

The scope of the Biogeography as a field of study on interaction between Ecological factors and Human beings.

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Abstract

Geography has been defined as a discipline that surveys relationship between man and the environment and its spatial variations. Hence its subject matter spreads through a wide range of fields namely, geomorphology, climatology and pedology etc. Biogeography is the subject that deals with the study of main divisions of living and non-living organisms in the earth. This science examines into that the factors maintain the relationship the animate and inanimate components in the environment and their expansion. It could also be identified as a science that span over various fields exploring into spatial patterns of biodiversity, perceiving them in detail, collecting information and recording them for future use and reference. It could further be reckoned as a discipline that investigates regarding the frequencies of organisms living on earth, its expansion, its interior and exterior existence and also regarding the variables and changes of such organism as well. While Biology deals with the study of plant and animal species and the interrelationship, biogeography deals with correlation between Biology and Geography. This paper discusses Biogeography as a field of study on interaction between Ecological factors and Human beings.

Introduction

Geography is one of the oldest earth science which has been defined as a discipline that study of the interaction of all physical and human phenomena and landscapes created by such interactions. It is believed that the word ‘geography’ was first used by the Greek scholar Eratosthenes in the third century B.C. The literal meaning of this Greek word is “description of the earth”. The best Known definition of the fields was provided by the American Geographer, Richard Hartshorne, as “Geography is concerned to provide accurate, orderly and rational description and interpretation of the variable character of the earth’s surface” (Hartshorne, 1961, p.21). Ackerman (1963, p.435) described the discipline’s goal as “...nothing less

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than an understanding of the vast, interacting system compromising all humanity and its natural environment on the surface of the earth (Haggett, 1965, p.3). Furthermore the book named 'An introduction to Geography' has been mentioned about three distinct areas of analysis explored by geography as follows.

1. The distribution and relationship of mankind over the earth and the spatial aspects of human settlement and use of the earth.
2. The interrelationship between human society and the physical environment as part of the study of areal differences.
3. The regional framework and the analysis of specific regions (Edward, 1965, p.5).

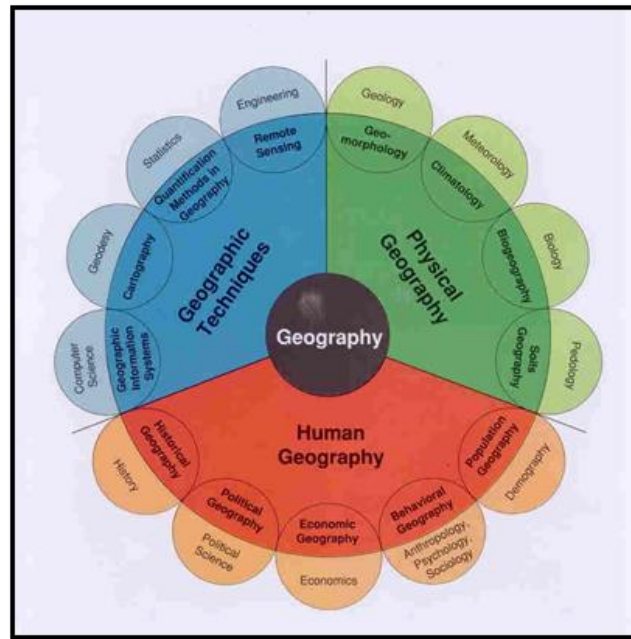
Accordingly, above definitions we can identified Geography as a discipline that study of features of earth's surface, places and the relationships between people and their environments. It also examine how human culture interacts with the natural environment, and the way that locations and places can have an impact on people. Geography seeks to understand where things are found, why they are there, and how they develop and change over time.

Geography is an integrating and synthesizing discipline which interrelates with many fields of study, such as hard and natural sciences, engineering, social sciences and humanities. The subject matter as Geography has been divided to three main sub discipline namely,

1. Physical Geography
2. Human Geography
3. Geographic Techniques

Figure 1.

The scope of Geography



Source: Ranasinghe, 2012, p.8

Figure 1 illustrates that three groups and interrelated subjects with them. Biogeography is a one of the science which belongs the group of physical Geography.

Man and environment relationship

Humans are part of nature and interact constantly with it in many ways on the molecular and the larger systems level. The nature of man differs from that of animals because of man's intellectual capacity. Man can deal with the environment in the way he wants. Accordingly, changes in ecological factors and their interactions could be observed when investigating into the human life of different environments.

Eskimos living in regions like Arctic regions are well acclimatized to the regions they are living in. About a months of year when the area is covered with snow, they wear a soft leather clothing to protect themselves from cold. They do not gain anything from the greenery but they fulfil their requirements of food from hunting and fishing. They have to use a lot of food which accumulates more fat to stand the cold. Their most popular hunt is seal hunting and they put up their settlements closer to places where seal are living in.

The nature of people living in tropical forests are completely different. Especially, Pygmies or Negritos are a complete different kind of people from others. Their height is about 4 feet 5 inches to 4 feet 11 inches. They are short people with short legs. They are strong people with long hands. They find their food from hunting. They sleep naked in outdoors. They find shelter under short tents covered with palm leaves only during the rainy season.

Negros living in Africa are not aware of time, years and seasons because they constantly live in forests which cover the sky with canopies and the mist. They are a group of people who are always feel hungry and even compel to eat human flesh. Normally, they live in huts made of palm leaves and sticks on river banks. Domestic equipment and utensils are limited and their food is yams, kinds of long beans and plantains. They kill elderly people and infants. As such people over 50 years of age cannot be found.

The most important feature in human life of Sahara is their life style being shepherds. These desert settlers get their food from animal, milk and flesh from goats and sheep. Camel is a very important animal for them. When there is a scarcity of food, they get their requirements from inhabitants of oasis. Because of the movement system assigned by the environment, they have no prime strength or a feeling of development in their life.

Actually, more than half of earth is without inhabitants. Polar Regions, Tundra regions, warm deserts and equatorial forests, people live in groups at faraway places with great difficulty. It is because they cannot live according the environment. It is easy to develop a composite society in places where there is no greenery. They can live on animal flesh. Mostly human settlements can be seen in savannah grasslands with tropical monsoon climate and also in mediterranean regions where *Oats*, *Rye* and *Barley* could be richly cultivated. In such places human colonies could be seen ample. However, it appears that man cannot beat certain climatic conditions (eg: white men cannot acclimatize with the tropical desert climate). Due to the reason that world is getting used to the modern technology, there is a threat of extinction of Eskimos in polls and the Negrito community in equatorial regions.

Humans can effect changes in the environment through agricultural systems change according to different areas of the world enabling the people living in those

regions to get used to the environment and to proceed with their capacity of interaction. It could be observed that Shifting Cultivation is carried out in tropical regions, Intensive Subsistence Cultivation in tropical, Commercial Gardening and Mediterranean Agriculture in temperate regions. Each of these agricultural patterns are determined based on geographical factors.

It could be well observed that due to various human activities, the entire biosphere has faced a threat that cannot be avoided. Depletion of Ozone layer, desertization, greenhouse effects and acid rains are the adverse effects of the above threats. As a result, it could be seen that living beings, flora and fauna are being destroyed. Accordingly, the interaction between man and the environment become diverse.

Accordingly the information that mentioned above the relationship between man and environment has changed one region to another region in the world. Human behavior and their life styles which live in different places of the world have different formation because of the influence of ecological factors. Mankind deal with environment accordingly topography, climate and vegetation of the areas they live in. In Biogeography subject study about as a living being of the earth how mankind interact with the environment. Therefore we have to consider some definitions about biogeography to understand how study on interaction between ecological factors and human beings in this subject.

Definitions and Scope of Biogeography

Biogeography enables us to identify biodiversity patterns in the past and present, identify the expansion of organisms while enables us to study about the relationship between living and non-living factors influence organisms to exist. Diversity of flora and fauna exists according to the relationship that emerges with the above factors. Nigel Pears in his book titled 'Basic Biogeography (1977)', also mentions similar idea that "Biogeography implies a linkage between Biology and Geography. It studies the distribution of biological materials over the earth's surface and the factors responsible for the observed spatial variations" (Pears, 1977, p.3). Similarly, we can identify same viewpoint in R.L Jones's book titled 'Biogeography (1980)'. He describes Biogeography as a subject that studies the expansion pattern organisms in the past and present. Jones further describes while questioning in to

whether the situation of identifying the life styles that existed in the past are being practiced in the present, whether those practices are being followed in past have been subjected to changes and what the factors that influenced such changes. He have mentioned that idea in his book as follows.

“Biogeography seeks to describe and analyse distributional patterns exhibited by organisms at present and in the past. To enable it to comprehend distributional patterns, biogeography needs to study physical and organic factors as they are now and as they have been in former time. To acquire this knowledge, it must use information drawn largely from the natural and earth sciences. It is an interdisciplinary subject within these domains” (Jones, 1980, p.6).

The subject of Biogeography includes certain fundamental problems and this subject can find solutions for such problems. These problems are:

- Why various types of organisms are could be seen on this Earth?
- Where have these organisms spread?
- What is the reason for the spreading at such places?
- Can that diffusion pattern maintained continuously?
- Do various changes take place in maintaining it continuously?
- What are causations for different change?
- Similarly, how will the diffusion patterns change in the future?
- What are the factors that influence such changes?

Accordingly, the study through biogeography is the study about biodiversity. Nature of the lives of flora and fauna where biologists are paying attention regarding their physical shapes and characteristics, a theoretical and conceptual ideas provide a detail study under the biogeography field. Therefore, biodiversity carries a very important place in the scope of biogeography. The reason for this is that Biogeography enables us to study different characteristics and features in different regional environments with a geographical view point. Accordingly, it enables us to identify the environmental diversities of Biogeography and the fluctuations of diversities and the problems arising in the environment.

Richard Hagette have also mentioned significance of these questions in his own words. Biogeographers address a misleadingly simple question: why do organisms

live where they do? Why does the speckled rangeland grasshopper live only in short-grass prairie and forest or brushland clearings containing small patches of bare ground? Why does the ring ouzel live in Norway, Sweden, the British Isles, and mountainous parts of central Europe, Turkey, and southwest Asia, but not in the intervening regions? Why do tapirs live only in South America and Southeast Asia? Why do the nestor parrots – the kea and the kaka – live only in New Zealand? (Huggett, 2004, p.3).

Meadows and Pitman describe about biogeography as follows. ‘Biogeography is an interdisciplinary natural science with a complex, even cryptic identity that defies definition. In essence, it is the science of the distribution of living organism and the factors that underlie this distribution. Such a one-line descriptor does no justice, however, to the range of approaches and concepts that constitute contemporary biogeography. Not only is biogeography concerned with spatial patterns in the contemporary sense, but also there is a strong evolutionary component and a concern with change over time. It is a discipline that leans heavily on several other scientific fields of enquiry, such as ecology, systematics, the environmental sciences, the various branches of physical geography and even, in an applies context, aspects of the social sciences’ (Meadows, p.1) . ‘Biogeography is the study of past and present-day spatial distributions of life (both flora and fauna) on earth in relation to environmental factors such as geology, climate and soils. Within biogeography there are various degrees of specialization, usually involving taxonomic study of either fauna (zoogeography) or flora (phytogeography). As such, biogeography depends heavily upon the observations and concepts of its parent subjects– geography, earth science and biology, and especially ecology and palaeoecology’ (Pitman, 2011, p.1).

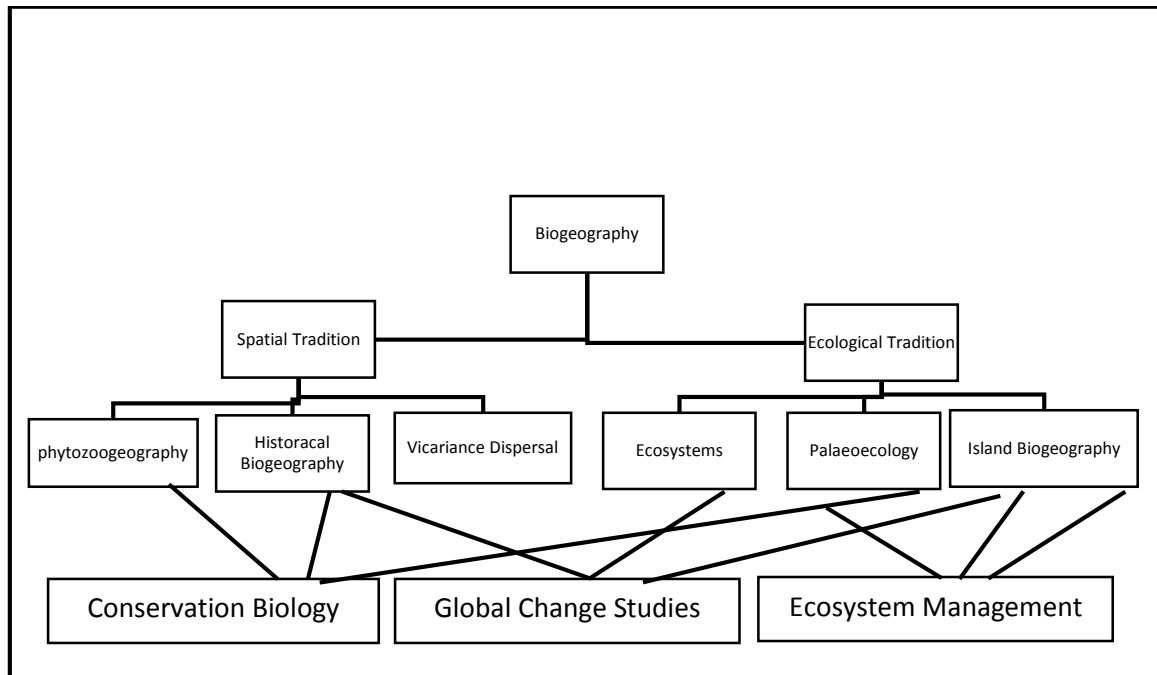
According to that definitions biogeography is concerned with the biological phenomena in space, especially in terms of the distribution of various kinds of floral and faunal species. It has developed interact with many other subjects and try to seeks relationships between living beings and non-living things with change over time.

The major approaches to discipline are classified broadly into those rooted in the spatial tradition and those associated with a more ecological theme, as shown in

the schematic representation of Figure 2. Although they are obvious connections and interdependencies between many of themes represented on the schematic, it is convenience to discuss the various elements separately. The applied nature of biogeography is illustrated in the three shaded boxes at the base of Figure 1; these elements are discussed subsequently (Meadows, p.5).

Figure 2.

Themes in Biogeography



Source: Meadows, p.5

Two major sub-field have been recognized in biogeography as spatial and historical biogeography and ecological biogeography and their respective histories. That sub-field can be categorized in to two main traditions as spatial tradition and ecological tradition. In spatial tradition of biogeography we study on Phytogeography, Zoogeography, Historical Biogeography and vicariance dispersal. Respectively phytogeography and zoogeography are concerned with the geographic distribution of the plant species and animal species. Historical biogeography study about how species distribution have changed overtime in relationship to the history of landforms, ocean basis and climate as well as how those changes have contributed to the evolution of biota. Vicariance dispersal means how species have been distributed the division of a widespread group of organisms by a geographic barrier, such as a mountain range or a body of water, often resulting in the evolution of related

species on either side of the barrier. In ecological tradition study on Ecosystem, Paleocology and Island Biogeography. Ecology is the study of the interaction among organism and an ecosystem is comprised of habitats, biological communities, and eco tones. Therefore to understand the distribution of species on earth a fundamental knowledge of ecology and ecosystems is essential. Paleocology study on fossil animals and plants in order to realize their ecology and the environmental conditions in which they lived. Island biogeography projects seek to understand the generation of biodiversity on island archipelagos in relation to geographical isolation and dispersal abilities of taxa.

In 1929, Russian Biogeographer named Vernadsky mentioned that Biogeography enables us to study about the biosphere. He illustrated this biosphere as a life zone where smallest to the largest creature is living along with flora and other organisms. Vernadsky considered that the basis of Biogeography is the study of diversities due to these organisms being combined with various biological factors and their different changes taking place constantly.

Edward Wilson of Harvard University states that the responsibility of a biogeologist is to consider every biological phenomenon and to find the different factors that influence the same and also to ascertain us to what extent such factors have subjected to changes spatially and timely. He further states that identifying various types of flora (eg: Tropical rain forests, Savanna grasslands, Temperate forests, Tundra grasslands), identifying the changes of animal and presenting the information after analyzing is an aspect which belongs to Biogeographical scope.

From all these definition, it appears that biogeography enables us to study about its special factors being organisms while investigating into different areas as to why so many organism species are living?, in which area are each of those species are found?, why are those species are found in these areas?, if there is a special kind of species in which area are those species agglomerate mostly? and so on. These various species living on earth nurture the man, provide medicines, contributes to the production of textiles, provide shelter and cooling effects to man, contributes specially in the production of oxygen, purifying water while flora species contributes specially in the provision of fuel. Therefore, within the entire biosphere, each and every organism maintain a bio cycle while depending on each other. Biogeography

observes our environment, conducts researches on different organism species based on various concepts.

Flora and fauna are two important parts in this scope. Initially, a study is conducted regarding these two parts. Flora is treated as a lively component without intelligence. Similarly, flora life consists of a food productive component. Biogeography is the only subject that studies about the cooperative relationship between vegetation without intelligence and the man with intellectual capacity. When considering about the sciences connected to geography, it appears that biogeography deals with a very wide scope intelligence. Fauna depends on vegetation. Human life depends on flora and fauna. Initially, vegetation engages in the process of photosynthesis and every living being depend on the food that is produced by such flora. Vegetation produce carbohydrates (the starchy component) with the help of sunlight, water, manure and carbon dioxide. Such starchy components are stored in the trunks, leaves and roots.

These living beings are categorized as herbivorous, carnivorous and omnivorous. Food that is produced by vegetation is eaten by the category called herbivorous. Animals eating flesh of other animals are called carnivorous animals and those who eat both the above categories are known as omnivorous animals. If the amount of calories produced by flora is assumed on 3000, trees store about 1500 calories. The balance gets into different parts of the environment. Accordingly, an enervation takes place between flora and fauna life. Mostly, environmental features depend on and maintained by these flora and fauna life. Flora and fauna living on environmental features change by acclimatizing to the changes of environmental features of vegetation in a short period with modification of such environmental features. This mutual relationship is studied conceptually based on this mutual relationship. Biogeography mainly pays its attention especially towards the diversities according to spatial changes. Among the factors, landscape features and changes in categories of greenery on upland vegetation and lowland vegetation could be illustrated. Biogeography studies about the different changes of animal life (same as animals, humans are also identifies as highland settlers) Biogeography also studies about the manner how different types of animals get acclimatized to the environment.

Changes in flora and fauna life take place according to the climate. As for animals, animals living in warm regions are different from animals living in cold regions. Studies are carried out by biogeography in respect of lithosphere, living beings of interior earth, there living beings, soil and rocks. It studies more on soil than rocks and pays attention about carnivorous fauna as stagnated in caves without sunlight and food production (eg: *Cactus plant*) and also about mass movement of micro ecological systems. Rocks also cannot be set apart from biogeography. As an example, coral reefs form after having being water borne for a long period. These are particles of organisms which have been under water. When such corals decay they form a different type of soil region. In those soil regions changes could be observed according to various climatic conditions. This type of soil causes a diversity in the evergreen trees growing in this area. Attention is paid towards human effects in addition to physical and biological factors. Especially, the natural flora changes in agricultural process. (Eg: clearing of forests for chena cultivation, changes the ecological condition which existed before). Accordingly, biogeography studies about the human effects towards the environment.

Related Fields

Biogeography is a synthetic discipline which has relationship with many other subjects. It is a science that not only has its own theoretical and empirical approaches, but also readily incorporates conceptual and factual advances from many other sciences such as, Ecology, Biology, Systematics, Earth Sciences.

Ecology is study on the interactions between organisms and their environment. It has also been included the study on abundance of organisms in space and time and the processes in biological communities. In 19th century ecology was going to have close links with biogeography, because both ecologists and geographers were interested in the pattern of distribution of organisms in space and time and the processes determined those patterns. These two subjects are closely related, interdependent and sometimes their subject matter has been overlapped. In 19th century Ecology was going to have close links with biogeography because, both ecologists and geographers were interested in the pattern of distribution of organisms in space and in time and the process which determined those patterns. Swedish

botanist Carl Linnaeus published a book named “*Systema Naturae*” and outlined a classification of the plant kingdom. That nomenclature genus and species still in use and of considerable significance to Biogeography.

We cannot draw a sharp line between biogeography and its related fields, because biogeography is relying heavily on theory and data from other related subjects (Lomolino, 2006). Biogeography is closely tied to ecology and it is a branch of biology, and knowledge of biology is very important for the biogeographers. ‘For example, the theory of island biogeography is widely considered to be fundamental in ecology. Similarly biogeography is a major topic in classic text on phylogenetic systematics. Given these long standing connections an outsider to ecology and evolutionary biology might assume that biogeography is an integrative discipline that combines phylogeny and ecology to addresses important questions about the distribution of lineages and global patterns of diversity’ (Wiens, 2004, p.639). Similarly it is important to know about some geography and geology. The locations of continents, mountain ranges, deserts, lakes, major islands and archipelagoes and seas during the past as well as the present, indispensable information for biogeographers, as are past and present climatic regimes, ocean currents and tides (Lomolino, 2006, p.6).

Notable Biogeographers and Their works

The first who asked the central biogeographic questions is Aristotal (384 BC-322BC). The question was which has mentioned in his written records ‘How are organism distributed around the world? We can identified many notable bigeographer in historical development period of biogeography.

1. Age of European Exploration
 - Carl Linnaeus
 - Georges-Louis Buffon
 - Johann Reinhold Forester
2. Age of Enlightenment
 - Alexander von Humbolt
 - Agutin de Candolle

3. 19th Century
 - Charles Lyell
 - Charles Darwin
 - Alfred Russel Wallace
4. First half of the 20th century
 - Alfred Wegner
 - Ernst Mayr
 - G.E. Hutchison
5. Late 20th Century
 - Robert H. MacArthur
 - Edward O. Wilson

Carl Linnaeus developed a species classification system and the hypothesis to explain biodiversity distribution. Georges-Louis Buffon studied about live and fossilized mammals. And also he recognized climatic shifts and their importance to understanding species spread. He criticized Linnaeus's ideas and developed the hypothesis of species dispersal. Johann Reinhold Forster affirmed Buffon's law for plants, mammals and birds and recognized plant assemblages and relationship with specific climatic conditions. Alexander von Humbolt was the father of phytogeography who in 1806 attempted to classify plant growth forms and the types of cover that they comprised over the earth's surface. Agutin de Candolle was the first to put forward the idea of "Nature's war", writing of plants being "at war one with another" with the meaning of different species fighting each other for space and resources. Candolle had established a new genus, and he went on to document hundreds of plant families and created a new natural plant classification system. 'During the first part of the nineteenth century, Charles Lyell, a pioneer of geological science, stressed the principle of uniformitarianism: this states that the physical features of the earth could have been produced in the past by processes similar to those still operating' (Jones, 1980, p.8). Charles Darwin synthesized a wide range of data, and published in 1859 in his 'Origin of Species'. Furthermore he established that all species of life have descended over time from common ancestors, and in a joint publication with Alfred Russel Wallace introduced his scientific theory that this branching pattern of evolution resulted from a process that he called natural selection, in which the struggle for existence has a similar effect to the artificial selection involved in selective breeding. Alfred Russel Wallace who was father of

Zoogeography developed a numerous biogeographic principles. 'In 1912 Alfred Wegner, noting the same fossil distributional relationships and what appeared to be the 'jigsaw' fit of certain continental outlines, postulated that the world's land masses had drifted apart. There was no known mechanism to allow for such lateral movement, however; and, while continental drift was discussed for the next forty or so years as a possible cause of biogeographical patterns, more store was set upon vertical lithospheric motion' (Jones, 1980, p.9). Ernst Walter Mayr was one of the evolutionary biologists who was also a renowned taxonomist, tropical explorer, ornithologist, and historian of science. His work contributed to the conceptual revolution that led to the modern evolutionary synthesis of Mendelian genetics, systematics, and Darwinian evolution, and to the development of the biological species concept. George Evelyn Hutchinson is known as one of the first to combine ecology with mathematics. He became an international expert on lakes and wrote the four-volume 'Treatise on Limnology' in 1957. He built on Charles Elton's idea of an ecological niche. Robert MacArthur was a professor at the University of Pennsylvania who played an important role in the development of niche partitioning, and with E.O. Wilson he co-authored The Theory of Island Biogeography, a work which changed the field of biogeography, drove community ecology and led to the development of modern landscape ecology. His emphasis on hypothesis testing helped change ecology from a primarily descriptive field into an experimental field, and drove the development of theoretical ecology. Edward O Wilson is "the father of sociobiology" and "the father of biodiversity". Among his greatest contributions to ecological theory is the theory of island biogeography, which he developed in collaboration with the mathematical ecologist Robert MacArthur, and which is seen as the foundation of the development of conservation area design, as well as the unified neutral theory of biodiversity of Stephen Hubbell.

Conclusion

Within the scope of Biogeography, studies are conducted with the main divisions namely animate and inanimate in biological systems. Studies are carried out in identifying the animate and inanimate parts, categorizing them and the patterns while observing the interrelationships among such systems. Investigations are conducted to ascertain where these different organisms live? Why do they live in such regions?

and as to why these organisms live in such special regions? A broad study is conducted regarding tropical rainforests, savannah grasslands and temperate zone forests. Similarly the above facts reveal that Biogeography is a subject that investigates into the interactions between human and ecological factors with a biogeographical point of view.

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