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Community Conservation

Amritpal Singh Kaleka and Gagan Preet Kour Bali

Abstract

Floral and faunal diversity represents the health of an ecosystem. Increase in the number of endangered plants acts as an alarming sign of ecosystem's imbalance. The ecological failure pose threat to our own health, thus by saving endangered species our own health is being saved. Government, non-profit international organizations, local communities and individuals are working together to protect and restore population levels. Biological Diversity Act (2002) for conservation of biodiversity is a landmark effort by Indian government as it provides mechanisms for knowledge, sustainable use of components of biological diversity and fair and equitable sharing of the benefits arising out of the use of biological resources. The various awareness campaigns have been conducted for local communities with regard to the conservation of endangered species. Both in-situ (on site) and ex-situ (off site) conservation strategies target critical habitats under continuous threat of extinction. Conservation programmes that centred mainly on the local masses which completely depend upon the environment including forests, lakes and wildlife for their needs truly showcase the leadership of local and indigenous communities in protecting biodiversity. The rights of local communities in decision making must be recognized and supported through clear laws and regulations. Sacred groves, a legacy of prehistoric traditions of nature conservation act as an ideal centre for biodiversity conservation. Besides providing vital ecosystem services to people, these are of immense ecological significance. Community conservation is the need of the hour in terms of conserving biodiversity at ground level.

Keywords: awareness, communities, conservation, ecosystem, regulations

1. Introduction

The plant and animal species form the foundation of a healthy ecosystem. Endangered species give the indication that the ecosystem is slowly falling apart/ degraded. A loss of single species triggers the loss of other species within the ecosystem. The fast rate of extinction and species introduction pose a major threat to our biodiversity. Over 50% of species face extinction during five mass extinctions that occurred in the past 500 million years [1, 2] and now at present we are in the opening phase of sixth mass extinction [3] which is predicted to be human impacted [4]. Plants are significantly important for conservation of biodiversity both from ecological and biological point of view. Unsustainable harvesting and habitat degradation are posing tremendous threat to plant diversity. Cure for diseases eventually comes from plants. Over 50% of the 150 most prescribed

medicines were originally derived from plants or other natural products. According to the world conservation and monitoring Centre (WCMC) more than 8000 tree species are estimated to be endangered worldwide (www.unep-wcmc.org), however, between 22% and 47% of the world’s plants are predicted to be endangered [5]. So, all the plant species must be protected before they are lost forever from nature’s medicine cabinet.

Plants which are scare as the total population of the species have few individuals or are restricted to a narrow geographic range are known as rare plants [6]. A non-profitable conservation organization “Nature Serve” provides the scientific information and tools needed to help and guide effective conservation action and has developed a consisted method for evaluating relative imperilment of species emphasizing rare species. A variety of factors have been summarized and assessed based on the best available information i.e.,

- Total number and condition of occurrences (e.g., populations)
- Population size
- Range extent and area of occupancy
- Short and long term trends in the above factors
- Scope, severity and immediacy of threats

“Nature Serve” has provided ranks (**Table 1**) for species based upon the status of their availability and the extent of threat possessed by the plants.

To halt the rapid loss of biodiversity (plants & animals), the Endangered Species Act (ESA) was passed in 1973. It is referred as “Crown jewel” of United Nation’s environmental laws and one of the world’s strongest species protection laws [7]. The ESA is uniquely effective piece of environmental legislation as it does not demand a cost benefit analysis before action.

In India, the Biological Diversity Act (2002) for conservation of biodiversity strongly recommends the creation of Biodiversity Management Committees (BMC) at village level. It also provides mechanism for declaration of the areas being conserved for agricultural or wildlife biodiversity as Biodiversity Heritage Sites (BHS). Conservation communities represent the sustainable model of community development, a new approach providing alternative to conventional development approaches. It creates sustainable employment opportunities for the local inhabitants of the community and the surrounding region [8].

Rank	Definition
G ₁	Critically Imperiled- At very high risk of extinction due to extreme rarity (often 5 or few population); very steep decline
G ₂	Imperiled- At high risk of extinction due to very restricted range; very few populations (often 20 or fewer); steep decline
G ₃	Vulnerable- At moderate risk of extinction due to restricted range; relatively few populations (often 80 or fewer), recent and widespread declines
G ₄	Apparently secure- Uncommon but not rare; long term decline
G ₅	Secure- Common; widespread and abundant

Table 1.
Nature Serve Global Conservation Status Ranks for Species (G-ranks) [6].

2. Initiatives of government authorities

During last three decades, the Department of Biotechnology (DBT), GOI has undertaken a programme for conservation of 156 threatened plant species which has been successfully compiled and reviewed. A successfully tested protocol following an integrated approach for threatened species conservation is recommended for future conservation action.

Traditionally, community conserved areas throughout the country such as sacred groves and other community based protected areas have been providing in-situ conservation opportunities for the endangered and threatened species. Government has taken initiative for prioritization of threatened species and conservation actions largely on flagship faunal species. The successful in-situ conservation measures for plant groups are mainly Orchid Sanctuary at Sessa in Arunachal Pradesh and Rhododendron Sanctuary at Singba in Sikkim. The only means of ex-situ conservation of threatened plant species include field germplasm banks and institutional botanic gardens. Such programmes generally focus on ex-situ conservation of medicinally and economically important plants, and on-farm conservation of agricultural crops. All these activities are largely mentored and executed by the Ministry of Environment, Forests and Climate Change and Ministry of Agriculture, GoI. Under Umbrella Species Conservation programmes targeting big mammals, threatened plants get conserved. A protocol has been formulated for conservation of threatened plant species as under [9].

- a. Through ecological niche modeling (ENM), population inventory, characterization and mapping.
- b. To determine the conservation status, minimum viable population size and to assess extinction risk, meta-population modeling of selected species populations.
- c. Identification of factors responsible for depleting species populations and developing a species specific recovery strategy to remove detrimental factors.
- d. To identify species with greater diversity for genetic enrichment based on source-sink concept, the selected species populations undergo molecular characterization.
- e. Characterization of active principles in selected species in different habitats/populations.
- f. For mass multiplication, to standardize the macro and micro-propagation techniques.
- g. To address the regeneration failure, the reproductive biology of the selected species is studied in detail.
- h. Production of planting materials for reintroduction of the species in the areas identified through ENM.
- i. Establishment of field gene banks and herbariums at appropriate ecological zones.
- j. MoU with Forest Department and communities, and reintroduction with post-introduction monitoring protocol.

3. Why community-centred conservation

The only strategy to protect biodiversity is the conservation enclosures which restrict the access of communities to nature. Indigenous controlled territories are crucial to sustain habitats rich in biodiversity and the cultural knowledge that comes with those environments.

To achieve global targets of protecting biodiversity, the leadership of local and indigenous communities plays a significant role. Community conservation centers around the people that know and depend on their environment including forests, lakes and wildlife [10]. The rights of local communities to make decisions about their own resources must be recognized and supported through clear laws and regulations. The five principles have been framed by Global Biodiversity Framework 2020 through which governments and conservation partners can support community-centered conservation [11].

1. **Build trust based networks of people to collaborate for conservation:** Working together of governments, communities, environmental NGOs or other partners has positive influence on conservation outcomes due to increase in levels of trust.
2. **Promote equity and Gender equality:** The equity and equality for different groups like vulnerable communities and women are protected by International human rights. Women should be fully supported for developing strategies for the solution to the conservation dilemmas they face.
3. **Support reconciliation and redress:** Strict conservation enclosures over social injustice in conservation like land grabs etc. are characterized by forced displacement and exclusion. A conservation agenda across all levels i.e., local, regional, national and international should frame strategies to promote reconciliation and redress conservation injustices. The rights related to recognition of local and indigenous land and resource must be prioritized.
4. **Adopt a 'rights-based' approach:** For the success of conservation efforts in 2020 Global Biodiversity Framework, social justice is important. It is always neglected. It provides greater transparency about the access to critical resources, habitats and even the abilities of a person for participation in decision making. For local and indigenous communities, the transitions to rights-based are important as it enables local guardianship, thereby, improving conservation strategies. It requires increased collaboration from government and private sectors which still is an issue.
5. **Respect and revitalize local rules for decision making:** Local rules or customary systems are provided due respect. It also requires revitalization and support from partners. Efforts have been made to revitalize indigenous languages. The focus on customary rules led to the alignment with rights-based conservation strategies and focused on reconciliation as a pathway to conservation.

All these principles reflect the efforts of various international organizations along with that of government initiatives that supported community-centred conservation. These principles reflect the realities of communities (local and indigenous) as a whole and their aspirations (**Figure 1**).

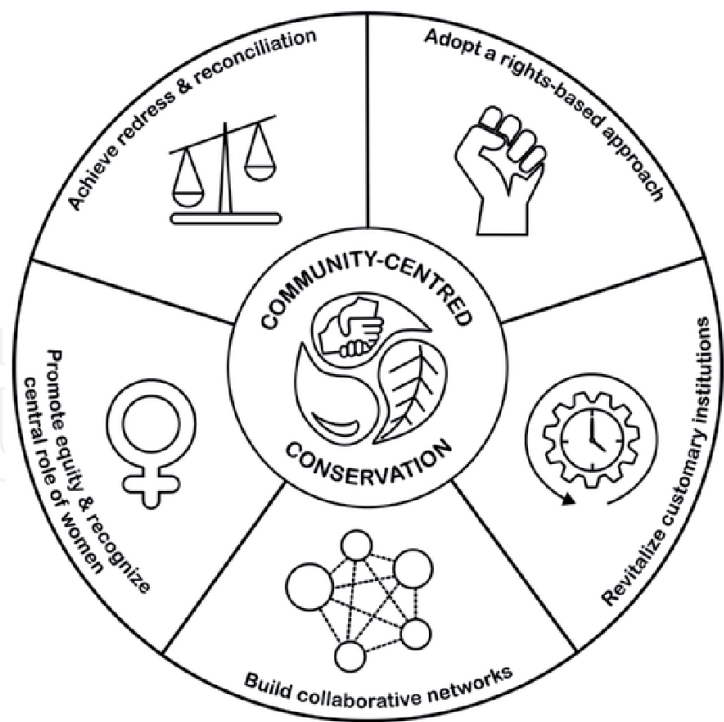


Figure 1.
Governance principles and community-centred Conservation.

4. Conservation strategies for endangered plants

The endangered plants are considered as jewels of our natural heritage and are best conserved, managed and protected by experts in collaboration with local communities. In India, the endangered species of plants (**Table 2**) are in urgent need of conservation as these are under continuous threat of extinction. The geographical areas with high number of endangered plants and large potential to protect those species should be given due attention and then the resources of endangered plants should be conserved [15].

The endangered plants which thrive in their natural habitats i.e., forests and grasslands are best conserved by maintaining healthy native habitat. The periodic monitoring is the only action taken to ensure that the plant populations are still thriving. It provides long term existence as the decreasing populations of plants can be survived at initial stages. Periodic monitoring plays a significant role in detecting early signs of decline and degradation in endangered plant populations and their habitat. Habitat restoration is possible by simple practices like removal of weeds and for those plants which rely on disturbance-dependent ecosystems like fire, wind or water.

Some plants are endemic and restricted to special soil types and other topological factors which are impossible to recreate. So, the conservation of viable habitat and maintenance of natural ecological processes are mandatory. Example: Limestone, Dolomite Mountains of San Bernardino County, California is home to plant species like Cushenbury milk-vetch (*Astragalus albens* Greene, 1885).

Pollinator decline acts as a major cause for the rarity of the plant species. In such cases, the propagation of endangered plants is carried out off-site and re-plantation of seedlings in their natural habitats is preferred. Reintroduction of pollinators in the specified habitats is also monitored, e.g., Clay phacelia (*Phacelia argilacea* Atwood, 1973).

For the conservation of endangered plant species, various in-situ and ex-situ measures have been adopted [16, 17]. Both of the practices target critical habitats, i.e.,

specific geographical areas which form the basis for the conservation of an endangered or threatened species. In-situ techniques focused on the prevention of total loss of the species and provide new plants for population re-establishment or habitat restoration. Botanical gardens using the system of Botanic Gardens Conservation International mainly constitute the ex-situ method for maintenance of species [18, 19].

Plant	Family	Common name	Region	Status
<i>Acer osmastonii</i> Gamble	Aceracea	Osmaston's Maple	West Bengal	Endangered
<i>Actinodaphne lawsonii</i> Gamble	Lauraceae	Not Known	Karnataka, Kerala	Endangered
<i>Amentotaxus assamica</i> Ferguson	Taxaceae	Assam Catkin yew	Arunachal Pradesh, Assam	Critically Endangered
<i>Belosynapsis vivipara</i> (Dalzell) C.E.C. Fisch.	Commelinaceae	Spiderwort	Madhya Pradesh	Endangered
<i>Buchanania bariberi</i> Gamble	Anacardiaceae	Not Known	Kerala	Critically Endangered
<i>Calanthe anthropophora</i> Ridley	Orchidaceae	Christmas orchid	Meghalaya	Endangered
<i>Cayrata pedata</i> var. <i>glabra</i> Gamble	Vitaceae	Kattuppirandai	Tamil Nadu, Kerala	Critically Endangered
<i>Ceropegia odorata</i> Nimmo Ex. J. Graham	Apocynaceae	Jeemi kanda	Gujarat, Melghat Tiger, Rajasthan, Salsette Island	Endangered
<i>Cissus spectabilis</i> (Kurz) Planch	Vitaceae	Not Known	Sikkim, West Bengal	Endangered
<i>Commiphora wightii</i> (Arnott) Bhandari	Burseraceae	Indian Bdellium tree, Guggul	Gujarat, M.P, Maharashtra, Rajasthan	Critically Endangered
<i>Cycas beddomei</i> Dyer	Cycadaceae	Beddomes' cycad	Andhra Pradesh	Endangered
<i>Decalepis hamitonii</i> Wight & Arn.	Apocynaceae	Swallow root	Peninsular India	Endangered
<i>Dicliptera abuensis</i> Blatt.	Acanthaceae	Not Known	Rajasthan	Endangered
<i>Eugenia argentea</i> Bedd.	Myrtaceae	Not Known	Kerala	Endangered
<i>Ilex khasiana</i> Purk.	Aquifoliceae	Not Known	Shillong peak in Meghalaya	Critically Endangered
<i>Impatiens nilagirica</i> Fischer	Balsaminaceae	Not Known	Tamil Nadu	Endangered
<i>Kingiodendron pinnatum</i> (DC.) Harms.	Fabaceae	Malabar Mahagony	Kerala, Karnataka, Tamil Nadu	Endangered
<i>Ophiorrhiza incamata</i> Fischer	Rubiaceae	Not Known	Kerala	Endangered
<i>Pterocarpus santalinus</i> Linn. f	Fabaceae	Red sandalwood	South Eastern India	Endangered
<i>Renathera imschootiana</i> Rolfe	Orchidaceae	Red vanda	Manipur, Nagaland, Mizoram	Endangered

Table 2.
Endangered plants in India [12–14].

The recent advancement in plant biotechnology permits the maintenance and propagation of endangered species. It allows high added value compounds to be obtained in a sustainable and ecological way in plant cell and organ cultures without need to harvest plants under pressure in their native habitat. Nowadays, it is easier to investigate the population structure, genetic variations and recent demographic events in threatened species using population genomic approaches. A genomic approach provides detailed account of the present and past demographic parameters, phylogenetic issues and molecular basis for inbreeding. It also helps to understand genetic diseases and provides information about the mechanisms related to low fitness with low genetic variations. Genetic and environmental methodologies are integrated into conservation biology and used to design fast monitoring strategies [20].

Seed banks can be maintained through desiccation or by cryopreservation (-196°C) [18, 21]. The Royal Botanic Gardens of Kew is host to the world's ex-situ collection of seeds from wild flowering plants. The plant species which cannot be conserved through conventional seed banking need other treatment as dormancy of rupture [19]. In some plants the seed production is very low so seed storage is impossible. Therefore, the strategies which induce physiological and mechanical seed dormancy rupture must be carried out to cause a positive response on seed germination [21].

Micro propagation is a method of producing certain plants in much larger numbers than by natural methods. It results in large number of clones of the original plant via tissue culture techniques, the clones can be further used to cryopreserve or reestablish the plant populations [21]. It is the only viable option for ex-situ conservation of those plants which cannot be conserved through conventional seed banking [18].

There are many ways to develop strategies for conservation of endangered plant species. In order to protect plant species and stop further plant declination, get involved in the conservation strategies and programmes [22].

5. Main objectives of communities involved

Communities embodied a wide range of objectives for which they ultimately conserve biodiversity. It is not necessary that Biodiversity conservation is the main objective behind the action. Some of the objectives of the communities involved are as under [23]:

- a. **Resource enhancement/maintenance:** A serious scarcity of timber, fuel wood, fodder, medicinal plants etc. faced by communities initiated an effort towards conservation along with sustainable management of ecosystem. Conservation is also initiated by local inhabitants to ensure the continuous availability of resources for future generations. Examples include: Van Panchayat forests in Uttarakhand; Kailadevi Wildlife Sanctuary in Rajasthan; Jardhargaon in Uttarakhand; CFM (Community Forest Management) villages in Orissa and West Bengal etc. Resource enhancement and maintenance is one of the highest motivational factors for communities to start conservation.
- b. **To counter ecological threats:** Ecological threats like frequent landslides, drought conditions, reduced soil fertility, non availability of water and other natural calamities led the communities to take action. Examples: Hunsur village in Karnataka and Konark-Balukhand in Orissa.
- c. **To counteract developmental threats:** The natural resources are under continuous and alarming threat from commercial and developmental projects. Community's livelihood completely depends upon these resources. So as to

safeguard them, the community conservation is initiated. Examples: Chipko movement (against timber logging) in Uttarakhand and Mendha village (against dams and paper mill) in Maharashtra.

d. Religious sentiments and Cultural ethics: India is a land of divine entity and home of saints. The religious sentiments of people are associated with plant/animal species, sacred landscapes and rivers. To protect these religious entities, communities bound themselves to conserve biodiversity. Examples: Sacred groves (**Table 3**) like Ajeevali village in Maharashtra, sacred landscapes of Sikkim, sacred ponds and forests of Uttarakhand etc. The sacred grooves include relic forest patches that form important repositories of forest biodiversity and provide abode to numerous plant and animal species. An inextricable link between the present society and past in terms of biodiversity, culture, religious and ethnic heritage exists in sacred grooves [25]. These grooves act as ideal centre for biodiversity conservation. Sacred grooves are found all over India especially in those regions where indigenous communities inhabit.

Our country is a place where multiple customs and traditions not necessarily linked to religious sentiments are being practiced. These customs and traditional beliefs also inculcate the sense of responsibility in common folks towards the protection of resources. Examples: Community land use in North-East India, heronries in villages like Kokkare Bellure in Karnataka etc.

S. No	States	No. of Documented Groves
1.	Andhra Pradesh	750
2.	Arunachal Pradesh	58
3.	Assam	40
4.	Chhattisgarh	600
5.	Gujarat	29
6.	Haryana	248
7.	Himachal Pradesh	5000
8.	Jharkhand	21
9.	Karnataka	1424
10.	Kerala	2000
11.	Maharashtra	1600
12.	Manipur	365
13.	Meghalaya	79
14.	Orissa	322
15.	Rajasthan	09
16.	Sikkim	56
17.	Tamil Nadu	448
18.	Uttaranchal	01
19.	West Bengal	673
Total = 13,720		

Table 3.
Sacred Groves in India [24].

6. Global scenario of community conservation

Conservation of biodiversity is a global issue, important for humanity as a whole [26]. Conservation is typically a complex system as the natural environment itself is a complex adaptive system [27]. The global as well as the local objectives of conservation of resources are fulfilled by community-conservation strategies and programmes. The global scenario of community based conservation is being supported by a case study of indigenous communities of Kenya.

Maasai and Rendille Communities of Kenya: A case study

The two indigenous communities namely Maasai and Rendille in Kenya played a significant role in conservation of biodiversity. Maasai people are basically nomadic community that co-existed with wildlife. The land resources along with the flora and fauna were under continuous developmental threat that initiated the community conservation.

The Maasai from Trans Mara, Narok country and the Rendille from Kargi, Kamboye, Korr and Logoloho of Marsabit country carried out conservation strategies after witnessing the increasing biodiversity loss. They created and managed 6,000 acres of land under Nyekweri Forest Kimintet trust so as to conserve forests and wildlife. Maasai are considered as unique for their cultural prohibition against hunting of wild animals except in extreme conditions [28]. The community members asserted that their area is an important biodiversity hotspot with indigenous forests hosting sacred sites; sheltering wildlife; trees providing food, fodder, fuel and medicinal plants. During assessments, community men from Nyekweri Forest Kimintet trust identified key external threats such as the erosion of cultural values governing conservation, privatization of lands and loss of traditional, ecological knowledge and deforestation due to charcoal burning and overgrazing to the existing biodiversity [29].

Women of these tribes rarely participate in decision making bodies. They are the stake holders of traditional knowledge and values and act as inter-generational transmitters of knowledge [30]. The community members undertake reforestation initiatives and conserved their area. It helped in restoration of degraded areas with the indigenous tree species. The community members of trust proposed solutions to threats including support for the community as [29]:

- Exchange visits to other wildlife conserved areas for practical learning and adaptation of best practices.
- Strengthening linkage with country and national government environmental authorities like Kenya Forest Service (KFS) and Kenya wildlife service (KWS).
- Financial support for management and reforestation initiatives.
- Raising awareness to strengthen the role of women in conservation by creating women's networks for conservation.

Alias Morindat (International Institute of Environment & Development) has advocated the significant role of local people in conservation strategies and put forth as,

“Indeed people should not be seen as objects or empty vessels’ but rather as drivers of their destinies and masters of their own development.”

7. Limitations of community conservation

Communities that are actively involved in the conservation of an area that provides livelihood to them are under continuous threat from internal as well as external factors thereby restricting them to get social, administrative and legal recognition. Community conservation has certain, unavoidable limitations that require urgent thought process for better understanding and resolution. Community conservation may not necessarily address the issue of overall biodiversity conservation as species that are useless or undesirable to the community may not be given attention [10]. Both ecological as well as social conditions hinder the conservation programmes. The limitations should not be demoralizing but emphasize areas where the community and other partners (NGO) have little control and need to build partnerships. It highlights the need for government partnerships. Some of the important limitations are discussed as under:

- a. **Man-Animal conflict:** Due to the protection of the areas, the population of wild animals and birds increased leading to the increase in crop damage and livestock loss. This situation leads to serious man-animal conflict for the procurement of resources. In some areas, the concerned villagers have opted for reopening of regulated hunting of animals. Even the government has taken initiative to help local people in such conserved areas e.g., the Snow Leopard Conservancy in Hemis National Park in Ladakh has initiated a programme aimed at helping local people in reducing damage to livestock caused by the snow leopard and help them in getting adequate and timely compensation for the incurred damages [31].
- b. **Lack of Monitoring and Evaluation:** For the better and expected results the working of the communities should be properly and timely monitored. But there are few community conservation efforts that are monitored and evaluated for assessment of social and ecological impacts. The internal monitoring system in maximum of the involved communities is lacking. The trends and changes observed through monitoring and evaluation are purely technical and need critical assessment.
- c. **Lack of baseline information:** The basic information about the flora and fauna of the area is not available. Communities rely on the oral histories and information narrated by the older people which are not authenticated. The youth of the area should be motivated and trained to document the flora and fauna of the local area so as to implement conservation strategies. Environment education is essential for the future of conservation and educational components are thus critical for sustainable community-based conservation initiatives.
- d. **Limited capacity:** It is not possible for communities to manage finances, manage ecosystems and monitoring and evaluating results. They rely on others for administrative skills. The capacity building programmes for various government officials including forest officers and officials of other departments, NGO's should be organized to sensitize them to work together for the common cause of conservation. They should play a role of support, facilitation, guidance and mentorship. Community conservation is a slow process as it is mainly a social process and has to progress taking into consideration various issues. The implementing agencies along with the collaborated NGO's have to work in accordance with each other to achieve the targets at stipulated time.

The success of community conservation mainly depends upon the empowerment of the whole community. Vulnerable communities which are affected by ecological changes should be involved actively in conservation practices. Conservation reforms lead to other reforms in that area such as empowerment, gender equity, education, cooperation etc. Thus, community-centred conservation is not an isolated entity.

8. Conclusion

Eliana Elias- National geographic Explorer has accurately mentioned, “A Community in balance leads to a planet in balance”. Community based conservation is being increasingly recognized as a major global force in the protection and sustainable management of ecosystems and species [32]. Plants are ecologically and biologically an important constituent of ecosystem. Forests host sacred sites, provide food, fodder, fuel, medicinal plants etc and are home to diverse flora and fauna. Forests are socially and culturally significant for those who have conserved them through customary laws. But the present scenario of continuous habitat destruction, introduction of invasive species, decline in natural pollinators and most devastating the threats from developmental projects led to the species extinction and increased number of endangered species. The over exploitation of medicinal plants aids the destruction caused to rare plants.

Despite of strict implementation of conservation laws which include prohibition of the collection of endangered plants from grasslands and forests; rigorous punishment to the defaulters etc. are still the prime motive i.e., conserving flora of a region is not fulfilled effectively. Conservation should be people centred and address the diverse livelihood of community along with the conservation of biodiversity. Sacred grooves are legacies of ancient traditions of nature conservation forming a strong linkage between present and past in terms of biodiversity. Biodiversity rich sacred grooves possess immense ecological and social significance. These grooves thrive well and automatically conserved at those places where indigenous communities inhabit. Communities hold the key to expand conservation strategies so as to safeguard biodiversity although it facilitates recovery but does not consider the requirements of each species [33]. By developing involvement with communities and engaging in development and conservation strategies, win-win solutions can be created [29]. Women although considered as inter generation transmitter of knowledge and values should be involved in decision making process i.e., providing gender equity and thereby emerging as allies in affecting change in the society. A sustainable earth cannot be created alone. Communities must be advocated for conservation and collaboration.

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