

SUBJECT- ENVIRONMENTAL SCIENCE

SEMESTER – 4TH SEMESTER (CC8)

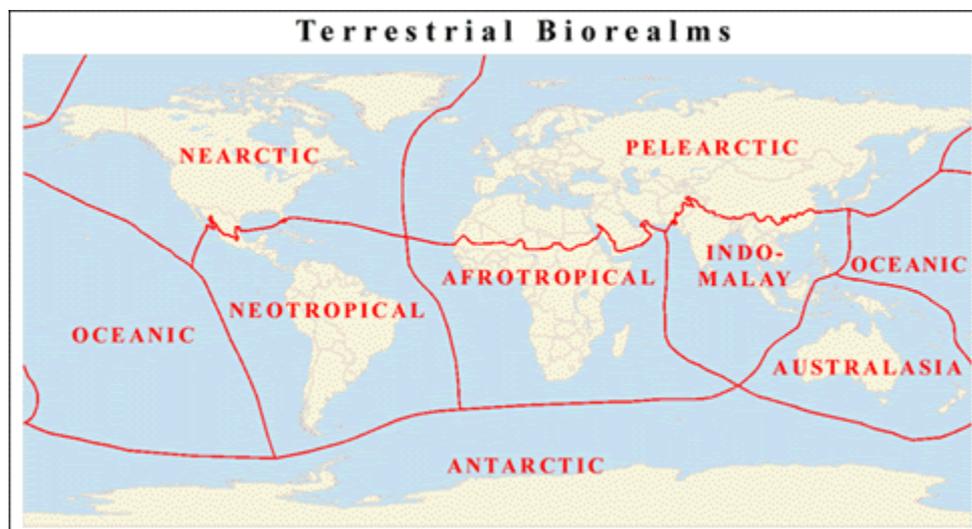
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TOPIC- BIOGEOGRAPHY

Biogeographical Realms:

A large spatial region, within which ecosystems share a broadly similar biota. Eight terrestrial biogeographic realms are typically recognized, corresponding roughly to continents

- Australasian,
- Afrotropical,
- Nearctic,
- Oceanic,
- Antarctic,
- Indo-Malayan,
- Neotropical,
- Palearctic



(Source: WWF)

It is a matter of general experience that the plants and animals of the land and inland waters differ to a greater or lesser degree from one part of the world to another. Why should this be? Why should the same species not exist wherever suitable environmental conditions for them prevail?

Geographic regions around the world that have similar environmental conditions are capable of harbouring the same type of biota. This situation effectively separates the biosphere into **biomes**—ecological communities that have the same climatic conditions and geologic features and that support species with similar life strategies and adaptations. The biome is the **fundamental unit** of which larger biogeographic regions (floral kingdoms and faunal realms) consist.

The tropical forest is one type of terrestrial biome; it is located at various points around the planet where climatic and geologic conditions produce similar environments. The tropical forest biome contains the same general kinds of biological communities wherever it occurs; however, the individual species will not be the same from one tropical forest to another. Instead, each forest will support organisms that are ecologically equivalent—i.e., different species that have a similar life cycle and have adapted analogously to environmental conditions.

Antarctic Biogeographic Realm

The Antarctic biogeographic realm covers a total area of 0.12 million square miles, making it the smallest of all the realms. The Antarctic biogeographic region is located in the Southern Ocean and is comprised of the area surrounding the South Pole, including: Antarctica, the islands above the Antarctic tectonic plate, the ice in the waters, and the ocean itself. All of these different components make up 20% of the Southern Hemisphere. Because of the freezing temperatures here, just under 1% of the Antarctic is actually exposed land. This realm is home to plant species such as: lichens, mosses, Antarctic hair grass, and microfungi. Additionally, some animal species may be found here, depending on the time of year. These animal species include: penguins, whales, squid, albatross, seals, and Antarctic petrels.

Oceania Biogeographic Realm

The Oceania biogeographic realm covers a total area of 0.39 million square miles, making it the second smallest of all the realms. The Oceania biogeographic region is located in the Pacific Ocean, in a region referred to as Asia Pacific. It is comprised of a number of islands, including: the US state of Hawaii, a part of Japan, the Juan Fernandez Islands, the Cocos Islands, and the Campbell islands (to name a few). Although it covers a larger area than the Antarctic realm, Oceania actually has the smallest land area of all the biogeographic realms on earth. It has a permanent human population of over 40 million individuals. Geographically, Oceania is known for its large amounts of coral reef, the most famous of

which is the Great Barrier Reef. Because of the isolated nature of the islands within this realm, each location has very unique plant and animal life.

Indo-Malayan Biogeographic Realm

The Indo-Malayan biogeographic realm stretches across the southern reaches of East Asia, the greater part of South Asia, and the area known as Southeast Asia. It covers a total area of 2.9 million square miles, which includes: the Indian subcontinent, parts of southern China, Indonesia, and the Philippines (as well as other locations). This realm is primarily covered in tropical and subtropical forests that have been further divided into 3 bioregions: Indochina, Indian subcontinent, and Munda Shelf and the Philippines. The Indo-Malayan biogeographic realm is home to a number of endemic species, both plant and animal. Some examples of endemic species found here include: fairy bluebirds, gibbons, treeshrews, Kitti's long-nosed bat, and Philippine creepers. Other large mammals that can be found in the Indo-Malayan realm are the leopard, tiger, orangutang, Indian rhinoceros, Asian elephant, and water buffalo.

Australasian Biogeographic Realm

The Australasian biogeographic realm covers a total area of 2.9 million square miles, making it the same size as the Indo-Malayan realm. It includes New Guinea, New Zealand, Tasmania, Australia, and the eastern region of the Indonesian archipelago. Australia is considered the most environmentally diverse country within this realm as it is made up of desert, rainforest, grasslands, and mountains. The Australasian realm sits between the Antarctic realm and the Indo-Malayan realm; it is separated from the Asia realm by the Wallace Line. Because of this position, some of the plant and animal species of this realm can also be found in the Indo-Malayan and Antarctic realms as well. Researchers believe this is because all three realms once made up the Gondwana supercontinent. In fact, New Guinea, Tasmania, and Australia continued to be connected long after the dissolution of Gondwana and today, are only separated by relatively shallow waters.

Neotropical Biogeographic Realm

The Neotropical biogeographic realm covers an entire area of 7.3 million square miles and is made up of the tropical regions of the Americas. It includes all of South America, Central America, the Caribbean, the Yucatan Peninsula of Mexico, the southern region of the US state of Florida, and a small part of the southern tip of the US state of Texas. The plant and animal species of this realm are distinct from those found in North America, which is why the two regions are characterized separately. This difference in species occurred because of the two realms were physically separated until between 2 and 3 million years ago. Interestingly,

the Neotropical biogeographic realm has more tropical rainforest coverage than any other realm. It is further divided into 8 ecological regions.

Afrotropical Biogeographic Realm

The Afrotropical realm covers a total area of 8.5 million square miles and is made up of southwestern Pakistan, southern Iran, the southern regions of the Arabian Peninsula, the area south of the Sahara Desert in Africa, the island of Madagascar, and the islands in the western part of the Indian Ocean. The majority of this realm has a tropical climate, although it is diverse in ecological habitats, including: deserts, highlands, savannahs, and forests (coastal, montane, and lowland). It is home to over 200 endemic fish species, 12 endemic plant families, 7 endemic bird families, and 3 endemic mammal families. Additionally, the Afrotropical realm is home to 2 gorilla species and 2 chimpanzee species, which belong to the Hominidae genus along with humans.

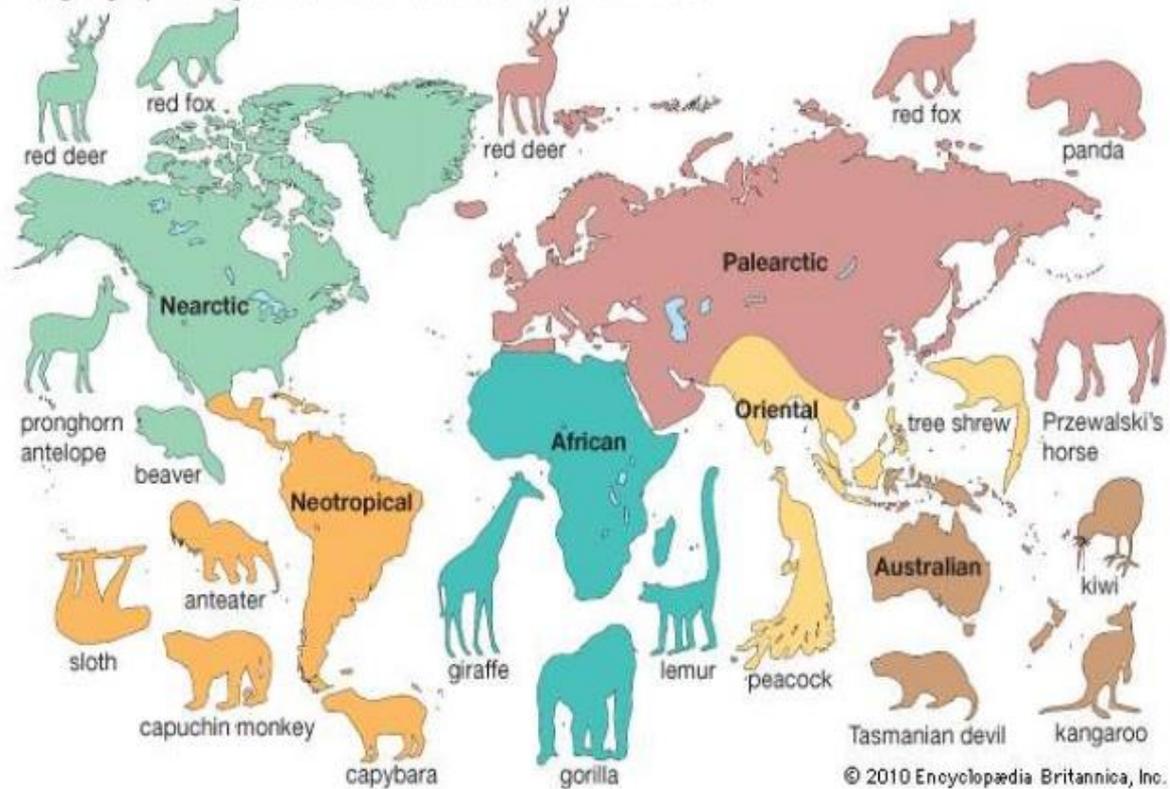
Nearctic Biogeographic Realm

The Nearctic biogeographic realm covers a total area of 8.8 million square miles, making it the second largest of all the realms. It encompasses the US (including most of Texas and northern Florida), Canada, Greenland, and the highland regions of Mexico. This realm is further divided into 4 ecological regions including: eastern, western, southwestern (which includes the northern part of Mexico), and the Canadian Shield. Each of these regions has distinct environmental habitats that support a diverse range of plant and animal species. Animal families that originated and continue to thrive in this realm include: canines (dogs, wolves, coyotes), equine (horses and donkeys), and antelopes. Some of the animal families that originated here are now extinct, although their relatives inhabit the Neotropical realm.

Palaearctic Biogeographic Realm

The Palaearctic biogeographic realm covers a total area of 20.9 million square, making it the largest of all the realms. It is made up of the area north of the Saharan Desert in Africa, the area north of the Himalayan Mountains in Asia, the northern region of the Arabian Peninsula, and the entire area of Europe. It is further divided into 7 ecoregions, which contain boreal forests, Mediterranean climates, coastal deserts, river basins, and mountainous terrain. The Palaearctic is home to several endemic animal families, including: red pandas, mouse-like hamsters, and accentor birds.

Zoogeographic regions and some characteristic animals



What is Endemic Species?

Endemic species are those that are found in just one region and nowhere else in the world. For example, kangaroos are originally endemic to Australia and are found nowhere else in the world. The cases where they have been spotted outside their natural habitat is due to humans introducing them when the animal was in captivity.

There are also other marsupials that are endemic only to Australia and its surrounding islands. The Tasmanian Tiger is one such animal that was endemic to Australia, Tasmania and New Guinea. But now, it is extinct.

Endemic species are those which are only found in a given region or location and nowhere else in the world. So the region which the species is endemic to ends up being called the “endemic site”, a “national endemic”, a “geographical range endemic”, or a political region endemic depending on the location.

But as we see endemic plants and animals are unique to a particular geographical region; they are incredibly unique and more vulnerable to extinction. As a result, special efforts are required to conserve them.

Examples of Endemic species

There are several ways in which a species may come to be endemic to a particular area. A broadly distributed population may disappear from several habitats due to changes which

have occurred in their natural habitat. The changes could be an influx of predators, human activities, and climate changes.

All other species that were widely distributed around the world starts to die out until the species becomes forcefully restrained to just one region.

For example, Endemic species, such as the tortoises of the Galápagos and the lemurs of Madagascar can be found small islands. Big islands also provide the same isolation but on a larger scale.

Antarctica Hawaii and Australia are all huge land masses where we can find a lot of endemic species. Kangaroos, koalas, and polar bears are all endemic to these places.

In the case of endemic plants, sometimes species become endemic due to habitat destruction as discussed above.

The Redwood Forest on the West Coast of the United States has become endemic as it is now almost entirely limited to California. While there was a time when Redwoods used to cover much of the United States but have been destroyed by logging and are now limited to a small conservation area.

Endemic Species of India

A list of the endemic species of India is mentioned below:

- Asiatic Lion, Gir Forest

Asiatic Lion is also known as the Indian Lion and can be only found in and around Gir Forest National Park of Gujarat. These are listed as endangered species. These are one of the five big cats found in India, the others being Indian Leopards and Bengal Tigers.

- Kashmir Stag, Kashmir Valley

Also known as Hangul, Kashmir Stag is found in the dense forests of Dachigum National Park, Kashmir Valley and Chamba district, Himachal Pradesh.

- Lion-Tailed Macaque, Western Ghats

It is the rarest and the most threatened and endangered primate species found only in the Western Ghats of Southern India.

- Purple Frog, Western Ghats

The purple frog, also known as Pignose frog is only found in the rainforests of western ghats in India. It spends most of its life underground.

- Sangai Deer, Loktak Lake

It is also known as Brow Antlered Deer exclusively found in Keibul Lamjao National Park of Manipur. This park is a marshy wetland located in the southern parts of Loktak lake.

- Nilgiri Tahr, Nilgiri Hills

It is a wild sheep species, endangered and endemic to the Nilgiri Hills of Western Ghats.

Other endemic species of India include:

- Pygmy Hog, Assam
- Bronzeback Vine Snake, Western Ghats
- Nilgiri Blue Robin, Nilgiri Hills
- Malabar Civet, Western Ghats
- Anaimalai Gliding Frog, Anaimalai Hills
- Namdapha Flying Squirrel, Arunachal Pradesh
- Indian Giant Squirrel
- Bonnet Macaque

Rare species

A **species** that is uncommon, few in number, or not abundant is a rare species. A species can be rare and not necessarily be endangered or threatened, for example, an organism found only on an island or one that is naturally low in numbers because of a restricted range. Such species are, however, usually vulnerable to any exploitation, interference, or disturbance of their habitats. Species may also be common in some areas but rare in others, such as at the edge of its natural range.

"Rare" is also a designation that the IUCN—The World Conservation Union gives to certain species "with small world populations that are not at present 'endangered' or 'vulnerable' but are at risk. These species are usually localized within restricted geographical areas or habitats or are thinly scattered over a more extensive range." Rarity rests on a specific species being represented by a small number of organisms worldwide, usually fewer than 10,000. However, a species having a very narrow endemic range or fragmented habitat also influences the concept. Rare species are generally considered threatened because a small population size is more likely to not recover from stochastic events. Some American states have also employed this category in protective legislation.

Exotic Species

Exotic species, which are also known as alien species, invasive species, non-indigenous species, and bioinvaders, are species of plants or animals that are growing in a nonnative environment. Alien species have been moved by humans to areas outside of their native

ranges. Once transported, they become removed from the predators, parasites, and diseases that kept them in balance in their native environments. As a result of the loss of these controls, they often become pests in the areas into which they are introduced.

Many plants and animals can disperse naturally into new habitats. The colonization of North America by cattle egrets from Africa, and the slow spread of the nine-banded armadillo into Texas and Louisiana occurred without human intervention. But the most destructive invasions are invariably those caused by human activity, whether deliberate or inadvertent.

Native trees, such as mangroves and cypress, are being replaced by exotic (introduced) species from other countries.

What Makes a Species "Invasive"?

An invasive species can be any kind of living organism—an amphibian (like the cane toad), plant, insect, fish, fungus, bacteria, or even an organism's seeds or eggs—that is not native to an ecosystem and causes harm. They can harm the environment, the economy, or even human health. Species that grow and reproduce quickly, and spread aggressively, with potential to cause harm, are given the label "invasive."

An invasive species does not have to come from another country. For example, lake trout are native to the Great Lakes, but are considered to be an invasive species in Yellowstone Lake in Wyoming because they compete with native cutthroat trout for habitat.

How Invasive Species Spread

Invasive species are primarily spread by human activities, often unintentionally. People, and the goods we use, travel around the world very quickly, and they often carry uninvited species with them. Ships can carry aquatic organisms in their ballast water, while smaller boats may carry them on their propellers. Insects can get into wood, shipping palettes, and crates that are shipped around the world. Some ornamental plants can escape into the wild and become invasive. And some invasive species are intentionally or accidentally released pets. For example, Burmese pythons are becoming a big problem in the Everglades.

In addition, higher average temperatures and changes in rain and snow patterns caused by climate change will enable some invasive plant species—such as garlic mustard, kudzu, and purple loosestrife—to move into new areas. Insect pest infestations will be more severe as pests such as mountain pine beetle are able to take advantage of drought-weakened plants.

Threats to Native Wildlife

Invasive species cause harm to wildlife in many ways. When a new and aggressive species is introduced into an ecosystem, it may not have any natural predators or controls. It can breed and spread quickly, taking over an area. Native wildlife may not have evolved defenses against the invader, or they may not be able to compete with a species that has no predators.

The direct threats of invasive species include preying on native species, outcompeting native species for food or other resources, causing or carrying disease, and preventing native species from reproducing or killing a native species' young.

There are indirect threats of invasive species as well. Invasive species can change the food web in an ecosystem by destroying or replacing native food sources. The invasive species may provide little to no food value for wildlife. Invasive species can also alter the abundance or diversity of species that are important habitat for native wildlife. Aggressive plant species like kudzu can quickly replace a diverse ecosystem with a monoculture of just kudzu. Additionally, some invasive species are capable of changing the conditions in an ecosystem, such as changing soil chemistry or the intensity of wildfires.

Few examples of invasive species

Asian Carp

Asian carp refers to several carp species native to Asia including grass carp, silver carp, bighead carp, black carp, common carp and others.

Native To: Eastern Russia and China

Introduced To: North America and Europe

How did they get there? Asian carp were brought over as food, part of the pet trade and for sport fishing.

Why are they a problem? Asian carp are large, have big appetites and reproduce quickly. They take food and habitat away from native fish and have been known to prey on the eggs of other fish species. When carp eat, they stir up sediments and organisms from the lake and river beds changing a clear lake into murky one and changing the type of species that can survive there.

Zebra Mussel (*Dreissena polymorpha*)

Native To: Black, Caspian, Aral and Azov seas

Introduced To: Russia, Europe and North America

How did they get there? Zebra mussels were brought over in ballast water (water carried by ships to help them stay balanced while at sea). They also attach to the outsides of boats or get carried around by floating vegetation.

Why are they a problem? Zebra mussels are one of the most aggressive freshwater invaders because their population numbers grow so quickly. Massive populations of zebra mussels filtering water can severely impact native plankton, which reduces food for fish. These plankton-eating fish then have to find a new source of food or move to a new lake in order to

survive. Unfortunately, that isn't an option for many species. Zebra mussels also leave very little for native mussels to filter, causing them to starve as well.

Cane Toad (*Rhinella marina*)

Native To: Northern South America, Central America and Mexico

Introduced To: Many countries with warm climates, like Australia

How did they get there? Cane toads were brought over as a way to control crop pests.

Why are they a problem? Cane toads have an amazing defense mechanism; they produce toxic ooze. While predators in their native habitat are immune to this toxic ooze, predators in other areas are not. Many animals that attempt to eat a cane toad die instead. With nothing around to keep their numbers in check, populations of cane toads in non-native habitats have exploded and they are taking their toll on native animal and plant species.

European Starling (*Sturnus vulgaris*)

Native To: Europe, Asia and Northern Africa

Introduced To: North America, Southern Africa, Australia and New Zealand

How did they get there? European starlings were brought over as a way to control pests, as pets and by a group of people trying to introduce all the birds mentioned in the works of Shakespeare into North America.

Why are they a problem? European starlings form huge flocks, many times with more than 3,000 birds. When a flock this size feeds on fruit and grains, it can cause serious damage to a farm. These birds are also aggressive, fighting with native species over food and territory. They will even take over other birds' nests, leaving native birds without a place to lay their eggs or raise their young.

Small Indian mongoose (*Herpestes auropunctatus*)

Native To: Southeast Asia

Introduced To: Asia, Central America, South America

How did they get there? Small Indian mongooses were brought over for pest control for rats and snakes.

Why are they a problem? Small Indian mongooses are aggressive predators. They are blamed for the decline of bar-winged rail (extinct), Jamaica petrel (critically endangered and

possibly extinct), hawksbill turtles (critically endangered), pink pigeon (endangered), Amami rabbit (endangered) and many other birds, reptiles and mammals. Mongooses also carry rabies and other human diseases.

Additional examples:

- **Cogongrass** is an Asian plant that arrived in the United States as seeds in packing material. It is now spreading through the Southeast, displacing native plants. It provides no food value for native wildlife, and increases the threat of wildfire as it burns hotter and faster than native grasses.
- **Feral pigs** will eat almost anything, including native birds. They compete with native wildlife for food sources such as acorns. Feral pigs spread diseases, such as brucellosis, to people and livestock. *E. coli* from their feces was implicated in the *E. coli* contamination of baby spinach in 2006.
- **European green crabs** found their way into the San Francisco Bay area in 1989. They outcompete native species for food and habitat and eat huge quantities of native shellfish, threatening commercial fisheries.
- **Dutch elm disease** (caused by the fungus *Ophiostoma ulmi*) is transmitted to trees by elm bark beetles. Since 1930, the disease has spread from Ohio through most of the country, killing over half of the elm trees in the northern United States.
- **Water hyacinth** is a beautiful aquatic plant, introduced to the U.S. from South America as an ornamental. In the wild, it forms dense mats, reducing sunlight for submerged plants and aquatic organisms, crowding out native aquatic plants, and clogging waterways and intake pipes.

Curbing the Spread

One way to curb the spread of invasive species is to plant native plants and remove any invasive plants in your garden. There are many good native plant alternatives to common exotic ornamental plants. In addition, learn to identify invasive species in your area, and report any sightings to your county extension agent or local land manager.

WHAT IS A COSMOPOLITAN SPECIES? According to Biogeography, organisms are said to have cosmopolitan distribution if they live in many different habitats around the world. A cosmopolitan species is very widespread and can be found on all continents and on many islands as well.

Examples of Cosmopolitan Species

Both modern and ancient species can exhibit cosmopolitan distributions. Before their extinction, several species of dinosaurs were once considered to be cosmopolitan including the *Lystrosaurus*. In modern times, the killer whale is considered to be one of the most cosmopolitan species on the planet. This puts them in a category which includes cats, humans, orchids, and dogs.

