARCH TO FIND NATURAL PREDATORS, BACTERIA, AND VIRUSES TO CONTROL THE POPULATION OF THE INVADER SPECIES.

RARE SPECIES

Protect those species from poaching

- THESE ARE SPECIES WITH SMALL POPULATION SIZE IN THE WORLD, DISTRIBUTED IN LOCALISED OR RESTRICTED AREA.



PREVENTING SPECIES TO EXTINCTION



Rauvolfia
Rauvolfia septentina,
Southeast Asia
Anxiety, high
blood pressure



Foxglove
Digitalis purpurea,
Europe
Digitalis for heart failure



Pacific yew
Taxus brevifolia,
Pacific Northwest
Ovarian cancer



Cinchona
Cinchona ledgeriana,
South America
Quinine for malaria treatment



Rosy periwinkle
Catharanthus roseus,
Madagascar
Hodgkin's disease,
lymphocytic leukemia



Neem tree
Azadirachta indica,
India
Treatment of many
diseases, insecticide,
spermicide



Species Interaction

By

Dr. V. Sai Saraswathi., M. Pharma., Ph. D.,

Environmental Science Professor,

Asst. Prof. (Sr.)

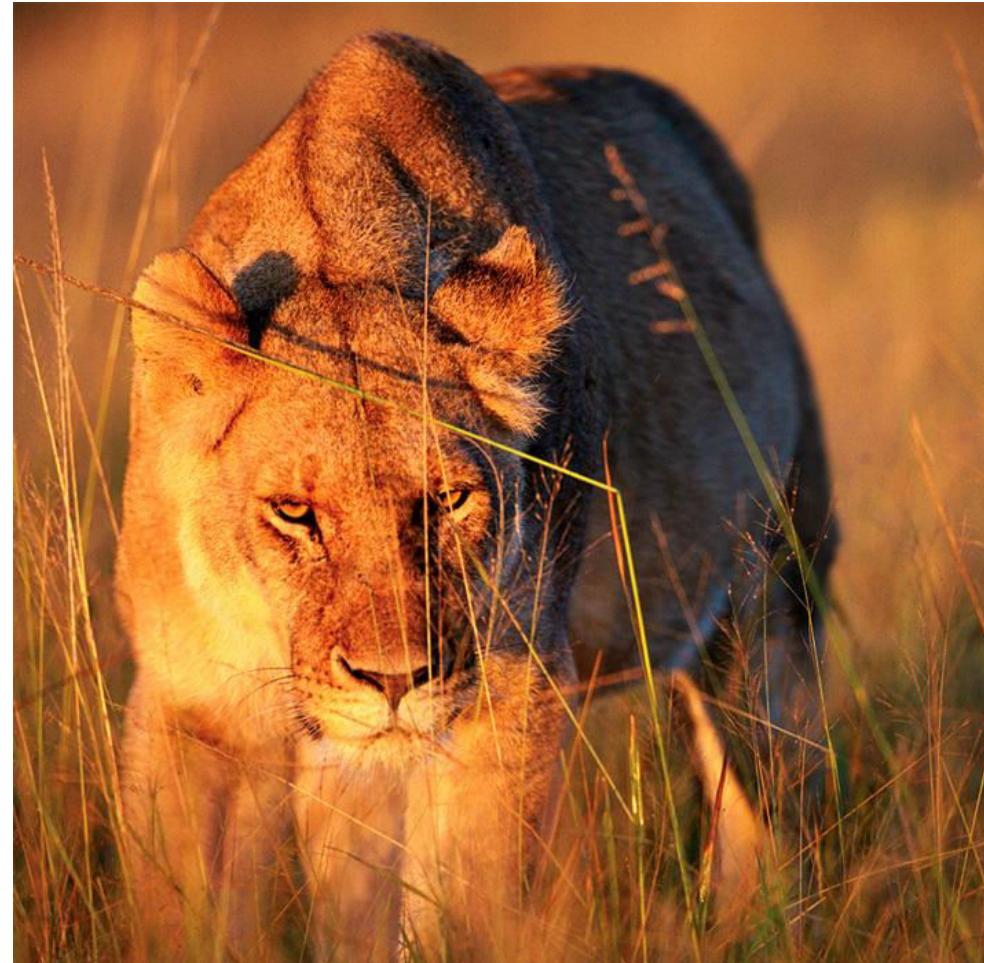
School of Advanced Sciences

VIT University

Vellore- 632014

Habitat and Niche

- A habitat is the home of the animals or an organism lives.
- Niche: An organism role in the ecosystem.
- No two species can exact same niche, because they do not exact same thing.
- It gets the food, water, shelter and space to live in



Ecological equivalent: species occupy similar niches and live in different geographical regions.



Camouflage

- **Camouflage** is protective coloration in which an animal resembles its background.







Species interaction

- Predator/Prey
- Parasitism
- Commensalism
- Mutualism

Prey – predation

- It is any interaction between two organisms in which one organism (predator) and consumes all or part of the other (prey)



Herbivorous prey predation



An herbivore grazing on a plant is another example of predation.



Figure 4: A carnivorous pitcher plant.

A carnivorous pitcher plant that preys upon insects by luring them into the elongated tube where the insects get trapped, die and are then digested.

© 2013 **Nature Education** Courtesy of M. E. Benbow. All rights reserved. 

Predation as Herbivory



Figure 5: Sharp thorns on the branch of a tree, used as anti-herbivory defense.

Symbiosis

- **Symbiosis** is an intimate relationship between different species in which at least one species depends upon the relationship to survive.

TYPES OF SYMBIOSIS

- **Mutualism:** Both partners benefit from the relationship (+, +)
- **Commensalism:** One partner benefits from the relationship; the other partner is not affected (+, 0)
- **Parasitism:** One partner benefits from the relationship; the other partner is harmed (+, -)

Mutualism



(a) Acacia tree and ants (genus *Pseudomyrmex*)

Copyright © 2008 Pearson Education, Inc., publishing as Pearson Benjamin Cummings.

- Acacia ants live in acacia trees.
- The tree provides big hollow thorns as a home for the ants.
- The tree also provides food for the ants in yellow swellings on the leaves (red oval).



(b) Area cleared by ants at the base of an acacia tree

13

Flowers and their Pollinators (examples: Bees and hummingbirds gather nectar and spread pollen)



Examples of Mutualism

- The oxpecker is a bird that has a mutualistic relationship with a rhino or a zebra.
- Ocean: Zooxanthellae are photosynthetic algae that lives inside the corals tissues.

Commensalism

Cattle Egret

- The cattle egrets eat insects that are flushed as the big herbivores move around.
- The herbivores get no benefit or harm from the egrets



Orchids Growing on Branches of Trees

- Orchids belong to a family of flowering plants that form a commensal relationship with the trees.
- It is a well-known epiphytic plant that grows on the branches or trunks of other trees.
- Orchids are usually found in dense tropical forests. They form their base of attachment on the branches of trees,
- and benefit by getting adequate sunlight and nutrition that flows down the branches.
- The orchids do not grow to a large size, and thus the host tree is not harmed in any way.



Epiphytic bromeliads that grow on the limbs of large tropical rainforest trees.
These benefit by occupying space on the limb receiving rain and sunlight but do not harm the tree.



Parasitism

- An organism that lives at the expense of another (host), which it does not usually kill.” *Usually smaller than host.*



Ticks



Fleas



Tomato Hornworm with Wasp Eggs



Tape worm



Mosquito on humans

Thank You



BIODIVERSITY HOTSPOTS

By

Dr. V. Sai Saraswathi., M. Pharma., Ph. D.,

Environmental Science Professor,

School of Advanced Sciences

VIT University

Vellore- 632014

Introduction

- To protect the earth's biodiversity, conservation biologist have identified the emergency action plans and protect the biodiversity hotspots. – Norman Myers.
- 34 global terrestrial hotspots are there, which covers 2% of the earth's land surface.
- 50 % -world's flowering plants, 42 % of vertebrates (Mammals, birds, reptiles, amphibians)
- Acc. ***To International Union of Conservation of Nature (IUCN)***, large majority of world's endangered or critically endangered species, -92% of earth's amphibians, 86% of birds, 72% of mammals.

World's 35 Biodiversity Hotspots

I. Africa

1. **Cape Floristic Region**
2. **Coastal Forests of Eastern Africa**
3. **Eastern Afromontane**
4. **Guinean Forests of West Africa**
5. **Horn of Africa**
6. **Madagascar and the Indian Ocean Islands**
7. **Maputaland-Pondoland-Albany**
8. **Succulent Karoo**

II. Asia-Pacific

9. **East Melanesian Islands**
10. **Himalaya**
11. **Indo-Burma**
12. **Japan**
13. **Mountains of Southwest China**
14. **New Caledonia**
15. **New Zealand**
16. **Philippines**
17. **Polynesia-Micronesia**
18. **Southwest Australia**
19. **Forests of Eastern Australia (new)**
20. **Sundaland**
21. **Wallacea**
22. **Western Ghats and Sri Lanka**

III. Europe and Central Asia

23. **Caucasus**
24. **Irano-Anatolian**
25. **Mediterranean Basin**
26. **Mountains of Central Asia**

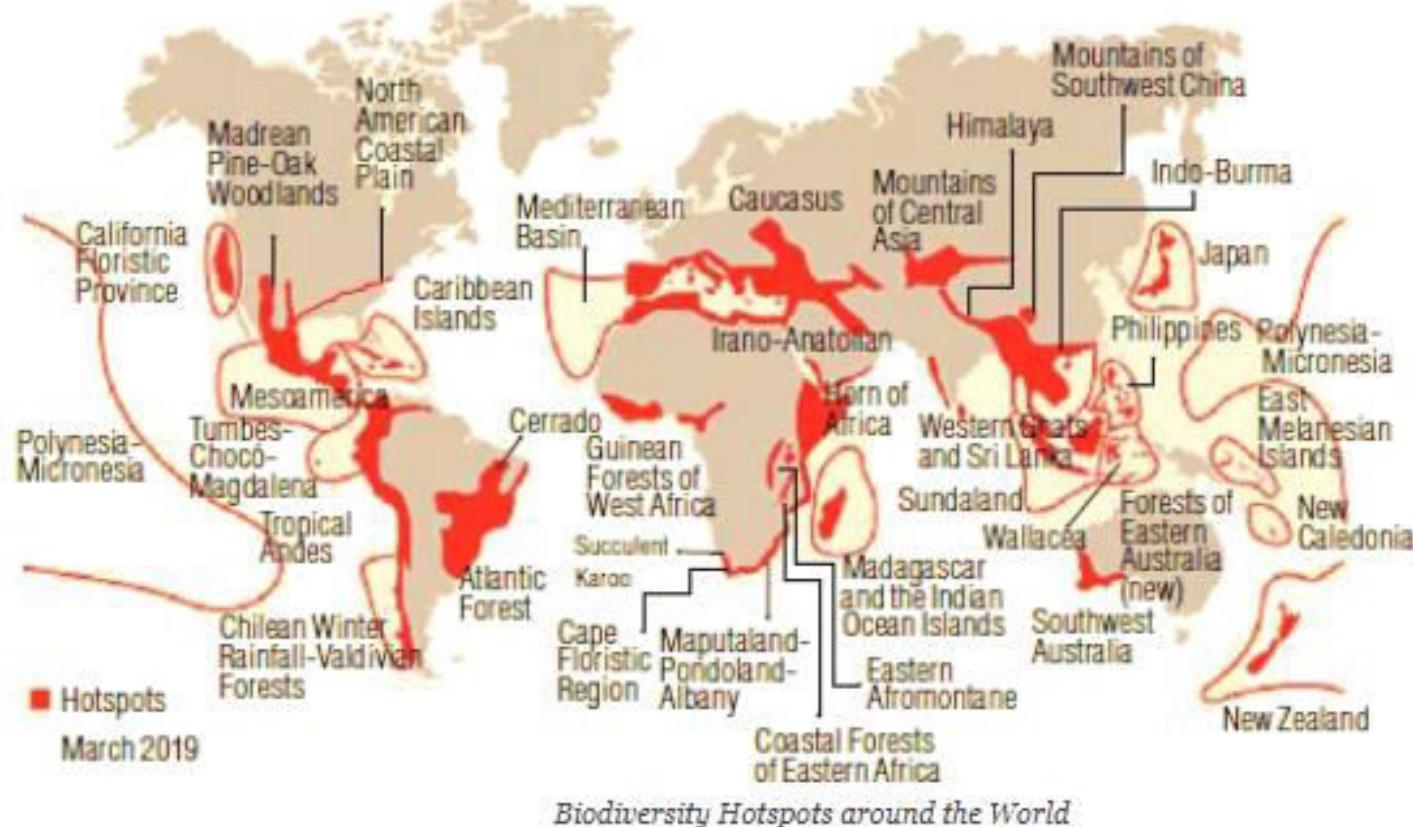
IV. North and Central America

27. **California Floristic Province**
28. **Caribbean Islands**
29. **Madrean Pine-Oak Woodlands**
30. **Mesoamerica**

V. South America

31. **Atlantic Forest**
32. **Cerrado**
33. **Chilean Winter Rainfall-Valdivian Forests**
34. **Tumbes-Chocó-Magdalena**
35. **Tropical Andes**

36 Biodiversity Hotspots - Globe



There are 36 biodiversity hotspots around the globe which represent only 2.4 per cent of earth's land surface.

Biodiversity Hotspots around the World

Since 1964, IUCN -established a “Red List”

THE RED LIST CATEGORIES

Extinct



EX



EW

Threatened



CR



EN



VU

Least Concern



NT



LC

Extinct (EX): no reasonable doubt that the last individual has died

Extinct in the Wild (EW): known only to survive in captivity, cultivation or well outside its natural range

Critically Endangered (CR): facing extremely high risk of extinction in the wild

Endangered (EN): facing a very high risk of extinction in the wild,

Vulnerable (VU): facing a high risk of extinction in the wild.

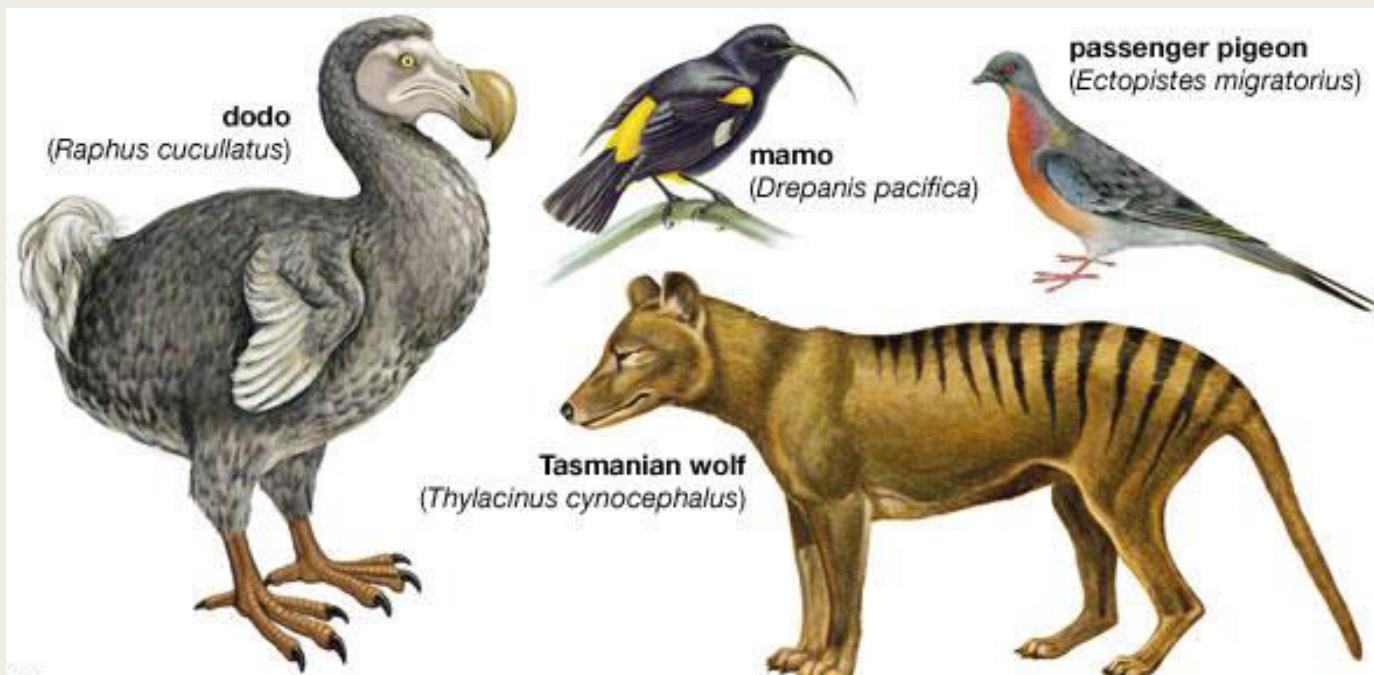
Near Threatened (NT): close to qualifying, or likely to qualify for a threatened category in the near future

Least Concern (LC): population is stable enough that it is unlikely to face extinction in the near future

Data Deficient (DD): not enough information on abundance or distribution to estimate its risk of extinction

Extinct Species

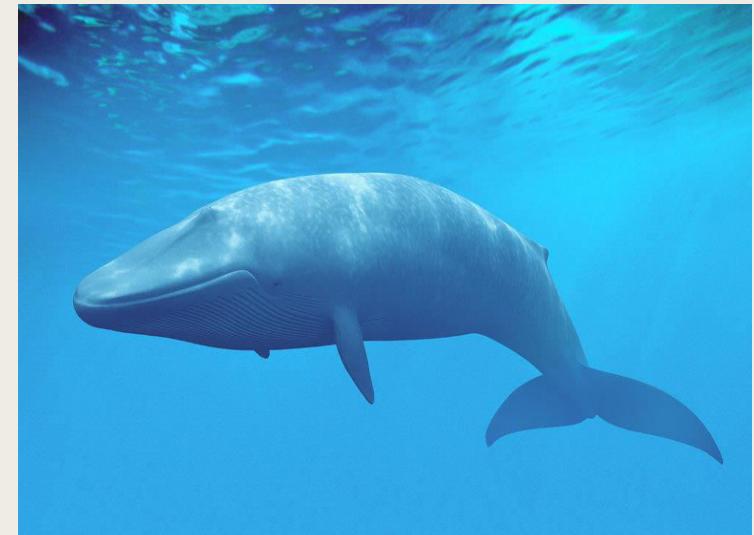
- Extinct Species: Species that are no longer known to exist in the wild.
- <https://www.indiatoday.in/education-today/gk-current-affairs/story/world-wildlife-day-2020-here-are-7-significant-wildlife-species-that-went-extinct-in-2019-1652013-2020-03-03>



Endangered Species

- Endangered: Species is found less in number and verge to be extinct.
Eg. Asian elephant, *Elephas maximus* (endangered).

Early in the 20th century, perhaps 100,000 elephants roamed across Asia. Since then, their population likely has been cut in half. They're killed not just for their ivory tusks but also for their meat and hides—and sometimes in retaliation for the damage they do to crops.



Vulnerable Species

- A vulnerable species is a species which has been categorized by the International Union for Conservation of Nature as likely to become endangered unless the circumstances that are threatening its survival and reproduction improve.
- The Black spider Monkey, Dudong



Endemic Species



The **Nilgiri laughing thrush** (*Montecincla cachinnans*) is a species of laughing thrush endemic to the high elevation areas of the **Nilgiris** and adjoining hill ranges in Peninsular India.

The Nilgiri tahr (*Nilgiritragus hylocrius*) is an ungulate that is endemic to the Nilgiri Hills and the southern portion of the Western & Eastern Ghats in the states of Tamil Nadu and Kerala in Southern India. It is the state animal of Tamil Nadu.



Endemism or Endemic species of India

- ♣ Species, which are confined to a particular area, are called endemic species.
- ♣ Our country has a rich endemic flora and fauna.
- ♣ About 33% of the flowering plants, 62% of amphibians, 50% lizards.

Endemic species of plants in India

Group	No. of species
Pteridophyta	200
Angiosperms	4950

Endemic species of animals in India

Group	No. of species
Freshwater	64
Marine	14
Amphibia	123
Reptilia	182
Mammalia	44

Hot-Spots of Biodiversity

Definition: The hot spots are the geographic areas, which possess the high endemic species.

Criteria for recognizing hot spots

1. Richness of the endemic species is the primary criterion for recognizing hot spots.
2. Hot spots should have a significant percentage of specialized species.
3. Site is under threat.
4. Should contain gene pools of potentially useful plants.

Reason for rich biodiversity in the tropics

1. Tropics have a more stable climate.
2. Warm temperatures and high humidity provide favorable conditions.
3. No single species domination, thus giving an opportunity for many species to coexist.
4. Among plants, rate of out-crossing appear to be higher in tropics.

Area of hot spot

- The term hot spot was introduced by Myers (1988).
- There are 25 such hot spots of biodiversity on a global level out of which two are present in India, namely the Eastern Himalayas and Western Ghats.
- These hot spots covering less than 2% of the world's land area are found to have about 50% of the terrestrial biodiversity.
- According to Myers et al (2000) an area is designated as a hotspot when it contains at least 0.5% of the plant species as endemics.
- About 40% of terrestrial plants and 25% of vertebrate species are endemic and found in the hotspots.

To Qualify as a Hotspot

- According to CI, to qualify as a hotspot a region must meet two strict criteria:
- It must contain at least 1,500 species of vascular plants (> 0.5% of the world's total) as endemics,
- and it has to have lost at least 70% of its original habitat. In 1999,
- CI identified 25 biodiversity hotspots in the book "Hotspots: Earth's Biologically Richest and Most Endangered Terrestrial Ecoregions".
- Collectively, these areas held as endemics about 44% of the world's plants and 35% of terrestrial vertebrates in an area that formerly covered only 11.8% of the planet's land surface.
- The habitat extent of this land area had been reduced by 87.8% of its original extent, such that this wealth of biodiversity was restricted to only 1.4% of Earth's land surface.

BIODIVERSITY HOTSPOTS IN INDIA

1. Himalaya: Includes the entire Indian Himalayan region (and that falling in Pakistan, Tibet, Nepal, Bhutan, China and Myanmar)

2. Indo-Burma: Includes entire North-eastern India, except Assam and Andaman group of Islands (and Myanmar, Thailand, Vietnam, Laos, Cambodia and southern China)

3. Sundalands: Includes Nicobar group of Islands (and Indonesia, Malaysia, Singapore, Brunei, Philippines)

4. Western Ghats and Sri Lanka: Includes entire Western Ghats (and Sri Lanka)



Two of which are found in India

1. **Eastern Himalayas** : Indo-Burma region
2. **Western Ghats** : Sri Lanka region

1. Eastern Himalayas: Geographically these areas comprise Nepal, Bhutan, and neighboring states of Northern India. There are 35,000 plant species found in the Himalayas, of which 30% are endemic. The Eastern Himalayas are rich in wild plants of economic value.

Examples: Rice, banana, citrus, chilli, jute, and sugarcane

2. Western Ghats: The area comprises Maharashtra, Karnataka, Tamil Nadu and Kerala and has 40% of the total endemic plant species, 62% amphibians and 50% lizards are endemic in Western Ghats. It is reported that only 7% of the original forests are existing today while the rest has been deforested or degraded.

Some common plants: Ternstroemia japonica, Rhododendron and Hypericum

Some common animals: Blue bird, lizard hawk



Facts & Figures – Western Ghats

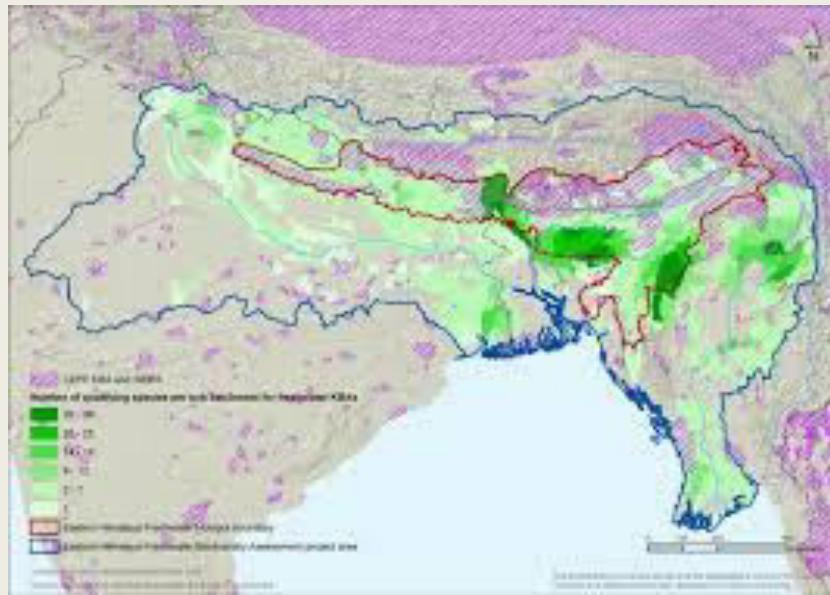
- The Western Ghats are one of the world's biodiversity hotspots with over 5,000 flowering plants, 139 mammals, 508 birds and 179 amphibian species.
- At least 325 globally threatened species occur here.
- The range covers 60,000km² and forms the catchment area for a complex of river systems that drain almost 40% of India.
- At 2695m, Mt Anamudi in Kerala, India is the highest peak in the Western Ghats.
- The Western Ghats are being considered as a UNESCO World Heritage Site.

Species in Western Ghats



The Himalayan Biodiversity Hotspot

- It extends over an arc of 3000 km and includes the entire Indian Himalayan region and this region which fall in Pakistan, Tibet, Nepal, Bhutan, China and Myanmar.
- The Indian Himalayas Hotspot has eight endemic threatened species, four endemic threatened mammals and four endemic threatened amphibians.



***Rafflesia Arnoldii* – The Largest Flower in The World is in Indonesia**

Himalayas - Hotspots



Sundalands- Biodiversity

- Sundaland holds about 25,000 species of vascular plants, 15,000 of which are found nowhere else. There are at least 117 endemic plant genera in the hotspot; 59 of these endemic genera are found in Borneo, 17 in Sumatra, and 41 on the Malay Peninsula.
- Of the approximately 770 bird species that regularly occur in Sundaland, nearly 150 are endemic.
- Native species include the Critically Endangered Bali myna.
- Of Sundaland's more than 380 mammal species, more 170 are endemic to the hotspot.
- The best known are the orangutans, represented by two species: the Critically Endangered Bornean orangutan (*Pongo pygmaeus*) and the Critically Endangered Sumatran orangutan (*P. abelii*).
- 1,000 known species of freshwater fish in the hotspot.
- 240 species of amphibians, nearly 200 of which are endemic.

International Organisations to Conserve Biodiversity Hotspots

- Critical Ecosystem Partnership Fund (CEPF)
- Conservation International (CI)
- Global 200 Ecoregions(WWF)
- Bird life International (Endemic Bird Area - EBAs)
- Plant Life International
- Alliance for Zero Extinction

Thank You



Aquatic Biodiversity

By

Dr. V. Sai Saraswathi., M. Pharma., Ph. D.,

Environmental Science Professor,

School of Advanced Sciences

VIT University

Vellore- 632014



Ecological Services of Biodiversity

Ecological services:

- Balance of nature
- Biological productivity
- Regulation of climate
- Degradation of waste
- Cleaning of air and water
- Cycling of nutrients
- Control of potential pest and disease causing species
- Detoxification of soil and sediments
- Stabilization of land against erosion
- Carbon sequestration and global climate change
- Maintenance of Soil fertility

Water

- Earth is Covered with Water (97%)
- Salt water (71%)
 - Oceans and Estuaries
 - Coastlands and shorelines
 - Coral Reefs
 - Mangrove Forests
- Fresh Water
 - Lakes
 - Rivers and Streams
 - Inland Wetlands



The Ocean Planet

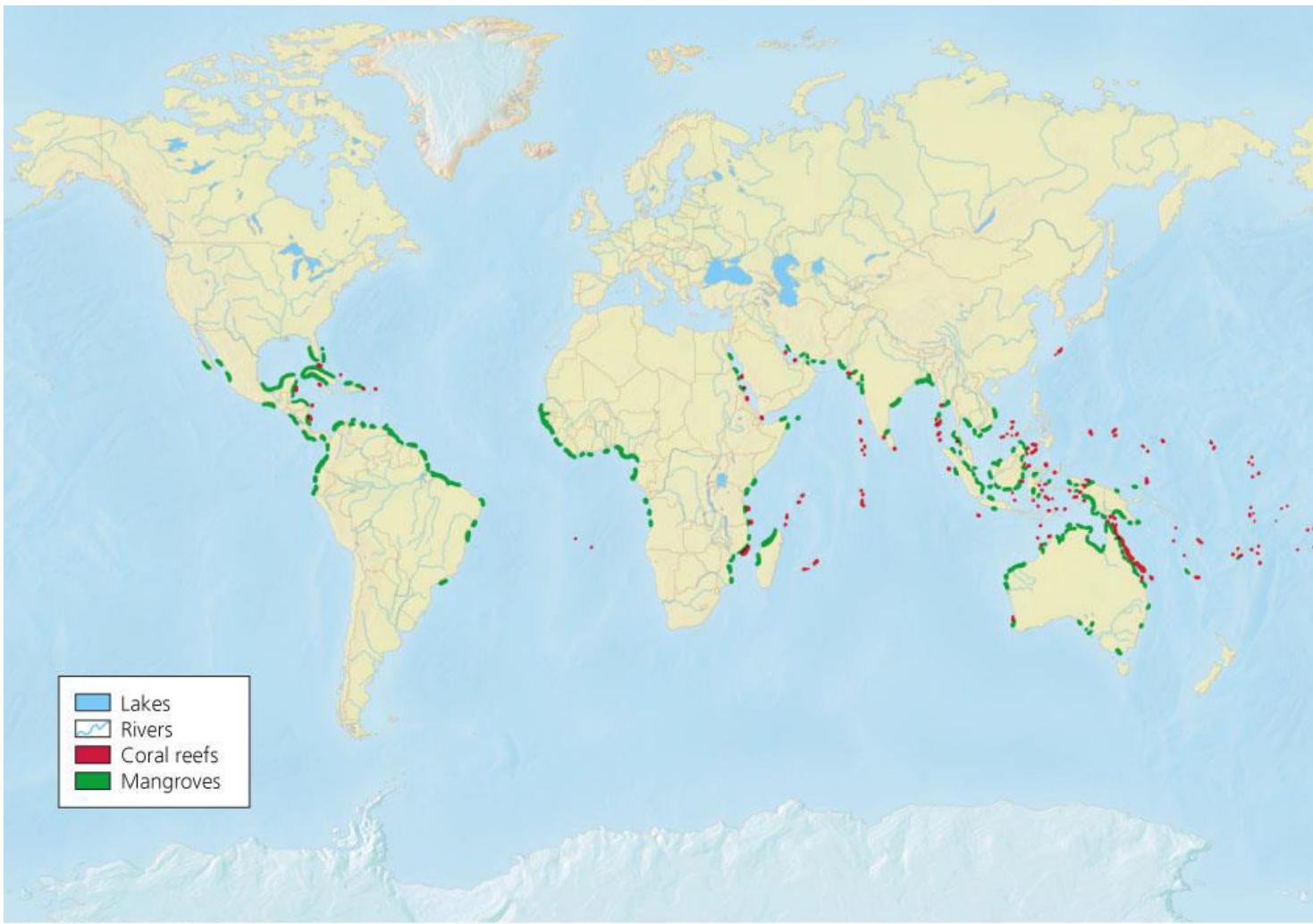


Ocean hemisphere



Land–ocean hemisphere

Distribution of the World's Major Saltwater and Freshwater Sources



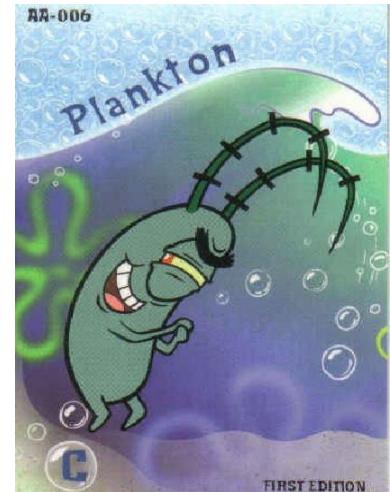
Marine Ecosystem

- Salt marshes
- Intertidal zones
- Estuaries
- Lagoons
- Coral Reefs
- Deep Sea
- Sea Floor



Aquatic Zones

- Saltwater and Freshwater portions of the biosphere- support life
- Aquatic Zones
- **Plankton:** Free Floating (Plants, Algae etc)
 - Zooplankton: Plankton that feed on other plankton
 - Ultra plankton: Photosynthetic bacteria.



- **Nekton:** Strongly fishing Consumers – Fish, Turtles and whales



- **Benthos or bottom Dwellers:** Oysters, Clams and Lobsters



- **Decomposers:** bacteria

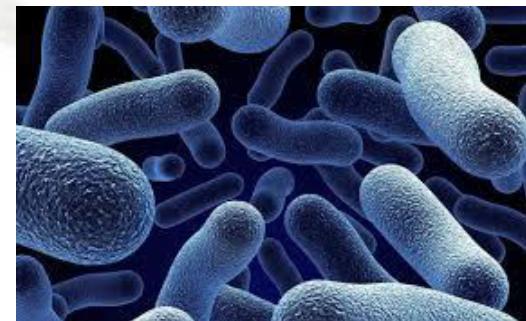
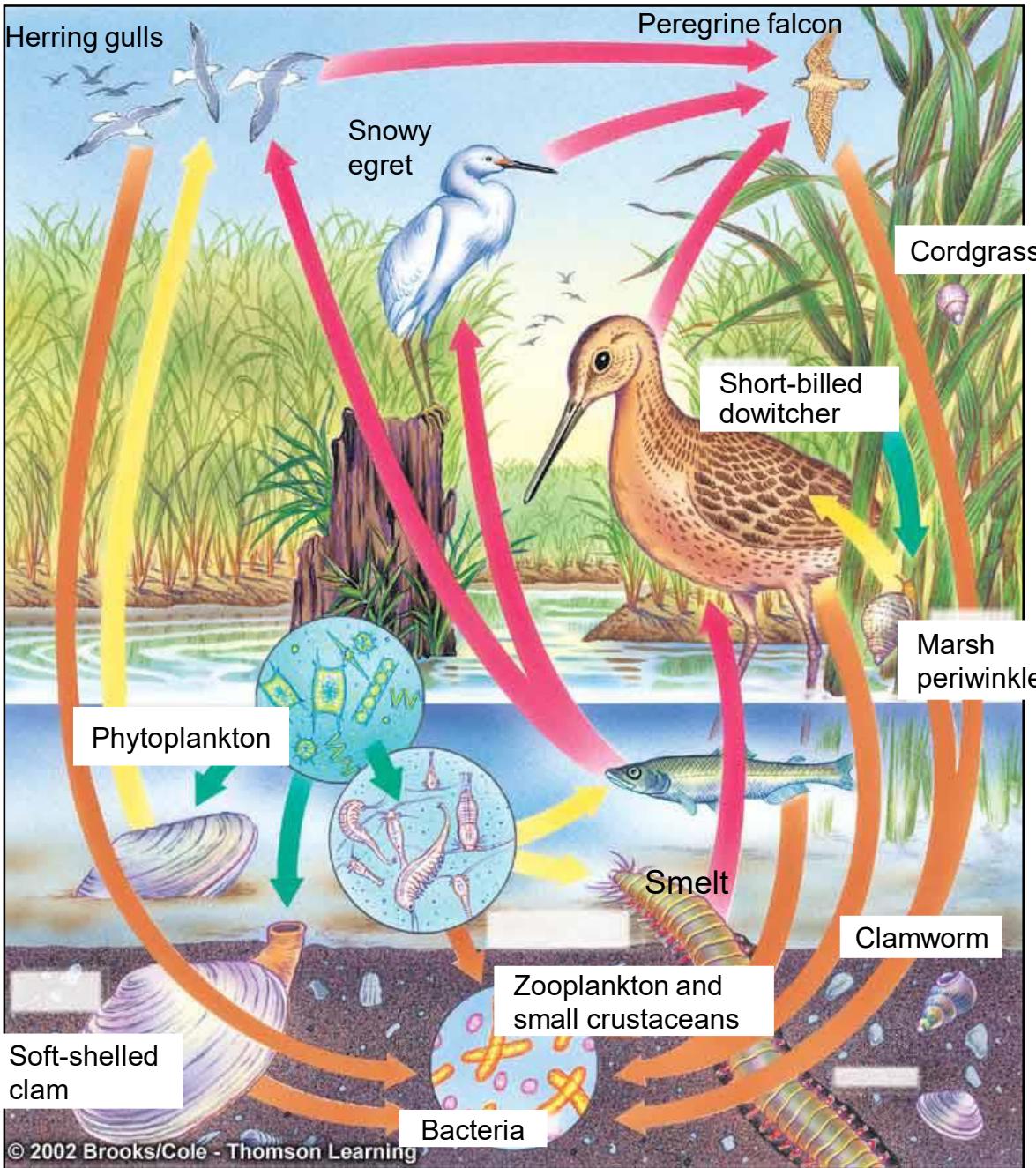
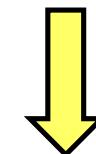


Figure 7-8
Page 132



Producer
to primary
consumer



Primary
to secondary
consumer



Secondary to
higher-level
consumer

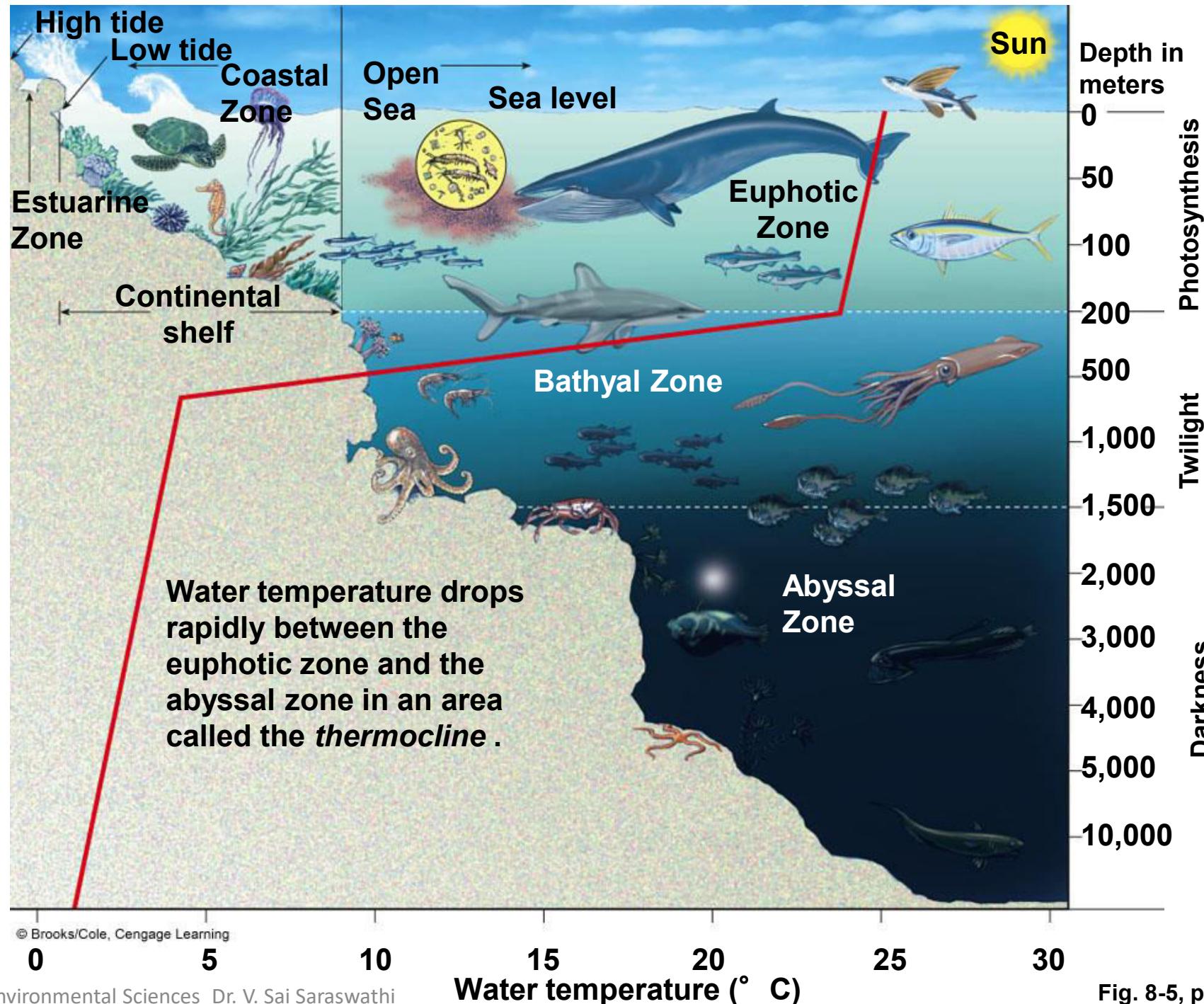


All producers and
consumers to
decomposers

Salt marsh food web

Zones

- Coastal zone: warm, Nutrient rich, shallow water that extend from high tide mark on land to the gently sloping.
- Shallow edge of continental shelf
- Coastal zone contains 10% ocean, but 90% of all marine species and is the site for commercial fishing.



Importance of Aquatic Biodiversity

- Enormous Economic
- Aesthetic value
- Food
- Medicines
- Materials – recreational and commercial purpose for fishing and Tourism

What are the major ecological and economic services provided by marine systems?

Natural Capital

Ecological Services

Marine Ecosystems

Economic Services

Climate moderation



CO₂ absorption

Nutrient cycling

Waste treatment and dilution

Reduced storm impact (mangrove, barrier islands, coastal wetlands)



Habitats and nursery areas for marine and terrestrial species

Genetic resources and biodiversity



Scientific information

Food

Animal and pet feed (fish meal)

Pharmaceuticals

Harbors and transportation routes

Coastal habitats for humans

Recreation

Employment

Offshore oil and natural gas

Minerals

Building materials

Treats to Aquatic Biodiversity

Human activities – Degrading fresh water

- Dams and canal alter and destroy- terrestrial and aquatic biodiversity.
- Reduces the water flow and increasing damage from coastal storms.
- Flood control – rivers disconnect the rivers from their flood plains.
- Pollutants – eutrophication
- Inland wetlands drain.

Conservation of Aquatic Biodiversity

- Reduce Carbon Dioxide
- Safe and sustainable seafood choice
- Reduce plastic pollution
- Take care while – Beach- walking – coastal zone – Not polluting
- Be eco-friendly
- Don't over exploitation

Conservation of Aquatic Biodiversity

- Aquarium – endangered and rare species
- Individual species conservation- Tertiary Consumers – Thereby Ecological Balance – Maintained

The Biggest Aquariums in the World

Rank	Aquarium	Location	Size (million gallons)
1	Chimelong Ocean Kingdom	China	12.9
2	Marine Life Park	Singapore	12.0
3	Oceanografic	Spain	11.0
4	Georgia Aquarium	United States	10.0
5	Moscow Oceanarium	Russia	6.6
6	The Seas with Nemo & Friends	United States	5.7
7	Shedd Aquarium	United States	5.0
8	uShaka Marine World	South Africa	4.6
9	Atlantic Sea Park	Norway	4.0
10	Ambassador Lagoon	United Arab Emirates	2.9

Thank You



GM CROPS

BY

DR. V. SAI SARASWATHI., M. PHARMA., PH. D.,

ENVIRONMENTAL SCIENCE PROFESSOR,

SCHOOL OF ADVANCED SCIENCES

VIT UNIVERSITY

VELLORE- 632014

Introduction

An artificial selection to change the genetic characteristic of populations with similar genes.

Animals or plants can be selected.

- Eg. **Tomato, Wheat, Fruit, or dog.**

Selective breeding ends with populations of species containing large no. of individuals with the desired traits.

Recently scientist are using genetic engineering to speed up the manipulation of genes.

All5!



Original



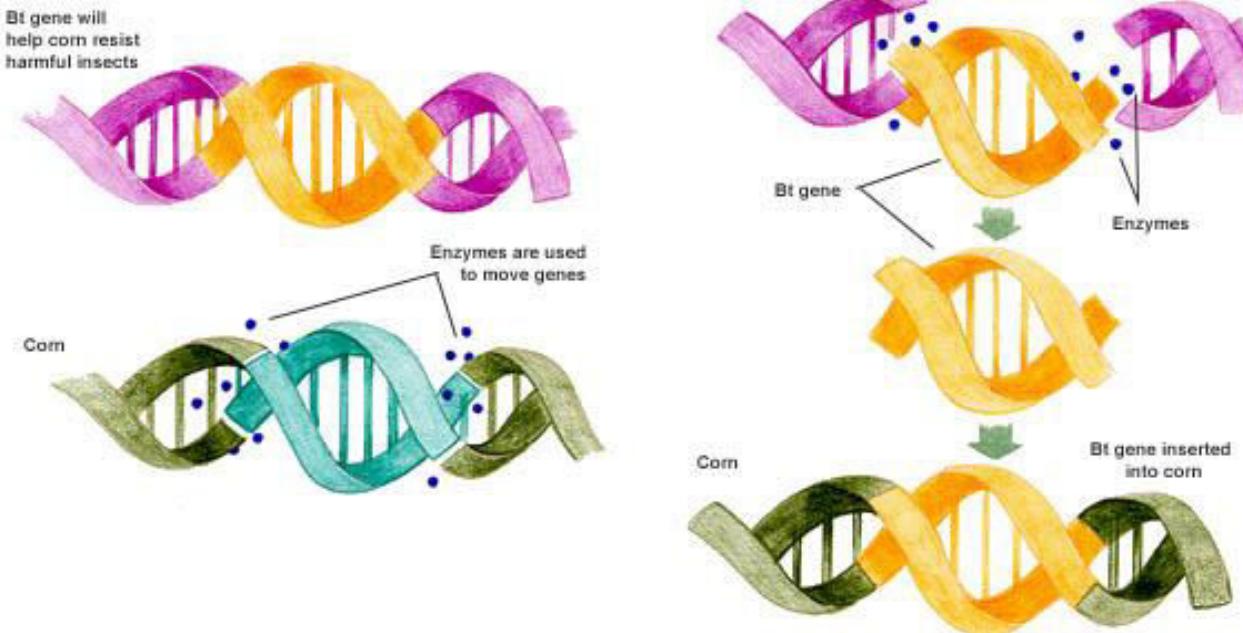
Now





Definition

Genetic engineering or gene splicing is the alteration of an organism's genetic material, thro' adding, deleting, or changing segments of its DNA



Genetically Modified Organisms

Eg: Genes from a fish species can be transferred into a tomato plant to give its properties.

The resulting organism are called as **Genetically modified organisms (GMOs) or Transgenic Organisms.**

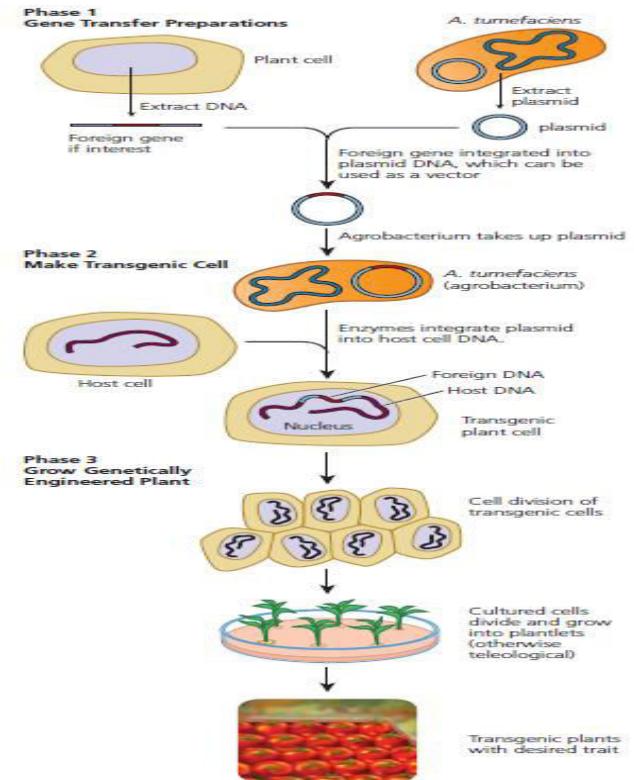


Figure 4-8 Genetic engineering: steps in genetically modifying a plant. Question: How does this process change the nature of evolution by natural selection?

Examples

- Bioengineers have developed many beneficial GMOs that may low the cholesterol eggs.
- Wheat that thrives in drought conditions
- Bananas that don't rot on the way to market.
- Tomatoes with genes can help to prevent some type of cancer.
- Genetic engineers have produced two mice – schwarzenegger mouse- muscle building genes and marathon mouse – never seems to tire.



Figure 4-9 An example of genetic engineering. The 6-month-old mouse on the left is normal; the same-age mouse on the right has a human growth hormone gene inserted in its cells. Mice with the human growth hormone gene grow two to three times faster and twice as large as mice without the gene. **Question:** How do you think the creation of such species might change the process of evolution by natural selection?

What are GM crops?

- Plants which have been genetically altered to express a desirable trait (Perry 2003)
 - Herbicide resistance
 - Virus resistance
 - Insecticides
 - Environmental Tolerance
 - Increased nutritional value

Genetically Modified Crops and Foods

Projected Advantages

Need less fertilizer

Need less water

More resistant to insects, disease, frost, and drought

Grow faster

Can grow in slightly salty soils

May need less pesticides

Tolerate higher levels of herbicides

Higher yields

Less spoilage



Projected Disadvantages

Irreversible and unpredictable genetic and ecological effects

Harmful toxins in food from possible plant cell mutations

New allergens in food

Lower nutrition

Increase in pesticide-resistant insects, herbicide-resistant weeds, and plant diseases

Can harm beneficial insects

Lower genetic diversity

Critics to GM crops

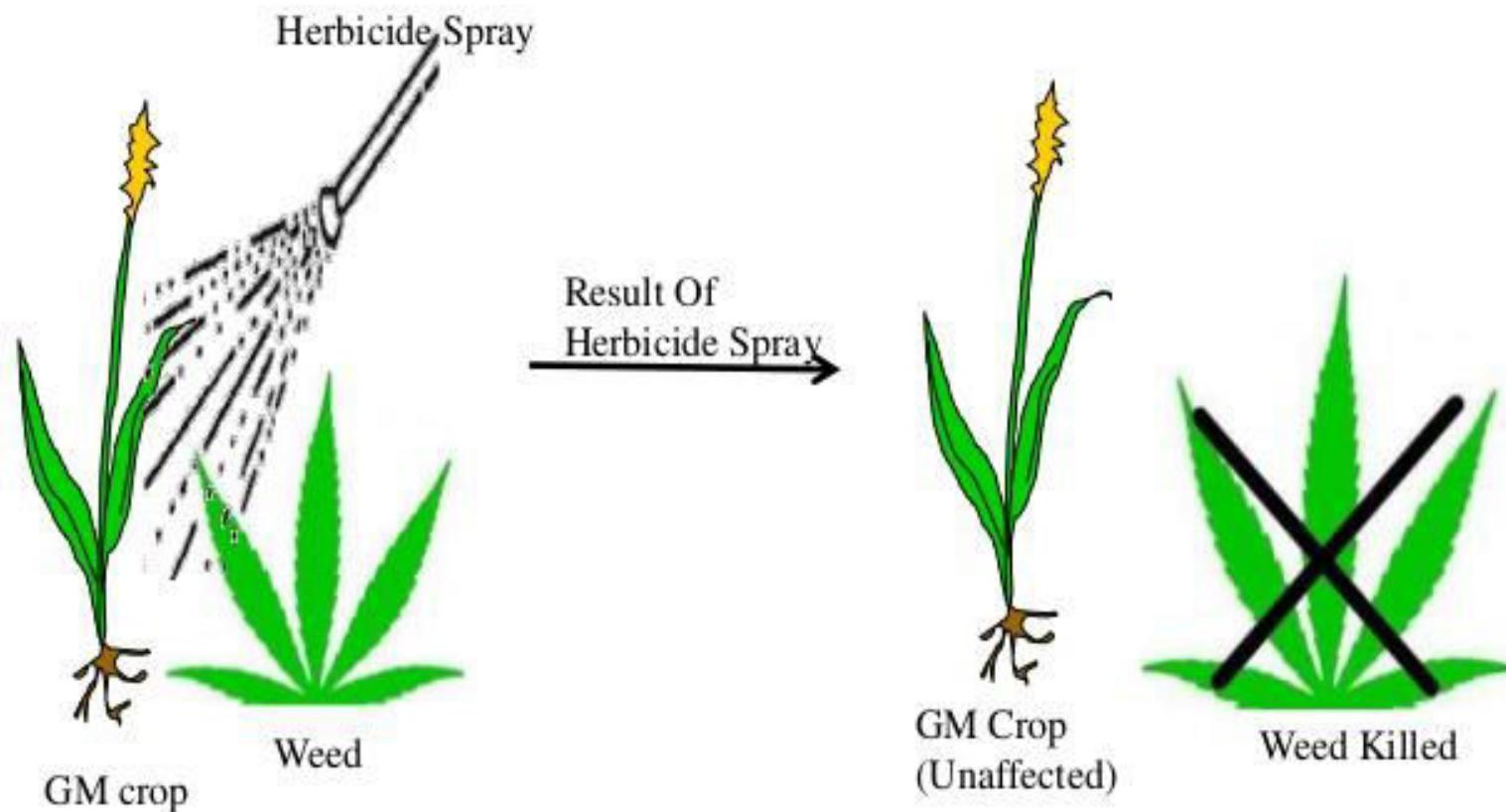
- ❖ Safety issues
- ❖ Ecological concerns
- ❖ Economic concerns
- ❖ These organism are subjected to IPR.

Benefits to GM foods

- ❖ Easing for worlds hunger
- ❖ Reduced use of pesticides and herbicides
- ❖ Improved crop quality
- ❖ Improved Nutritional quality,

Herbicide Tolerance

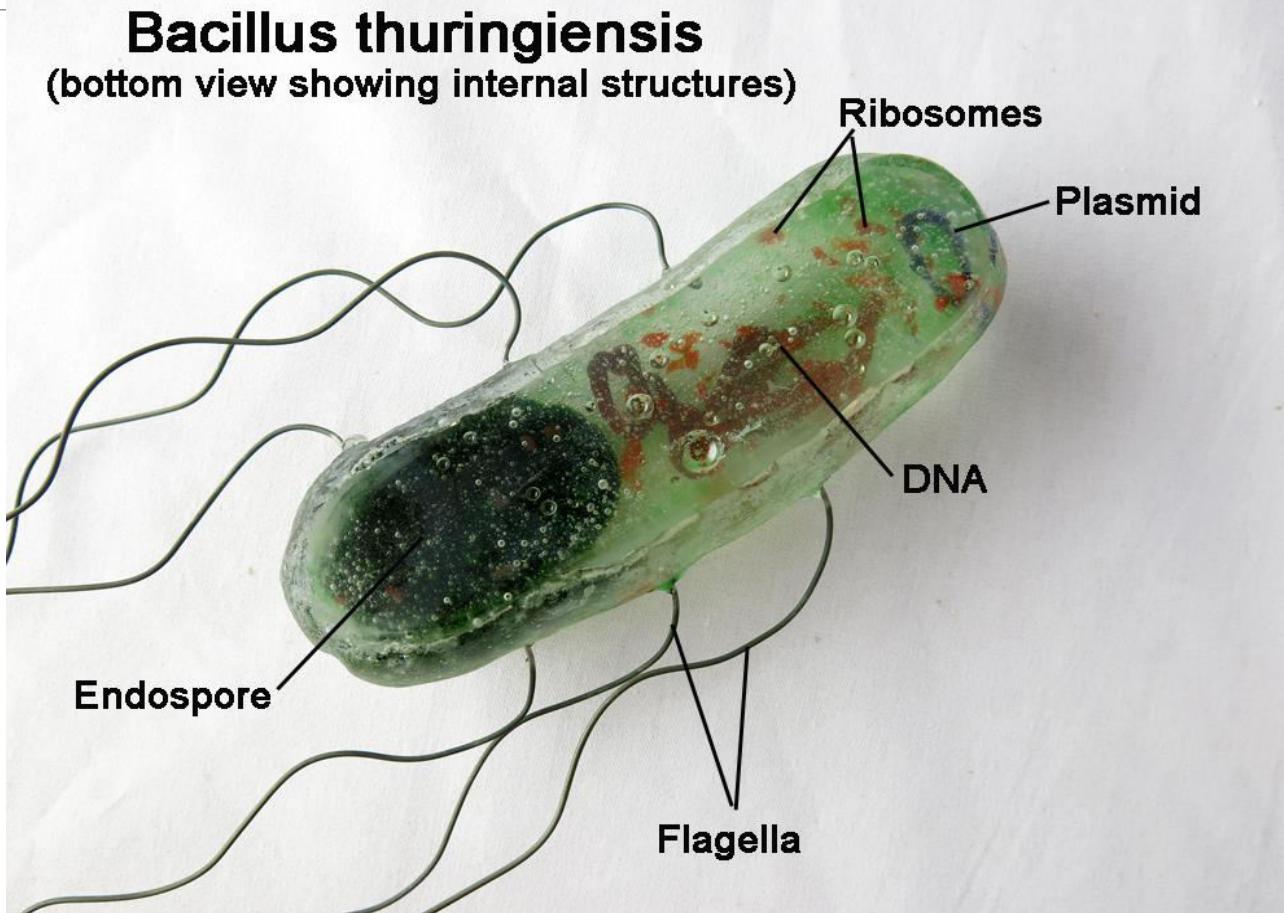
- Over 63% of GM crops grown globally have herbicide tolerance traits.
- Herbicide tolerance is achieved through the introduction of a gene from a bacterium conveying resistance to some herbicides. In situations where weed pressure is high, the use of such crops has resulted in a reduction in the quantity of the herbicides used.



Our concern.....



Bt cotton – a new plant to add to biodiversity?



Bt Bringal

The **Bt brinjal** is a suite of transgenic bringals (also known as an eggplant or aubergine) created by inserting a crystal protein gene (*Cry1Ac*) from the soil bacterium *Bacillus thuringiensis* into the genome of various brinjal cultivators.

The insertion of the gene, along with other genetic elements like Promoters, Terminator and an antibiotic resistance marker gene into the brinjal plant is accomplished using Agrobacterium -mediated genetic transformation



Why should we be worried in eating Brinjal

- ❖ Antibiotic resistance
- ❖ Toxicity of the proteins released in brinjal
- ❖ No long term safety for usage
- ❖ Babies are at high risk
- ❖ Organic risk
- ❖ Increase of cost
- ❖ Irreversible gene transformation
- ❖ Regulatory problem



Bt targets.....

Cry1A-K; Cry2A
Cry7B; Cry8D
Cry9A-C,E; Cry15A
Cry22A; Cry32A
Cry51A



Lepidoptera

Cry1A-C; Cry2A
Cry4A-B; Cry10
Cry11A-B; Cry16A
Cry19A-B; Cry20A
Cry24C; Cry27A
Cry32B-D; Cry39A
Cry44A; Cry47A
Cry48A; Cry49A
Cyt1A-B; Cyt2A-B



Diptera

Cry1B, I; Cry3A-C; Cry7A
Cry8A-G; Cry9D; Cry14A
Cry18A; Cry22A-B; Cry23A
Cry34A-B; Cry35A-B; Cry36A
Cry37A; Cry43A-B; Cry55A
Cyt1A; Cyt2C

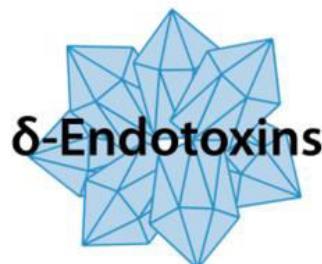


Coleoptera

Cry5A-B; Cry6A-B
Cry12A; Cry13A
Cry14A; Cry21A
Cry55A

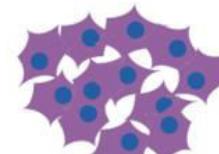


Rhabditida



δ -Endotoxins

Cry31A
Cry41A
Cry42A
Cry45A
Cry46A



Human-cancer
cells

Cry2A
Cry3A
Cry11A



Hemiptera

Cry3A
Cry5A
Cry22A



Hymenoptera

Cry1Ab



Gastropoda



Non-target organisms

37 MILLION DEAD BEES

*“Once the corn started
to get planted our
bees died by the
millions...”*

Europe got the
message. When
will we?



**“LOOK
DEEP INTO
NATURE,
and then you
will understand
everything better.”**

– Albert Einstein



Thank You



Threats to Biodiversity

By

Dr. V. Sai Saraswathi., M. Pharma., Ph. D.,

Environmental Science Professor,

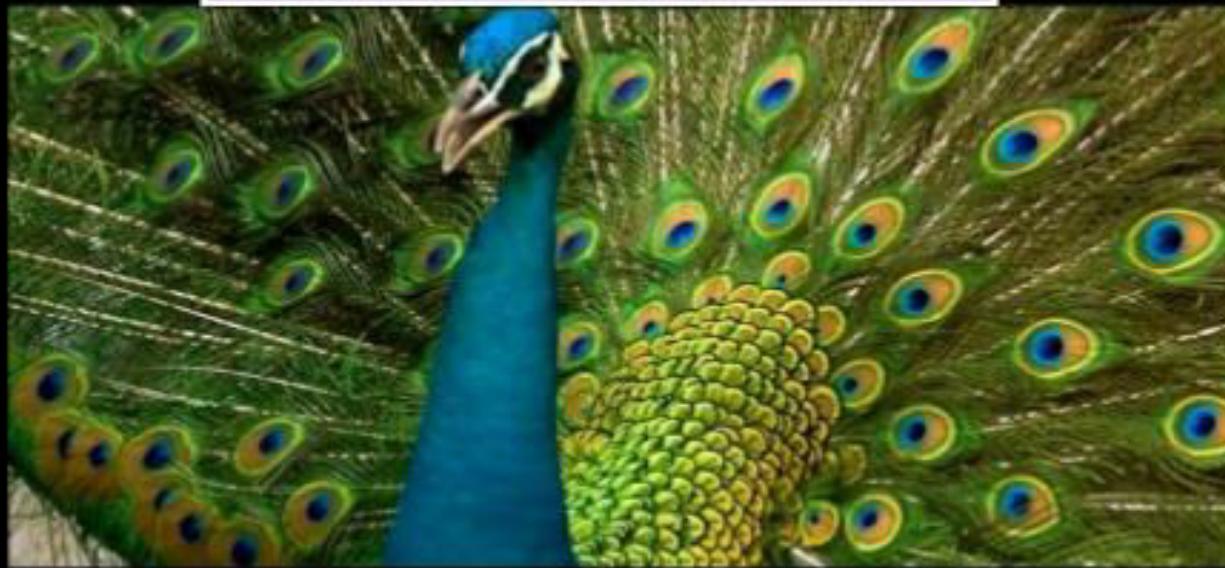
School of Advanced Sciences

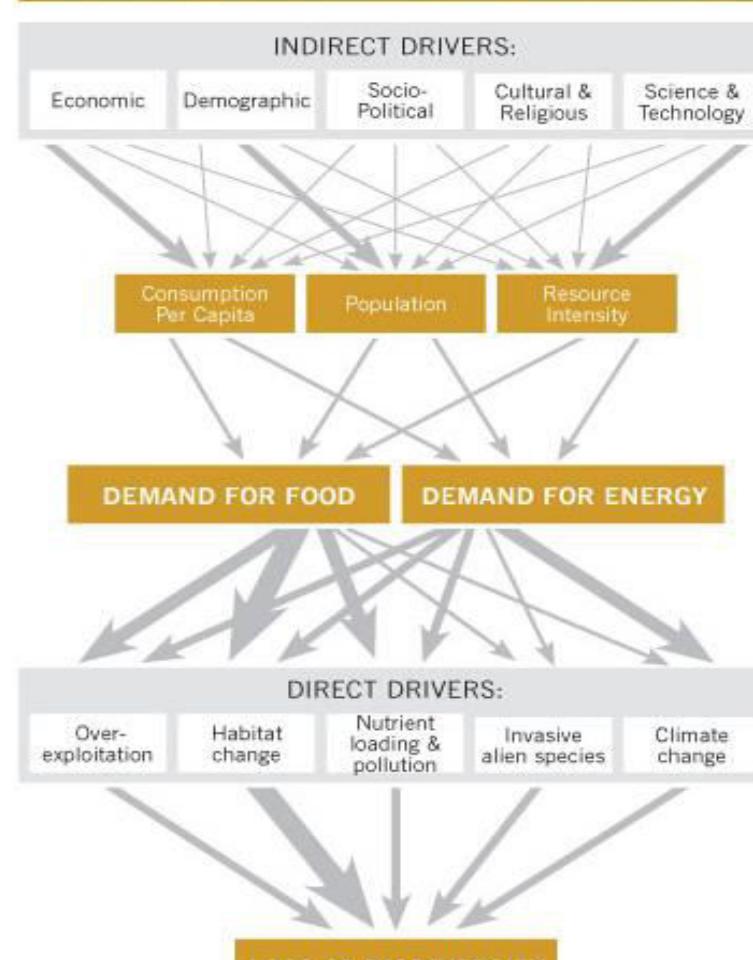
VIT University

Vellore- 632014



Biodiversity and threats to it





Schematic representation of the links between biodiversity loss, the direct and indirect drivers of change, and the demand for food and energy. The width of the arrows gives a broad and approximate illustration of the importance of the economic sectors in driving biodiversity loss.

Threats in terrestrial areas	
Degradation, destruction and fragmentation of natural habitats	Spread of the urbanised areas, road network and industrial areas and associated problems (noise, pollution); abandon of former agricultural practices that were favourable to biodiversity
Decrease in the capacity of the agricultural areas to host wildlife	Intensification of agricultural practices (yielding pollution and disturbance) and disappearance of landscape elements that provide food and shelter that are exploitable by wildlife (such as hedges, trees, ponds, etc.)
Pollution of soils, air and water	Excess of heavy metals (industry, roads), manure and pesticides (agriculture) and other pollutants
Invasions by alien species	International trade and transport (roads, railways, rivers), gardening practices, exotic trees in forestry, exotic pests released in the wild, climate change, etc.
Epidemics affecting wildlife	Arrivals of pathogens that are favoured by the introduction of exotic species, pollution and the destruction of habitats
Climate change	Carbon emissions, deforestation and other land use changes due to human activities
Dessication of soils and wetlands	Excess pumping of underground water tables
Recreation and leisure	Overuse of green open spaces and wild areas, little respect for nature, mountain biking and motor sports in fragile areas, dogs not on leash
Threats in marine areas	
Overfishing and decline of species	Industrial fishing, overexploitation of target species, by-catch species
Pollution and eutrophication	Land-based activities (river run-off), atmospheric deposition, maritime traffic
Degradation and destruction of the sea floor	Beam trawling, dredging, sand and gravel extraction
Alien species introductions	Maritime trade (ballast waters, fouling), leisure navigation, mariculture, climate change
Leisure and tourism	Coastal development, water quality in summer (high population), mechanical beach cleaning, noise and other perturbations due to the high population

Causes of threats to biodiversity

- **Habitat destruction**
- **Global climate change**
- **Habitat fragmentation**
- **Pollution**
- **Over exploitation**
- **Invasive species**
- **Disease**
- **Poaching**



- **Reason for habitat loss by humans**

- Agriculture farming.
- Harvesting natural resources
- Industrial era
- Urbanization – urban sprawl
- Habitat destruction is currently ranked as a primary causes of species extinction world wide.

Forest fire – Man Made or Natural



Habitat Fragmentation



Human development, such as subdivisions, can fragment large blocks of habitat into smaller, scattered pieces.

Habitat Destruction

Habitat destruction and fragmentation, the carving of large blocks of habitat into smaller, scattered pieces, are the biggest threats to most species. Without adequate habitat in which to grow, survive and reproduce, births decrease, deaths increase, and it isn't long before species goes extinct.

Poaching

Poaching



Figure 9-15 White rhinoceros killed by a poacher for its horn in South Africa. **Question:** What would you say if you could talk to the poacher of this animal?



Poaching is not limited to animals
its also for plants too.....!

Three of the most often poached species in the park
are galax, black cohosh, and ginseng.



GALAX



BLACK COHOSH



GINSENG

Illegally killing and capturing – threat to species

- 2/3 of the live animals smuggled around the world die in transit.
- Poor people in areas rich with wildlife may kill or trap them for money to survive and feed their families.
- To poachers
 - Mountain gorilla – \$150,000
 - Gaint panda \$1,00,000
 - Chimpanzee \$ 50000
 - Dragon reptile from Indonesia – \$ 30000
 - One horn rhinoceros \$ 28,600
 - Bengal tiger or Indian tiger is at risk for its fur – \$ 1,00,000

Encroachment of animals – man wildlife conflicts



- Human Encroachment into the forest.
- The ill, weak, and injured animals- attack man.
- Forest dept. cultivate the staple foods for animals.
eg. One adult elephant- 2 quintal of green fodder.
- Villagers – electric wiring around the fields, suffer with pain & turn violent.
- Due to human settlement in the forest, the animals attack the settlement.

- The cash compensation paid by the government – damage – farmers crop is not enough.
- In Mysore, a farmer gets the cash compensation of Rs. 400/- per quintal. While the market value is Rs. 2400/-
- Revengeful and kills the wild animals.



Remedial Measures of Man- Wildlife Conflict

- Tiger conservation project.
- Adequate cash compensation.
- Solar Powered fencing.
- Cropping pattern near the forest region should be changed.
- Seasonal migration.
- Sanctuary.

Disease –Animals

GRASS TETANY (GRASS STAGGERS)

- Cause
 - Low blood Mg and in many cases low blood Ca
 - Cattle grazing on lush grass pastures in latter stages of gestation or early lactation
- Symptoms
 - Nervousness, staggering, convulsions, coma and death



Invasive species- case study

- Introducing the exotic species also disturb the ecosystem.

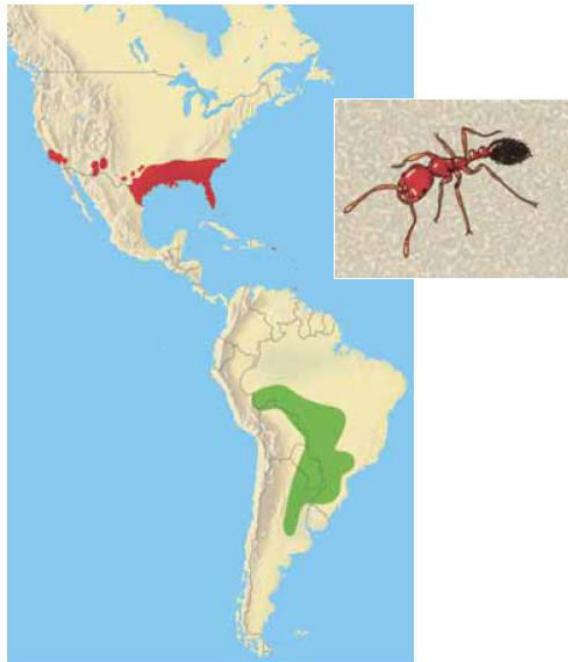


Figure 9-11 Accidentally introduced invasive species: the Argentine fire ant, introduced accidentally into Mobile, Alabama, in 1932 from South America (green area), has spread over much of the southern United States (red area). This invader is also found in Puerto Rico, New Mexico, and California. **Question:** How might this accidental introduction of fire ants have been prevented? (Data from S.D. Porter, Agricultural Research Service, U.S. Department of Agriculture)

- Aggressive argentina fire ant introduced
Into the United states.
- When these ant invade an area, they
wipe off 90% native species.
- They killed the deer, fawns, birds, livestock
Pets, 80 % people was allergic to their venom.

Pollution

- Air pollution lead to acid rain- therefore the pH of the soil/water bodies go acidic.
- The monuments get corroded. Eg. Taj mahal.
- Hence the species living in those aquatic system may die.
 - Eg. Fishes, frog, reptiles, insects become extinct.



Global warming is a major threat to biodiversity

- Acc. To 2007 IPCC report, changes in climate may affect the biodiversity. Eg. Weeds, insect pest- fire ant, etc.

By 2050 polar bears may be found in zoos,
due to arctic sea ice melts.



Figure 15-19 Melting of Alaska's Muir Glacier in the popular Glacier Bay National Park and Preserve between 1948 and 2004. **Question:** How might melting glaciers in Alaska and other parts of the Arctic affect your lifestyle during this century?

Premature extinction

- Changes in structure and location of wildlife cause to premature extinction
 - Eg: golden toad – found in Costa Rica's mountainous region. In 1989 it became extinct.
 - **Reason:** warmer air from global climate change caused the area's moisture bearing clouds in Caribbean Sea to rise and dry out the habitat for this frog.



Figure 4-7 Depleted natural capital: male golden toad in Costa Rica's high-altitude Monteverde Cloud Forest Reserve. This species has recently become extinct because changes in climate dried up its habitat.

Ways to reduce threat of global warming

- Four major strategies
 - Improve energy *efficiency* to reduce fossil fuel use
 - Shift to renewable resources
 - Stop cutting down tropical forest.
 - Capture CO₂ as possible in soil, vegetation, and deep in ocean.



Figure 15-22 Methods for slowing atmospheric warming during this century (**Concept 15-5A**). **Question:** Which five of these solutions do you think are the most important? Why?

Thank You



Conservation of Biodiversity

By
Dr. V. Sai Saraswathi., M. Pharma., Ph. D.,
Environmental Science Professor,
School of Advanced Sciences
VIT University
Vellore- 632014

Biodiversity - Conservation

Types of Biodiversity Conservation

There are two types of biodiversity conservation

1. In-situ conservation (within habitat)
2. Ex-situ conservation (outside habitat)

4.11.1. In-situ conservation

- ♣ In-situ conservation involves protection of fauna and flora within its natural habitat, where the species normally occurs is called in-situ conservation.
- ♣ The natural habitats or ecosystems maintained under in-situ conservation are called '*protected areas*'.

4.11.2. Ex-situ Conservation

- ♣ Ex-situ conservation involves protection of fauna and flora outside the natural habitats.
- ♣ This type of conservation is mainly done for conservation of crop varieties and the wild relatives of crops.

In- situ Conservation

Important In-situ conservation: National parks, Wildlife sanctuaries, Biosphere reserves, Gene sanctuary etc.

Methods of In-situ conservation

Around 4% of the total geographical area of the country is used for In-situ conservation. The following methods are presently used for In-situ conservation

In-situ Conservation	Numbers available
National Parks	80
Wild-life sanctuaries	420
Biosphere reserves	7
Botanical gardens	120

National Parks in India

Some important national parks in India

Name of National Park	State	Important Wildlife
Kaziranga	Assam	One horned Rhino
Gir National Park	Gujarat	Indian Lion
Bandipur	Karnataka	Elephant
Dachigam	J & K	Hangul
Corbett	U.P	Tiger
Kanha	M.P	Tiger
Ranthambore	Rajasthan	Tiger
Sariska	Rajasthan	Tiger
Periyar	Kerala	Tiger, Elephant

Watch Top Wildlife Sanctuaries & National Parks, India:

<https://www.youtube.com/watch?v=zP1Yux3qBIE>

Wildlife Sanctuaries

Some Important Wildlife Sanctuaries in India

Name of Sanctuary	State	Major Wildlife
Mudamalai Wildlife Sanctuary	Tamil Nadu	Tiger, Elephant, Leopard
Vedanthangal Wildlife Sanctuary	Tamil Nadu	Water birds
Nal Sarovar Bird Sanctuary	Gujarat	Water birds
Wild Ass Sanctuary	Gujarat	Wild ass, wolf, nilgai, chinkara
Hazaribagh Sanctuary	Bihar	Tiger, Leopard
Ghana Bird Sanctuary	Rajasthan	Birds
Abohar Wildlife Sanctuary	Punjab	Black buck
Jaldapara Wildlife Sanctuary	W. Bengal	Rhinoceros, Elephant, Tiger

Biosphere Reserves in India

Some important Biosphere Reserves in India

Name of Biosphere	State
Gulf of Mannar	Tamil Nadu
Nilgiri	Tamil Nadu, Kerala, Karnataka
Nanda Devi	U.P
Nokrek	Meghalaya
Mannas	Assam
Sunder bans	West Bengal
Great Nicobars and Similipal	Orissa

Role of biosphere reserves

1. It gives long term survival of evolving ecosystem
2. It protects endangered species
3. It protects maximum number of species and communities
4. It serves as site or recreation and tourism
5. It is useful for educational and research purposes

Madhya Pradesh: Unesco stripes for Panna Biosphere Reserve



Source: <https://timesofindia.indiatimes.com/city/bhopal/madhya-pradesh-unesco-stripes-for-panna-biosphere-reserve/articleshow/78963588.cms>

<https://en.unesco.org/news/panna-india-fuvahmulah-and-addu-atoll-maldives-join-unescos-world-network-biosphere-reserves>

Ex-situ Conservation

Role of Ex-situ conservation

1. It involves maintenance and breeding of endangered plant and animal species under controlled conditions
2. It identifies those species which are at more risk of extinction
3. It prefers the species, which are more important to man in near future among the endangered species

Important Ex-situ conservation: Botanical gardens, seed banks, microbial culture collections, tissue and cell cultures, museums, zoological gardens.

Methods

Methods of Ex-situ Conservation

The following important gene bank (or) seed bank facilities are used in Ex-situ conservation

1. National Bureau of Plant Genetic Resources (NBPGR)

It is located in New Delhi. It uses cryo preservation techniques to preserve agricultural and horticultural crops.

Cryo preservation technique: It involves the preservation of seeds, pollen of some important agricultural and horticultural crops by using liquid nitrogen at a temperature as low as -196°C. Varieties of rice, pearl millet, Brassica, turnip, radish, tomato, onion, carrot, chilli, tobacco, etc., have been preserved successfully in liquid nitrogen for several years.

2. National Bureau of Animal Genetic Resources (NBAGR)

It is located at Karnal, Haryana. It preserves the semen of domesticated bovine animals.

3. National Facility for Plant Tissue Culture Repository (NFPTCR)

It develops the facility for conservation of varieties of crop plants or trees by tissue culture. This facility has been created within the NBPGR

Case Study

- Endangered vultures found dead @ Botswana. Vulture is excellent scavengers play its critical role in keeping ecosystems clean of diseases found in rotting carcasses. These endangered vultures are poisoned deliberately by poachers, or accidentally by farmers in Southern Africa.



White backed Vulture, Africa

KMTR

THE HINDU
STORY

Forest dept. road endangers core KMTR habitat: activists

But officials insist they only cleared the 'katcha' road to have better access for officials to the core areas for better surveillance

B ARAVIND KUMAR
P. SUDHAKAR

A road laid by the Forest Department with heavy machinery inside the core, inviolate habitats of the Kalakkad Mundanthurai Tiger Reserve (KMTR) in Tirunelveli district could endanger its very existence, activists say.

While KMTR officials insist that they were only clearing the 'katcha' road to have better access for Forest Department officials to the core areas for better surveillance and that no heavy machinery was used, activists point out that for decades, foresters have only travelled by foot and not on jeeps, and this could set off a dangerous trend.

Photographs accessed by *The Hindu* show that bulldozers are being used to lay the road. The road was being laid in gross violation of the Forest (Conservation) Act



Photograph accessed by *The Hindu* shows that bulldozers are being used to lay the road.

and the Wildlife Protection Act. The new road and the resultant vehicular movement could endanger the KMTR's core and threaten its very survival, and activists have called for a halt to this activity.

Type-I unit

KMTR was declared a tiger reserve in 1988, the first in Tamil Nadu. It has been identified as a Type-I tiger conservation unit representing the tropical moist evergreen

forests. It also forms part of the inter-State Agasthiyamalai Biosphere Reserve, declared one of the plant diversity centres by UNESCO.

It was also declared the Regional Centre of Endemism in the Indian subcontinent. There are 2,255 species of Angiosperms so far recorded from the KMTR, including 448 species endemic to the Western Ghats, in addition to 150 species that are strictly endemic to the Agasthiyamalai, say researchers

working in the reserve.

According to activists, this core habitat is one of the highly protected areas with the least entry points. One has to cross the Papanasam checkpoint and reach the Mundanthurai plateau and thereon travel to Servalar and the Karaiyar dam inside the core.

The vehicular movement is usually restricted up to the dam, as *pucca* roads have been laid only up to that. Only 5 kani tribal settlements are present in the core area. There are very few elephant areas in the reserve.

About 10 years ago, trekking was also stopped. There are only patrolling/combing routes available from the Karaiyar dam to Kalivarpul until recently, which lead to Bomacadu (Kerala border). The forest staff and the anti-poaching watchers were patrolling the forest by foot, say activists.



Importantly, activists and researchers said these were the few tropical evergreen patches left in the country, free from any man-made interventions and serving as a water catchment for the perennial Tamirabarani river.

Alleging that heavy machinery was being operated now to clear rainforest patch along Karaiyar-Kannikatti-Kalivarpul Mottai for 30 km, the activists say such clearing would amount to loss of biodiversity, encourage a larger vehicular movement and allow easy access to poachers and even Maoist infiltration.

And for an area that had no road entry, creating a

road by clearing the forest inside the core area raises suspicion, they add.

"Another reason for laying the road could be to facilitate access for high-profile pilgrims to the Agasthiyar temple in the peak in vehicles. Now they have to trek," says an activist.

KMTR field director Yogen Singh did not react and said the local officer (a deputy director) would answer. KMTR deputy director (Ambasamudram division) Kommu Omkaram denied that heavy equipment was used to lay roads in the core zone between the Papanasam dam and Kalibar Pullmottai. The 30-km 'katcha' road connecting the border with Kerala through the dense jungle would usually be maintained to ensure the movement of the vehicles of KMTR officials to reach the spots within the shortest possible time.

Thank You

Environmental Sciences_Dr. V. Sai Saraswathi