

Revitalizing Biogeographical Research and Discourse In India: Some Observations*

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1.1 Introduction

In the epilogue of his seminal book *Biogeography*, the British biogeographer H Robinson (1972), while emphasizing on evolving strategies for nature conservation, tried to draw attention of all concerned to some crucial points, one of which reads—“ he must educate himself to the vital importance of preserving the natural environment and its natural balance so that it remains economically productive, socially amenable and esthetically satisfying.” Robinson observed that with ever-increasing power and technological advantage at his disposal human has subdued and controlled nature and has interfered with every ecological principle relating to energy flow, community interaction and population control. Consequently human has experienced the dangerous results of his ruthless exploitation and wanton destruction of nature. However, man’s knowledge and scientific understanding of the biological principles may show him ways and means to adjust the processes of development with the natural settings causing least possible damage to the environment. “Here lies

the need and significance of the study of biogeography”-thus said Robinson on the relevance of biogeographical study about half a century back from now. Since then till date we have experienced lot of environmental changes including severe loss of habitats and biological diversity. The problem of climate change and related issues have made the situation more grave, which demands, among others, revitalization of the study and research in environmental geography in general and biogeography in particular.

Unfortunately, works in biogeography in India are very limited and we rarely come across any serious debate on the burning biogeographical issues confronted by different regions of the country. This is evident from the last few Country Reports presented in the International Geography Congress in the form of *Progress in Indian Geography* where works in biogeography are referred only marginally reflecting no any visible trend (Singh, 2012). However, in view of the growing relevance of this branch of geography in the present environmental context let us try to develop renewed interest

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in biogeography and revitalize it to address the emerging problems arising out of the changing nature-culture interaction from interdisciplinary perspectives integrating with them the area- and culture- specific traditional knowledge and wisdom carefully.

1.2 The Field of Biogeography

As an interdisciplinary approach towards understanding the geographical dimensions of the biological world, biogeography occupied an important position in the research agenda of geography. Plants and animals are integral part of the earth's natural environment in which human operates to create a built environment. The plant communities vary greatly over space in terms of species, association, and morphological characteristics providing variable habitats for the wild animals. One of the prime responsibilities of biogeography was initially to classify the earth's surface into regions on the basis of the distribution of flora and fauna. Biogeography draws heavily from biosciences in terms of concepts, principles and information and share common grounds with the latter. While attempting a classification of the subject geography long back, Geer (1923) observed that "owing to extraordinary wealth of species in the vegetable and animal world, its geographical treatment usually requires co-operation with Zoology and Botany". To him, physical geography "still occurs in its old signification, embracing also the lithosphere and, quaintly enough, even the biosphere". Remarkably, in

his general classification of geography, Geer identified three different biogeographies: biogeography of hydrosphere (plant and animal world of the sea), biogeography of the atmosphere, and the lithosphere (plants and animal world of the land). Whatever may be the perception and purpose behind such a classification, due recognition was given to biogeography as an important field of geographical enquiry during those days.

As defined by Brown and Lomolino (1998), "biogeography is the science that attempts to document and understand spatial pattern of biodiversity. It is the study of distributions of organisms, both past and present, and of related patterns of variations over the earth in the numbers and kinds of living things". According to them, biogeography tries to address the basic question of distribution of organisms over the surface and the history of the earth. However, being stimulated mainly by path-breaking research in genetics, ecology, paleontology and environmental biotechnology, biogeography has witnessed remarkable change in its research trend during the last few decades. Thus biogeography, from its humble beginning during the age of exploration to its post-1950s developments, has made significant progress from mere classification of the earth's surface on the basis of the distribution of plants and animals to the present climate change and biodiversity-related issues over space and time. During the course of more than one and a half century, this sub-

field of geography has experienced lot of changes not only in its scope, but also in its perspectives and methods of analysis. Its core has been strengthened by introducing innovative ideas and useful frame of references, while its peripheries have been extended to the interfaces of related disciplines and problems.

Biogeography embraces an exceptionally vast field. It is as broad and diverse as the earth's biosphere. It handles huge amount of information, adopts a variety of perspectives and applies both traditional and advanced analytical tools. The discipline, with wide ranging interests and ability, provides scope for a number of specializations within it, such as historical biogeography, phytogeography, zoogeography, ecological biogeography, island biogeography, applied biogeography and so on. Within the two broad taxonomic specializations phyto- and zoogeography, lower order specializations like ornithogeography and microbial biogeography have already received due recognition.

As a sub-field historical biogeography carries great value as it tries to trace the biological past of the areas under study and reconstruct the origin, diffusion and extinction of selected taxa and biota (Brown and Lomolino, 1998). Ecological biogeography on the other hand, studies the distribution of life forms with respect to their interaction with the biotic and abiotic environments. The process and patterns of distribution and

variations of biological elements over space and geographical contexts are matters of concern for the ecological biogeographers. Importantly, island biogeography, the origin of which dates back to early nineteenth century, now assumes additional significance as many of the low altitude islands are suspected to get submerged due to the impending rise of the sea level caused by global warming. If these small isolated worlds are biologically rich, then their submergence would mean extinction of many species, mainly the endemic ones, unless necessary measures for their *ex-situ* / *in-situ* conservation are urgently undertaken. Issues relating to such type of recent developments have already drawn attention of the environmentalists, biologists, biogeographers and policy-makers. Even the river islands like those of the Brahmaputra river, Assam (Bhagabati, 2004) and the spacious deltas created by the big rivers may be of great importance so far micro-level biogeographical studies on such delicate ecosystems are concerned.

It is important to note that the discovery of certain new biotic properties of flora and fauna, their interrelationships and behavioral changes resulting from some phenomena like global warming on the one hand and the ability to apply satellite-based technology and computer-aided mapping, the scope for biogeographical research has expanded greatly. This has led to either carving out new frontiers of research or intensifying research in the existing fields with innovative

concepts and principles, new data sets and more reliable methods. At the same time the rapid growth of population and the growing demand for natural resources have put tremendous pressure on the biotic world giving rise to more complicated problems needing new strategies and action plans for their sustainable management. This has further widened and strengthened the field of biogeographic study and research.

1.3 Some Emerging Areas of Research

Almost all parts of the continents and ocean basins including the remotest areas have been presently brought under the purview of some kind of human control and activities. Consequently, the entire biosphere, extending from some depth of the land surface, the whole range of seas and oceans, the surface of the earth to the lowermost layer of the atmosphere, is under severe pressure generated by the ever-increasing human population and their diverse activities. This is reflected, among others, in the shrinking green cover, diminishing fresh water bodies (wetlands) and rapidly losing biodiversity. Thus, the processes and patterns of biodiversity loss together form fertile fields for problem-oriented research that can contribute substantially towards sustainable management of the earth's deteriorating environment. Biogeography has the ability to address the emerging biodiversity-related problems and issues as presented in the following sections and thus can help in translating the ideas of restoration and

conservation of habitats and species into reality.

Biodiversity

Biodiversity is now a commonly used expression in biological and other related sciences. As a key issue of the Rio Earth Summit, biodiversity moved to centre stage as one of the central subject of scientific and political concern throughout the world (Wilson, 1997). It is the total variability within all living organisms and the environmental complexes they inhabit. Biodiversity implies diversity of form right from molecular level through individuals, populations, communities, ecosystems, landscapes and biosphere (Dwivedi, 2007). It is, however, interpreted from three different considerations: (a) genetic diversity, (b) species diversity and (c) habitat diversity. These three aspects, when put together, give the total picture of biodiversity of an area. It is important to note that the habitat fragmentation and loss adversely affect species diversity and population leading to erosion of genetic diversity.

Conservation of biodiversity requires, among others, a landscape perspective. The shrinkage and fragmentation of habitats leave remnants no longer connected to a larger wilderness and hence the species therein get endangered and lost over time (Lovejoy, 1997). Landscape ecology, which is closely associated with geographer's landscape systems, suggests that landscape-based approaches may be more desirable

than species-based approaches in order to maintain the existing biodiversity (Turner, 1998).

So far the geographical aspects and approaches related to biodiversity are concerned, land use system are of immense significance. Land use change may alter the relative status of the natural habitats and give rise to a new land cover type with modified landscape diversity. Moreover, land use dynamics may alter the spatial pattern of habitats causing fragmentation of the otherwise continuous habitats (Turner, 1998). It is important to note that land use constitutes an important field of study in geography, which may be easily reoriented to study it as a factor of landscape change and modification of biodiversity. Interestingly, the biologists and environmental scientists have now recognized the importance of land use study for better understanding of the habitat characteristics and the emerging problems like climate change and desertification.

As has been observed by Lovejoy (2009), a great deal of attention needs to be paid to the process of 'adaptation' to make biodiversity and ecosystems sustainable in the face of climate change. Climate change will greatly affect the existing distribution of flora and fauna, and new process and pattern of their dispersal will emerge eventually. Natural linkages among habitats need to be reestablished urgently in the degraded landscapes particularly so that species can follow the conditions required for dispersal and survival. Here also, by studying the

changing situations biogeographers can greatly contribute towards conserving the species suspected to be affected by the problem of climate change and other associated events.

The earth's biodiversity in certain areas experienced unprecedented pressure from humankind more than a thousand years ago when people started living a well-organized sedentary life with agriculture including domestication of animals as the mainstay of the economy. Since then the changing human response to environment in general and biodiversity in particular started attaining such levels that managing the earth's heritage of biodiversity became a task of great challenge. With the mobilization of around 40 per cent of all primary production towards human ends and with man-made objects ranging from molecule of DDT and CFC to massive buildings and vehicles affecting the entire earth's environment, the present-day human impact on the biosphere is really staggering (Gadgil, 1993).

In Indian context, the root and proximate causes of biodiversity loss include: (i) conceptual and policy level weakness, (i) population growth and high density, (ii) habitat fragmentation and destruction by anthropogenic factors, (iv) overgrazing, (v) flood, soil erosion and drought, (vi) application of agro-chemicals, (vii) poaching, (vii) biopiracy, (ix) insurgency and other political problems, and (x) poverty (Bhagabati, 2006). All these causes in some way or the other are associated with the geographical, historical and

political-economic dimensions of the development process. Biogeographers by virtue of their knowledge and experiences of spatio-temporal interrelations and complexities of phenomena can substantially contribute towards scientific management of these causes and their probable consequences. This is an emerging area of global concern which may be attended by the biogeographers with utmost care and academic sincerity. As a matter of fact, geographic patterns of biodiversity are central to both biogeography and conservation biology (Brown and Lomolino, 1998).

Gender and Biodiversity

Social scientists are seen to be increasingly inclined towards documenting the discrepancies made between men and women with respect to access to goods and services, participation in policy-making and overall progress of the society. It has been argued that the social bases of gender relations and unequal distribution of power between women and men have not received due attention as yet. However, gender does not concern only women but the unequal social relations between women and men as well. Whereas biological differences between women and men are universal, gender relations vary greatly within and between societies and cultures. Gender relations have strong influence on how environmental resources are used and managed, and hence on the patterns of ecological changes over time (NBSAP-India, 2000). Gender perspective thus

allows the policy-makers to consider everyone's interest, capacity, skills and knowledge in the design and implementation of sustainable solutions of the problems around.

The status and role of women vary significantly from society to society and from region to region. In the less developed peripheral countries, women produce more than half of all the food; they also build houses, dig wells, plant and harvest crops, make clothes and perform many other activities that are not recorded as economically productive (Blij and Murphy, 1998). By virtue of their indispensable roles in ensuring domestic food security, millions of rural women, especially in the third world countries, have naturally greater familiarity with their local environment and the bioresources. Under such circumstances women get enough opportunity to acquire practical knowledge of the local biodiversity personally and also socially by sharing experiences with others. Thus women become repositories of inherited knowledge of the micro-environment around and the local biodiversity.

In countries like India, the rural women folk, whether they are in the forest fringes or any other traditional areas, have to perform a range of activities right from collecting fuel wood and fodder to various kinds of agriculture-related works and cooking just to support their family members. With their close involvement in crop farming, livestock rearing and gardening, women develop unique experience and knowledge and thus can

offer important perspective in natural resource management and biodiversity conservation. In almost all parts of India, rural households irrespective of their level of living generally have some form of homesteads (*bastis*) within their habitats. The homesteads, however small they may be, contain a wide range of cultivated plant species. Often a part of the homesteads is put to some kind of kitchen gardening. In the urban and industrial areas also, many people practice this type of tiny but important form of gardening (Bhagabati, 2005). Because of acute shortage of land in the towns and cities some people use to raise vegetables even in bags and boxes. Also there are examples of raising vegetables and flowers in the thin layers of lifted soil over the concrete roofs of the multi-storied buildings. In all such gardening, women play the prime role. The rural women in the less developed countries develop a good understanding of the useful plants, insects, domesticated and wild animals primarily because of their constant association with farming and homestead gardening, various elements of rural ecosystem and socio-economic activities of the villagers. Such experiences and understanding may be of great value in any effort for bioresource use and conservation. It is important to note that by virtue of their intimate relation with and inherited experiences of the local natural environment, rural women may come forward with positive attitude towards conservation of nature and bioresources.

As has been appreciated globally, it was the indigenous knowledge and environment-friendly practices that basically prepared the women folk of the hills of Uttarakhand and Garhwal to protect the valuable trees of their locality from the clutches of the timber contractors. This organized effort of the women at the grassroots with the wholehearted participation of the people in general finally acquired the character of a great environmental movement popularly known as the Chipko Movement. The Chipko Movement has presented before the world a success story of forest protection accomplished by groups of women, who happened to be locationally far away from the so-called advanced society. This has adequately proved that women can play effective role in mass movement for protection and conservation of forests and other bioresources, if they are empowered to think and act as a responsible segment of the society. What is urgently needed, particularly in the context of India, is a gender sensitive approach towards preparation of plans and policies for biodiversity conservation giving due recognition to the fact that a large section of the rural women in different parts of the country have been playing active role in bioresource conservation as part of their day-to-day household responsibilities (NBSAP-India, 2000).

Indigenous Knowledge Systems (IKS) and Biodiversity Conservation

IKS has emerged as an important field of interdisciplinary research, where

biogeographers can also play a leading role. The ethnobotanical studies carried out mainly in the tribal areas have opened new vista for research in floral and faunal diversity associated traditionally with the relatively less developed ethnic groups. The territorial environment that a culture group traditionally shares and shapes provides a wide range of substance required for their sustenance. While interacting with their environment, people acquire and also establish systems of knowledge and practices on the biological diversity of their immediate environment. Indigenous knowledge and biodiversity are thus complementary phenomena essential for human development (Warren, 1992). Indigenous people are the real custodians of the biological resources available in their environment and they are traditionally prepared to use and conserve these over generations. There is no doubt that traditional and indigenous communities not only depend on biodiversity for their livelihoods, but they also perceive ecosystems as part of their heritage and territory to have a sacred relationship with their ecosystem (Djoghla, 2011). Interestingly, more than half of the world population comprising the indigenous and local communities depend fully on their own food production system which incorporates traditional knowledge on diverse aspects like cropping methods, seed production, storage, animal behaviour and local plant diversity (Scott, 2011).

Environmental factors like climate, topography and soil set broad limits

on farming practices, but the farmers observe, operate and modify the environment in a variety of ways to overcome these limits. Based on the idea of relative importance of various alternatives, farmers adopt a particular practice perceived to be suitable to the situation. In this regard an example may be cited from the Upper Manang Valley of Nepal (Subedi and Chapagain, 2008). Local knowledge on the mountain environment and farming system is very important for understanding the adaptive strategies evolved by the mountain people. In a high mountain area like the Upper Manang valley of the Himalayas, for the agro-pastoral communities the knowledge of soil is vital in opting for a livelihood practice. The people living in this valley have their indigenous system of soil classification and decision-making for selection of suitable crops and agricultural inputs and implements for different categories of fields. Interestingly, scientific analysis of the soil properties made for the area by a group of experts could not find any significant lapse on the part of the community in deciding the type of land use based on their indigenous knowledge and experiences.

The advantage of empowering local communities to take active part in conservation efforts is now universally recognized. The people, such as the tribals, peasants, herders, fishermen, and rural artisans, who live close to nature, depend on the biological resources available in their immediate environment for day-to-day sustenance. They have for centuries

sustained their lives without destroying the basic natural diversity. The tradition of leaving portions of the landscapes completely untouched (sacred groves for instance) has made possible the survival of species like *Kunstleria keralensis* in the coastal of Kerala, India (Gadgil, 1998). Such people, who are sometimes called 'ecosystem people', may play the role of genuine custodians of the local resources. Many such examples may be cited from the country's north-eastern region where more than 200 tribal communities have been sharing and sustainably adapting to their highly sensitive ecosystems for centuries (Bhagabati, 2007).

Indigenous knowledge systems are basically sets of spontaneous understanding and experiences acquired through intimate and repeated interaction with nature at community level, the dimension and authenticity of which are in many cases yet to be fully explored. Just like biodiversity loss due to ignorance and mismanagement, indigenous knowledge and experiences are also pushed to the verge of extinction. It is, however, encouraging that there has been a renewed interest among some researchers and institutions to record, document and restore such knowledge before they are lost in the growing generation gaps. The biogeographers may be the most appropriate scholars to appreciate the linkages between the indigenous knowledge developed by the people and the environments they continuously share through generations for sustenance and document them for further scrutiny. It must be noted

that the competitive market economy, whose aim is to maximize profit, does not care much for the ill effects of modernization and environmental degradation. This is a very powerful force generated by capitalistic mode of production which has covertly cracked down all the indigenous, ethical, cultural and historical agreements that the societies in different parts of the world have carefully evolved through ages. Competitive markets have emerged as the most effective means for the co-ordination of diverse economic activities and freely transacting agents (Corbridge, 1993), which obviously have great bearing on the associated people and environment.

1.4 Restoration of Mountain Ecosystem

In the context of rapid habitat loss, eco-degradation and climate change in different parts of the world, the mountains hold special significance. Because of their high relief the mountains manifest some delicate landscapes with highly complicated biotic environments. In Indian situation, not only the great Himalayas, but also the Western Ghats, Vindhya, Arravalli, Satpura, Nilgiri, Eastern Ghats and the hills of North-East India bear immense significance in keeping up the richness in diversity of plants and animals in the country. However, during the recent period, the spatial spread and intensification of human activities in the high slopes have caused enormous damage to the green cover and top soils of the mountain areas. This has

remarkable impact on the climate of the highlands on the one hand and the overall environment of the plains and lowlands around.

So far the Himalayas are concerned, there have been disturbing signs of troubles created by widespread degradation of the mountain environment. The growing incidences of extreme events like cloudburst and associated flash floods and their far reaching effects and also the frequent slope failures experienced in the highlands may be linked with the expanding human activities which are directly or indirectly responsible for environmental degradation. As reported by ICIMOD (2009) 30 per cent of the wetlands in the Himalayas has disappeared. For 250 million people living in the valleys and plateau-like areas of the Himalayas, wetlands are the central to their livelihoods. Importantly, the lowlands contiguous to the mountains have already confronted with a range of problems including shifting of stream courses, enormous sand casting and fluctuation of underground water table. The construction of dams, roads and such other engineering structures in the highlands has aggravated the environmental problems primarily in the downstream parts and the lowlands as well. These man-made disturbances have eventually led to habitat fragmentation and complete loss at places endangering many of the endemic plants and animals of the region.

Under such circumstances the immediate need is to protect the

remaining forests as far as possible and to adopt new development strategies in which man and nature can coexist in harmony (Ives and Messerli, 1989). This may be possible only when the communities sharing the mountain environment are allowed to meet the basic needs on their own. One of the best examples in this regard is the Apatani Valley landscape in the Arunachal Himalaya where the natives have traditionally developed a way of life (*genre de vie*) befitting to their ecosystem to exclusively meet the community's demands. The Apatanis are known for their unusual skill in water management and cultivation of wet rice (Dikshit and Dikshit, 2014). Their indigenous community ideas and skills to adapt to the unique environmental elements of the valley including water and forest cover have made the entire area ecologically and economically viable and sustainable. Thus the present challenge for development in the mountain areas is to evolve and accomplish programmes to which the ecological and life supporting roles of the forests have to be sustainably integrated.

It is, however, disappointing to note that useful studies on the mountain ecosystems in India, more particularly in the country's North-East, are still too scanty to prepare programmes confidently for improving the condition of the deteriorating mountain ecosystems. Micro-level biogeographical studies may go a long way firstly, in understanding the changing state of the ecosystems and

secondly, in evolving strategies for eco-friendly development in the concerned areas. If such area based development programmes are translated into reality by the communities themselves, the areas that are already stripped of their native biota may be restored to bring back the biological diversity and environmental stability, to a considerable extent. Since large-scale afforestation in the mountains may not be realizable due to ecological and socio-cultural obstacles, efforts may be directed towards plantation of fast-growing local tree species in the valley areas in order to lessen the pressure on the high altitude forests (Schickhoff, 2006).

1.5 Ornithogeography

In a Forward to the voluminous book titled *Important Bird Areas of India*, Graham Wynne, Chief Executive of the Royal Society for the Protection of Birds (RSPB), the largest wildlife conservation charity of Europe, with appreciable commitment wrote- “I have no doubt that India will continue on her impressive development paths through continued endeavour, enterprise and robust democracy. My fear is that in the interim period - the next 20 years or so - the pressure on natural resources, arising from the needs of the half a billion rural poor and rapidly expanding industry, will squeeze birds into ever smaller and more degraded sites. This, coupled with the overarching problems of climate change, will leave many species vulnerable to local and perhaps total extinction” (IBAI, 2004). This statement clearly points to the impending

danger to the avifauna diversity in the country caused by human pressures on the ecosystems needing immediate attention of all concerned towards their protection and conservation. There is no doubt that the biogeographers along with the biologists and environmental scientists can play an important role in this regard.

Avifauna have increasingly attracted attention of the ornithologists and the biogeographers as well because of their conspicuous presence in the landscapes and appealing character. The appealing nature of the birds and their role in the ecosystems have encouraged many people get engaged in bird-watching. Geographers rarely consider bird-watching as a way to study the geography of birds and their habitats (Bonta, 2010). Diversity of birds in an area indicates the area's biological richness to a considerable extent. Birds are, however, under great threats and pressures everywhere from a variety of factors. Human beings, who are held responsible for extinction of birds in most cases, contribute to this loss in four major ways: (i) direct predation, (ii) introduction of non-native species, (iii) spread of disease, and (iv) habitat degradation and loss (Steadman, 1997). Interestingly, the geographical distribution of birds indicates that 20 per cent of all living species and 70 per cent of all threatened species of birds are confined to only 2 per cent of the earth's land surface (Bibby *et al.*, 1992). This may be considered as both a blessing and a curse. This means that by protecting a small area,

many bird species can be saved. On the other hand, many species may be lost due to degradation of certain small areas. Whatever may be the case, biogeographical studies on the change and status of the bird habitats may be of great help in conservation of avifauna in the concerned areas.

So far India is concerned, it is a mega-diversity country falling among the top ten nations having world's biodiversity. The country's biodiversity represents about 7 per cent of the world's flora and 6.5 per cent of the fauna. It is estimated that there are more than 9,000 bird species in the world and the Indian subcontinent has 1225 species or over 13 per cent of the world's birds (Deshmukh, 2004). During the recent period, however, with the shrinkage of both terrestrial and aquatic habitats, growing industrialization and modernization of agriculture accompanied by application of chemical fertilizers and insecticides, there has been some negative impact on the ecosystems enjoyed by certain bird species. Biogeographical studies on the habitat change and its relation with diversity and density of bird species in specific areas may help generate reliable database required for planning for sustainable development of habitats and also eco-restoration.

One of the important habitats of birds, for example, is the grassland that occurs in river plains, deserts, hills, and arctic areas. Besides providing unique habitats for a large variety of fauna, grasslands fulfill many of the basic human requirements. Grasses

produce bulk of the forage for the cattle and house-building materials in many of the tropical areas in addition to their universal role in maintaining ecological balance. Because of such diverse utilities grasslands are under constant threat in almost all parts of the world. Pressure is found to be more on the small grassland patches near the human habitations which can no longer support the threatened grassland birds that have specially adapted to that specific type of grassland ecosystem. Important species like the endangered Indian Bustard (*Ardeotis nigriceps*), Bengal florican (*Houbaro bangalensis*) and Jerdon's Courser (*Rhinoptilus bitorquatus*) found in Indian grasslands, for example, are under growing threat from anthropogenic pressure. Ornithological studies and discourses with respect to the distribution and habitat characteristics of such avifauna may be of immense help in conserving them and their habitats. Almost similar is the case with the aquatic birds supported by the wetland ecosystems.

1.6 The Issue of Human-Wildlife Conflict

Conflicts of different types between humans and wild animals are now a world-wide phenomena. The rapid loss and fragmentation of habitats caused by the growing human activities in all the biomes of the world has deprived increasingly the wild animals of required food and natural movement. Some of the protected areas also are not spared from human interference beyond limit.

Most of the African and Asian countries with rich biodiversity are particularly reported to have suffered from an emerging phenomenon called human-wildlife conflict. This basically arises out of the extraordinary pressure exerted by human society on the wildlife habitats. Here an example from the Semen Mountain habitats of Ethiopia may be cited (Tadesse, 2010). Semen is blessed with outstanding wildlife in certain areas where natural habitats are still maintained. Semen received attention of the global community for the presence of endemic animals like Walia Ibex, which is recognized as a national symbol, for protection and ultimately in 1969 Semen Mountains was declared a national park. But the rapid demographic change around due to in-migration of people during the recent years and consequent demand for food and other resources have caused tremendous pressure on the park environment leading to deforestation and degradation of the sustainability of the mountain livelihood system. There has developed a situation in which safeguarding the wildlife from the nearby inhabitants in a conflicting and strained environment has really become a challenging task. Human-wildlife conflict is thus a phenomenon that poses serious challenges for both biodiversity conservation and human well-being (Barua, 2015).

In India, while human-elephant conflict remains a major concern for the people and policy-makers, electrocution of elephants has emerged as a critical area in the management of wildlife

habitats. It is reported that between 2009 and 2017 as many as 50 elephants have died on an average every year due to electrocution. Notably, the states of eastern and north-eastern regions of the country- Odisha (90 elephants), West Bengal (48), Chhattishgarh (23) and Assam (70) - have accounted for most of the deaths. Karnataka, which has the highest elephant population, has recorded the largest casualties (106) followed by Tamilnadu (15) and Kerala (50) during the period. The main cause behind this is the large-scale deforestation and continued impairment of corridors used by the elephants.

Coming to India's north-east, it has been observed that the rapid loss of habitats and for that matter biodiversity in different parts of the region is now manifested in the form of growing conflicts between humans and wild animals. The forest margins in Assam and the deforested Assam - Arunachal, Assam - Nagaland, Assam - Meghalaya borders are the areas where human-animal conflict has become a regular feature. The destruction of standing crops, valuable trees, houses, and kitchen gardens caused by elephants and monkeys has currently reached an alarming dimension at most places. Generally the conflict is attains its maximum where the scale of deforestation is relatively large. In Assam particularly, human-animal conflict has attained a critical level. It is amazing to know that during the period of nearly 10 years (1990-2001) more than 450 people in the state were killed by wild elephants. The property damaged by elephants every year in the

state has not yet been estimated properly. As a counter action, cases of killing wild elephants by the affected people applying poison and other methods are also not rare in the state. As many as 19 elephants were killed by poisoning during 1998-2001 as per records of the state forest department. Importantly enough, the conflict between people and the monkeys (mostly *Assamese macaque*), both in the rural and urban areas of Assam, has currently turned into a kind of hazard needing immediate initiatives for its scientific management. The peasants, who operate small and marginal landholdings particularly in the deforested areas, are the worst sufferers in this regard as major share of their small produces go to the wild monkeys regularly. This furthers the poor people's dependence on the nearby forests and wetlands.

The Assam-Arunachal Pradesh border area presents some interesting cases of conflict between people and elephants. The people of the Tipi area in Arunachal Pradesh and the adjacent Lower Bhalukpong area in Assam, for instance, consider the problem caused by wild elephants to be an acute one. Human settlements have come up in these two foothill areas very fast ignoring the fact that the elephants have been using these tracts for their normal movement for a long time. The Tipi area, which is identified as one of the most active elephant corridors is now preferred by the local people for settlement because of its flat topography. As a result, some kind of undeclared competition has emerged between the people and the

wild elephants for level space within the broad hilly environment. In the Lower Bhalukpong area also, large-scale felling of trees and degradation of grasslands during the recent years have made the problem of human-elephant conflict highly complicated (Bhagabati and Bhattacharya, 2009).

As stated above, the human-wildlife conflicts resulting from a complex of ecological and socio-economic factors constitute an important theme for intensive biogeographical research. Works based on proper field survey and scientific analysis of the data thus generated may contribute towards understanding the problems of the affected areas comprehensively. Biogeographers can efficiently handle most of the issues related to human-animal conflict and suggest workable strategies and action plan for managing them sustainably. Application of modern technology such as Remote Sensing, GIS and GPS in mapping and analysis of the conflict-prone areas and the natural corridors of wild animal may be of immense help in managing such complicated problems practically.

1.7 Reviving Micro-biogeographical Study

It is now recognized by all concerned that geography has a long tradition of micro level study, especially since the time of the great explorer Alexander von Humboldt. Humboldt described in great detail some quite small areas, which he visited to expose their entire geo-environmental scenario. The attention that he paid to the small

areas justifies that Humboldt was one of the pioneer of micro geographical interpretation (Hartshorne, 1960). Any effort for conservation of nature, more particularly wildlife of smaller order, requires knowledge and understanding at micro habitat level. Details of the habitat characteristics, food-chain and behaviour of wildlife therein, particularly in the case of restricted-range species, are required to work for their conservation.

For eco-restoration also, studies on micro ecological history and present status of the habitats including soil characteristics are required. It needs no special emphasis that clearing land for farming, deforestation for other purposes, overgrazing, and man-made forest-fire are some of the most important anthropogenic factors responsible for accelerated soil erosion. The loss of soil in the uplands and catastrophic sedimentation in the valleys and coastal plains are the obvious results of such degrading processes (Van Andel, 1997). Micro-biogeographical studies carried out using scientific methods on such areas may expose the ground realities of how these processes are operating leading to environmental degradation and biodiversity loss. Moreover, in the present context of expanding human habitation and intensification of activities, village level or village-cluster level biogeographical studies may prove to be quite practical in ensuring people's participation in conserving and restoring the native species. Studies of places, ponds, streams, abandoned channels, narrow riverine and coastal habitats,

dam sites and down streams, degraded and polluted spots, vegetated fallow lands, etc from micro-biogeographical perspectives may be very useful in local level conservation initiatives. There was a time when places were identified by the plants and animals they supported (Parent and Ebach, 2009). Places form micro habitats for plants and animals and thus offer good fields for micro-biogeographical study. Geographers in general and biogeographers in particular are conceptually and methodologically competent to carry out such type of studies as they inherit the required perspectives and ability to interpret the biotic and abiotic phenomena at all spatial levels - from micro to macro and also the complicated processes of interaction among them.

1.8 Concluding Remarks

The forgoing discussions present some of the crucial issues concerning the dynamics of the biological world and the growing relevance of the study and discourses in the sub- discipline of biogeography. The rapid growth of population in most parts of the world and application of modern science and technology in all sectors of the economy to meet the ever-increasing demand have intensified the pressure on the earth's biosphere causing visible changes in the human-environment relationship. Thus almost all elements of environment and society have experienced some kind and degree of change, more particularly during the recent period. Consequently some fields of interest are fading out, while new ones are gaining ground. As

a discipline, geography has to reorient its eyes and ways to keep pace with the changing situation. The change in the world order is one of the major stimuli to change the discipline with respect to the theoretical apparatus on which it draws, the research methodologies its practitioners employ, and the context of its academic curricula and discourses and its contribution in influencing the change (Johnston, 1993).

What is true for geography is essentially true for biogeography also. The biological world has been changing fast, proper appreciation of which calls for reorienting and revitalizing the thoughts and approaches in order to make them more responsive, effective and interdisciplinary in nature. Viles (2000) in his paper *A Divided Discipline?* observed,- "Much ecology and biogeographical research, for example, is carried out by biologists. Biogeographers and ecologists currently working in geography department may realize significant advantages to working in plant science or biology department". They can together share fields and ideas, and take care of the dividing and dwindling biological world to save from further fragmentation and degradation. Serious research and useful debate and discourses on the most pertinent and recent biogeographical issues and problems would bring the discipline of geography closer to the people and make its position in the knowledge domain and policy-decisions more firm and durable. Finally to the end this little address, I would like to refer to a statement made

by the famous Harvard bio-scientist Edward O Wilson (2001) in his book *The Diversity of Life* - "Humanity is a part of nature, a species that evolved among other species. The more closely we indentify ourselves with the rest of the life, the more quickly we will be able to discover the sources of human sensibility and acquire knowledge on which an enduring ethics, a sense of preferred direction, can be built".

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