

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

| A Monthly Peer Reviewed & Referred Journal |

Vol. 3, Issue 12, December 2014

Conservation of Biodiversity by Managing National Parks

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ABSTRACT: Habitat loss due to human activities and climate change is synergistically posing serious threats to the global biodiversity leading to irreversible extinction of several species. In wake of recent extinction, several forests are declared as protected areas where no more human activities are allowed. However, the scope of these protected areas got broadened from mere conservation to poverty alleviation and sustainable development during the past decades. Though these protected areas seem to be supportive of the biodiversity conservation, several challenges and gaps have emerged that need to be addressed for effective conservation and sustainable management in these protected areas. Therefore, the present chapter aims to address the roles, challenges, and approaches for conservation, and sustainable management in protected areas of India. Based on the published literature, we have found that protected areas proved to be a successful strategy for the conservation of wild animals and plants. However, management of poaching, man-wildlife conflicts, funding, extensive resource use, and tourism is still a challenge for some national parks of the country. Although governmental policies have addressed some of these challenges, only limited success has been achieved so far. Therefore, further studies need to assess the efficiency of protected areas for biodiversity conservation and devise the mechanisms for effective sustainable management of these protected areas.

KEYWORDS: habitat loss, biodiversity, conservation, sustainable, national parks, management, extinction

I. INTRODUCTION

The variability in all life forms at different scales on the earth is collectively termed as biodiversity. Further, biodiversity is not evenly distributed on the globe as tropical regions are relatively more diverse than other geographical regions. It is an integral component that ensures and sustains our own life by providing necessary services from oxygen to clean water and from food to clothing. Despite their central role in sustaining life, species are disappearing at alarming rates, and it has been estimated that about 27% of the total species are facing threats to extinction [1]. Much of today's large-sized vertebrate animals represent less than 5% of their historical ranges. Many species such as the greater one-horned rhino (*Rhinoceros unicornis*), Asiatic lion (*Panthera leo persica*), and the hard-ground barasingha (*Rucervus duvaucelii branderi*) are restricted to microscopic remnants of their historical range. The biggest threats are posed by habitat destruction by human activities together with changing climatic conditions. Therefore, there is an urgent need to take measures to protect biodiversity in order to sustain life on earth. Several strategies and measures have been proposed for biodiversity conservation that varies with the type of habitat and their requirement. Protected areas are one of the prominent strategies for the in situ conservation of species and their habitats. However, this concept is not recent to India, and provisions for the establishment of reserved forests and laws such as the death penalty for killing elephants date back to the third century B.C. as mentioned in Kautilya's *Arthashastra* [2]. Many of today's existing national parks once served as a hunting preserve for the local Maharajas and Emperors during the colonial and precolonial era [3]. It was in 1936 when the Hailey (now Jim Corbett) National Park was formally notified as to the first national park of the country, and there were only four national parks till the 1970s (Figure 1). However, the continued hunting and habitat destruction resulted in a dramatic decrease in the population of tigers in the country. In the wake of this alarming decline of tigers, the then prime minister of India, Late Smt. Indira Gandhi, launched the "Project Tiger" in 1973, which still stands as the world's most comprehensive tiger conservation initiative. She established nine tiger reserves, hired guards to patrol them, and forcibly moved whole villages outside their perimeters. These efforts proved to be fruitful as the tiger numbers topped to 4,000 along with an

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increase in their prey, and thus, India had put forward a global model for wildlife conservation. Since then, the protected area network of the country increased exponentially after the 1980s, and presently there are about 104 IUCN Category II national parks covering an area of 40,501 km², which is 1.23% of the geographical area of the country [4]. Currently, there are about 870 protected areas in 2009 including 104 national parks, 551 wildlife sanctuaries, 88 conservation reserves, and 127 community reserves.

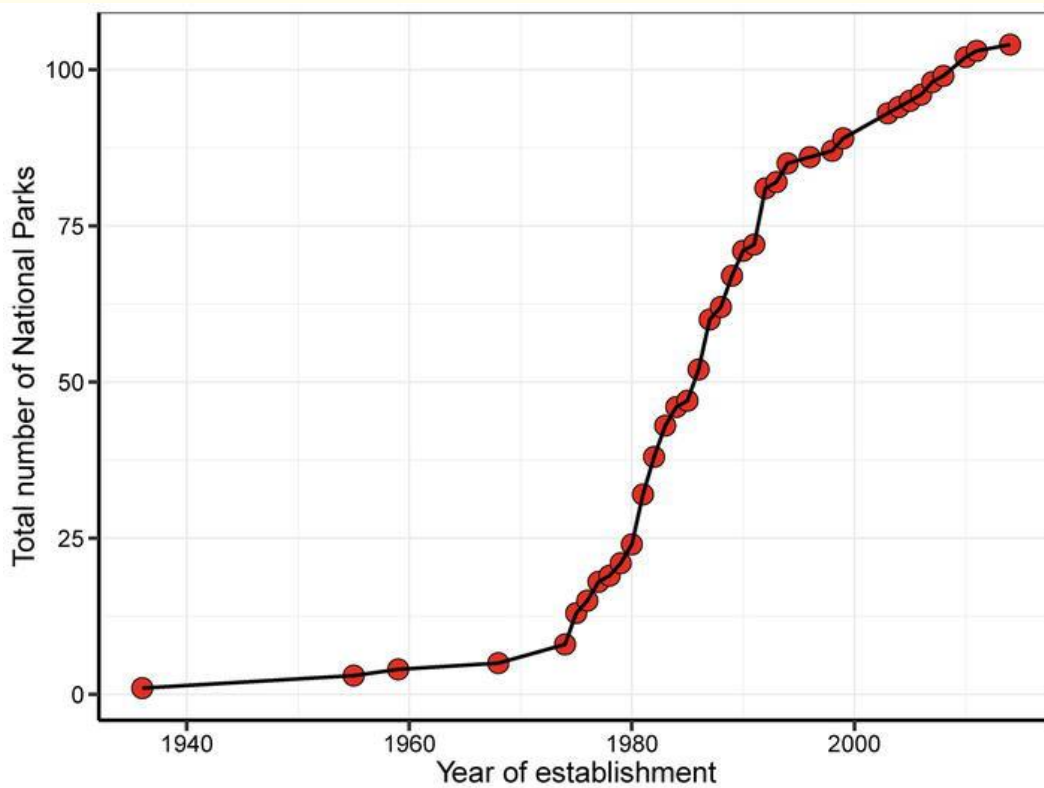


Figure 1.

An exponential increase in the total number of national parks in the country India after the 1970s .

Although these protected areas were initially established for biodiversity conservation, their objectives have now expanded to also include human-centered socioeconomic development. Besides being critical to preserving global biodiversity and stemming from the extinction crisis, these protected areas bring tremendous cultural, ecological, spiritual, and scientific benefits to society. Now, a new paradigm of conservation incorporates the socioeconomic development of local people and encourages the sustainable use of resources within the protected areas. This approach promotes the utilizing of various benefits from protected areas for the socioeconomic development of the local residents. Thus, the scope of national parks has been broadened to poverty alleviation and the development of the nation. Although this paradigm shift has been widely accepted and appreciated, there are some challenges to the effective management of these protected areas. Therefore, the present chapter aims to assess the roles and challenges of national parks for biodiversity conservation and sustainable development in India using published case studies. To accomplish this, we have searched the available literature databases, viz., Web of Science, Scopus, Google Scholar, ScienceDirect, and NCBI, using keyword combinations such as “National parks AND India,” “Sustainable development AND India,” “Wildlife sanctuary AND India,” and “protected areas AND India” from the year 1985 to

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recent. Additionally, gray literature from other additional sources including books, unpublished theses, governmental reports, and newsletters was also consulted. After removing the duplicate, insignificant, and inappropriate studies, in total, 50 more relevant studies were included for the preparation of this chapter. Here, we have first discussed the major roles of national parks in conservation, tourism, and ecosystem services. Then various challenges faced by national parks such as conservation, tourism, resource use, human relocation, and conflicts have been discussed. In the next section, two major conservation paradigms, i.e., preservationism and sustainable use, their merits, and demerits are discussed. Furthermore, major challenges to conservation and management of national parks are highlighted with suitable examples from Indian case studies (Figure 2).

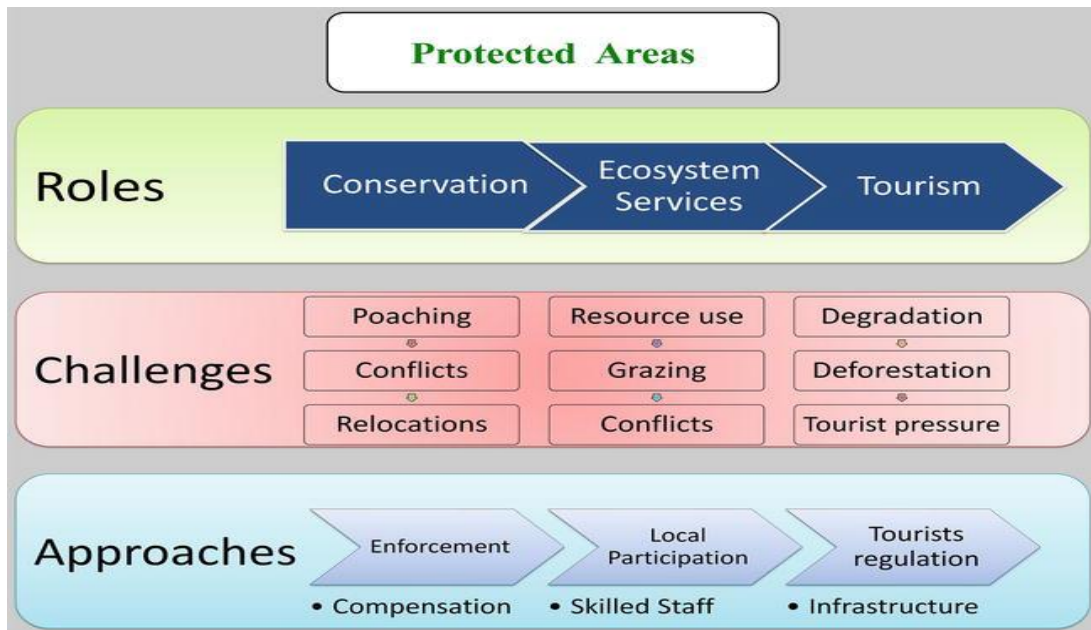


Figure 2. Major roles, challenges, and approaches for sustainable development of protected areas in India.

II. DISCUSSION

National parks including tiger reserves not only conserve biodiversity but also play an important role in local people's livelihoods by providing several direct and indirect benefits and services [5]. These areas are important components of tourism, agro-biodiversity, spirituality, capacity building, poverty reduction, and sustainable development. The ecological, economic, social, and cultural benefits provided by protected areas both conserve biodiversity and support human well-being. Apart from providing economic benefits through sustainable use of bioresources, these areas also serve as important sites for documenting and quantifying biodiversity and various services provided by them. In addition, protected areas act as a buffer to mitigate the impacts of environmental disturbances and climate change. National parks are the critical tool to conserve biodiversity in the face of the global crisis of species extinction and the loss of the world's natural capacity to support all life and human existence. This can be evidenced by the fact that a large proportion of biological diversity exists only in protected areas. Many national parks of the country harbor important wild relative of cultivated crops and thus serving as a reservoir of agro-biodiversity. Furthermore, some species like brow-antlered deer (*Rucervus eldii eldii*), the Indian rhinoceros (*Rhinoceros unicornis*), the Asiatic lion (*Panthera leo persica*), and other large vertebrates can be found only in some national parks, and their populations outside are almost diminished. According to the report of the country-wide assessment of the status of tigers, co-

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predators, and their prey in India, there are about 1,706 tigers occupying 81,881 km² of the area in 2010. This 20% increase in tiger numbers is due to the good management of tiger reserves and protected areas. Thus, national parks in India proved to be an effective strategy for species conservation. While conserving species, these areas also protect habitat, and therefore these are effective for checking land use pressures throughout the world as most of the national parks have maintained their borders against human-based encroachment [6]. Furthermore, healthier ecosystems with high biodiversity tend to resist erosion, soil loss, or water quality loss. According to a study conducted by the Indian Institute of Forest Management (IIFM) Bhopal, it has been estimated that the stock value of tiger reserves to protect and conserve tigers vary from INR 22 to 656 billion [7]. Protected areas provide a range of associated economic, social, cultural, and spiritual benefits, which are together called ecosystem services. Clean water, clean air, access to food sources, buffers of weather events, cultural and spiritual values, and raw materials for consumers are some of the ecosystem services that ensure the well-being of humanity. Many cities and villages directly rely on these natural reserves for essential resources such as clean drinking and irrigation water. For example, the metropolitan city of Mumbai receives its drinking water from the Sanjay Gandhi National Park [8]. About 70% of protected areas of the country are inhabited by local communities and also partly grazed by local livestock. Almost 60% of protected areas are subjected to the collection of non-timber forest products [9]. For example, forest products like fuelwood, fodder, and green leaves are consumed and sold by the local people living close to Kalakad Mundanthurai Tiger Reserve [10] and Kumbhalgarh Wildlife Sanctuary [3]. Furthermore, natural and cultural resources in tiger reserves are important drivers of tourism, supporting local earnings, and employment [7]. A study conducted by the Indian Institute of Forest Management, Bhopal, provided quantitative and qualitative estimates for as many as 25 ecosystem services from selected tiger reserves of the country. It revealed that the benefits originating from selected tiger reserves had a monetary value ranging from INR 8.3 to 17.6 billion annually. In terms of unit area, this translates into INR 50,000–190,000 per hectare per year. While creating a new tiger reserve in the Pilibhit-Dudhwa landscape, covering an area of approximately 1000 km² would cost approximately INR 500 billion [7]. Although tourism in India is dominated by its cultural heritage, wildlife also acts as a significant component of tourism in the country. Since India is now hosting more than 50% of world tigers, therefore it is a center of attraction for a large number of domestic and foreign tourists every year. Further, national parks represent the beauty of undisturbed nature, and thus, it significantly attracts tourists, enthusiasts, and nature lovers, though the number of tourists has fallen in some national parks such as Keoladeo of Rajasthan [11]. Therefore, wildlife and nature tourism can potentially benefit local communities economically by creating opportunities for jobs and businesses. For example, some of the local *Adivasis* of Sanjay Gandhi National Park are employed within the park as caretakers of the animals, security guards, cleaners, casual labor, and workers in the lion and tiger safari [12]. Similarly, local people associated with ecotourism in Kaziranga National Park of Assam not only became economically well-equipped and enjoys better living conditions, but they also feel more politically empowered [13]. Furthermore, the Gonda people of Pench National Park earn livelihoods for their unique traditional arts and dance activities, which can alleviate poverty and improve the quality of life among these people. Thus, national parks are an important source of earning money for both local people and the government. For example, the park authorities of Sariska National Park collect and deposit to the state government about INR 28–53 lakh per year, while the Pench National Park has collected a revenue of about INR 28,808,123 during 2012–2011 [14]. Furthermore, it can also potentially promote the participation of local stakeholders for the effective conservation of biodiversity. Though the number of visitors in national parks and wildlife sanctuaries are increasing in the country, it still contributes less than 10% of all tourism in India. The park offers unusually large numbers of local employment opportunities for non-park staff [11].

III. RESULTS

Although protected areas provide opportunities for biodiversity conservation and sustainable development, numerous challenges related to the effective management of national parks also emerge which need to be addressed. It has been acknowledged that many of the national parks in the country are under pressure from the clearing, hunting, logging and, to a lesser extent, fire and grazing. Also, the majority of eco-development projects have not effectively addressed the importance of local concerns [15, 16]. These issues and conflicts have developed a confidence crisis and negative

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attitude in local people's perceptions. Furthermore, linking economic benefits to conservation is difficult where wildlife is highly endangered, pressure on biomass resources is high, and stakeholders are many. This could be more serious if the economic benefits from the parks are few and the number of beneficiaries is large. India takes pride in tiger conservation worldwide through the establishment of tiger reserves under its Project Tiger. However, it turned a matter of shame, when the news of the disappearance of all the tigers from the Sariska National Park haunted all the conservationists, nature lovers, and the whole country in December 2004. Investigations revealed that poachers along with local villagers and trading middlemen had been killing the tigers since July 2002 [14]. This local extinction of tigers from the Sariska was the first confirmed tiger extinction in a Tiger Reserve, though Kailadevi Wildlife Sanctuary was also speculated for the local extinction of tigers. Not only in Sariska but more recently in 2010, the Panna Tiger Reserve has also become "tigerless," and even Sanjay Gandhi National Park may face the same in upcoming years [17]. Thus, wildlife conservation is not ensured against human pressures even under the well-controlled mechanisms of protection [18]. Apart from poaching, habitat degradation and destruction by various human-mediated activities possess serious threats to the wildlife even in the protected areas. For example, developmental works cause habitat degradation and fragmentation as happened in the Raja Ji National Park and Corbett National Park [19]. Also, the expansion of pastoralists creates pressure on wildlife, which results in increased human-wildlife conflicts [19]. Wild animals including tigers and elephants are frequently killed by surrounding villagers citing various reasons such as damage to crops, preying of livestock, and killing of local people. A series of such incidents can be cited in different protected areas such as poisoning and killing of elephants in Bandipur National Park and Palamau Tiger Reserve, poisoning of wild dogs in Kanha Tiger Reserve, and killing of tigers in Dudhwa Tiger Reserve, Kanha Tiger Reserve, Nagarjunasagar-Srisailem Tiger Reserve, and Pench National Park. Thus, human-wildlife conflicts pose a major constraint for the conservation and sustainable development of protected areas. The nature and intensity of these conflicts vary with bio-geographical distribution and social characteristics [20]. Many protected areas in Chhattisgarh and Jharkhand are under the control of Naxalites (a group of people following the legacy of Marxism-Leninism), and these people often poison wild animals citing that they kill people. For example, as many as 20 cases of tiger poisoning were reported from the Nagarjunasagar-Srisailem reserve of Andhra Pradesh. The control of Naxalites is so prominent in some areas that no forest guard had even courage to enter in the Indravati reserve of Chhattisgarh since 2002. Regulating and managing resource use and extraction has always been a major challenge for protected area management. However, increased intensity of conservation efforts has introduced a complex bribery system, which opened another window to local people for accessing forest resources [3]. Further, activities of smugglers and poachers such as Veerappan continue to extract a substantial amount of forest resources, kill wildlife, and even murder government officials in some protected areas. This access eventually increased extensive pressure from the local communities in the form of illicit tree felling, grazing, and extraction of various forest products leading to the degradation of the forest [21]. Such reports of forest degradation also echoed from the Bhadra Tiger Reserve, Biligiri Rangan Hills Temple Sanctuary, and Sariska National Park. These activities lead to poaching, jhum cultivation, construction, and developmental activities, which resulted in the extinction of some primates and other wildlife animals [22]. All these activities and resource use intensity lead to altered vegetation through time [23] resulting from reduced richness, regeneration, and density of forest trees [24]. Thus, man-made activities become more serious threats than natural fire and grazing in protected areas [6]. This is why the rate of forest loss is still high in some protected areas, not only in India but across the world [25]. Therefore, it becomes essential to protect natural areas from human impacts in such severe cases. Local people are severely restricted or relocated from protected areas such as Sariska Wildlife Sanctuary, the Gir Forests, and Dachigam National Park for the sake of conservation during the 1970s, and thus, another important challenge has emerged for the sustainability of protected areas. The Baigas were displaced from the Banjar Valley Reserved Forest (now the Kanha National Park) because their slash and burn agriculture was interfering with the regeneration of the Sal (*Shorea robusta* C. F. Gaertn.). After the launch of Project Tiger in 1973, several relocations including Bandipur, Kanha, Nagarhole, and Ranthambhore National Park were carried and funded by the government [26], and recently the Adivasis and slum dwellers have been isolated from the Sanjay Gandhi National Park in Mumbai [12]. Whenever such a relocation takes place, there are great chances of compromise of livelihoods and rights of the local communities and forest dwellers. For example, the livelihoods of local communities were severely affected after displacement from Kuno Wildlife Sanctuary and Tadoba Andhari Tiger Reserve. The Sariska

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rehabilitation was ineffective because many spaces to which villagers were relocated lacked basic facilities and many residents returned to their original village in the sanctuary [14]. Such memories develop a negative attitude of local communities toward subsequent relocation programs. This eventually leads to the conflicts which again hinder the conservation and sustainable management of protected areas. The Indian Institute of Public Administration, New Delhi, in 1989 reported that most of the forest managers have communicated about the cases of illegal grazing, hunting, and poaching in wildlife reserves. Furthermore, the forest guards have faced offenses such as setting reserves on fire, and while opposing such offenses, they often get attacked and assaulted by local communities [9]. Thus, the growing conflict between forest staff and local people perceived as an emerging threat to conservation. Wildlife tourism works both ways; if it provides economic benefits on the one hand, it can also prove to be detrimental for biodiversity on the other hand. Tourism often causes environmental degradation and threat for biodiversity leading to a compromise in ecological services. For instance, in Kashmir, tourism has caused increased extraction of forest resources such as firewood and other raw materials. The construction of hotels and guesthouses in forests causes forest degradation and deforestation, and after construction, they pollute the environment due to unscientific disposal of solid and liquid waste. This results in ecological disturbance by soil erosion and forest destruction [27]. The increasing number of tourists and their management has appeared as another challenge for the sustainability of protected areas. The number of visitors in protected areas of India has increased several folds only during the past few years. However, the levels of sustainability and carrying capacity are not estimated for many protected areas. Although the increased number of tourist visitors is often blamed for the negative impacts and environmental degradation, the lack of resources for effective visitor management technologies is also the real gap that one should blame for. This is because all the money collected locally needs to be submitted to the central government in most national parks in the country [8]. Nevertheless, tourism is not considered a major problem in some national parks such as Keoladeo National Park of Rajasthan [11]. Similarly, increased pilgrimage tended to degrade the biodiversity and habitat in some protected areas such as Periyar Tiger Reserve and Sariska National Park. Further, the economic benefits generated from tourism are not shared with local inhabitants, which causes a conflict between local communities and park authorities [5]. A recent study found that lack of coordination among various stakeholders and lack of government incentives are the most significant barriers to sustainable development in protected areas of the country [28].

IV. IMPLICATIONS

“Preservationism” and “sustainable use” are perhaps the two conservation models among the conservationists of India. Although both conservation models aim to conserve bioresources and landscapes, “preservationism” restricts any human-mediated activities, whereas the “sustainable use” approach advocates the involvement of local people [29]. The sustainable use approach involves local communities for conservation of biodiversity with extractive human use, while preservationists argue that some species especially large vertebrates, habitat specialists, and other sensitive species cannot be conserved with high human densities and extractive use of forests. Both the paradigms have their own strengths and weaknesses, and therefore, none of the models can be explicitly applied to all the cases. The preservationist paradigm of conservation is based on its biological, ecological, and ethical values of each species. It considers that mere maintaining ecosystem services and sustainable use do not go to preserve all the forms of biodiversity. Thus, it advocates strictly protecting natural ecosystems from human activity and ensuring that they are minimally altered [29]. Successful implementation of this approach has resulted in fruitful results, which are evident from the fact that most of the threatened wildlife is now only restricted to protected areas. For example, the Asiatic lions and the wild Ass can only be spotted in Wildlife Sanctuaries of Gujarat. Similarly, Kaziranga National Park of Assam has now become home to the single highest population (more than 60% individuals) of one-horned rhino and the Asian water buffaloes in the world. Further, the number of tigers has increased significantly from 268 in 1972 to more than 2900 in 2010 through the establishment of tiger reserves. Although this approach is most common and successful for the conservation of large vertebrate animals and another organism including plants, it too has some demerits. The restriction of human activities and resource use usually gives rise to conflicts with local communities and administration. It emphasizes more on law and order problems, protection, poaching, and illicit resource use. Resettlements carried out in this approach often considered overly bureaucratic, authoritarian, and expensive.

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Furthermore, civil engineering works such as the construction of roads, waterholes, and watchtowers are taken more into consideration rather than conservation aspects such as implementation and effective management of wildlife. Therefore, preservationists must prove with examples that they can compensate the costs of local communities for their extractive use and livelihoods along with conservation of endangered species and ecosystems. Government policies for conservation and sustainable development of protected areas must respect the social and cultural traditions of the community while preparing rules and regulations. The management and action plans of the government should consider the improved development of both local people and protected area. Also, the state rules must consider the local adaptation and cultural traditions of a specific community. Thus, the selection of a conservation approach must be chosen wisely based upon the needs and requirements of the protected area. For example, the “sustainable use” approach may not be effective for species that are highly sensitive to human interference. Similarly, “preservationism” will not be effective in protected areas with a high density of local people that are highly dependent on forests for their livelihoods. Further, the governmental policies like compensation policy are governed by the bureaucratic style that is quite different from the environmental governance at local levels. Therefore, such policies are needed to be designed in such a manner that it considers the ecological and social dimension of human-wildlife conflicts so as to achieve better conservation and development priorities [38]. The governmental action plans must be clear enough and transparent in order to avoid conflicts and disputes. For example, the agreements for resource use and conservation between park officials and local communities must be very clear and transparent. Similarly, the rights and duties of local communities and forest should be undoubtedly defined, so as to avoid any disputes later on. Also, there should not be any incompatibility or inconsistency between state rules and local institutions. Further, the boundaries and zones of any protected area should be clearly demarcated for the effective implementation of action plans. The governance and legislation must be conveyed effectively to the forest officials and local people in order to develop confidence and local participation. Thus, increasing awareness about their rights will be effective for sustainable forest management in India [23]. Enforcement and implementation of governmental policies have remained a great challenge for the effective management and sustainability of protected areas in the country. This can be overcome by employing a sufficient number of local people as forest staff and forest guards. This forest staff should be trained well and equipped with modern facilities and good communication skills. In cases where human resettlements are necessary for conservation, newer sites must provide a better quality of life for the local population in order to achieve effective and voluntary human relocations. The government must put forward examples of providing improved necessary facilities (such as education, medical, household, etc.), good infrastructure (such as water supply, sewerage, transportation, and electricity, etc.), income sources, and other cultural-, religious- and ritual-oriented requirements with the relocated sites. This will develop a positive attitude and respect for rules associated with conservation.

India has scope for both collaboratively managed and community conserved protected areas because many of the protected areas in the country are distinguished by human settlements and resource use [8, 39]. Thus, the participation of local people becomes necessary for achieving sustainability in such areas because these people will be directly involved in any intervention to be implemented. These people including women should be encouraged to get involved in management plans by providing incentives in the form of social and economic benefits. The economic benefits generated from the developmental activities like tourism should be shared and rewarded for effective conservation activities of the local people. However, in many cases, wildlife conservation became a second priority for villagers. Therefore, national parks should not be always projected for economic benefits; rather we must highlight the roles of wildlife and forests for essential services and ecological balance. Local communities should be encouraged to protect the environment and bioresources for future use. If any conflicts or disputes arise during implementation, they must be minimized through communication and respecting the local cultural rules in order to develop confidence in governmental policies and good relations with forest officials. Therefore, the formation of some local conservation councils that chiefly include local people and associated NGOs will be effective for moderating disputes and management of the protected area. Further, the efficiency of any protected area depends on basic management practices such as enforcement, local participation, boundary demarcation, and direct compensation to local communities. Therefore, effective management of national parks demands increase and moderation in funding [6]. Thus,

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businessmen, industrialists, private organizations, and international bodies should provide financial assistance to the protected area development.

Tourism activities that operate within ecological capacities and also contribute to the economic prosperity of local communities can be referred to as sustainable tourism. This approach can generate economic benefits to local communities, which might be more supportive of conservation as well as development. Further, tourism also makes people aware from corporate and other external agencies about the beauty of charismatic animals and undisturbed forest landscapes. Thus, tourism helps to raise funding for biodiversity conservation which would be more effective for keeping conservation programs longer. However, the sustainability of each protected area must be ensured before promoting any tourism-related activities. To accomplish this, the number of tourists needs to be regulated depending upon the carrying capacity of each protected area. Further, impacts of tourism need to be evaluated periodically, and infrastructural facilities should be developed by promoting low-impact activities such as walking trails and other nonconsumptive wildlife utilization. Local communities participate actively and support conservation when they see direct economic benefits from activities such as tourism. Tourism that involves local communities can further result in fruitful development of these protected areas.

V. CONCLUSIONS

It has been observed that several local communities use resources in a much judicious way rather than exploiting the resources. These traditional resource use practices involve temporal shifts in resource use such as food preference, hunting, spatial limitations for some forest areas (such as sacred groves), and shifting agriculture. Such resource use patterns of indigenous communities are considered sustainable which forms the basis of “sustainable use” paradigm of conservation in India [29]. This paradigm assumes that the upkeep and survival of biodiversity can be enhanced by providing control to local communities for traditional management as their livelihoods depend on biological resources. For example, nomadic Changpas of Ladakh have sustained their pastoralist lifestyles for centuries and coexisted with endangered wild species like the Snow leopard [8]. Similarly, the Indian state Kerala has attained social sustainability through their mutualistic equitable resource use rather than unequal competitive resource consumption [30]. Thus, when local communities are provided with the complete access and management of land use like shifting cultivation and pastoralism, local sustainability is maintained, and biodiversity is conserved in a more effective way [29]. However, this is not the case in every protected area and these traditional practices are not being followed in some reserved areas. For example, Kailadevi Wildlife Sanctuary, which was considered as a successful model of participatory conservation, has too suffered from the local extinction of tigers. Similarly, intensive jhum cultivation in a locally managed forest has not only reduced forest cover but also caused a decline in biological diversity [31]. Further, many local people such as Tibetan refugees, Gujjar, and other pastoralists do not follow the traditional practices of pastoralism that were maintained for centuries [8, 19]. Similarly, selling of community-owned reserves and growing of cash crops in northeast India have increased during the past decades [32]. Thus, traditional sustainable practices no longer seem to exist in reality, and they are being faded away even in sacred groves [33]. Therefore, this approach needs to put forward as examples for the successful conservation of large vertebrate species such as the tiger and elephant compatible with extractive use and high-density human populations. Before adopting any sustainable use models, the impact of uncontrolled human pressures on wildlife should be evaluated carefully [18]. India followed the “preservationism” model for biodiversity conservation during the initial establishment of protected areas, but it resulted in increased conflicts with local people. In order to buffer conflicts of the local people, India was the first country to introduce the concept of “Joint Forest Management” in its National Forest Policy, 1988, which has the provision of involving the local communities for sustainable conservation and management of forests. Thus, there is a shifting paradigm from “preservationism” to “sustainable use” approach during the recent times. This approach is managing forest resources with varying degrees of success by taking care of community needs and aspirations for the past 30 years. Although rural communities and forest officers are developing a positive attitude toward forest conservation, there are still some concerns like the functioning of forest committee, the role of women, freedom of working, and participatory approach in forest conservation and management [34].

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The human-wildlife conflict was one of the major challenges for the conservation of species within protected areas. The government of India launched the eco-development project in the 1990s, to minimize such conflicts and effective conservation. In order to promote human security and protecting biodiversity simultaneously, the government of India introduced financial compensation as a policy against human-wildlife conflicts around the protected areas of the country. Similarly, some compensation incentives are instituted in Wildlife Trust of India (WTI) in response to crop damage, livestock, or human injuries caused by wildlife in protected areas. For example, crop loss due to wildlife is compensated by providing equivalent incentives under the “grain-for-grain” scheme in Pakke Tiger Reserve and northeast states of India [35]. Similarly, active bio-fences consisting of beehives or defensive crops (with pungent smell and thorns) were used to keep away elephants and other wild animals in Kaziranga National Park of Assam. Several services are implemented by WTI to help the cases of human-wildlife conflicts such as Mobile Veterinary Service, Guardians of the Wild, Primary Response Teams (PRTs), Rapid Response Teams (RRTs), and Sociologist-Biologist-Veterinarian expert teams that have been constituted to respond and handle human-wildlife conflict cases in Dudhwa National Park of Uttar Pradesh. Further, the safety of wildlife was ensured by developing canopy bridges in Chakrashila Wildlife Sanctuary of Assam, regular removal of snares from Bandipur Tiger Reserve of Karnataka, and installation of low voltage solar-powered fences in parts of Wayanad Wildlife Sanctuary, Aralam Wildlife Sanctuary, and Kaziranga National Park. Often resource use in many protected areas of the country is banned or restricted. According to the Supreme Court orders (dated 14.02.2000 and 21.02.2000 in I.A. No. 548 in WP No. 202/1995), the removal of dead, diseased, dying, or wind-fallen trees, driftwood, and grasses, etc. is restrained from any national park or game sanctuary [36]. This develops conflicts among the local people and forest officials, which is one of the major challenges for sustainability in protected areas. Later, the Government of India enacted the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, with provisions to acknowledge rights within forests including within protected areas. Until recently, bamboo has been considered as a “tree” in the country under the Indian Forest Act, 1927, and its felling and transit required prior permission from the forest department. However, a recent amendment has taken out bamboo from the category of “trees,” and now local farmers can freely cultivate and harvest bamboo. This major step by the Indian government has economically empowered almost 20 million people including farmers, forest dwellers, and poor sections of society. Moreover, it has not only enhanced the income of farmers but also created job opportunities through boosting bamboo-dependent industries like handicraft industries in the country. Furthermore, the local people especially poorer sections, support conserving wildlife as it did not affect their livelihood as far as their primary needs are met [16]. Several eco-development projects have been launched in the country to reduce the dependency of local people from forest products, enhancing their livelihoods. Currently, such eco-development projects are running in more than 80 protected areas of the country, most of them are centrally funded, while few heritage sites have received grants from international organizations such as Global Environment Facility and the World Bank. In order to conserve large mammals and sensitive species that are threatened by human-wildlife conflicts, village relocations are often carried out. Many villagers are happy after relocation outside the protected areas, as they were provided with better facilities such as land for cultivation, drinking water, electricity, jobs, etc. Such happy relocations have been carried out satisfactorily in Nagarhole National Park of Karnataka and Sariska National Park of Rajasthan. In Bhadra wildlife sanctuary of India, the resettled families are satisfied with the relocated sites as they are now living a better life with all necessary facilities such as electricity, drinking water, transport, market, etc. [37]. Under these projects, the cooperation of local communities has been awarded in terms of economic incentives and legal support as evidenced by the Periyar National Park. Further, the money collected by tourism is used to pay for salaries of members and park management and to build up a community development fund. However, these developmental activities are only promoted as long as the biodiversity and wildlife are not exploited. Despite enormous funding from India Eco-Development Project, the people-initiated natural management could no longer be managed to sustain the tigers and their prey [18]. Protected areas were initially established to conserve biodiversity in the face of inevitable human-centered development. However, they have emerged as a critical tool for not only safeguarding species but also for poverty alleviation, improving human livelihoods, and overall development of a nation. This broadened scope of protected areas has posed several challenges for effective conservation and sustainable management. Among major challenges, human activities such as extractive resource use, grazing, development, and tourism are disproportionately degrading and compromising the sustainability of the forests in such protected areas.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

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The lack of baseline data and research is exaggerating the issue, and therefore, further studies need to carefully assess these impacts in order to develop effective management strategies. The conservation paradigm in the country has been shifted from “preservationism” to “sustainable use” approach during the past decades. Now, local resource use and socioeconomic development are advocated, which often compromise the long-term ecological balance and biodiversity conservation. Therefore, a sustainable future demands a balanced approach including both preservationism and sustainable use depending on the needs of target species to be conserved and local inhabitants. The diverse ecosystems and ethnic groups of India do not allow a single conservation approach to be implemented successfully across the country. Therefore, a feasible approach based on primary field data should be promoted for the successful conservation of the species and ecosystems. Further, the success and failure of any protected areas should be judged on the basis of conservation of species and ecosystems rather than planning whether to restrict or allow local communities and other such factors.

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