



ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.03
TPI 2018; 7(1): 444-450
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www.thepharmajournal.com
Received: 21-11-2017
Accepted: 22-12-2017

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Local people strategies in biodiversity conservation and sustainable development

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Abstract

Sustainable development is improving the quality of human life while living within the carrying capacity of supporting ecosystems^[1]. Biodiversity conservation and sustainable development are two interrelated branches focusing on social progress, economic growth and environmental protection on one side, and ecosystem conservation on the other^[19]. Conservation includes the efforts carried out in protected areas and community reserves, and in other areas with rich and important biodiversity where conservation is not the main focus. Sustainable management of natural resources by the local peoples is the main approach for preserving these landscapes for long-term social, economic and ecological benefits^[2]. Biodiversity provides goods and services such as food, fiber, medicine, air, water purification, climate regulation, erosion control and nutrient cycling. Biodiversity also plays an important role in economic sectors that drive development, including agriculture, forestry, fisheries and tourism^[23]. More than 3 billion peoples rely on marine and coastal biodiversity and 1.6 billion people rely on forests and non-timber forest products for their livelihoods^[36, 37]. Biodiversity conservation in developing countries has its own set of challenges. Biodiversity conservation does not happen in a vacuum^[43]. It requires the participation of many different groups of people, working with various conservation mechanisms both *in situ* and *ex situ*. The sacred groves have been reported from different continents of the world such as Africa, Asia, Europe, Austro- pacific region and America^[13]. As on March, 2011 there are 1, 18, 213 JFM committees across 29 states and UT of Andaman & Nicobar Islands which are managing 22.94 million ha of forests in the country^[21].

Keywords: Biodiversity, Conservation, JFM, Sacred groves and Sustainable development

Introduction

Currently the planet is inhabited by several million species in about 100 different phyla^[4]. About 1.8 million have been described by scientists^[5], but conservative estimates suggest that there are 5–15 million species alive today, since many groups of organisms remain poorly studied. Over 15,000 new species are described each year^[6], and new species are evolving during our lifetimes. However, modern extinction rates are high, at 100 to 1000 times greater than background extinction rates calculated over the eras^[15]. Although new species appear, existing species go extinct at a rate 1000 times that of species formation^[45]. Many biologists agree that we are in the midst of a mass extinction, a time when 75% or more of species are lost over a short geological time scale^[43]. The last great mass extinction was 65 million years ago, at the end of the Cretaceous, when the dinosaurs went extinct. IUCN estimates that 22% of known mammals, 32% of amphibians, 14% of birds, and 32% of gymnosperms (all well-studied groups) are threatened with extinction^[41, 42]. Species that were abundant within the last 200 years have gone extinct. For example, passenger pigeons, which numbered three to five billion in the mid 1800s^[39], are now extinct. As per available data, the varieties of species living on the earth are 1753739. Out of the above species, 134781 are residing in India although surface area of India is 2% of the earth's surface. Wild life Institute of India has divided it into ten biogeographical regions and twenty five biotic provinces. Before we discuss the way to achieve biodiversity conservation, we first need to know the reason why we actually need to conserve the existing biodiversity^[3]. It is believed that an area with higher species abundance has a more stable environment compared to an area with lower species abundance. We can further claim the necessity of biodiversity by considering our degree of dependency on the environment^[7, 8, 9]. We depend directly on various species of plant for our various needs. Similarly, we depend on various species of animals and microbes for different reasons. Biodiversity serves our need for different types of food, raw materials, fuel, etc.

There are two major ways in which biodiversity conservation is practiced, namely – in-situ conservation and ex-situ conservation. The most striking feature of the Earth is the existence of life and most striking feature of life is diversity. Biodiversity is one of the major livelihood options; it provides 13 types of ecosystem services [38]. But due to overexploitation and habitat degradation, biodiversity is decreasing with an alarming rate [37]. At present, the rapid loss of species is estimated to be between 100 and 1000 times higher than expected natural extinction rate. Major threats to ecosystems and biodiversity are habitat loss and fragmentation, over exploitation, pollution, invasion of alien species and global climate change [18, 22] and disruption of community structure. The International Union for Conservation of Nature and Natural Resources (IUCN) has estimated about 10% of the vascular plants of the globe to be under threat. The IUCN Red List of threatened species compiled by IUCN classifies species that have a high probability of extinction in the future as Critically Endangered, Endangered, or Vulnerable. Degradation and fragmentation of 470% of the original habitats placed Himalaya in the list of Global Biodiversity Hotspots [10]. Only 25% of the original habitats remain unaffected in the Himalaya [42]. The Convention on Biological Diversity Summit in June 1992, global recognition of the alarming loss of biodiversity. The growing awareness of importance and high rates of loss make it imperative to rapidly assess and conserve biodiversity at local, regional and global levels. Since then, various studies have been carried out to explore and identify the threatened plants of the world [34]. Biological diversity means the variability among living organisms from all sources including, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystems. Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs [11].

Dependence of people on forests around the World

350 million of the world's poorest people depend almost entirely for their subsistence and survival on forests. A further 1 billion poor people - about 20% of the world's population - depend on remnant woodlands, on homestead tree gardens, and on agro-forestry systems for their essential fuel wood, food and fodder needs. Indigenous peoples and other communities living in forests and depending on them for subsistence number some 60 million people worldwide. 1.6 billion rural people are dependent upon forests to some extent. In developing countries about 1.2 billion people rely on agro-forestry farming systems. 1 billion out of 1.2 billion extreme poor depend on forest resources for all or part of their livelihoods. 240 million people live in predominantly forested ecosystems [12]. 300 - 350 million people are highly dependent on forests and live within or adjacent to dense forests on which they depend for their subsistence and income. 600 million forest users qualify as long-term users. There are an estimated 500 million forest-dependent people of which 200 million are indigenous people. Trade in forest products was estimated at \$327 billion in 2004. 80 percent of the world's forests are publicly owned, but ownership and management of forests by communities, individuals and private companies is on the rise. 30 percent of forests are used for production of wood and non-wood products. Forests are home to 300 million people around the world [13, 15]. The annual value of

wood removed from forests is estimated to be more than \$100 billion.

People's dependence on forests in India

Forestry is the second-largest land use in India after agriculture, covering about 641,130 square kilometres or 22 percent of the total land base. Roughly 275 million poor rural people in India- 27 percent of the total population-depend on forests for at least part of their subsistence and cash livelihoods, which they earn from fuelwood, fodder, poles, and a range of non-timber forest products, such as fruits, flowers, and medicinal plants. Seventy percent of India's rural population depends on fuelwood to meet domestic energy needs. Half of India's 89 million's tribal people, the most disadvantaged section of society, live in forest fringe areas, and they tend to have close cultural and economic links with the forest. Forestry and logging accounted for just 1.1 percent of India's Gross Domestic Product (GDP) in 2001; adding nonmarket benefits of environmental services, subsistence fuel wood, fodder, and many other non-timber forest products, doubles the GDP contribution. Around 1.73 lakh villages are located in and around forests. The estimates put the figures from 275 million to 400 million people depending on forests [14]. People living in these forest fringe villages depend upon forests for a variety of goods and services.

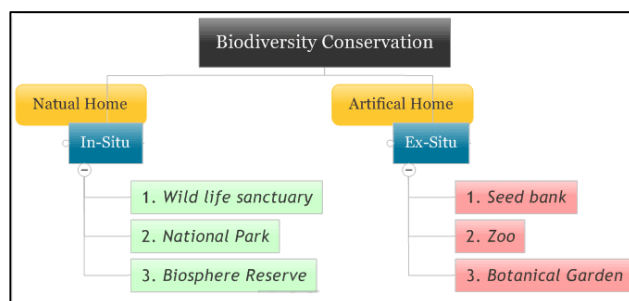
Need for Biodiversity conservation

Many people want to know "Why is biodiversity important?" Firstly, it is important because it represents the almost infinite variety of plant and animal life, and the variety of the types of Earth's ecosystems that support life as we know it. It enables humans to survive in what would otherwise result in adverse conditions [15]. Biodiversity is the very stuff that supports the evolution and differentiation among the varying species. It's why cats are cats and horses are horses and humans are humans. And, further, it is responsible for the differences among groups within the larger species [17, 18]. Look at how many seemingly different types of humans there are or jungle cats or birds. Water, wind, and sunlight generate much of the energy we use, and the action of the planet on various substances over the course of centuries create and provide things like coal, which is used to generate heat and more energy. Energy from wind, water, sunlight, and coal heats our homes and power all our appliances. Decaying animal matter has, over the centuries created the fossil fuels we use on a daily basis to power the vehicles that make transportation relatively easy and convenient [16, 19].

Without biodiversity we would be (if we existed at all) a homogeneous population, with each of us having the same vulnerabilities. This would mean that in case of an epidemic, we would all be killed since there would be no biologic differences that would enable some of us to survive and adapt. Much of our modern medicine is based on combinations of biologically diverse substances isolated from various plants (which we, therefore, label medicinal). Even before the rise of modern medicine, Ayurveda and Unani systems of medicine used various plants to achieve various results. Without those plants, and the great variety of insects that pollinate and cross-pollinate them, humans would be much more vulnerable to disease. The biodiversity contained in the ecosystem provides forest dwellers with all their daily needs- food, building material, fodder, medicines and a variety of other products. Biodiversity also provides us with lumber, granite, and marble – to name a few of the building materials much human

habitation depends upon – we would largely be without shelter. While humans are omnivorous, without biodiversity there would be virtually no variety in our diets^[44]. One reason to ask “why is biodiversity important?” is because biodiversity provides a literal treasure trove of foods, from things as common as wheat or corn to things as exotic as some of the seafood used in sushi. Further, not all the nutrients we need are in any particular food, so without a diverse base of foods to make combinations from our general health would suffer. Biodiversity sustains the bodies we live in, and affects the lives we lead, and the societies we form. Once a specie gets extinct, there is no second chance which is possible in climatic change^[20, 12]. Pollination is dependent on various agents such as bee’s or humming bird. Different species such as bats, bees, beetles, birds, butterflies, and flies are known to provide these essential pollination services that guarantee the continuation of plants in our croplands, backyard gardens, rangelands, meadows, and forests. Human beings have used around 7000 plant species for food over the course of history, and another 70 000 plants are known to have edible parts^[46].

Approaches to Biodiversity Conservation



There are two major ways in which biodiversity conservation is practiced, namely – in-situ conservation and ex-situ conservation^[46].

In-situ conservation

As the name suggests, it is carried out locally. It is basically impossible to save the entire ecosystem for protecting a few endangered species. Hence, came the requirement of localizing the process of conservation. This gave rise to the identification of areas known as ‘biodiversity hotspots’. They are the regions of high species diversity and the species are distinctively specific to that region^[21]. Thus, conservation becomes relatively easier for a limited area of land. It can be considered as a process of optimizing the process of conservation as many species can be protected with fewer efforts. There are 34 biodiversity hotspots identified all over the world which occupy a very small area but comparatively account for a huge species diversity. In India, we have legally protected areas which help in conservation of various species that includes – National parks, sanctuaries, biosphere reserves, etc. Here animals live in their natural habitat and have freedom of movement. Hunting and other means of animal’s exploitation in such regions are banned. Many of these regions today are struggling to save the endangered animals. The most common example that we see is that of tiger protection at places like the Corbett National park.

Ex-situ conservation

It is majorly a man-made technique in which the endangered

species are usually put in enclosures, away from their natural habitat. For examples, Zoological parks and wildlife safaris are such areas in which the animals are bound in an area and are taken care off. With recent advancement in technology, ex – situ conservation has taken a whole new meaning. With the help of cryopreservation techniques, gametes of some endangered species are conserved for fertilization in labs to give rise to new organisms.

Role of local people in Biodiversity conservation and sustainable development

The Biodiversity Act, 2002 is a federal legislation enacted by the Parliament of India for preservation of biological diversity, for local people, conservation of biodiversity is not an isolated concept but an integrated part of their lives. They view conservation areas as integral, functional parts of the landscapes in which they live. The engagement of local people in biodiversity conservation represents a win to win situation. Local people conserve biodiversity and maintains its sustainability through many ways such as creation and protection of community conserved areas (Sacred groves, temple trees), Joint forest management etc. These are given below:

Community Conserved Biodiversity Reserved Areas

Community conserved areas are spaces de facto governed by local communities with evidently positive outcomes for the conservation of biological and cultural diversity. Community conserved areas (CCAs) are forests, wetlands, coastal and marine areas, grasslands, or other ecosystems and wildlife populations managed and conserved by local communities for a variety of reasons. Like many countries around the world, India has a rich history and diversity of CCAs. The Gond tribal community (Gadchiroli District, Maharashtra) initiated protection and de facto control over 1800 hectares of forest over two decades ago. Villagers have prevented a paper mill from destroying bamboo stocks, stopped forest fires, and promoted the sustainable extraction of NTFPs. Jardhargaon village in Uttarakhand has regenerated and protected 600-700 hectares of forest, revived several hundred varieties of agricultural crops, and created synergistic links between agricultural and wild biodiversity. Villagers in Shankar Ghola, Assam, are protecting forests that contain the highly threatened Golden Langur^[22]. With the help from the NGO, several dozen villages in Alwar district have restored the water regime, regenerated forests and, in one case (Bhaonta Kolyala), declared a “public wildlife sanctuary”. Community forestry initiatives in several thousand villages of Orissa have regenerated or protected, thousands of hectares of forests, including Dangejheri’s forest, managed entirely by women. Elephants are reported to be now using these forests.

Community Conserved Areas for Individual Species Protection

- Protection of sea turtle eggs, hatchlings and nesting sites by fisherfolk communities is taking place at Kolavipaalam, Kerala, Galjibag and Morjim in Goa, and Rushikulya in Orissa.
- At Rushikulya, local fisherfolk used to collect the eggs for consumption or sale. Some youth in the village learned of the threatened status of the Olive Ridley Turtles and the importance of the beach as a nesting site.
- They stopped eating and selling turtle eggs, and educated fellow villagers about the importance of these turtles.

They then registered themselves as the Rushikulya Sea Turtle Protection Committee, and constructed an interpretation centre.

- Youth clubs from the villages around Loktak Lake (Manipur) have formed the Sangai Protection Forum to conserve the greatly endangered Brow-antlered deer, which is endemic to this area. They take part in the management of the Keibul Lamjao National Park, which forms the core of the lake.
- There are a few other sites where Blackbuck can be seen grazing freely with domestic livestock. At Buguda village in Ganjam District, Orissa, inhabitants have been protecting Blackbucks for centuries.

Sacred Groves

Sacred groves are dedicated by local communities to their ancestral spirits or deities. These groves are protected by local communities, usually through customary taboos and sanctions with cultural and ecological implications are segments of landscape, containing vegetation and other forms of life and geographical features that are delimited and protected by human societies under the belief that to keep them in a relatively undisturbed state is expression of an important relationship of humans with the divine or with nature [23].

Distribution of sacred Forests in India

Sacred groves have been reported from different continents of the world such as Africa, Asia, Europe, Austro- pacific region

and Americas. Countries like Korea, Japan, China, Thailand and Indonesia, Germany, Britain, Italy and Finland in Europe had thousands of sacred groves in ancient times. The sacred groves are widely known in the Austro-Pacific Region, New Zealand and Polynesia.

In India - all over the country especially in the regions inhabited by indigenous communities, particularly along the Western Ghats in the states of Maharashtra, Kerala, Karnataka and Tamil Nadu. In North-east India most of the sacred groves has been reported from Arunachal Pradesh, Meghalaya and Manipur [24, 25]. Although there has been no comprehensive survey of the sacred groves in the entire country approximately 11669 sacred groves have been documented so far. Experts estimate that the actual number could be much higher in the range of 100,000 – 150,000. Large number of SGs in Maharashtra are under the control of the local peoples and have documented 223 such groves. Legally most of sacred groves in Meghalaya are under the control of village forest committees. As a result of these sacred groves we still possess a great heritage of diverse gene pool of many forest species [26]. Several studies have shown that many groves in Meghalaya Kerala, Maharashtra and Himachal Pradesh harbour rich floral and faunal biodiversity. The biological spectrum of groves in Kerala closely resembles the typical spectrum of tropical forest biodiversity. For example, the SGs occupying only 1.4 sq. km contained 722 species of angiosperm, compared with 960 species occurring in 90 sq. km of the Silent Valley forest.



Fig 1: Distribution of sacred groves in India.

Joint Forest Management

As per the Forest Policy of Government of India in 1988, the participation of local community living in and around the forest areas is imperative need for the conservation and development of forests. In order to implement this policy, the Government of India issued a clear Guideline on 1st. June, 1990 to develop and manage degraded forestland under the custody of SFDs with the help of the local community and voluntary organizations. In pursuance of this guideline, states came out with their own resolutions which facilitated expansion of JFM in the state ^[27].

Most of the State Forest Departments notified their resolutions in early 90s and thousands of JFMCs were constituted all over the country to develop and manage millions of hectares of degraded forestlands. It could get further impetus in the states which were implementing donor assisted forestry projects. In a similar manner, the Government of India through its National Afforestation and Eco-development Board also gave 100% central grant for Forest Development Agency (FDA), which is a federated body of JFMCs and State Forest Development Agency (SFDA), which is consolidated body of FDAs in the state. For the management of the Wildlife Protected Areas, Eco Development Committees (EDCs) are also formed to ensure people participation in wildlife conservation ^[38]. Joint Forest Management (JFM) is an approach and program initiated in the context of the National Forest Policy of 1988 wherein state forest departments support local forest dwelling and forest fringe communities to protect and manage forests and share the costs and benefits from the forests with them. Communities organize themselves into a JFM Committee to protect and manage nearby forests, guided by locally prepared byelaws and micro plans. The key element in JFM is that communities have the power to manage the use of forests by members and also exclude non-members ^[28, 29]. The benefits to them is direct access and control on the use and sale of most NTFPs and a share in the income from timber as well as other intangible benefits from local ecosystem services – like water recharge, pollination, wildlife habitat etc. Thus involvement of communities in conservation of forests and wildlife is of paramount interest.

- The Joint Forest Management (JFM) is the generic term in India for partnership in forest management involving the state forest department and the local communities.
- The local village committees and the forest department enter into an MoU to manage the forest area jointly and are entitled to get usufructs benefits from the forest area managed under JFM.
- As on March, 2011 there were 1,18,213 JFM committees across 29 States and UT of Andaman & Nicobar Islands which are managing 22.94 million ha of forests in the country.
- Madhya Pradesh is having the largest number of JFMCs with 1,228 JFMCs and also the forest land being managed 6.69 million ha.
- A total of 14.5 million families are involved all over the country which includes 4.6 million Scheduled Tribe (ST) families and 2.5 million Scheduled Caste (SC) families.
- The approach has also been envisaged in the recently launched Green India mission which proposed to increase quality of forest cover in 5 million ha and increase in forest cover in another 5 million ha.
- The JFMCs is one of the overarching institutions in the implementation of the scheme together with other

institutions especially in non-forest areas.

- Encouraged by the success of JFM Indian government has expanded it and nearly 4000 sq. Km. of degraded forests are managed by more than 3500 local communities with Forest Department which includes 5.5% of forest cover in India.
- A major lesson learnt from JFM experience in India is that involving local communities in management of forests has led to more effective biodiversity conservation and poverty alleviation in the country.

Role of local women in biodiversity conservation & sustainable development

Women groups from many parts of the country have driven successful initiatives to conserve the forest and coastal biodiversity. This social revolution started in 2000, with many of the women coming forward and resolving to conserve the adjoining forest areas and other natural resources, including other forms of biodiversity and its sustainable development. The Women Committee's patrols the forest and nobody is allowed to collect additional firewood. The regulations established by the Committee are strictly adhered to and respected by the villagers ^[30, 10]. The Committee's had also fixed different levels of fines, as a sort of localized compliance mechanism for the sake of conserving biodiversity and its sustainable development. The Women's Committee have also influenced the local youth and children of the villages in the protection natural resources. The strong commitment and action of the community members has yielded rapid and positive results, both for biodiversity conservation and its sustainable development. The first recorded instance of such action was in 1604 among the Bishnoi's community in Rajasthan when two Bishnoi women, Karma and Gora, sacrificed their lives in an effort to prevent the felling of Khejri (*Prosopis cineraria*) trees.

Role of tribal's in conserving biodiversity

The knowledge of tribal's in biodiversity conservation and sustainable development can be seen in different practices such as collection and management of wood, traditional ethics, norms and practices for restraint use of forests. The Khasi Hills of Meghalaya are characterised by pockets of rich biodiversity that have been protected by the Khasi tribe for a longer period of time ^[31]. The Khasi people believe that those who disturb the forest will die, and that sacred animals such as the tiger bring about prosperity, happiness and well-being. Large areas have been conserved as forest and wildlife reserves in Nagaland by various tribes, with over 100 villages, managing several hundred sq.km of forest, including the Khonoma Tragopan Wildlife Sanctuary. The Bishnois, a community in Rajasthan famous for its self-sacrificing defence of wildlife and trees, continue strong traditions of conservation. Bishnois have been declared the Abohar Sanctuary in recognition of their wildlife value. At all the Bishnoi sites, Blackbuck and Chinkara are abundant. There is a belief that an intimate relationship exists between the totem animals and the tribe ^[32]. Therefore, the members do not eat, kill or trap these animals.

Indigenous knowledge for biodiversity conservation

- There is an immense potential of indigenous knowledge to contribute towards conservation of biodiversity all around the world.
- In the Ashanti region of South - Western Ghana, trees

which were regarded as housing spirits are not felled without performing rituals. This custom had a protective effect on tree conservation.

- In Africa animals in a particular habitat are regarded as sacred and are therefore protected from hunting such as Black and White colobus (*Colobus polykomos*) and the Mona monkey (*Cercopithecus mona*).
- A similar situation is reported for the bats in the South Eastern part of the country that are said to be conserved by the local community.
- From a biodiversity conservation point of view, traditional farming practices entailed strong elements of long-term land rotation and conservation of indigenous plants.
- Coastal ethnic groups know days when they do not fish. Tuesdays and Fridays are in Ghana often set aside and the ecosystem were expected to rest. This resting period coincides with the period when the fishes lay their eggs.
- In the Fesu laguna, the banned period is during the months of May and June. This period is obviously linked to the procreation of the fishes including the youngsters to mature.
- Various species could not be hunted during certain seasons (such as the breeding season). In this way the communities are able to ensure sustained population growth of their wildlife resources.
- These traditions of local people have positive effects on the conservation of biodiversity and its sustainable development.

Attitude of local people towards wildlife conservation

A study was carried out around Dachigam national park, Jammu & Kashmir. The majority of respondents expressed a positive attitude toward wildlife conservation, but said that conservationists and the government seemed to care more about wildlife than about human well-being³³. Government and nongovernmental organizations should introduce compensation and livestock insurance schemes to make up for losses caused by wildlife. While important for the conservation of wildlife in this region of Jammu and Kashmir, the results of this study have wide applicability to conservationists and policy-makers throughout the developing world and can support efforts to protect rare species and involve local people in conservation. Livestock losses and crop damage were the major factors responsible for negative attitudes toward wildlife conservation policy around the park, so reducing crop and livestock damage could have a strong positive effect^[34, 41]. Dachigam National Park and the landscape surrounding it has one of the highest-density populations of the Asiatic black bear in India, and Dachigam National Park is surrounded by protected areas, though human settlements fragment protection. Corridors between these protected areas need to be secured to reduce the chances of conflict while animals move from one protected area to another.

Conclusion

Biodiversity conservation and sustainable development are two inter-related branches focusing on social progress, economic growth and environmental protection on one side, and ecosystem conservation on the other. Involving local communities in management of forests and other natural resources can be more effective way for sustainable development of biodiversity³⁵. The precious wild animals and

plants can be protected, their habitats can be restored if people of all sections, classes, age groups and organizations wholeheartedly support the conservation of forests and wildlife. Sustainable development depends on the co-operative attitudes of local people and forestry officials and significantly, on the legal and institutional backing of the state. Most of the time in human history, conservation means protecting nature for the spiritual gifts it provides, and protecting sacred places in the local landscape^[36]. The biodiversity effects on cultural development can be shown by heterogeneity of the world's mythology, folk dances and folk art which contribute to the richness of literature and global arts. In different landscapes, different cultures are present which influenced our language, diet, occupation and various types of activity.

Uniqueness of each habitat is presented by their animals and plants that why each country and state have their flagship animals as well as plants. Even during traveling, motivation of the peoples is to see biological diversity, different cultural and landscape. Ecotourism is travel with the aim to view, support and sustain the local cultures and its natural ecosystem. Support from ecotourism can be very helpful to reduce habitat destruction as well as to preserve endangered species^[33].

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