NATIONAL OPEN UNIVERSITY OF NIGERIA

BIO 308

Biogeography

Module 3

BIO 308 (Biogeography)
Module 3

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Module 3

Unit 1 Zoogeographical Regions

1.0 Introduction

This unit will describe the zoogeographical regions one after the other. The animals will be classified accordingly. Classification of families of both animals and births will be made also in their various regions.

2.0 Objectives

At the end of this unit, you should be able to:

- relate animals to regions they belong
- state the characteristic features of each zoogeographical region.

3.0 Main Content

3.1Palaearctic Region

This is the largest of the six regions is covering an area of 14,000,000 square miles. In this region Europe, Asia, North of Himalayas and Northern parts of Africa. It lies on Longitudes 10°W to 170°W and latitudes 25°N to 80°N covers a total area of approximately 46 million $km^{2.}$

This region shows wide range of temperature fluctuations. It also shows wide range of fluctuation in the amount of rainfall. It includes polar arctic region. On its Northern side it shows temperate conditions. Eastern Asia shows deciduous forests and in the Northern region 'Steppe' grass lands are present. The region also shows wide fluctuations in physical and climatic features. So, it supports good fauna.

Sub-Regions of Palaearctic Region

European Sub-region: Northern and central Europe, Black sea and caucasus rare included in it. It is represented by 85 families of vertebrates. Amphibians and Reptiles are represented with six families each. Myogale, only one genus of mammal is present. Bird like Tits, wagtails, mammals like wolf and moles are common in this sub-region.

Mediterranean Sub-region: Remaining parts of Europe; Africa and Arabian portions are included in it. 124 families of terrestrial vertebrates are present. Birds like Upupa and Pastor; mammals like elephant scurew, Hyena and porcupine are seen in this sub-region.

Siberian Sub-region: Northern Asia, Himalayas are included in it. 94 families of vertebrates are included in it. Families of Musk deer and Moles are confined to this sub-region.

Manchurian Sub-region: Mangolia, Japan, Korea, and Manchuria are included in it. Mammals like, Tibetan Languor, Great Panda, Tufted deer, Chinese water deer are common.

Fauna of the Palaearctic Region

This region is supported by good fauna. Fishes, Amphibians, Reptiles, Birds and Mammals are represented.

Fishes: Most of the fishes show greater affinity to North America. Paddle fishes in China, Cyprinus, Anabas and Sucker fish (Echenis) are present.

Amphibians: Frogs like Discoglossus, Bufo, Hyla, Rhacophorus, Salamanders like Proteus, Megalobatrachus, and a number of tailed am- phibians are seen in palaearctic and Nearctic regions.

Reptiles: Snakes like Natrix, Dasypettis, T,rphlos, lizard like Monitor, tortoise like Testudo are common. True pit vipers, Colubrids are most commonly seen. ‘

Birds: Birds like Hawks, Cukoos, rails, finches, crows are present which are migratory. Nearly 37 species of birds are present. Parrots are absent.

Mammal: Camel, deer, wolf, horse, pig, hedgehog like mammals are common, Fruit bats, panthera bear are also present. The common mammalian fauna includes Deer, Beavers, Dog, Cat, Squirrels, Rabbits, Mice, Bats and moles.

3.2 Nearctic Region

This cuts across North America, Mexico north of the tropics, and Greenland. It lies along Longitudes 168°W to 15°W and latitudes ~20°N to 85°N with a total area of approximately 21 million km^2. It shows great variations in climatic conditions and temperatures. In the North Greenland, frozen ice is seen. It has range of mountains which extended from North to South. In the South west of North America deserts are present.

Sub- Regions of Nearctic Region

California sub-region : A part of North America Nevadaand Cascade ranges and part of British Columbia are included in it Nearly 86 families of vertebrates like HaplodotidaeAnielhade Vampires and Free tailed bats are seen in this sub region

Rocky Mountain sub-region: It includes mountains of East California with nearly 107 families of terrestrial vertebrates. Goats, Haplocerus, Prairie dogs and Lizards are commonly seen.

Alleghasysub-region: It includes rocky mountain sub- region, Lakes of Eastern parts of U.S.A. Vampire bats, Star nosed moles, Opossums, Turkeys and Carolina parrots are present.

Canadian sub-region: It includes remaining parts of North America and Greenland. Bison, Gluttons, Polar bears, arctic fox, Reindeer are commonly seen. ‘

Fauna of the Nearctic region: This includes Fishes, Amphibians, Reptiles, Birds and Mammals.

Fishes: Cat fishes, Garpike, Paddle fishes, and Cyprinidonts are commonly present.

Amphibians: Amphiuma, Salamanders, Bufo, Amblystoma, Hyla, and Rana are seen in this region.

Reptiles: Rich number of Reptiles like, Musk turtle, Trionyx, Emydines, *Alligators ophiosaurs*, and vipers like *Pituophiscouophis* and Chilomeniscus are present.

Birds: Nearly 39 families of birds including Pelicans, Heron, Humming birds, Woodpeckers, l9ycatchers, Mocking birds, Larks and Sand- pipers are present.

Mammals: Mammals like Squirrels, Moles, Rabbits, Beavers, Cats, Bats, Deers, Bears, Weasels, Opossum, Porcupine and Armadillo are present. Nearly 24 families are seen in this region.

3.3 Neotropical Region

This includes tropical Mexico, Central America, South America and adjacent islands (Galapagos, Falklands), and the West Indies. It lies along Longitudes 112°W to 35°W; latitudes 20°N to 57°S. Total area of this region is approximately 8.2 million km^2. This region includes S. America, Central America, Mexico and West Indies.

This region shows tropical conditions. The southern part of South America shows temperate zones, because of these varied environmental conditions Luxuriant forests, Deserts, Plains and Rivers are common. In the Amazon region thick forests are present. They are all evergreen forests while grassy plains are present in Argentina. This region shows Andes Mountains. Because of these conditions good vegetation is seen and rich fauna is present.

This region is divided into four sub-regions: Chillian sub region, Brazilian sub region, Mexicon sub-region and West Indies sub-region.

Chilliansub-region: It includes West Coast of South America. It contains Ands mountain ranges Bolivia =, Peru, Argentina. It includes 3 toed Ostrich called Rhea Americana, Clams, Oil birds are common.

Brazilian sub-region: It includes tropical forests of South America. It shows evergreen forests. Plains are also seen Rivers are present hence more vegetation is seen. It supports rich fauna. In this region American Monkey, Blood sucking bats (Vampire) Armadillos are common. ‘

Mexican sub-region: North of Isthmus of Panama is called Maxton sub-region. This region shows Rocky Mountains. It is showing subtropical conditions. In this region Tapiers, Mudterrapins etc., are common.

West Indies or Antillean Sub-region: The region contains West Indies, islands. Trinidad and Tobago are not included in this region. These islands contain mountains. In this sub-region the Vertebrate fauna is poor.

Fauna in Neotropical region: In this region many endemic species are present, and 39 families are recognized.

Fishes in Neotropical region: In this region many fresh water fishes are present. The important features of the regions are the absence of Carps. In this region Cat fishes; Trygonids, Edi fishes are present.

In South American region one Dipnoi fish is present Lepidosiren is called South American Fresh water Lung fish.

Amphibians in Neotropical region: In this zone 14 families of Amphibians are present which include *Pipapipa*, Hyla, Bufo, Rana etc. Caecelians are also represented in this region by Siphanophis, and Rainotrema with Urodeles being very few.

Reptiles in Neotropical regions: The reptiles of the sub-region will resemble those of Ethiopian and Oriental zone. The reptiles in the region include Crocodiles, Alligator, many turtles, and tortoises (which are common in the region), etc. 15 families of lizards are represented out of which 5 families are reported in this region. Examples include Helodermidae (Poison lizard), Andidae, Crcosauridae etc. In this region many snakes are present. Coral snakes, Pit vipers, Typhiops and many other snakes are present.

Birds in Neotropical: The Avian fauna of this region is striking and peculiar. Hence South America is called bird continent. Birds in the region include *Rhea Americana* (3 toed ostrich) - American Ostrich, Tinamus (Flightless bird is Endemic to this region), Ducks, Pigeons, Patrots, Swifts, Wood peckers, King fishers, Starks. Ant thrushers, Tree creepers, Oil birds are endemic to this region only.

Mammals in Neotropical region: 32 families are available. Nearly 10 families are endemic to this region. Examples include Hapalidae, Cebidae etc. families of New World monkeys. Armadillos, sloths, Ant eaters, Didelphis etc., are also seen in this region. Other mammals like Tapiers, Uamas, Deer, Squirrels, Rabbit, and Armadios are common in this region. In this region, Hyenas (*Aye-aye*), Hedge-hog and native horses are absent.

3.4 Afrotropical (Ethiopian) Region

This includes Africa south of the Sahara and Indian Ocean islands (Madagascar, Comoro Islands, Seychelles) and Mascarene Islands on Latitudes 20°N to 35°S. Total area is approximately 21 million km^2. This Ethiopian region is divided into four sub regions namely: East African sub region, West African sub region, South African sub region, and Malagasy sub region.

East African sub-region: This region includes Tropical Africa and tropical Arabia; because of high temperature desert conditions are available. Sahara desert is included in the region. In this region desert animals are included. Giraffe, Zebra, Camel, Ostrich etc., are common.

West African sub-region: This region shows thick forest. River Congo is included in this region. This region shows heavy rainfall. It has rich flora which supports good fauna. Gorilla, gibbon, great apes, elephants, panthers, lions are present while pittedae family of birds are common.

South African sub-region: This Southern part of the African continent is included in this region. It shows peculiar fauna like secretory birds, African moles, rats, bandicoots, and South African lung fish (Protopterus).

Malagasy Sub-region: It includes Madagascar and nearby islands. Darlington separated this Madagascar from Ethiopian region. In this region Chameleons are more popular.

Fauna of Ethiopia Region

Mammals: *Aye aye* (Hyaena), Galeopithicus, *Gorilla gorilla*, Chimpanjee, Gibbon, *Equsequs* (horse), elephant, *Pantheratigris* (Tiger), *Pantheraleo* (lion), Assionomyx (Leopard), Camelus (Camel), Deer, Sus (Pig), *Equs acinus* (Donkey).

Birds: The most important birds of this region are two toed ostrich- struthiocamelus. Others include Horn bills, heron, pigeons, parrot, cuckoos, storks, finches etc. In this region some exclusive birds are present. They are: ostriches, pittedae. Hammer headed birds, mouse birds etc.

Reptiles in Ethiopian region: Crocodiles and reptiles are very numerous. Examples are: Testudo, trionyx, chameleon which is the characteristic of this region and geck (a flying lizard). In this region many snakes are present such as: rattle snakes, cobras, vipers, pythons and typhiops etc., (common in this region).

Amphibians: This fauna is distinctive and is represented by cicaelians, anura. rhacophorus, hyla, microhyla, xenopus (clawed toad) which is exclusively in this region, cicaeans (which are abundant). Tailed amphibians are absent.

Fishes in Ethiopian region: Fish fauna is diverse is diverse in this region. Examples include protopterus (African fresh water lung fish), sharks, tuna fishes, cat fishes, cyprinids, electric fishes which are common in this region.

3.5 Indomalayan (Oriental) Region

This is found in Southeast Asia and adjacent islands south of the Himalayas though the Indonesian Archipelago, Philippines, and Borneo to "Wallace's Line" between Bali and Lombok. It has a total area ~9.6 million km^2. This region includes Indian sub-continent Ceylon Burma Philippines. Formosa and Scathe China, form the North of this region Himalayas are present. On the West of it Arabian Sea is present. In the South east corner physical boundary is absent.

This region includes 4 sub regions. This region shows tropical and temperate zones. In the North East Asia rain forest is present towards the west desert is present. The remaining part shows plains and rivers hence this region shows different types of conditions. Hence more vegetation is present and more fauna is seen. The 4 sub regions in this region are Indian sub-region, Ceylon sub-region, Indo-China sub-region, and Indo-Malayan sub-region.

Indian sub-region: It includes North India and central part. It starts from the root of Himalaya and extend up to Malabar Coast. This region shows plains and deserts. It shows temperate and tropical conditions. In this region Antelopes, Peacock, Indian Bison, Black Elephant, Equas and some important snakes are present.

Ceyloniansub-region: It includes Ceylon, Small Indian Peninsula. It shows loris, elephants, equas, rat, bandicoots and snakes.

Indo-China sub-region: It includes China south of Palaerctic region. It includes Gibbons, Lemurs, Rhinoceros, Salamanders, Disc tongued frogs are present.

Indo-Malayan sub- region: It includes Malayan peninsula and surrounding Islands. This region supports 132 families of fauna Gibbon, Rhinoceros, Badger, Broad bills etc. are very common in this region.

Fauna of oriental region: The fauna of Oriental region shows resemblances that of Ethiopian region. The fauna in the oriental region include:

Fishes: Fish fauna of Oriental region resemble that of Ethiopian region. Oriental fish fauna is dominated by carps and cat fishes. Notopteridae, Anabantklae, Syngnathus, and Cypsilurusetc.

Amphibians: Tailed amphibians are very rare, only one genus is represented *Tylptotritonverrucosus*. Anura and apoda amphibians are more. Rana species, hyla, rhacophorus, bufo, discoblastidae members, Icthyophis, Uraeotyphlus, Gegenophis etc. are some of the amphibians found in the oriental region.

Reptiles: Many reptiles are seen in this region. This fauna is dominated by lizards, snakes, turtles and crocodiles. The other reptiles found in the region include gvialis, gecko (flying lizard), chameleon, varanus (Indian monitor lizard), python, typhlops, testudo, cobra etc. In this region xenopeltidae, uropeltidea forms are exclusive.

Birds: In this region 66 families of birds are included. These include honey guides, wood pecker, horn bill, pea- cock etc.

Mammals:This region includes 30 mammalian families. Shrews, rabbit, canis, cat, aye-aye (hyaena), sues, equas rhinoceros, great apes like orangutan, gibbon gorilla, chimpanzee alirus (Himalayan pander), camel etc., are the major mammals in the region. In this region tree shrews, flying lemurs, Indian bisons are exclusive.

3.6 Australian Region

Australian region contains Australia, Newzealand, New Guinea and nearby Islands in the Pacific ocean Walice" includes Celebas islands in Australian region. The realm is sub divided into four sub regions: a) Australian subregion, b) AustromalayanSubregion, c) Polynesian Subregion and d) NewzealandSubregion.

Australian sub-region: It includes Australia and Tasmania. This region is located towards Southwest of Pacific Ocean. In this region very peculiar fauna is seen. It is because this part is separated from the main land by a big stretch of Ocean. It shows tropical and temperate climate. In this sub-region 34 genera of marsupials included. Hence it is called "Home of Marsupials**".** Tailed amphibians are reported in this region. Flightless birds like emus are included in this region.

Austromalayansub-region: This region includes Malayan Archepelago islands, New Guinea, Solmon Islands etc., Dendrolagus, Dayrus etc., Marsupials are present while crowned pigeons, and flyriver turtles are common.

Polynesian sub-region: This region includes Polynesian Islands. In this region fauna is poor. Tooth build pigeons are common.

New Zealand sub-region: In this sub-region New Zealand is included. In this sub-region snakes are absent while flightless birds (kiwi) are present. Hence, these people are called Kiwis. Rats and bats are common and sphenodon, a living fossil is confined to this region only.

Fauna of Australian Region

Mammalian Fauna in Australian region: These include ornithorhynchus (duck billed platypus), macropus (kangaroo), dasous (tiger cat), dendrologous, pteropus (flying fox), paramoles (marsupial bandicoot), echidna(spiny ant eater), *Rattusrattus* (Rat), *Equsequs* (horse), and *Equs acinus* (donkey), Sus (pig).

Avian Fauna in Australian region: In this region flightless birds are common. Such include Apteryx (Kiwi); present only in New Zealand, Dromaeus (Emu) New Guinea, and Casso wails- present in Australia. The other birds can be seen in this region are Pigeon (Columba livia), duck, crane, crow, *Passer domesticus* (sparrow), tooth billed region.

Reptiles in Australian region: the major reptiles found in this region include Varanus (monitor lizard), Trionyx, *Testudo elegans*, *Carettacaretta*, chameleon, calotes versicolor, mabuya etc. In New Zealand snakes are absent; sphenodon is seen only in this region.

Amphibians: Tailed amphibians, frogs and apodans are common in Australian region. Rana species, *Hylaarbouria*, *Micro hyla*, Rhachophorus, Alytes etc., amphibians are common.

Fishes in Australian region: In this region the most important fish is a lung fish. Ceratodous is seen in this region. It is called **"**Australian Lung Fish**".** In this region many other fresh water and marine fishes are present. Examples include Scoliodon, Macarell, Cynoglosus, Catlacatla, Anabas, Saccobranchus.

Invertebrates in the Australian region: "Trigonia" a freshwater bivalved Molluscan is seen.

4.0 Conclusion

The different zoogeographical regions have been shown in this unit. Each zoogeographical region has subdivisions (sub regions). Some animals are endemic in certain regions while some are absent in certain regions.

5.0 Summary

In this unit, you have learnt the:

- different zoogeographical regions
- subdivisions in each zoogeographical region
- animals present, endemic and absent in each zoogeographical region.

6.0 Self-Assessment Exercise

1. Distinguish between the types of mammals found in the various zoogeographical regions
2. Give the characteristics features of each zoogeographical region.

7.0 Reference/Further Reading

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Unit 2 Island Biogeography

1.0 Introduction

Island biogeography is a term used to describe locations that are isolated from other location. Such isolation may be due to difficult access to the locations and hence little interaction with other locations. The concept and the theory of island biogeography will be explained in this unit.

2.0 Objective

At the end of this unit, you should be able to:

- describe the concept of island biogeography and the theory of its explanation.

3.0 Main Content

3.1Concept of Island Biogeography

Island biogeography is a field within biogeography that attempts to establish and explain the factors that affect the species richness of natural communities. The theory was developed to explain species richness of actual islands. It has since been extended to mountains surrounded by deserts, lakes surrounded by dry land, fragmented forest (Sahney*et al*., 2010) and even natural habitats surrounded by human-altered landscapes.

Now, it is used in reference to any ecosystem surrounded by unlike ecosystems. The field was started in the 1960s by the ecologists MacArthur and Wilson (1967) who coined the term theory of island biogeography, as this theory attempted to predict the number of species that would exist on a newly created island.

For biogeographical purposes, an "island" is any area of suitable habitat surrounded by an expanse of unsuitable habitat. While this may be a traditional island—a mass of land surrounded by water—the term may also be applied to many untraditional "islands", such as the peaks of mountains, isolated springs in the desert, or expanses of grassland surrounded by highways or housing tracts. Additionally, what is an island for one organism may not be an island for another: some organisms located on mountaintops may also be found in the valleys, while others may be restricted to the peaks.

3.2 Theory of Island Biogeography

The theory of island biogeography proposes that the number of species found on an undisturbed island is determined by immigration and extinction. And further, that the isolated populations may follow different evolutionary routes, as shown by Darwin's observation of finches in the Galapagos Islands. Immigration and emigration are affected by the distance of an island from a source of colonists (distance effect). Usually this source is the mainland, but it can also be other islands. Islands that are more isolated are less likely to receive immigrants than islands that are less isolated.

The rate of extinction once a species manages to colonise an island is affected by island size (area effect or the species-area curve). Larger islands contain larger habitat areas and opportunities for more different varieties of habitat. Larger habitat size reduces the probability of extinction due to chance events. Habitat heterogeneity increases the number of species that will be successful after immigration.

Over time, the countervailing forces of extinction and immigration result in an equilibrium level of species richness.

Modifications

In addition to having an effect on immigration rates, isolation can also affect extinction rates. Populations on islands that are less isolated are less likely to go extinct because individuals from the source population and other islands can immigrate and "rescue" the population from extinction (rescue effect).

In addition to having an effect on extinction, island size can also affect immigration rates. Species may actively target larger islands for their greater number of resources and available niches; or, larger islands may accumulate more species by chance just because they are larger (target effect).

3.3 Influencing Factors on Island Biogeography

These include:

- degree of isolation (distance to nearest neighbour, and mainland)
- length of isolation (time)
- size of island (larger area usually facilitates greater diversity)
- the habitat suitability which includes:
- climate (tropical versus arctic, humid versus arid, etc.)
- initial plant and animal composition if previously attached to a larger land mass (e.g. marsupials, primates)
- the current species composition
- location relative to ocean currents (influences nutrient, fish, bird, and seed flow patterns)
- serendipity (the impacts of chance arrivals)
- human activity.

4.0 Conclusion

Island biogeography explains the richness of species in natural communities. The concept has been explained by several theories which have been modified over the period. The species richness is affected by certain factors like human interference, climate, and current species composition amongst others.

5.0 Summary

In this unit, you have learnt the:

- factor that influences species richness in a natural community
- theories that explain island biogeography.

6.0 Self-Assessment Exercise

With reference to a named location, state the factors that make such location described biogeographically as an island.

7.0 References/Further Reading

MacArthur, R. H. & Wilson, E. O. (1967).*The Theory of Island Biogeography*.

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Albert, J. S. & Reis, R. E.(2011). *Historical Biogeography of Neotropical Freshwater Fishes.* Berkeley: University of California Press, p.424

Unit 3 Relationship between Vegetation and Climate

1.0 Introduction

The growth and the nature of plants in an area depend largely on the climatic situation of a given area. The relationship between climate and vegetation is examined in this unit.

2.0 Objectives

At the end of this unit, you should be able to:

- explain how climate affects vegetation
- evaluate how vegetation affects climate
- describe with particular reference to Nigeria, the interaction between climate and vegetation.

3.0 Main Content

3.1 Relationship between Climate and Vegetation

Generally, the climate of a place or a region influences the type of vegetation to be found in such region. Moisture content, availability of nutrient in the soil depends on the climatic conditions of an area. These in turn determine the type of vegetation that can be found in a given place.Köppen's climate classification system was among the firsts attempts to establish quantitative relationships between climate and vegetation on a global scale.

Holdridge used three climatic variables (predictors) - annual precipitation, bio-temperature (temperature above 0°C), and ratio of mean annual potential evapotranspiration to mean total annual precipitation - to separate 38 climatic "life zones" from each other.

On a global average, of 100 units of energy entering the global climate system, 46 are absorbed by the surface and 31 are exchanged in the form of sensible and latent heat. Vegetation influences the absorption of energy by the surface via modification of the surface albedo as well as via alteration of energy partitioning between sensible and latent heat. Additionally, vegetation modifies the surface roughness length. These processes are accounted for by soil-vegetation-atmosphere transfer schemes (SVAT) which serve as land surface modules within atmospheric general circulation models (GCMs).

In regions with strong zonal atmospheric circulation, like the northern middle latitudes, the effect of local vegetation changes on the regional climate may be smaller than the effects due to such changes in remote regions. At the same time, changes in vegetation cover affect not only the region with altered vegetation, but also neighbouring regions. The local effect is most pronounced for temperature, as vegetation changes directly affect the local radiative budget.

Changes in vegetation also alter the evaporation. However, changes in air moisture content may result in quite remote effects due to the long-distance transport of moisture. For

example, in Europe there is a general reduction in precipitation towards the continent's interior as the transport of moisture from the Atlantic Ocean declines with distance to the ocean.

A substantial fraction of precipitation re-evaporates via plant transpiration. The significance of water recycling on a way of moisture transport increases for continental regions. Thus, changes in regional climate depend on both remote and local changes in vegetation.

3.2 Climate-vegetation Interaction in Sahara/Sahel Region

The dependence of vegetation on climate in subtropical deserts and semi-deserts can in a first approximation be expressed in terms of precipitation because the vegetation productivity is strictly limited by low water availability. Vegetation does not completely cover the land surface. The drier the climate is, the scarcer is the vegetation and the greater is the fraction of bare soil. The physical characteristics of bare soil (albedo, roughness, and water conductivity) differ from those of vegetation cover. That, in turn, creates a basis for the influence of vegetation on climate.

Low precipitation results in little vegetation cover, and the surface albedo is determined by bare ground with a high albedo. This positive feedback supports a desert that is self-sustaining. On the other hand, if there is more precipitation, there is more vegetation; this is darker than sand so the albedo is lower, the surface temperature is higher, and the gradient in temperature between land and ocean increases, amplifying monsoon circulation and upward motion over the desert.

As a result, the summer rainfall in the region increases. Another positive vegetation-precipitation feedback active in the region is based on an ability of vascular plants to transpire water from the soil, enhancing evapotranspiration in comparison with bare ground.

3.4 Nigerian Vegetation: Case Study of Relationship between Vegetation and Climate

Nigeria has a tropical climate with sharp regional variances depending on rainfall. Nigerian seasons are governed by the movement of the intertropical discontinuity, a zone where warm, moist air from the Atlantic converge with hot, dry, and often dust-laden air from the Sahara known locally as the harmattan. During the summer, the zone of intertropical discontinuity follows the sun northward.

As a result, more and more of the country comes under the influence of moisture-laden tropical maritime air. As summer wanes, the zone shifts southward, bringing an end to the rainy season. Temperatures are high throughout the year, averaging from 25° to 28°C (77° to 82°F). In the higher elevations of the Jos Plateau, temperatures average 22°C (72°F). Northern Nigeria typically experiences greater temperature extremes than the south.

Rainfall varies widely over short distances and from year to year. Parts of the coast along the Niger Delta, where the rainy season is year-round, receive more than 4,000 mm (160 in) of rain each year. Most of the country's middle belt, where the rainy season starts in April or May and runs through September or October, receives from 1,000 to 1,500 mm (40 to 60 in).

Within this region, the Jos Plateau receives somewhat more rain, due to its higher elevation. In the dry savanna regions, rainfall is especially variable over distance and time. The region

along Nigeria's northeastern border receives less than 500 mm (20 in) of rain per year, and the rainy season lasts barely three months.

Climate (particularly rainfall) has an important influence on the distribution of vegetation in Nigeria. There are ten main vegetation zones: the Sahel, Sudan and Northern Guinea zones, Jos Plateau, Montane forest and grassland, rain forest, oil palm bush, Southern Guinea zone, swamp and mangrove forest.

These major zones have different vegetation types which can be further subdivided into coastal forest and mangrove, deltaic swamp forest, swamp forest and wooded savanna, secondary forest, mixed leguminous wooded savanna. *Isoberlinia* savanna, *Afzelia* savanna and semi-deciduous forest, plateau grass savanna, mixed Combretaceous woodland, wooded savanna, mixed wooded savanna, floodplain complex, *Sorghum* grass savanna, *Burkeo Africana* savanna, wooded tropical steppe and moist lowland forest.

Vegetation also varies dramatically at both the national and local level in relation to climate, soil, elevation, and human impact on the environment. In the low-lying coastal region, mangroves line the brackish lagoons and creeks, while swamp forest grows where the water is fresh. Farther inland, this vegetation gives way to tropical forest, with its many species of tropical hardwoods, including mahogany, iroko, and obeche.

However, only in a few reserves-protected from the chainsaw and the farmer-is the forest's full botanic diversity intact. Elsewhere, forest is largely secondary growth, primarily of species like the oil palm that are preserved for their economic value.

Immediately north of the forest is the first wave of savanna: the Guinea, or moist, savanna, a region of tall grasses and trees. The southern margins of the Guinea savanna-which has been so altered by humans that it is also called the derived savanna-were created by repeated burning of forest until only open forest and grassland were left. The burnings decimated important fire-sensitive plant species and contributed to erosion by removing ground cover. Tropical forest is giving way to the Guinea savanna at such a rate that the only forests expected to survive the next generation are in reserves.

Beyond the Guinea savanna lies the drier Sudan savanna, a region of shorter grasses and more scattered, drought-resistant trees such as the baobab, tamarind, and acacia. In Nigeria's very dry northeastern corner, the semidesert Sahel savanna persists. Throughout these drier savannas, drought and overgrazing have led to desertification-the degradation of vegetation and soil resources.

4.0 Conclusion

The interaction between vegetation and climate has been explained in this unit. The climate of an area generally influences the type of vegetation to be found in such area and the type of plants and the activities influence the climatic conditions to found in an area. Nigerian vegetative distribution shows a clear example of the interaction between climate and vegetation.

5.0 Summary

In this unit, you have learnt that:

- climate and vegetation influence each other

- the climatic factors like temperature and temperature affect the growth of plant and the type of vegetation to be found in an area while vegetation affects climatic factor like humidity
- the vegetation distribution in Nigeria is a typical example of how climate affects vegetation.

6.0 Self-Assessment Exercise

1. Explain how rain fall and temperature affect vegetation of an area.
2. Describe the vegetative zone of Nigerian linking such to the level of rainfall.

7.0 Reference/Further Reading

Woodward, F. I. (1987). *Climate and Plant Distribution*.Cambridge:Cambridge University Press, p.174 .

Unit 4 Relationship between Soil Type and Vegetation

1.0 Introduction

This unit introduces you to the close relationship between soil type and vegetation.

2.0 Objective

At the end of this unit, you should be able to:

- describe the relationship between soil type and vegetation.

3.0 Main Content

3.1 Influence of Vegetation on Soil Type

A close relationship between soil type and vegetation tends to develop as soils begin to form. Vegetation plays an important part in the formation of soils from solid rock. The acids released by the roots of some plants act to breakdown the rock on which the soil is forming. The vegetation on a soil is particularly important in supplying the soil with precious organic matter.

There is often a close relationship between the vegetation and the soil, the vegetation supplying its dying remains to the soil and the soil converting them into nutrients so the vegetation can continue to survive and develop in years ahead. Different types of vegetation give rise to different forms of organic matter in soils. The different soil processes and the potential plant influence on them are shown below.

S/N	Soil process	Defining soil characteristic	Potential plant influence on process
1	Sorption	Temperature (*T*)	Low, shading
		*Kd*of adsorption, pH	High, root exudates
		Solution ionic strength (μ)	None to low
2	Desorption/dissolution	*T*	Low, shading
		*Kd*of desorption, pH	High, root exudates
		μ	None to low
3	Mineralization/ immobilization	Volumetric water content (*q*)	High, transpiration
		T	High, shading

		Organic matter quality	High
		Enzyme concentration	High, phosphatase exudation
4	Mass flow	Hydraulic conductivity,*q*	High, transpiration effect on *q*
		Bulk density (*r)*	Low to medium, root action
		Pore-size distribution	Low to medium, root action
		Solution concentration *(Cl)*	Low to medium, root exudates
5	Diffusion	Impedance	High, transpiration effect on *q*, root action on soil structure
		Kd	Low to medium, root exudates
		Q	High, transpiration
		r, pore-size distribution	Low to medium, root action
		Cl	Low to medium, root exudates

Growth of plants and activities of plants also depend on the nature of soils. Soil types with high sandy particles have low water retention capacity with high porosity. With the high porosity, such soils have little retention of nutrients hence support little vegetation.

In the case soils with high level of fine particles, water retention is very high and the pore spaces are easily filled with water. This reduces gaseous exchange between the atmosphere and the soil making the soil to be more or less in aerobic in nature. Such soils support few plants as organic matter accumulation is usually poor.

In soil types with high clay particles, positively charged minerals are usually retained by the particles. Plants usually exchange hydrogen ions for such nutrients. However, since the clay particles do not usually retain negatively charged ions like nitrates, soil types with high clay contents have low nitrogen contents and do not support plants with high nitrogen demands. Loam soil types sufficiently retain water and nutrients while still allowing for enough drainage to provide air spaces in the soil. Such soil type allows for growth of plants.

The humus content of soils also affects the growth of plants. Humus has the capacity to absorb and swell with water and shrink as water is gradually released from it. These alternating swelling and shrinking aerate the soil. Also as decomposers work on the humus, nutrients are released to the soil which is taken up by plants. Generally, soil types with10-20% are favourable to plant growth while soil types with less than 10% or more than 90% humus are not good for plant growth.

4.0 Conclusion

The different ways that soil type affects vegetation have been highlighted in this unit. While the nature and actives of plants affect soil processes, the type of soil influences and determines the type of vegetation found in an area.

5.0 Summary

In this unit, you have learnt how the nature and type of soil influence the type of vegetation in an area and how soil processes are affected by vegetation.

6.0 Self-Assessment Exercise

1. Explain how plants affect soil formation processes.
2. How do soil particle sizes affect the water and nutrient availability to plants?

7.0 Reference/Further Reading

Dallman, P.F. (1998). *Plant Life in the World's Mediterranean Climates*. California Native Plant Society, California: University of California Press, Berkeley.