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A FRAMEWORK FOR ASSESSING THE IMPACT OF URBANIZATION AND POPULATION PRESSURE ON GARO HILLS LANDSCAPE OF NORTH-EAST INDIA

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Abstract

The important factors influencing landscape changes could be climate, geology, topography, plant succession, species extinction and species evolution. Human, since time immemorial, have influenced the landscape they live in a variety of ways resulting in varied land use changes. Increase in population leads to the expansion in agriculture land, built-up areas, uncontrolled forest fires, mining of minerals, extraction of timber and permanent plantations, which in turn are responsible for habitat degradation and loss of biodiversity. Garo hills districts of Meghalaya are endowed with rich biodiversity both in terms of flora and fauna. With the increasing of population there is pressure exerted on these natural resources for the livelihood as there is hardly any alternative available. In the meantime small forest based urban centers were developed and with the expansion of these the requirement of the local people also changed. Due to urbanization and population pressure the traditional shifting cultivation (jhum), which is still the only livelihood of many areas of the Garo hills; have been converted into permanent cash crop areas. This conversion has a reverse impact on the environment. In the traditional jhumming method the native forests which were slushed and burned for agriculture purposes could revive in 18 to 20 years' time (Jhum cycle). But due to the introduction of economically sound plantation crops like areca nut, cashew nut and tea the native diversity of the forest area is in the verse of extinction. The present study reveals that rapid population growth is the solely responsible factor for changes the landscape of Garo hills of Meghalaya.

Keywords: *Garo hills; jhum; cash crop; urbanization; population pressure; roads diversion*

Introduction

Urbanization and population pressure are two of the most important threats to biodiversity worldwide and their growth affected natural resources. Urban area may make threats ecosystem through direct habitat conversion [1, 2] and through various indirect effect of human population pressure like resource use, habitat fragmentation, waste generation and fresh water cooption [3]. Understanding the complex mechanism of biodiversity necessitates its spatial and temporal dynamics management of landscape and synergetic adoption of measurement approaches with long-term plot inventories are imperative [4]. Due to increase of

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population density many kind of precursor, both social and environmental, appears in habitat. One environmental precursor is pollution, the effect of which in forest ecosystem studied by many investigators [5]. The other is population pressure which is caused by excessive increase in population density in forest habitat leading to argumentation of industrialization and consumption of natural resources for livelihood. Increasing human intervention and excessive exploitation of resources have resulted in great changes and provide alarming signals of accelerated biodiversity loss [6]. The impact of population growth on environment is significant because each person make same demands on natural resources for the essential of life-food, water, clothing, shelter and so on.

Changes in habitat quality associated with urbanization have many different effects on biodiversity. They include a reduction in the size of habitat patches supporting indigenous fauna, the invasion and planting of alien flora, the increasing isolation of these remnant patches from other similarly ‘‘green’’ areas, an increase in the level of air pollutants due to road traffic and industry, and an increase in physical disturbance in and around the habitat fragments [7]. Due to high frequency of traffic on roads/railway, wild animals often divert from their original dispersal route and enter these hamlets leading to conflict situations [7] and human driven land use change (urbanization) usually considered as impacting biodiversity. The relation between human population and biodiversity arise because humans and other living organisms depend on processes that are driven or perhaps delimited by existing energy [9] and urban habitats generate break in the ecological continuum of many living organism, creating spatial heterogeneity in habitats [10] Another mechanism for this correlation but regardless of the explanation, one consequence of the coincidence between people and biodiversity is that pressure inflicted on important area for biodiversity might be greater than expected by chance and sometimes difficult to avoid [11].

Garo Hills landscape of Meghalaya is bestowed with biodiversity and natural resources. During last few decades phenomenal increase in urbanization and population pressure, causing large scale destruction and deterioration in the environment. This region is severely affected by sheet erosion mainly because of the age old tradition of shifting cultivation in the fragile hill slopes aided by other anthropogenic activities [12]. Drivers of deforestation like shifting cultivation, urbanization, forest fire, mining of minerals, extraction of timber and Plantation (Cash crops) are responsible for landscape dynamics in Garo Hills [13]. Fragmentations on large scale of land by human development are noticeable among these changes. If fragmentation reduces patches below the critical size, the remaining area may not be able to support many of its original species, local extinction occurs. As the landscape becomes more fragmented and contiguous areas of habitat for species become smaller and more isolated, the relationship between species diversity and patches size takes on crucial importance in the conservation of biological diversity. The management of habitats through interactive network of species at landscape level is considered important. High population density and growth have frequently been associated with forest loss and species extinction and discussing the relationship between population and environment is not simple. Human activities like sub-surface coal mining in the buffer areas of the Nokrek Biosphere Reserve of Garo Hills and shifting cultivation cause extensive degradation of the forest that support a variety of successional communities ranging from open forest to abandoned shifting cultivation fields [14]. The spread of urbanization has been a severe threat for forests in the current scenario of high population growth and vanishing cultural values. Study of the landscape at the patch level is an appealing ecological basis for understanding these processes. Landscape ecology seeks to understand the ecological function of larger areas and hypothesize that spatial arrangement of ecosystem, habitats or communities has ecological implications. Its analysis at broad economical and developmental scale is becoming important for conservation and management of biodiversity.

Methodology

The present study "A Framework for Assessing the Impact of Urbanization and Population Pressure on Garo Hills Landscape" of North-East India is conducted as preliminary survey in all districts of Garo Hills. The relevant information and data for study were collected mainly from secondary sources available in publications and reports of various government departments and academic institutions. However, some information pertaining to urbanization, population pressure and their impact on forest resources was also collected by conducting primary sample survey at village level. The details of data collection and compilation are given below:

Collection of data from Secondary sources

An extensive review of the available literatures on urbanization, agriculture and forest resources was carried out by visiting different government departments, academic institutions and various libraries. Published and unpublished data pertaining to land and forest resources, and their various goods and services were collected from journals, theses and technical reports.

Generation of Primary Data

Garo Hills one of the biodiversity rich landscape of Meghalaya. Different forest product, both timber and non-timber are collected by the people of the landscape for their own consumption as well sale in the market. Native Garo community is practicing Shifting cultivation (*Jhum*) for their livelihood from ancient time. Previous studies documented the impact of shifting cultivation on the local biodiversity of landscape. However no more information is available on type and quantity of permanent cash crop plantation and impact of population pressure on in biodiversity rich zone of landscape. During present study primary survey was conducted to the find out the changes in traditional cultivation and extraction of different type of forest product due to high demand of population pressure and urbanization. Some information was also collected by interviewing of the endemic Garo community.

In selected village, stratification of household was done on the basis of land ownership of local formers. Ten percent of the total formers were then randomly selected from each village with equal representations from the high, middle and low categories. The field survey was done during the month of February to April 2012 by using a structured questionnaire. The field survey questionnaire was designed mainly to obtain adequate information on extraction of forest products and changing pattern in their traditional cultivation. Information, both at village level and formers level were collected by interviewing the people. The interviews of the selected households were done by personal visits to the formers.

Results and Discussion

Living condition and livelihood

Forests in the Asian context are part of a cultural landscape complex that includes traditional societies as integral components, meeting their livelihood needs from forest based resources around [15]. Agriculture is the main occupation of the people of Garo Hills. It has rich but unexploited natural resource, including coal, limestone, kaolin, feldspar, quartz, mica, gypsum, bauxite and other minerals. Its sillimanite deposits (a source of high-grade ceramic clay) are reported to be the best in the world and account for almost all of India's sillimanite output. The Garo people practice shifting cultivation and important fruits grown here are orange, pineapple, lemon, guava, jackfruit and bananas, while potato, jute, mesta, cotton, areca nut, ginger, turmeric, betel leaf, black pepper and broom grass are the chief commercial crop (Fig. 1).

Being relatively under-developed compared to other regions of the country, opportunities for alternative livelihoods are limited. Local communities of this region are pre-dominantly agrarian, their dependence on forest product and meat for their livelihoods. This is apparently more so after a ban was imposed on the felling of trees, hunting and curtailing further any opportunities to earn livelihoods.

Fig. 1. Garo people cultivating in current jhum land (A) and collecting Areca nut (B).

There is a diversity of household livelihood strategies due to differential landholding pattern and availability of different opportunities. For instance, livelihood strategy of the people in a village varies with the landownership pattern, i.e. when most village land is communally owned, shifting cultivation and collection of forest products from the forest for sustenance are the main livelihood activities, but when the lands are privately owned, settled agriculture and cash crop cultivation are the main activities. The availability of different opportunities is usually policy driven, which are provided by the government and other donor agencies. The patterns of livelihood dependency on resources vary greatly between Khasi Hills and Garo Hills. In case of marginal land holdings or landlessness (non-availability of permanent agriculture land), which is more prevalent among Garos, there are a variety of complimentary livelihood activities, such as livestock holding, collection of forest products and seasonal migration for labour. However, in case of Khasis, migration for labour is practically absent. Because of the community ownership of land, shifting cultivation is still prevalent form of agriculture among all the tribes of Meghalaya, although there has been a slow transition towards settled cultivation in recent years. Other area-specific livelihood activities of the people include, vegetable cropping, ginger cropping, broomstick cultivation, horticulture, fishery, selling of non-timber forest products such as bay leaf, honey and bamboo shoots, coal and lime stone mining, and small trading.

Change in cropping pattern and agriculture practices

Timber extraction for fuel wood and household activities is a also a driver of deforestation in this landscape. There are many activities like lopping of trees for cattle fodder and bamboo extraction for construction of huts and bridges. They utilize this timber for making furniture and other wooden articles which is exported in the local markets and acts as a major source of income. The cattle population domesticated by Garo Tribes lead to overgrazing as well as habitat quality degradation due to lopping of trees as mentioned above.

Plantation of cash crops like Areca nut (*Areca catechu*), Pineapple (*Ananas comosus*) and different Tea varieties are also responsible for the loss of forest cover in the area (Fig 2). The main reason for they having a negative effect on the forest is because that after jhumming (7-8 years) native forest plant species revive but, due to plantation of such cash crops the native diversity is lost on a long term. Thus, prominent pressure to native forest biodiversity in the Garo Hills is the increasing anthropogenic conversion of mature and primary forest to permanent cash crop land.

Fig. 2. Plantation of different cash crops (A) Tea varieties and (B) Areca nut (*Areca catechu*)

Urbanization and construction

High population density and growth have frequently been associated with forest loss and species extinction [16] and discussing the relationship between population and environment is not simple. Due to increasing agricultural population pressure in the north-east India regions a significant deforestation has been experienced, which brings the new land cover cultivation [17]. The multi-dimensionality of population and environment, the relationship is also influenced by other mediating factors, including technological (e.g. energy production and consumption), political (e.g. policy environment), and cultural factors (e.g. way of life, attitudes towards nature). While climate change is primarily shaped by population size and growth, land-use transformation often arises from shifts in population distribution. Each demonstrate how the interaction of population and the environment operates at the different spatial scale-while climate change is global issue, land use change operates at the local and national levels. The spread of urbanization has been a severe threat for forests in the current scenario of high population growth and vanishing cultural values. Rapid population growth has responsible for clearance of vegetation for built-up area, agriculture, overgrazing and fuel wood. It has increased rate of tree cutting for diversion and expansion of roads. This selective cutting had adverse effect on land cover and is responsible for big land cover conversion in the landscape.

The growing population, human greed and lack of knowledge about ecological balance of nature destroyed the environment in such a manner that there is already a vast degradation of soil, water, air biodiversity and even light/temperature [18]. In recent times it has been noted that the Garo Hills landscape suffering from diversion and expansion of National Highway (NH-64) at large scale (Fig. 3).

Fig. 3. Expansion (A) and diversion (B) of NH-62 in Garo Hills

Bera et al. [19] already concluded that the forest of Garo Hills have been over exploited due to roads and other infrastructural development. Amount of sediments eroded away from

sites of road construction is ten times greater than that derived from agricultural land, about 200 times greater than that from grassland and 2000 times greater than that from forest land [20]. Construction of roads disturbs the stability of the hillside, causes serious damage to the hydrologic system and removes the protective cover from the vulnerable slopes [21]. The status of landscape is not satisfactory. High rate of urbanization like diversion of national highway (NH-62) and construction of new roads was also observed during the study period which may further catalyze the threat to the forests and act as drivers of landscape dynamics.

Mining of minerals

Mining of landscape (Fig. 4) create huge damage to the biological communities and negative impact depends on mining methods, geological conditions and whether the mines is working or abandoned [22]. Mining for minerals and fossil fuels causes vast tracts of forest lands to be cleared [23]. The problems of waste rocks dumps during mining become disturbing to the landscape, as result natural vegetation start struggling for surviving and habitats become poor, presenting very rigorous condition for plant growth. The unscientific mining of minerals poses a serious threat to the environment, resulting in the reduction of forest cover, erosion of soil in a greater scale, pollution of air, water and land and reduction of biodiversity [24].

Fig. 4. Sand mine (A) and coal mine (B) in Garo Hills landscape

Meghalaya is rich natural vegetation as well as large reserve of mineral resource. According to Directorate of Mineral Resources, Government of Meghalaya maximum limestone reserves are present in the Khasi Hills while maximum coal reserves are present in Garo Hills landscape. Coal mining has been most extensively practiced in all district of Meghalaya, northeast India as result of this the original lush green landscape have been converted to mine spoils [25]. Coal deposits of the state occur as thin seams (30 cm to 1.5 m) in sedimentary rock, sandstone and shale of the Eocene age [26]. The coal found in the state has low ash content, high volatile matter, high calorific value and comparatively high sulphur content [27]. In Garo Hills, coal, limestone and sands mining are done by primitive mining method calls 'rat hole' mining. There has been unusual increase in mining of coal, limestone, sillimanite and clay, causing large scale deforestation, and decline in environment during the last few decades. The indiscriminate and unscientific mining, absence of post-mining treatment and management of mined areas are making the fragile ecosystems more vulnerable to environmental degradation hence leading to large scale land cover/ land use changes [28]. In Garo Hills mining causes massive damage to the landscapes and biological communities as a result, soil erosion, scarcity of water, pollution of air, water and soil, reduced soil fertility and loss of biodiversity are some of the serious problems of the area.

Biodiversity and habitat decline

Human modification of ecosystem is reducing biological diversity worldwide [29] most commonly caused by habitat loss during the expansion of agriculture [30]. Urbanization

dramatically alters the composition of wildlife and communities, leading biodiversity loss and produce same of the greatest local extinction rates and frequently eliminates the large majority of native species [31, 32]. Previous research McKinney, [33]; Brooks et al. [34]; McKee et al. [35]; Norris and Harper [36] has shown that the most significant factors controlling to the decline of biodiversity are deforestation and land degradation, mainly in the same developing countries in tropical zone. The landscape level biodiversity is very sensitive to the land use/cover changes. In any region, land conservation forces the declining populations towards the edge of their species range, where they become increasingly vulnerable to collapse if exposed to further human impact. Land- use changes has been projected to have the largest impact of global biodiversity in the next century [37].

Due to increasing agricultural population pressure in the Garo Hills regions a significant deforestation has been experienced, which brings the new land cover cultivation. Thus, population pressure first exert its impact on expansion of marginal land under cultivation and some extent shortening the fallow period (Fig. 5), which in turn increase in gross agriculture production as well as exploitation for fodder, fuel wood and timber [38] worked at spatial patterns and processing for shifting cultivation landscape in Garo Hills. They find out that the landscape comprised 2459 km^2 of land with forest cover and shifting cultivation patches over 69% and 7% area of landscape, respectively. Yadav *et al.* [8] concluded that there was a tremendous increase in slash-and-burn land, i.e. 5.15 percentages in the year 2010 when compared to only 0.83 percentages in the year 1991. This provides one of the possible explanations for land-use change behavior in the Garo Hills landscape.

Fig. 5. Fallow land after shifting cultivation

Conclusions

The objective of this research is to find out arising predicament from these two major concerns urbanization and population pressure on the landscape in term of biodiversity. Increasing human population and demand for food, folder and transportation has leads to natural land cover degradation, resulting a habitat degradation, biodiversity loss, and ecological instability. Thus, proper measure and analysis of the Impact of Urbanization and Population Pressure are required for conservation habitat and biodiversity at the broad landscape level. There is an increasing realization that to ensure long-term sustainability of biodiversity conservation through educate the tribal communities for use natural resources sustainably and provide alternative livelihood. In the current context, with concerns about environment and conservation of biodiversity becoming an important forest management concern, and humans

population pressure in forested areas being seen as an obstacle to effective conservation, expansion of roads, high intensity of shifting cultivation, uncontrolled forest fire, mining of minerals, extraction of timber and permanent Plantation (cash crops).

On closer analysis it appears that the problem of plantation of permanent cash crop and shifting cultivation is more because of the shortening of the fallow cycle and the associated unsustainable practices in the management of shifting cultivation lands, rather than cash crop having a negative effect on the forest is because that after *jhumming* (7-8 years) native forest plant species revive but, due to plantation of such cash crops the native diversity is lost on a long term. This problem deepens as it is not possible, as in the past, to extend the area of shifting cultivation to keep the cycles long because on the one hand claims of dependent population on land is increasing while there is no solid evidence of increase in the productivity of shifting cultivation, and on the other hand more and more areas are taken up for urban amenities and expansion, industrial uses, infrastructure development, mineral exploitation, plantation of cash crops viz., rubber, tea, cashew nut, pineapple, broomgrass, and for conservation for local ecosystem services and biodiversity etc., and becoming no more available and leaving little room for man oeuvre by the village communities.

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References

[1] P. Clergeau, J.P.L. Savard, G. Mennechez, G. Falardeau, *Bird abundance and diversity along an urban-rural gradient: A comparative study between two cities on different continents***, Condor, 100,** 1998, pp. 413–425.

[2] M.L. McKinney, *Urbanization, biodiversity, and conservation*, **BioScience 52**, 2002, pp. 883–890.

[3] G. Mikusinski, P. Angelstam, *Economic geography, forest distribution, and woodpecker diversity in central Europe*, **Conservation Biology, 12,** 1998, pp. 200–208.

[4] P.K. Yadav S. Dookia, K. Sarma, *Application of Geospatial Technology for Management and Conservation of Biodiversity*, **Proceeding of the National Seminar on Environment Management & Biodiversity Conservation (Present Status & Future Strategy)** 7-8 October 2012, Govt. Lohia clg. Churu, pp. 59-60.

[5] F.H. Bormann, G.E.Likens, **Pattern and Process in a Forested Ecosystem**, Springer, New York, 1979.

[6] P.K. Yadav, K. Sarma, S. Dookia, *The Review of Biodiversity and Conservation Study in India Using Geospatial Technology*, **International Journal of Remote Sensing and GIS**, 2, 2013, pp. 1-10.

[7] S. McIntyre, G.W. Barrett, *Habitat variegation, an alternative to fragmentation*, **Conservation Biology 6**, 1992, pp. 146–147.

[8] P.K. Yadav, M. Kapoor, K. Sarma, *Land Use Land Cover Mapping, Change Detection and Conflict Analysis of Nagzira-Navegaon Corridor, Central India Using Geospatial Technology*, **International Journal of Remote Sensing and GIS**, **1(**2**),** 2012, pp. 90-98.

[9] A.Balmford, J.L. Moore, T. Brooks, N. Burgess, L.A. Hansen, P.H. Williams, C. Rahbek, *Conservation conflicts across Africa*, **Science 291**, pp. 2616–2619.

[10] P.B. Hardy, R.L.H. Dennis, *The impact of urban development on butterflies within a city region*, **Biodiversity Conservation 8,** 1999, pp.1261–1279.
[11] M.B. Araújo, C. Rahbek, *Conserving biodiversity in a world of conflicts*, **Journal of Biogeography, 34,** 2007, pp. 199–200.
[12] K.Sarma, P.K. Yadav, R.K. Sarma, *Landscape Dynamics in Relation to Slope and Elevation in Garo Hills of Meghalaya, North East India using Geospatial Technology*, **Global Journal of Human Social Science** *(BD)*, 13(2), 2013, pp. 17-25.
[13] P. K Yadav, *Landscape Dynamics in Garo Hills of Meghalaya, North East India using Geospatial Technology*, **M.Sc. Thesis,** Guru Gobind Singh Indraprastha University, New Delhi India, 2012.
[14] K. Sarma, S.K. Barik, *Geomorphological risk and conservation imperatives in Nokrek Biosphere Reserve, Meghalaya Using Geoinformatics,* **NeBIO, 1(**2**),** 2010, pp 14-24.
[15] P.S. Ramakrishnan, Ecology and Sustainable Development. National Book of India, New Delhi, 2001, p. 198.
[16] J.L. Pender, *Population growth, agricultural intensification, induced innovation and natural resource sustainability: an application of neoclassical growth theory*, **Agricultural Economics, 19(**1-2**)**, 1998, 99–112.
[17] P.K. Yadav, *Slash-and-burn agriculture in North-East India*, **Expert Opinion on Environmental Biology, 2**, 2013, p. 1
[18] Barthakur, D. N., *Environment and sustainable agriculture*, **Souvenir brought out at the National Conference (Eastern Region) on Environmental and Sustainable Development,** 13–14 October 1998, vol. I, pp. 14–16.
[19] S.K. Bera, S.K. Basumatary, A. Agarwal, M. Ahmed,*Conversion of forest land in Garo Hills, Meghalaya for construction of roads: A threat to the environment and biodiversity, **Current Science, 91(3),** 2006, pp. 281-284.*
[20] E.E. Dendy *Sedimentation in nation's reservoir*, **Soil Water Conserv**. 23, 1968, pp. 135–137.
[21] V.K. Kumar, J. Singh, *Frontiers in Environmental Geography,* **Environmental Crisis in South Mirzapur** (eds Singh, et al.), Concept Publishing Company, 1993, p. 199.
[22] F.G. Bell, S.E.T. Bullock, T.F.J. Halbich, P. Lindsey, *Environmental impacts associated with an abandoned mine in the Witbank Coalfield, South Africa,* **International Journal of Coal Geology, 45,** 2001, pp. 195-216.
[23] N.A.B. Aryee, B.K. Ntibery, E. Atorkui, *Trends in the smallscale mining of precious minerals in Ghana: a perspective on its environmental impact,* **Journal of Cleaner Protection, 11,** 2003, pp 131–140.
[24] * * *, *Living in the Environment*, **UNESCO/UNEP,** 1985.
[25] K. Sarma, S.P.S. Kushwaha, K. J. Singh, *Impact of coal mining on plant diversity and tree population structure in Jaintia Hills district of Meghalaya, North East India,* **New York Science Journal, 6(9),** 2010, pp.79-85
[26] S.K. Barik, H.N. Pandey, B.K. Tiwari, K. Sarma, B. Singh, **Coal mining in Meghalaya: An environmental perspective,** Regional Centre, National Afforestation and Eco-Development Board, North Eastern Hill University, Shillong, India, 2006, pp. 1-21
[27] * * *, **Technical Report of the Directorate of Mineral Resources**, Government of Meghalaya, Shillong Meghalaya, 1985.
[28] B.K. Tiwari, *Impact of coal mining on ecosystem health in Jaintia Hills, Meghalaya,* **Conservation and Management of Biological Resources in Himalaya** (Editors: Ramakrishnan, P.S., Purohit, A.N., Saxena, K.G., Rao, K.S., Maikhuri. R.K.), G.B. Pant Institute of Himalayan Environment and Development, Almora. Oxford IBH Co. New Delhi, 1996, pp. 466-475.
[29] E.O. Wilson, **The Diversity of Life,** Belknap Press, Cambridge, MA, USA, 1992.

[30] D.S., Wilcove, D.Rothstein, J., Dubow, A.Phillips, E. Lesos, *Quantifying threats to imperiled species in the United States*, **Bioscience**, **48**, 1998, pp. 607–616.
[31] I. Kowarik, *On the role of alien species in urban flora and vegetation, Plant Invasions*, **General Aspects and Special Problems** (Editors: Pysek, P., Prach, K., Rejmánek, M., Wade P.M.). SPB Academic, Amsterdam, 1995, pp. 85-103.
[32] J.M. Marzluff, *Worldwide urbanization and its effects on birds*, **Avian Ecology. An Urbanizing World** (Editors: Marzluff, J.M., Bowman, R., Donnelly, R.), Kluwer, Norwell (MA), 2001, pp. 19-47.
[33] M.L. McKinney, *Role of human population size in raising bird and mammal threat among nations*, **Animal Conservation, 4,** 2001, pp. 45–57.
[34] T.M. Brooks, R.A. Mittermeier, C.G. Mittermeier, G.A.B. da Fonseca, A.B. Rylands, W.R. Konstant, P. Flick, J. Pilgrim, S. Oldfield, G. Magin, C. Hilton-Taylor, *Habitat loss and extinction in the hotspots of biodiversity*, **Conservation Biology, 16,** 2002, pp. 909–923.
[35] J.K. McKee, P.W. Sciulli, C.D. Fooce, T.A. Waite, *Forecasting global biodiversity threats associated with human population growth.* **Biological Conservation, 115**, 2004, pp. 161–164.
[36] K. Norris, N. Harper, *Extinction processes in hot spots of avian biodiversity and the targeting of pre-emptive conservation action*, **Proceedings of the Royal Society of London Series B: Biological Sciences, 271,** 2004, pp. 123–130.
[37] O.E. Sala, F.S. Chapin, J.J. Armesto, R. Berlow, J. Bloomfield, R. Dirzo, E. Huber-Sanwald, L.F. Huenneke, R.B. Jackson, A. Kinzig, R. Leemans, D. Lodge, H.A. Mooney, M. Oesterheld, N.L. Poff, M.T. Sykes, H. Walker, M. Walker, D.H. Wall, *Global biodiversity scenarios for the year 2100,* **Science, 287**, 2000, pp.1770-1774.
[38] A. Kumar, B.G. Marcot, P.S. Roy, *Spatial patterns and ecology of shifting forest landscapes in Garo Hills, India*, 2008, pp. 125-139.

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