
MOBIUS
FOUNDATION
GUARDING
OUR
GREENS
A Call to Action for Biosphere Conservation

Guarding Our Greens - A Call to Action for Biosphere Conservation

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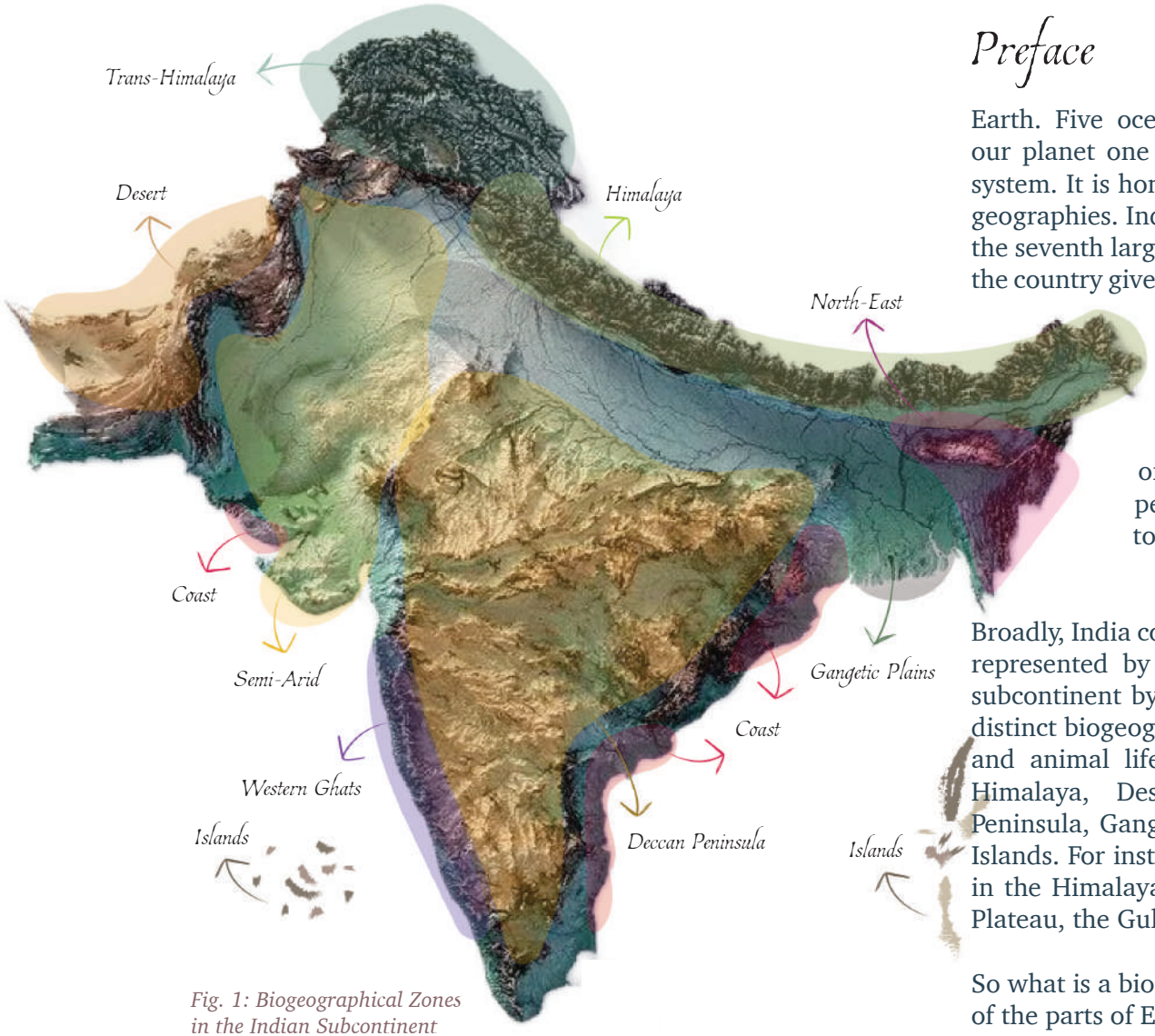


Fig. 1: Biogeographical Zones in the Indian Subcontinent

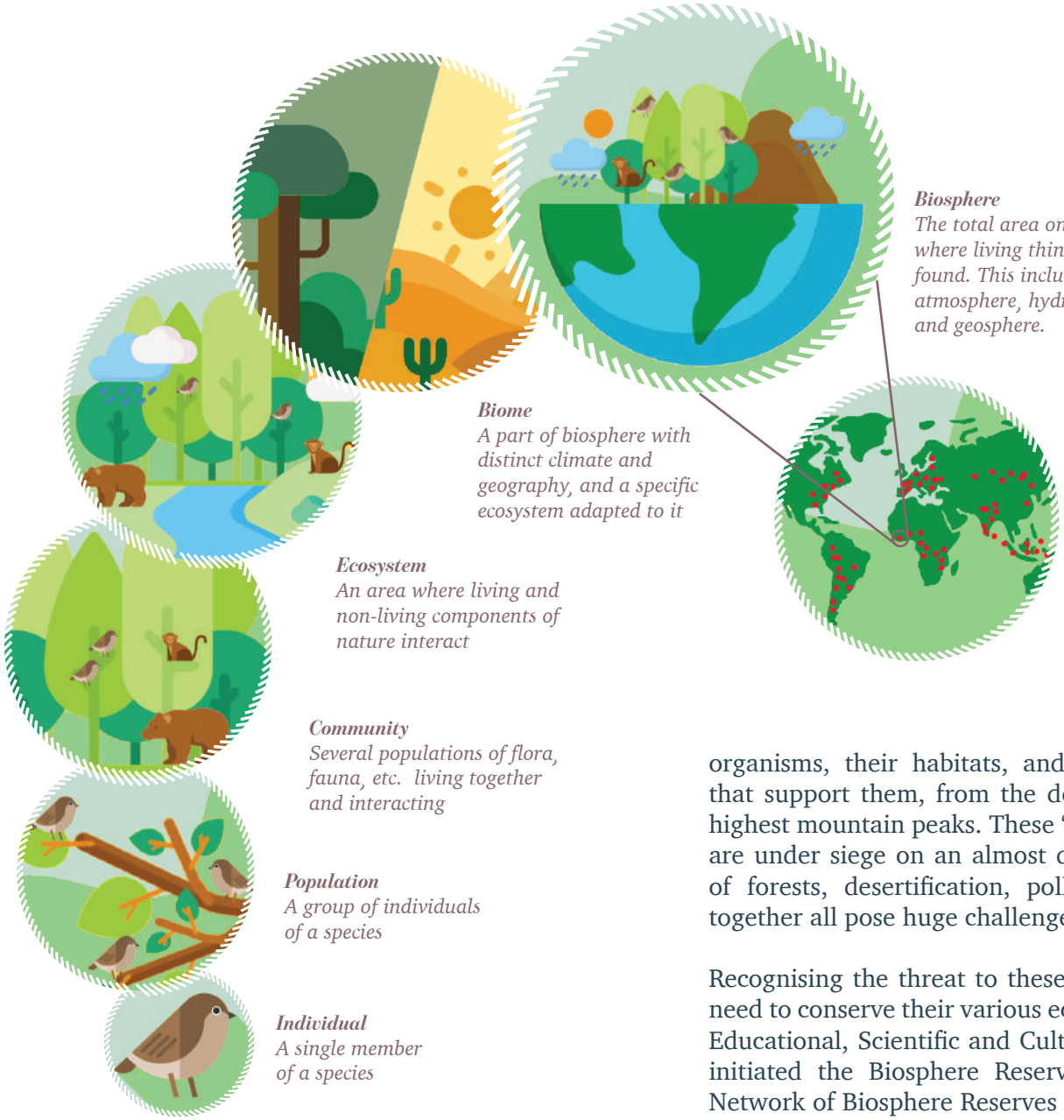
Preface

Earth. Five oceans, two poles and seven continents make our planet one of the most unique ecosystems in the solar system. It is home to incredible biodiversity spread across its geographies. India, given its sheer scale of size—the nation is the seventh largest country in the world—it is no wonder that the country gives its region its name: The Indian subcontinent.

Despite covering only 2.4 per cent of the world's landmass, India accounts for between 7 and 8 per cent of the planet's recorded species. The geographical location of India provides a wide latitudinal spread and permits a vast range of climatic, geological and topographic variations; resulting in the country being blessed with rich biosphere diversity.

Broadly, India consists of two 'Realms'—the Himalayan region represented by the Palaearctic Realm and the rest of the subcontinent by the Malayan Realm as well as 10 Biomes—distinct biogeographic zones with specific climate, vegetation and animal life. These are classified as: Trans Himalaya, Himalaya, Desert, Semi-Arid, Western Ghats, Deccan Peninsula, Gangetic Plains, Coast, the North East and lastly, Islands. For instance, the Nanda Devi Biosphere Reserve falls in the Himalayan biogeographic zone, Panna in the Deccan Plateau, the Gulf of Mannar in the Coastal zone and so on.

So what is a biosphere? Simply put, the biosphere is made up of the parts of Earth where life exists, encompassing all living



Biosphere
The total area on Earth where living things are found. This includes the atmosphere, hydrosphere and geosphere.

Biome
A part of biosphere with distinct climate and geography, and a specific ecosystem adapted to it

Ecosystem
An area where living and non-living components of nature interact

Community
Several populations of flora, fauna, etc. living together and interacting

Population
A group of individuals of a species

Individual
A single member of a species

Biosphere Reserves
Areas in various locations that serve as models for how humans can interact with nature in a harmonious way.

organisms, their habitats, and the non-living components that support them, from the deepest ocean trenches to the highest mountain peaks. These "living laboratories", however are under siege on an almost daily basis: Rampant clearing of forests, desertification, pollution and global warming, together all pose huge challenges to our biospheres.

Recognising the threat to these biospheres and the pressing need to conserve their various ecosystems, the United Nations Educational, Scientific and Cultural Organisation (UNESCO) initiated the Biosphere Reserves Program and the World Network of Biosphere Reserves in 1971. A Biosphere Reserve

is a protected area that hosts specific plant and animal life. The first Biosphere Reserve—the Everglades National Park in the US—was established in 1979. Nearly 50 years later, today that number has grown to 759 Biosphere Reserves spread across 136 countries, including 22 transboundary sites. In 1986, the Nilgiri Biosphere Reserve was designated India's first. Today that number has grown to 18 Biosphere Reserves; 12 of which are recognised by UNESCO. Indian Biosphere Reserves are spread across 14 states and seven biogeographic zones.

The problems that biospheres across the globe face reflect in the Indian context as well; deforestation, over-exploitation due to population pressure, change in land use due to agricultural expansion, illegal wildlife trade, climate change, and unregulated tourism, all pose very real threats. These issues collectively not just threaten their sustainability but their very survival, further challenging the efforts to maintain the biodiversity natural resources within these reserves.

In order to draw attention to, and raise awareness about these challenges, the New Delhi-based not-for-profit, Mobius Foundation organised a panel discussion, *'Biosphere Reserves: Strategies for Sustainable Development and Conservation'*. Held on February 7th 2025, at the storied Constitution Club of India—located at the heart of the capital's power centre—the event was hosted by Mr. Pradip Burman, Chairman, Mobius Foundation. Setting the tone for the evening, his welcome speech stressed the need for biosphere protection, "Biosphere Reserves serve as critical pillars of a sustainable future. Collaborative efforts are essential to preserving these declining valuable ecosystems, ensuring that future generations continue to benefit from their ecological and economic contribution."

The event brought together policy makers, experts from diverse fields such as ecology and academia as well as stakeholders, like members of indigenous communities, allowing them to share insights, address the challenges, and explore innovative approaches for the effective management and conservation of these reserves. Ably moderated by senior journalist, Abhilash Khandekar, the thought-provoking, interactive panel discussion featured experts such as Dr. Benno Böer, Chief of Natural Sciences, UNESCO, South Asia Regional Office, New Delhi, Dr. Erach Bharucha, Director, Bharati Vidyapeeth Institute of Environment Education and Research, Pune; conservationist, and author, Dr. Priya Gupta, PhD Lead, Social Development & Safeguard Governance, Law & Policy Division WWF-India, and Dr. Aditya Joshi, IFS (Retd), Ex-PCCF/HoFF, CWLW Manipur, Advisor, Mobius Foundation.

The discussion ranged over diverse subjects such as the status and issues faced by Biosphere Reserves, collaborative governance, stakeholder engagement, community involvement in conservation, adequate funding and better utilisation of funds in conservation, livelihood and development initiatives, concluding in a vibrant Q&A session between the audience and the panellists.

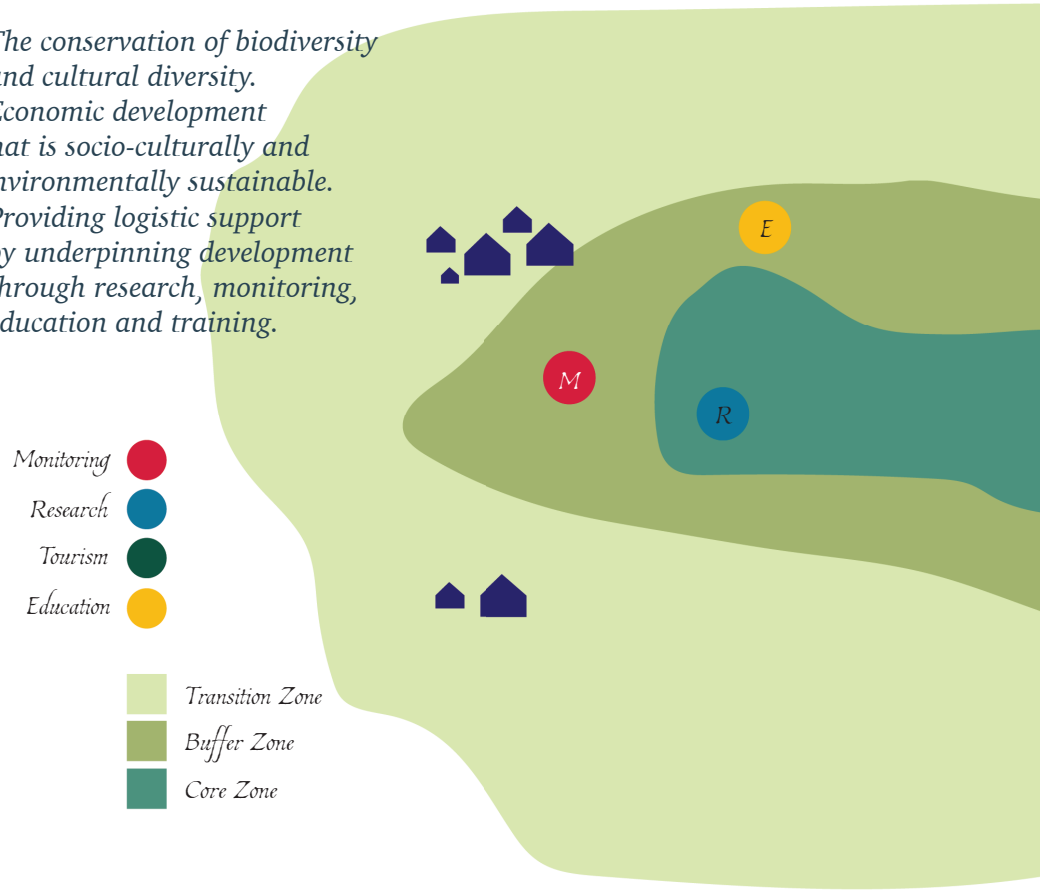
What are Biosphere Reserves?

Biosphere Reserves, commonly referred to as BRs, are areas that focus on conserving biodiversity, promoting sustainable economic development, and preserving its cultural values. These sites are used to test interdisciplinary approaches to understanding and managing changes and interactions between social and ecological systems, including potential conflict prevention and management of biodiversity. They are places that provide local solutions to global challenges. Biosphere Reserves include terrestrial, coastal and fresh-water ecosystems. Each site promotes solutions reconciling the conservation of biodiversity with its sustainable use. Since a key element in any biosphere is its resident indigenous population, they also enhance local identity, trigger economic development through sustainable activities, and strengthen community-based resource conservation.

Biosphere Reserves favour the discovery of solutions to problems such as biodiversity loss, deforestation, desertification, environmental pollution, climate change etc. These reserves are vital for exploring conservation and sustainable development approaches, while supporting research, education, and eco-tourism. They function as model regions for sustainable development and offer valuable insights for global ecological conservation.

In a nutshell, Biosphere Reserves have three main functions:

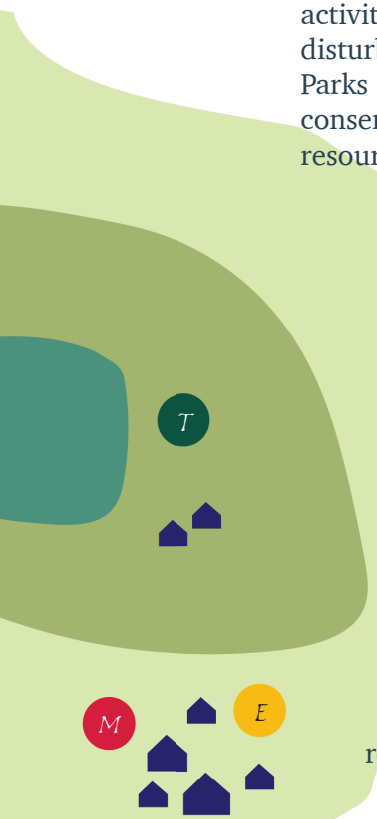
1. *The conservation of biodiversity and cultural diversity.*
2. *Economic development that is socio-culturally and environmentally sustainable.*
3. *Providing logistic support by underpinning development through research, monitoring, education and training.*



Biosphere Reserves are broadly divided into three zones:

Core Zone: These areas are protected areas, where human activity and intervention is restricted in order to limit disturbance. Typically Core Zones fall within National Parks and Wild Life Sanctuaries. Their main objective is the conservation of landscapes, ecosystems, species and genetic resources.

Buffer Zone: These surround or abut the Core Zone, and are used for human activities compatible with ecologically sustainable practices for development. Buffer Zones can also reinforce scientific research, monitoring, training & education without obstructing the conservation objectives of the Core Zone. Other permissible activities are those that help to manage natural vegetation, agricultural land, fisheries, or forests to enhance the quality of the ecosystem's production. This zone may also include limited recreational and eco-tourism activity.



Transition Zone: Transition areas are the peripheral areas of a BR where human interventions like community settlements, agriculture, forestry and recreational activities are permitted. Working in tandem with the reserve management and local communities, they foster socio-culturally and ecologically sustainable economic and human activities.

What Constitutes a Biosphere Reserve?

In 1971, UNESCO initiated the Biosphere Reserves Program and the World Network of Biosphere Reserves. Through the World Network of Biosphere Reserves, UNESCO maintains an information network that seeks to solve problems faced by Biosphere Reserves, using the best available technology, whilst promoting sustainable development and serving as a reference system or data base for monitoring and evaluating changes in natural ecosystems. In 1995, UNESCO's General Conference approved the Seville Strategy for Biosphere Reserves and the Statutory Framework of the World Network of Biosphere Reserves; the latter functions as the "soft legal framework" for the development and formal recognition of Biosphere Reserves. Biosphere Reserve sites can be proposed by all Member States and Associate Members of UNESCO.

The Man and the Biosphere (MAB) program also launched in 1971, is UNESCO's leading initiative in biodiversity conservation and sustainable development.

United Nations Educational, Scientific and Cultural Organization

Man and the Biosphere Programme

Its main focus is in enhancing the relationship between people and their environments. The MAB program is an intergovernmental scientific program that aims to establish a scientific basis for optimising the relationship between

communities and their historic habitats. It combines natural and social sciences with a view to improving human livelihoods and safeguarding natural and managed ecosystems, thus promoting innovative approaches to economic development that are socially and culturally appropriate as well as environmentally sustainable.

Individual national governments nominate areas that meet a set of minimal criteria for designation as a Biosphere Reserve under Article 4 of UNESCO's statutory framework of MAB program. These then remain under the sovereign jurisdiction of the states where they are located. Biosphere Reserves are designated as such, under the intergovernmental MAB Program, by the Director-General of UNESCO following the decisions of the MAB International Coordinating Council (MAB-ICC). Their status is internationally recognised. Member countries can submit their sites through a pre-determined designation process.

Once a Biosphere Reserve is notified, its functions are reviewed every ten years under the Periodic Review Process of the UNESCO's MAB program. This periodic assessment is important for the development and continuity of a Biosphere Reserve. It enables a review of the functioning, zoning, and scaling of the Biosphere Reserve as well as the involvement of the human populations living in and around the reserve. This periodic review presents an opportunity to carry out a qualitative survey of the actions implemented and their results. It is a time to take stock of the progress made by the Biosphere Reserve, especially as far as the updation of knowledge, skills and expertise in resource and ecosystem management is concerned. It also provides an opportunity to review and update the zonation system and assess its relevance. In addition, it allows re-examining the objectives and management approaches, as well as addressing the issues and the challenges related to implementation.

Considering the diversity of ecosystems in India, and also recognising the importance of Biosphere Reserves in ensuring its long-term conservation and sustainable use, in 1979, the Indian Man and Biosphere Committee identified potential sites for designation as Biosphere Reserves. Subsequently, in 1983, the Committee of Secretaries approved the establishment of Biosphere Reserves in India for the conservation of critical eco-systems. In 1986, the Indian National Biosphere Program was launched with the Nilgiri Biosphere Reserve being the first to be notified. Broadly following UNESCO guidelines, the program's main objectives are:

a) To serve as a wider base for the conservation of the entire range of living resources and their ecological foundations, in addition to the already established Protected Area (PA)

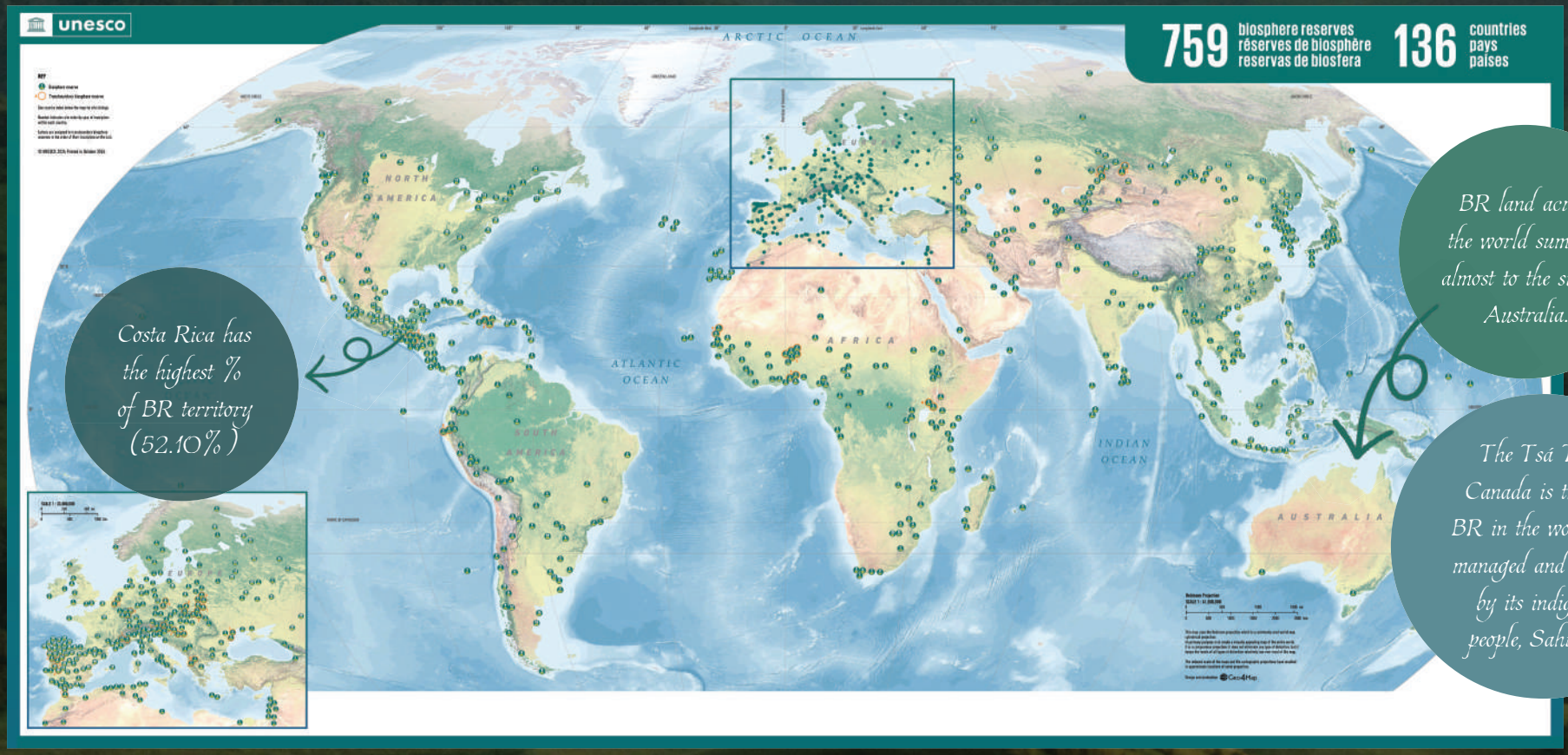


Fig. 3: Global presence of Biosphere Reserves as of October 2024

Spain has the most number of BR sites (52)

All individuals (6,600) of the highly-endangered Sumatran Orangutan live in the Gunung Leuser BR in Indonesia

Brazil has the biggest BR territory (1.7 million km^2)

There are about 275 million people living in Biosphere Reserves worldwide.

Mount Everest is located in the Qomolangma BR in China

network system.

b) To bring representative ecosystems under conservation and sustainable use on a long-term basis. To ensure participation of local inhabitants for effective management and advise on means of improving livelihoods of these local communities through sustainable use.

c) To integrate scientific research with traditional knowledge of conservation, education and training as a part of the overall management of Biosphere Reserves.

Today, India has 18 notified Biosphere Reserves, of which 12 Biosphere Reserves—which have been included in UNESCO's MAB World Network while 3 others are in the pipeline, bringing it to a total of 15—are recognised for their unique biodiversity, in the UNESCO's MAB World Network. Our Biosphere Reserves range over extreme geographies; from the warm tropical waters of the south to frigid Himalayan icescapes. They encompass a multiplicity of communities and cultures. India's contribution to the UNESCO-recognised list includes the Gulf of Mannar in Tamil Nadu, a marine biosphere renowned for its rich biodiversity—incidentally it is the first designated marine Biosphere Reserve in south and south-east Asia—the Nilgiris, the Sunderbans, Nanda Devi, Nokrek in Meghalaya; Pachmarhi and Panna in Madhya Pradesh; Similipal, in Orissa; Achanakmar-Amarkantak which straddles the borders of Madhya Pradesh and Chattisgarh; Agasthyamala in Kerala, Khangchendzonga (Kanchenjunga) in Sikkim and finally the Great Nicobar Biosphere Reserve.

Biospheres and Communities

Biospheres to be clear, encompass all life on Earth and its interactions with the environment; while communities are groups of different species living and interacting in the same area, forming part of the larger ecosystem within the biosphere. Communities are a fundamental part of the biosphere. They are among the building blocks of ecosystems, which in turn make up the larger biosphere. The biosphere is composed of numerous communities and ecosystems, each with its own unique characteristics and interactions. The health and stability of the biosphere depends on the health and functioning of its communities and ecosystems. Changes in one part of the biosphere, such as a community or ecosystem, can have far-reaching effects on the entire system.

Understanding the interactions within communities and ecosystems is crucial for understanding and addressing environmental challenges, such as climate change and biodiversity loss. Human communities—especially indigenous communities—that reside within various biospheres are especially important to biospheres. In a country as vast as India for instance, where language, diet, customs, generational knowledge and experience can change over a span of mere kilometres, the integration of community with their environment and a nuanced understanding of their particular needs, is vital, to not just the health but to the very survival of Biosphere Reserves. Indigenous communities like the Kani at Agasthyamala, Mishing at Dibru Saikhowa, Shompen and Nicobarese from Great Nicobar Islands, Van Gujjars, for instance, have lived in and around the jungles

Fig. 4: Two men of the forest-dwelling Kani community in the Western Ghats, collecting beeswax and honey.

Fig. 5: A Mishing woman climbing into her home—which are huts built on raised platforms, or stilts, to protect during floods in the Brahmaputra.

Fig. 6: Members of the Shompen tribe of the Great Nicobar out to forage and hunt.

Fig. 7: A Nicobarese family outside their hut; the house is also built on stilts much like the Mishing houses, since the population lives along the coast.

of Rajaji National Park in the state of Uttarakhand, for generations. A nomadic pastoral community that practices a unique form of transhumance—a seasonal migration along with their livestock between high altitude summer pastures locally called bhugiyals, and lower winter grounds within the park—Van Gujjars meaning "people of the forests", have coexisted with the Himalayan ecosystem for centuries. With incomes largely derived from selling dairy produce like milk etc. to the outlying villages, Van Gujjars are dependent on forest resources to provide fodder for their cattle. Their buffalos graze on specific grasses, promoting biodiversity and preventing the dominance of invasive species; vital for the health of this biosphere.
Similarly, there are many indigenous communities in other parts of India that have resided in jungles and harmoniously coexisted with nature for generations. Traditionally, they have collected forest produce like honey, herbs and bamboo etc. and have depended on these forest resources for their livelihoods. Their unparalleled knowledge of the forests' flora and fauna makes them equal stakeholders and valuable allies in biosphere conservation.

At the Mobius Foundation panel discussion, *'Biosphere Reserves: Strategies for Sustainable Development and Conservation'*, Dr. Böer stressed on the importance of community participation and the role of Biosphere Reserves in contributing to the green economy by promoting sustainable income-generating activities, such as eco-tourism and producing traditional handicrafts. In his opinion, these reserves play a crucial role in fostering harmony between human activities and natural ecosystems, ultimately supporting sustainable development and biodiversity conservation. Additionally, Dr. Böer emphasised the importance of robust governance mechanisms and collaborative approaches among stakeholders. He stated, "Biosphere Reserves are 'living laboratories' where we can apply, test, and demonstrate the best practices for humans living in harmony with nature. Active community participation in the planning, management, and zonation is crucial to their success." This approach not only ensures sustainable development but also strengthens local identity and ownership, enabling communities to actively participate in the conservation and management of their natural resources.

Adding to this, Dr. Priya Gupta highlighted that conservation should be approached with a local perspective, as it has a global impact. According to her, "Biosphere Reserves are not just ecological zones but also biocultural reserves, where cultural systems play a crucial role in the survival of biodiversity." Biosphere Reserves have three main functions: Conservation, sustainable economic development, and logistic support. Conservation focuses on conserving biodiversity and cultural diversity. Economic development emphasises socio-culturally and environmentally sustainable growth. And lastly, logistic support enables research, monitoring, education, and training, contributing to the knowledge and management of these ecosystems.

Van Gujjar community carrying their injured buffalo calf up the mountain.

The Challenges to Our Biosphere Reserves

Biosphere Reserves, across the globe face multiple challenges, the most dire being biodiversity loss, climate change, pollution and species invasion. In India, the main challenges for Biosphere Reserves include habitat degradation, climate change, conservation vs. livelihood conflicts, and the need for sustainable development and adequate funding. The pressures of rapid urbanisation, population growth and the need for infrastructural development have all contributed to habitat fragmentation and loss due to rampant deforestation. This in turn, threatens the integrity of ecosystems within Biosphere Reserves.

Natural resources like timber, non-timber forest products (NTFPs), water etc. have been overexploited and poaching due to the illegal wildlife trade, have all led to the depletion of environmental resources within Biosphere Reserves. Apathy from communities living in the Buffer and Transition Zones and the lack of awareness and engagement in conservation efforts can oftentimes lead to unsustainable practices, thereby hindering the long-term success of Biosphere Reserves.

Climate change poses a significant threat, altering weather patterns, increasing temperatures, leading to extreme events like forest fires, landslides, floods and droughts, that disrupt ecosystems and the biodiversity contained within them. Pollution from agricultural runoff, industrial activities, and waste disposal cause immeasurable harm to the environment within Biosphere Reserves, impacting water quality and the overall ecosystem's health.

The introduction of invasive species has also impacted the health of Biosphere Reserves. They disrupt the balance of native vegetation, adversely impacting biodiversity and ecosystem function. In India for instance, the common Lantana (Lantana camara) was introduced by the British as an ornamental plant in the early 1800s. Native to the South American tropics, it quickly escaped the confines of manicured gardens, and became naturalised, spreading rapidly across the country. A plant that was initially introduced for its beauty, Lantana today, is recognised as one of the world's most invasive species. Worryingly, it has occupied more than 40 per cent of India's tiger range. The species has not only devastated the forest floor, but its canopy as well. It is now also rampant along roadsides, in fallow fields and agricultural areas.

Fig. 8: Lantana infestation in a large green pocket.

Biosphere Reserves are largely dependent on government for their survival. Many Biosphere Reserves face a lack of funding and resources for conservation and management efforts, hindering their ability to effectively protect biodiversity and promote sustainable development. In some cases, the situation is further exacerbated by inadequate enforcement of environmental laws and regulations. This, coupled with weak

governance structures—which place Biosphere Reserves fairly low on their priority list—undermines the effectiveness of Biosphere Reserve management and the implementation of conservation measures.

Another key challenge that can also threaten the integrity of Biosphere Reserves is man-animal conflict. Community settlements, often abut the Buffer Zones of various Biosphere Reserves. Their livestock frequently falls prey to big cats and other predators. Standing crops in fields are also adversely impacted by the predations of wild animals like elephants, deer and wild boar. These animals cause significant damage to the crops by trampling, eating and uprooting them.

Fig. 9: Villagers in Sawai Madhopur district of Rajasthan chase away a leopard who strayed 40 km away from its territory.

This in turn can result in substantial economic losses for farmers, particularly those in areas where wild animal populations are high. These factors contribute to rising intolerance from some communities who see this as an issue of conservation at the cost of their livelihood. In the case of the Sundarbans Biosphere Reserve, home to the Bengal Tiger *(Panthera tigris tigris)*, which has witnessed an increase in human population, the incidence of man-animal conflict is on the rise as well. Development, deforestation and poaching have also contributed to a reduction of the tiger's natural prey base—buffalo, deer, wild boar, and other large mammals that are native to the Sundarbans. As a result human settlers who rely on the forest for their livelihood often end up falling prey to these apex predators.

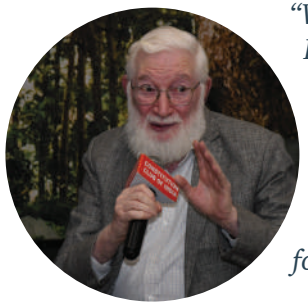
Similarly, in high altitude Biosphere Reserves, like the Nandadevi and Khangchendzonga Biosphere Reserves, home to the elusive and highly endangered Snow Leopard *(Panthera uncia)*, humans are their sole predator. The snow leopard's usual prey—the Argali *(Ovis ammon)* and Blue Sheep *(Pseudois nayaur)* or Bharal as it is known locally—are animals that are also hunted by local communities. As their natural prey becomes harder to find, snow leopards are forced to kill domestic livestock for their own survival. Snow leopards are often killed in retaliation by local farmers and herders resulting in human-wildlife conflict. The illegal wildlife trade is another major contributor to dwindling numbers of snow leopards. For generations, these creatures have been killed not only for their beautiful fur, but also for their bones and other body parts, which are used in some traditional medicine.

What We Can Do to Protect Biosphere Reserves

For Mobius Foundation, the driving ethos behind events like 'Biosphere Reserves: Strategies for Sustainable Development and Conservation' is to raise awareness about the environmental dilemmas that challenge every one of us across the globe. Through the medium of engaging, interactive sessions, the aim is to start a conversation. Broadly speaking, climate change and habitat degradation are very real phenomena and affect our Biosphere Reserves most directly, so must be addressed on a war footing. And the soldiers in this war are not only policy makers, academics and stakeholder communities, but also the young—the next generation who will inherit these problems and who will have to work towards finding solutions to them.

The experts gathered at the event, referenced their own experiences and areas of expertise and were unanimous in their opinion that community involvement, robust governance and financial security were key focus areas for Biosphere Reserves in the way forward. A new roadmap will be required to revisit the role and the scope of Biosphere Reserves in order to align with the United Nations 2030 Agenda for Sustainable Development and its Sustainable Development Goals (SDGs), which provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 Sustainable SDGs, which are an urgent call for action by all countries—developed and developing—in a global partnership. These objectives form a program of sustainable, universal, and ambitious development, a program of the people, by the people and for the people, conceived with the active participation of UNESCO.

While highlighting the challenges of managing vast landscapes with diverse land uses, Dr. Erach Bharucha stressed on the need for long-term planning and coordination among multiple agencies, with the Ministry of Environment, Forest, and Climate Change (MOEFCC) serving as the nodal agency,



"Without dedicated legal frameworks for Biosphere Reserves, conservation efforts remain fragmented. Strengthening governance and scientific research, along with greater financial investment policy support, and cross-sectoral collaboration, is crucial for sustainable development", he stated.

Dr. Priya Gupta elaborated by emphasising the importance of adopting integrated interdisciplinary policies that include inclusive management practices, community-driven solutions, and tenurial—relating to agricultural land holdings—security for marginalised groups. A holistic approach combining science, society, policy, and traditional knowledge is crucial for effective conservation. Future initiatives should prioritise collaboration, innovation, and adaptive management to safeguard these ecosystems for future generations. She further highlighted the need for combining modern technologies like the Geographic

Information System (GIS) and Global Positioning System (GPS) with traditional community wisdom and knowledge. She elaborated by pointing out the edge that technology could provide in resource mapping and planning, but added that they should complement rather than replace indigenous and traditional knowledge systems.

Dr. Böer highlighted the need for continuous adaptation and improvement of Biosphere Reserves to address environmental challenges, including the 'Triple Planetary Crisis' comprising of climate change, biodiversity loss, and pollution. Additionally he emphasised the importance of global platforms like the World Congress on Biosphere Reserves that foster collaboration, knowledge exchange, and innovative solutions that can enhance the effectiveness of Biosphere Reserves worldwide.

Dr. Aditya Joshi shared case studies of different Biosphere Reserves in India, where interventions address the main challenges. He explained, *"Biosphere Reserves are cultural and biodiversity hotspots, and through diverse approaches, integration of multi-stakeholder groups and successful models, we can achieve a balance between conservation and sustainable development."*

Many communities that have traditionally lived in and depended on the forest have been negatively impacted by the creation of National Parks and Wildlife Sanctuaries, many of which fall within Biosphere Reserves. For instance, in 1983, when Rajaji National Park was designated, the resident Van Gujjar community faced the brunt. Once traditionally seen as integral to the park's ecosystem, they were now being viewed as potential threats. Faced with displacement due to tenurial and zonation changes, their movement and centuries-old grazing practices were severely restricted.

In 2006, India passed the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, commonly known as the Forest Rights Act (FRA). It is a landmark piece of legislation that recognises the forest rights of Scheduled Tribes and other traditional forest dwellers. It aims to address historical injustices faced by these communities—often marginalised and denied access to the resources they need for survival—by granting them legal recognition of their rights over forest resources. These include their tenurial and food security, livelihood, and the cultural needs that they have traditionally depended upon. The FRA also acknowledges individual rights to hold and live on forest lands and allows access to minor forest produce, while ensuring sustainable management of forest resources.

Recognising that these indigenous forest communities are a vast repository of traditional and generational knowledge and wisdom, the FRA, also seeks to integrate them into responsible eco-tourism initiatives, thereby generating income and creating awareness about their unique way of life.

Fig. 10: Women in 135 tribal villages of Odisha observe 'Thengapalli'—a practice of patrolling with sticks, to safeguard forest resources from over-exploitation.

Sessions such as the Mobius Foundation's *'Biosphere Reserves: Strategies for Sustainable Development and Conservation'*, create a platform to bring together luminaries in the field of conservation, policy makers and the influencers of tomorrow—the young—future conservationists and environmental warriors. In the long run, it will influence policies and act as a push for more comprehensive efforts for the protection and conservation of biodiversity in Biosphere Reserves in India. Furthermore, it will result in a deeper understanding of the need for imaginative collaboration and sustainable community growth in order to move forward in the conservation of endangered species and the rejuvenation of these vital ecosystems; thereby fostering the aim of a more sustainable and resilient planet.

Panel Discussion

The Mobius Foundation panel discussion, *'Biosphere Reserves: Strategies for Sustainable Development and Conservation'* brought together not just the experts who elaborated on their specific areas of expertise and experience but also a sizeable audience. Drawing from the informative discussion, a vibrant Q&A session followed.

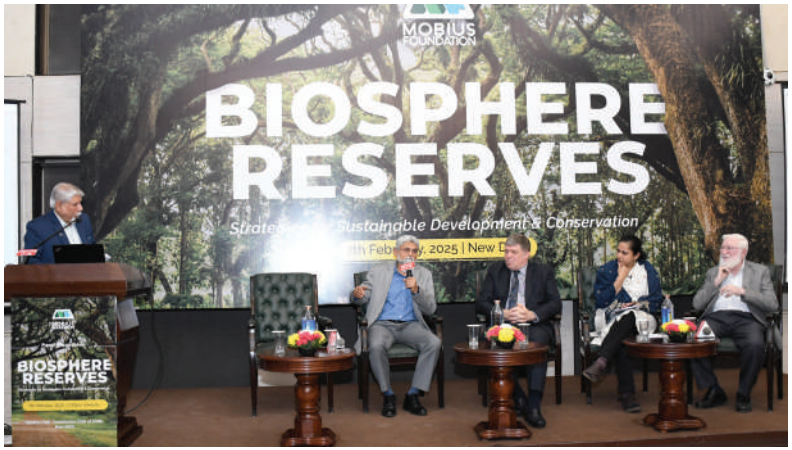
Throwing open the session, Mr. Praveen Garg IAS (Retd.), Former Special Secretary MOEFCC, President Mobius Foundation, asked:

Given that indigenous communities have inherently conserved forests for generations, how can we ensure that their rights and knowledge are integrated into the planning and management of Biosphere Reserves, rather than excluding them from these crucial areas?

Dr. Bharucha responded to the question about the role of indigenous communities in conservation. He acknowledged the invaluable contribution of indigenous people in preserving forests for centuries. He emphasised the need to recognise their traditional knowledge and integrate it into modern conservation practices. He highlighted that displacement from core and buffer areas undermines not only the livelihoods of these communities but also the sustainability of conservation efforts. He advocated the need for inclusive governance frameworks that actively involve indigenous people in planning and management processes. According to him, achieving a balance between conservation and community rights is essential for the long-term success of Biosphere Reserves.

The declining state of the Sundarbans Biosphere Reserve has led to significant habitat loss for the Bengal tiger, resulting in various conflicts. What strategies or interventions do you believe could effectively reverse this trend and promote sustainable coexistence between wildlife and local communities?

Dr. Bharucha highlighted the Sundarbans' critical ecological importance as the world's largest mangrove ecosystem, which acts as a natural barrier against coastal erosion and extreme weather events. He emphasised the challenges posed by climate change, rising sea levels, and increasing salinity, which threaten this delicate ecosystem. He stressed the need for community involvement, sustainable livelihood opportunities, and robust governance frameworks. He advocated collaborative conservation efforts that integrate scientific research, traditional knowledge, and cross-border cooperation to protect the unique ecological and cultural heritage of the Sundarbans.



Dr. Priya Gupta emphasised the Sundarbans' role as a crucial habitat for rich biodiversity, including the endangered Bengal Tiger (*Panthera tigris tigris*). She highlighted the importance of integrating traditional knowledge with modern conservation practices and involving local communities in preservation efforts. She discussed the environmental threats posed by climate change, which impact the livelihoods of indigenous communities dependent on the Sundarbans' resources. She stressed the need for inclusive governance, sustainable livelihood opportunities, and community-driven conservation strategies to enhance resilience against these threats.

Dr. Böer focused on the Sundarbans' significance as the largest mangrove forest in the world, spanning India and Bangladesh, which protects coastal regions from cyclones and tidal surges. He highlighted the rich biodiversity, including the Bengal Tiger and various bird species, and discussed the challenges of rising sea levels, increasing salinity, and habitat loss. He emphasised the importance of integrated management approaches that balance conservation with sustainable development.

Together, the panellists underscored the importance of collaborative, inclusive, and sustainable conservation strategies to reverse the declining trend of the Sundarbans Biosphere Reserve while ensuring the well being of local communities and preserving the region's unique biodiversity.

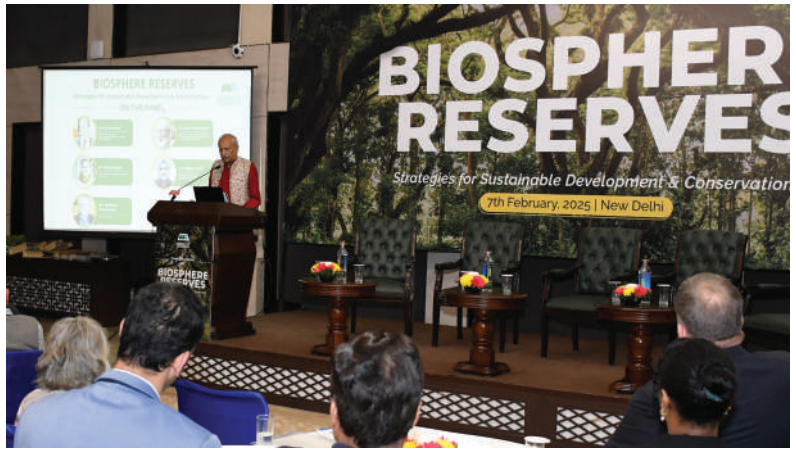
How effective is the management of the existing 18 BRs in India, considering their role in conserving biodiversity and promoting sustainable development?

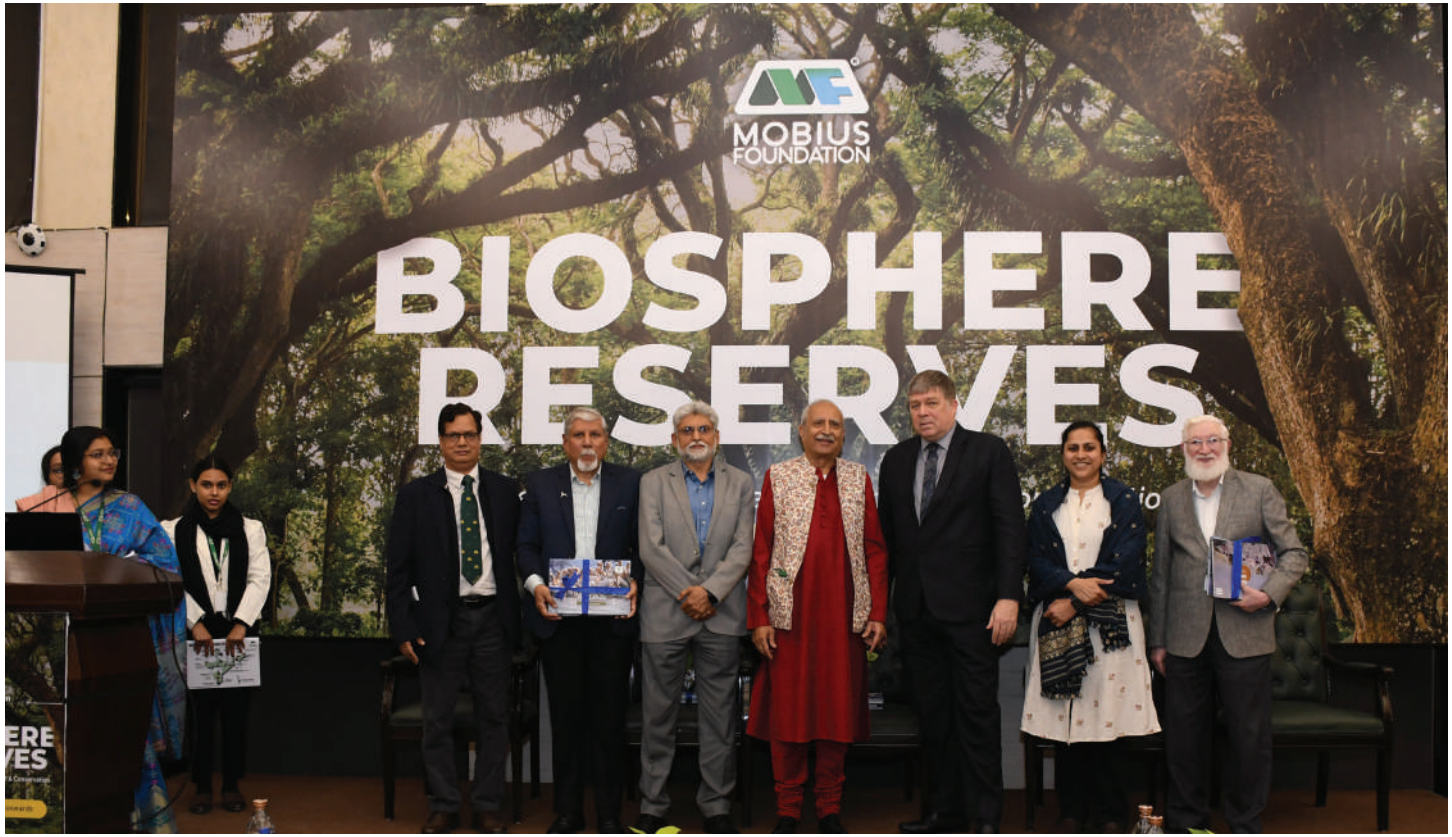
Dr. Böer addressed the question about the effectiveness of management in the existing Reserves in India. He acknowledged the significant role these reserves play in conserving biodiversity and promoting sustainable development. However, the effectiveness of management varies across the Biosphere Reserves due to differences in governance structures, resource allocation, and stakeholder engagement. He emphasised the need for robust governance mechanisms, enhanced financial investment, and capacity-building initiatives to strengthen management practices. He also highlighted the importance of community participation, cross-sectoral collaboration, and scientific research to address the challenges posed by climate change, habitat loss, and human wildlife conflicts. He concluded by advocating adaptive management strategies and continuous monitoring to ensure

the long-term sustainability of Biosphere Reserves in India.
In the context of Biosphere Reserves, solutions and strategies need to be localised and community-driven, yet the discussion also emphasised the role of Geographic Information System (GIS) and remote sensing technologies, suggesting that technology is the future of policy and governance. These seem like two opposing poles—technology on one side and local, ethnic, and tribal communities on the other. From a governance perspective, how can we bridge the gap between preserving traditional knowledge and integrating advanced technologies to achieve effective management of biosphere reserves?

Dr. Priya Gupta emphasised the importance of integrating technology with traditional knowledge for effective biosphere reserve management. She highlighted that tools like GIS and GPS can significantly aid in resource mapping and planning, but they should complement rather than replace indigenous and traditional knowledge systems. She stressed that combining modern technological approaches with the wisdom of local communities, can lead to more comprehensive and effective management strategies. She advocated a balanced approach that respects cultural heritage while leveraging technological advancements for sustainable development.

Dr. Benno Böer discussed the significance of the World Congress on Biosphere Reserves, which is held every 10 years as a platform for global discussions on best practices and local involvement in Biosphere Reserve management. He emphasised the importance of strong participation from India, highlighting the opportunity to share India's unique experiences and challenges while also learning from international counterparts. He stressed that such global dialogues foster collaboration, knowledge exchange, and innovative solutions that can enhance the effectiveness of Biosphere Reserves worldwide. He encouraged active engagement from Indian stakeholders to contribute to and benefit from this international platform.





In large (L-R): Panellists for the event, Mr. Praveen Garg, President, Mobius Foundation, Mr. Abhilash Khandekar, senior journalist, Dr. Aditya Joshi, IFS (Retd.), Ex-PCCF/HoFF, CWLW Manipur, Advisor, Mobius Foundation, Mr. Pradip Burman, Chaiman, Mobius Foundation, Dr. Benno Böer, Chief of Natural Sciences, UNESCO, South Asia Regional Office, New Delhi, Dr. Priya Gupta, PhD Lead, Social Development & Safeguard Governance, Law & Policy Division WWF-India, and Dr. Erach Bharucha, Director, Bharati Vidyapeeth Institute of Environment Education and Research, Pune; conservationist and author.

Biosphere Reserves in India

The following pages list some facts, figures and trivia about these Biosphere Reserves, including the key flora and fauna each reserve protects. The data uses the IUCN Red List to identify the risk status of each species. The key is as follows:
CR - Critically Endangered
EN - Endangered
VU - Vulnerable
NT - Near Threatened
LC - Least Concern
DD - Data Deficient
NE - Not Evaluated

1. Cold Desert

Biogeographical Zone: Trans-Himalaya
Location: Pinvalley National Park and its surroundings, Chandratal, Sarchu and Kibber Wildlife Sanctuaries
Designation: 2009

Area: 3500 km²
Core: 1135
Buffer: 1445
Transition: 920

Major Threats
- Climate Change
- Anthropogenic Pressures
- Minimal Water Resources

Key Flora: *Roundleaf Monkshood(NE), Ratanjot(NE), Gerard's Joint Fir(LC), Hingupatri(NE)*
Key Fauna: *Snow Leopard(VU), Tibetan Antelope(NT), Himalayan Wolf(DD), Red Fox(LC), Snow Patridge(LC)*

***713** Flora*
***119** Birds*
***62** Butterflies & Moths*
***17** Mammals*

Species protected in this reserve:
***Tibetan Antelope** (LC)*
***Snow Leopard** (VU)*

Tribes and Special Practices:
Indo-Mongoloids

The Spiti tribe (left) in the Cold Desert Biosphere Reserve operates the Kuhl irrigation system, a centuries-old practice of directing glacial meltwater through hand-dug channels. These gravity-fed systems ensure equitable water distribution in arid high- altitude regions, supporting climate-resilient agriculture and preserving community water rights. (source: 101 Reporters – Kuhl Irrigation)

flora, fauna & the people

One of the most fascinating biosphere reserves in India, Cold Desert is noted for the preservation of the snow leopard. It is stretched along the Western Himalayas, from Ladakh to Kinnaur, in Himachal Pradesh. Declared a biosphere reserve in 2009, it comprises the Pin Valley National Park and its surroundings, Kibber Wildlife Sanctuary, Sarchu and Chandratal, etc.

Snow Leopard (Panthera uncia)

2. Nanda Devi

Biogeographical Zone: Western Himalaya
Location: Parts of Chamoli, Pithoragarh and Almora districts in Uttarakhand
Designation: 1988 | UNESCO (MAB-WN): 2004

Area: 6407 km²
Core: 712
Buffer: 5148
Transition: 546

Major Threats
- Poor Infrastructure
- Unregulated Mass Tourism

Key Flora: *Himalayan Birch(LC), Brahma Kamal(CE), Himalayan Cedar(LC), English Yew(LC), Himalayan Pine(LC), Dwarf Rhododendron(LC)*
Key Fauna: *Himalayan Tahr(NT), Koklass Pheasant(LC), Asiatic Black Bear(VU), Himalayan Brown Bear(LC)*

***800** Flora*
***114** Birds*
***83** Mammals*
***18** Reptiles*

Species protected in this reserve:
***Snow Leopard** (VU)*
***Himalayan Musk Deer** (CE)*

Tribes and Special Practices:
Bhutiya

The Bhutiya tribe (left) practices transhumance, migrating seasonally with their yaks, and cultivates medicinal plants like Angelica glauca. Their sustainable harvesting and cultivation methods prevent overexploitation of wild herbs, support ecosystem stability, and enable responsible bioprospecting. This traditional ecological knowledge fosters mountain sustainability and offers potential for pharmaceutical collaborations. (source: Current Science – Bioprospecting in Nanda Devi)

flora, fauna & the people

Nanda Devi Biosphere Reserve, located in the Himalayan Mountains, includes as core areas the Nanda Devi and Valley of Flowers National Parks. It includes reserve forests, evam soyam (civil) forests, panchayat (community) forests, agricultural land, grassy slopes, alpine meadows (bugiyals) and snow-covered areas.

Himalayan Musk Deer (Moschus leucogaster)

3. Khangchendzonga

Biogeographical Zone: Eastern Himalaya
Location: Parts of north and west districts of Sikkim
Designation: 2000 | UNESCO (MAB-WN): 2018

Area: 2655 km²
Core: 1819
Buffer: 835

Major Threats

- Collection of wild medicinal plants
- Spread of diseases to wildlife
- Poaching & Snaring
- Hydroelectic Power Projects

Key Flora: *Oaks, Fir, Willow(Most LC, some NT), Sikkim Rhododendron(LC)*
Key Fauna: *Blood Pheasant(LC), Snow Leopard(VU), Serow(NT), Red Panda(EN)*

4500 ***Flora Species***
550 ***Birds***
42 ***Mammals***
19 ***Amphibians***

Species protected in this reserve:

Red Panda *(EN)*
Himalayan Black Bear *(VU)*

Tribes and Special Practices:

Lepchas, Bhutiyas, Nepalese, Limboo

The Bhutia tribe (left) in the Khangchendzonga Biosphere Reserve practices organic farming rooted in traditional ecological knowledge. By avoiding chemical fertilizers and pesticides, they preserve soil fertility and water quality. Their organic produce meets global demand for sustainable products and supports the region's status as India's first organic state. (source: SSOCA – Sikkim Organic Certification)

flora, fauna & the people

Located in the state of Sikkim, bordering Nepal to the west and Tibet (China) to the north-west, this biosphere reserve is one of the highest ecosystems in the world, reaching elevations of 1,220 to 8,586 metres above sea level. The site is one of the world's 34 biodiversity hotspots. It includes vast natural forests that support high species diversity with high levels of endemism.

Red Panda (Ailurus fulgens)

4. Manas

Biogeographical Zone: Eastern Himalaya
Location: Parts of Kokrajhar, Bongaigaon, Barpeta, Nalbari, Kamrup and Darang districts of Assam (Northeast Hills)
Designation: 1989

Area: 92,837 km²
Core: 520
Buffer: 2317
Transition: 947

Major Threats

- Poaching
- Logging
- Habitat Loss
- Deforestation
- Human-wildlife Conflicts

Key Flora: *Ban Chalta(NE), Silk Cotton Tree(LC), Malabur Nut(LC), Arjun(LC), Black Myrobalan(LC), White Siris(LC)*
Key Fauna: *Asian Elephant(EN), Bengal Tiger(EN), One-Horned Rhino(VU), Capped Langur(VU), Hog Deer(LC), Eastern Swamp Deer(VU), Golden Langur(EN)*

***543** Flora Species*
***327** Birds*
***61** Mammals **54** Fish*
***7** Amphibians **2** Reptiles*

Species protected in this reserve:

***Golden Langur** (EN)*
***Pygmy Hog** (EN)*

Tribes and Special Practices:

Bodo, Adivasi, Rabha-Hasang, Nepalese, Kochrajbongshi

In the Manas Biosphere Reserve, the Bodo tribe (left) has organized community-based anti-poaching teams that have significantly contributed to the revival of endangered species such as the golden langur and rhino. These efforts have provided alternative livelihoods as eco-guards and strengthened the local role in conservation enforcement. (source: Oryx Journal – Community Protection in Manas)

flora, fauna & the people

Declared as a National park in 1990. Manas National park is located at Himalayan foothills where its having an unique bio diversity and scenic landscapes. It is one of the first reserves included in the tiger reserve network under project tiger in 1973.

Greater One-horned Rhino (Rhinoceros unicornis)

5. Dihang-Dibang

Biogeographical Zone: Eastern Himalaya
Location: Districts of Upper Siang, West Siang and Dibang valley, Arunachal Pradesh
Designation: 1998

Area: 5112 km²
Core: 4095
Buffer: 1017

Major Threats

- Hydropower Projects
- Illegal Sand mining
- Deforestation
- Illegal Logging
- Poaching

Key Flora: *Smooth Pigweed(LC), Cyathea(NE), Begonia(Varies), Lady's Slipper Orchid(EN-CR), Rhododendron Species(Varies)*
Key Fauna: *Red Goral(NT), Green Pit Viper(NE), Red Panda(EN)*

***1500** Flora*
***195** Birds*
***45** Insects*
***36** Mammals*

Species protected in this reserve:

***Mishmi Takin** (VU)*
***Musk Deer** (EN)*

Tribes and Special Practices:

Ramo, Bokar, Bori, Shimmong, Karko, Minyong, Ashim, Tangam, Memba, Idu, Adi, Khamba

The Adi tribe (left) in the Dihang-Dibang Biosphere Reserve practices a rotational bamboo harvesting system that allows for forest regeneration. Bamboo is used for construction, daily utility items, and crafts, forming the backbone of their local green economy. This practice ensures long-term forest health and provides sustainable incomes. (source: Mongabay India – Sustainable Bamboo Use)

flora, fauna & the people

The Mouling National Park and the Dibang Wildlife Sanctuary are located within this reserve which spreads over three districts: Dibang Valley, Upper Siang, and West Siang. It covers high mountains of Eastern Himalaya and Mishmi Hills. The elevation ranges up to more than 5,000 metres. Interestingly, it has natural vegetation from the tropics to mountain tundra, stretching in an unbroken sequence.

Lady Slipper Orchid (Paphiopedilum spp.)

6. Dibru-Saikhowa

Biogeographical Zone: Brahmaputra Valley
Location: Parts of Dibrugarh and Tinsukhiya districts in Assam (Northeast Hills)
Designation: 1997

Area: 765 km²
Core: 340
Buffer: 425
Transition: Not defined

Major Threats

- Floods
- Heavy Grazing
- NTFPs Collection
- Extensive Fishing
- Agriculture and Logging
- Soild Erosion and Siltation

Key Flora: *Sarpagandha(EN in Wild), Elephant Apple(LC), Silk Cotton(LC), Ficus, Livistona Orchid(NE), Crepe Myrtle(LC)*
Key Fauna: *Bengal Tiger(EN), Hoolock Gibbon(EN), Sloth Bear(VU), Indian Civet(LC), Slow Loris(VU), Asiatic Water Buffalo(EN), Macaque(Pigtailed, Rhesus, Assamese)(LC)*

***500** Flora Species*
***503** Birds **105** Butterflies*
***104** Fish*
***42** Reptiles **17** Amphibians*
***37** Mammals*

Species protected in this reserve:

***White-winged Wood Duck** (EN)*
***River Dolphin** (EN)*

Tribes and Special Practices:

Mishing

The Mishing (left) and Deori tribes have adapted to flood-prone environments by building Chang Ghars—traditional stilt houses made of bamboo and wood. These structures are elevated to withstand seasonal flooding from the Brahmaputra River, offering safety and sustainability without relying on environmentally damaging construction materials. (source: Nowgong College – Chang Ghar Documentation)

flora, fauna & the people

Dibru-Saikhowa is a National Park as well as a Biosphere Reserve and an identified Important Bird Area (IBA), situated on the south bank of the river Brahmaputra in the extreme east of Assam in India.

Western Hoolock Gibbon (Hoolock hoolock)

7. Nokrek

Biogeographical Zone: Northeast Hills
Location: Parts of Garo Hills (east, west & south), Meghalaya Northeast Hills
Designation: 1988 | UNESCO (MAB-WN): 2009

Area: 820 km²
Core: 47
Buffer: 227
Transition: 544

Major Threats

- Mining
- Shifting Cultivation
- Grazing
- Deforestation
- Land Degradation
- Overexploitation & Urban Development

Key Flora: *Screw Pine(LC), Nipa Palm(LC), Ceylon Iron Wood(LC), African Jola-Nettle(NE), Cinnamon(LC), Indian Olive(NE), Wild Orange(NE)*
Key Fauna: *Elephant(EN), Leopard(VU), Macaque(LC), Giant Squirrel(LC)*

***1400** Flora Species*
***396** Birds*
***120** Mammals*

Species protected in this reserve:

***Red Panda** (EN)*
***Wild Orange** (NE)*

Tribes and Special Practices:

Garo

In Meghalaya's Nokrek Biosphere Reserve, the Garo tribe protects Citrus indica, a wild variety of orange that is critically endangered. Their efforts have helped conserve a unique genetic resource essential for future food security and agro-biodiversity. The conservation of this species has also opened pathways for bioprospecting partnerships and global recognition of traditional agricultural knowledge. (source: ProQuest – Citrus Indica Genetic Conservation)

flora, fauna & the people

Nokrek Biosphere Reserve, located in northeast India on the Tura Range of the Meghalaya Plateau, features gentle hills in the north and steep slopes in the south. It hosts key perennial rivers—Simsang, Dareng, and Ganol—that form vital catchments, with the Ganol flowing into the Brahmaputra and supporting regional water needs.

The Giant Flying Squirrel (Petaurista philippensis)

8. Sundarbans

Biogeographical Zone: Gangetic Delta
Location: Parts of river delta of the Ganges and Brahmaputra in West Bengal
Designation: 1989 | UNESCO (MAB-WN): 2001

Area: 9630 km²
Core: 1692
Buffer: 2233
Transition: 5705

Major Threats
- Over-exploitation
- Pollution
- Degradation of Mangroves
- Choking of estuarine rivers
- Land use for fishing & farming

Key Flora: *Sundari(EN), Mangrove Palm(LC), Bengal Quince(LC), Spurred Mangrove, Crabapple Mangrove (LC)*
Key Fauna: *Fishing Cat(VU), Olive Ridley Turtle(VU), Gangetic Dolphin(EN), Green Sea Turtle(EN), Shark(EN to CR), Ray(Varies)*

***81** Mangrove Species*
***165** Fish*
***163** Birds*
***56** Reptiles* ***40** Mammals*
***67** Crabs* ***23** Molluscs* ***15** Prawns*

Species protected in this reserve:
***Royal Bengal Tiger** (EN)*
***Estuarine Crocodile** (EN)*

Tribes and Special Practices:
Santal, Munda, Oraon, Bhumij, Kora, Chero, Ho, Baiga, Lodha, Khond

The Santhal tribe (left) practices a sustainable method of honey collection through the WWF-supported "blood-free honey" initiative. This method uses smoke and protective gear to avoid tiger encounters, ensuring both the safety of the honey collectors and the minimal disturbance to the mangrove ecosystem. The initiative supports biodiversity conservation, provides livelihoods, and helps maintain the ecological integrity of one of the most sensitive regions in the country.
(source: WWF – Blood-Free Honey Program)

flora, fauna & the people

The Sundarbans mangrove forest, among the world's largest, lies on the Ganges-Brahmaputra-Meghna delta along the Bay of Bengal. Adjacent to India's World Heritage site, it features a dense network of tidal rivers, mudflats, and salt-tolerant islands, showcasing dynamic ecological processes.

The Royal Bengal Tiger (Panthera tigris tigris)

9. Similipal

Biogeographical Zone: The Mahanadian east coastal region of the Oriental realm and the Chhotanagpur biotic province of the Deccan peninsular zone
Location: Part of Mayurbhanj district in Odisha
Designation: 1994 | UNESCO (MAB-WN): 2009

Area: 5569 km²
Core: 1194
Buffer: 1335
Transition: 3038

Major Threats

- Timber and NTFPs Extraction
- Poaching
- Landu-use Change
- Irregular Tourism

Key Flora: *Orchids(Varies LC to CR), Sal Tree(LC), Dog Teak Tree(NE), Sissoo(LC), Black Plum(LC)*
Key Fauna: *Royal Bengal Tiger(EN), Joranda Palm Civet(NE), Asian Elephant(EN), Ruddy Mangoose(LC), Four-Horned Antelope(VU)*

***1076** Vascular Plants*
***264** Birds*
***42** Mammals*
***39** Reptiles*
***12** Amphibians*

Species protected in this reserve:

***Royal Bengal Tiger** (EN)*
***Gaur** (VU)*

Tribes and Special Practices:

Mankidia, Bathudi, Bhumija, Kolho, Santal, Ho, Munda, Gonda, Khadiyas, Pauri Bhuyans

The Mankidia tribe (left) in the Simlipal Biosphere Reserve is known for weaving sabai grass into ropes, mats, and other products. Their use of grass instead of wood helps reduce deforestation and forest fire risks. This practice encourages forest conservation, supports local income generation, and promotes sustainable use of non-timber forest products, contributing to the resilience of both the forest and the community. (source: Live History India – Sabai Grass Weaving)

flora, fauna & the people

Located in northeast India, Volcanic sedimentary rocks are aligned in three concentric rings and accentuate the area's geologic formations. The highest peak in the Similipal hill range is Khairiburu (1,168 metres). Numerous waterfalls and perennial streams flow into major rivers, such as the Budhabalang, Baitarani and Subarnarekha.

Gaur (Bos gaurus)

10. Achanakmar Amarkantak

Biogeographical Zone: Central Highlands
Location: Parts of Anuppur & Dindori districts of Madhya Pradesh, and Bilaspur district of Chhattisgarh
Designation: 2005 | UNESCO (MAB-WN): 2015

Area: 3835.51 km²
Core: 551.55
Buffer: 1955.87
Transition: 1328.08

Major Threats

- Road in-between Tiger Reserve
- Excessive Tourism
- Grazing in Reserved Area
- Man-made Forest Fires

Key Flora: *Meado-Rue (NE), Native Rosella (LC), Monk's-Cress (NE), Himalayan Cypress (LC), Fire-Lily (LC)*

Key Fauna: *Chinkara (LC), Indian Muntjnac (LC), Eurasian Wild Boar (LC), Red Fox (LC), Golden Jackal (LC)*

***1527** Plants*
***276** Birds*
***67** Mammals*
***33** Reptiles*

Species protected in this reserve:

***Tiger** (EN)*
***Indian Pangolin** (EN)*

Tribes and Special Practices:

Baiga, Gond, Kol, Kanwar, Pradhan and Panka

The Baiga tribe (left) in the Achanakmar-Amarkantak BR practices "Beej-Mati," an indigenous seed banking method where traditional seeds of millets and pulses are preserved. This practice strengthens food sovereignty, promotes climate-resilient agriculture, and reduces dependency on commercial hybrid seeds. It supports agro-biodiversity and community autonomy.
(source: Millets News – Baiga Seed Conservators)

flora, fauna & the people

The most dramatic and ecologically diverse landscape in the Chhattisgarh and Madhya Pradesh states of India, the Achanakmar-Amarkantak resaerve is one of the lesser developed and least disturbed areas in both the states. It encompasses most of the original natural and cultural features.

The Asian white-backed vulture (Gyps bengalensis)

11. Pachmarhi

Biogeographical Zone: Deccan Peninsula and the Biotic Province of Central India
Location: Parts of Betul, Hoshangabad and Chhindwara districts in Madhya Pradesh
Designation: 1999 | UNESCO (MAB-WN): 2009

Area: 4981 km²
Core: 1555
Buffer: 1785
Transition: 1640

Major Threats

- Indiscriminate Harvesting
- Overexploitation of Natural Resources
- Threat to Gene Pool
- WIldlife and Meadows/Open Glades

Key Flora: *Sal Tree(LC), Teak(LC), Selaginella Fern(NE), Palimorpha Bamboo(NE), Wild Mango(LC), Whisk Fern(NE)*
Key Fauna: *Barasingha(VU), Wild Buffalo(EN), Red Jungle Fowl(LC), Gaur(VU)*

***1350** Flora Species*
***254** Birds*
***50** Mammals*
***50** Butterflies*
***30** Reptiles*

Species protected in this reserve:

***Indian Giant Squirrel** (LC)*
***Leopard** (VU)*

Tribes and Special Practices:

Gond, Bharia

In the Pachmarhi Biosphere Reserve, the Gond tribe (left) conserves sacred groves—patches of forest protected by spiritual beliefs and cultural taboos. These groves are biodiversity hotspots, harboring rare and endemic species. Their preservation reflects the tribe's strong cultural and ecological ethics and supports eco-tourism and community-based conservation. (source: ResearchGate – Sacred Grovesin Pachmarhi)

flora, fauna & the people

Pachmarhi comprises three protection sites: the Bori Sanctuary, Satpura National Park and Pachmarhi Sanctuary - otherwise known as the Satpura Tiger Reserve. The Pachmarhi Plateau is also known as the 'Queen of Satpura', because it contains valleys, marshes, streams and waterfalls, all of which have led to the development of a unique and varied biodiversity.

Herd of Barasingha (Rucervus duvaucelii) clicked at the Pachmarhi Biosphere Reserve

12. Panna

Biogeographical Zone: Vindhyan Highlands
Location: Parts of Panna and Chhattarpur districts of Madhya Pradesh
Designation: 2011 | UNESCO (MAB-WN): 2020

Area: 2998 km²
Core: 792
Buffer: 987
Transition: 1219

Major Threats

- Overexploitation of Natural Resources
- Threats to Indigenous Crops
- Spread of orchards
- Unwanted Weeds

Key Flora: *Teak(LC), Kardhai(LC), Tendu(LC), Seja Mahua(LC), Salai, Bel(LC)*
Key Fauna: *Tiger(EN), Leopard(VU), Chital(LC), Chinkara(LC), Sambhar Deer(VU), Siyah Gosh, Sloth Bear(LC), Long Snouted Crocodile(CE)*

***160** Flora*
***200** Birds*
***40** Mammals*

Species protected in this reserve:

***Royal Bengal Tiger** (EN)*
***Vulture** (Various species)(CE)*

Tribes and Special Practices:

Gond (Rajgond, Nandgond, Saurgond), Khairua, Yadav (Dauva), Sahariya

In Madhya Pradesh's Panna Biosphere Reserve, the Sahariya tribe crafts bamboo-based handicrafts like baskets and furniture. Bamboo is harvested sustainably, reducing dependence on hardwoods and supporting forest regeneration. This cottage industry enhances livelihood security while conserving natural resources. (source: ResearchGate – River Linking & Biodiversity in Panna)

flora, fauna & the people

Panna Biosphere Reserve includes well-protected, minimally disturbed zones with diverse land uses—forests, agriculture, water bodies, and settlements—offering rich research and management opportunities. It is home to rare and endangered species, and includes the Panna Tiger Reserve and designated Critical Tiger Habitat areas.

Royal Bengal Tiger (Panthera tigris tigris)

13. Kachchh Desert

Biogeographical Zone: Thar Desert/Coastal
Location: Patan, Surendranagar and Rajkot, Saurashtra region, Banaskantha of North Gujarat & Kachchh region
Designation: 1989 | UNESCO (MAB-WN): 2001

Area: 9630 km²
Core: 1692
Buffer: 2233
Transition: 5705

Major Threats
- Catlle Grazing
- Firewood Collection
- Salt Extraction Operations

Key Flora: *Colocynth(LC), Gugal, Brown Lily(NE), Salt Heliotrope(NE)*
Key Fauna: *Long-Eared Hedgehog(LC), Desert Fox(LC), Indian Wolf(LC), Striped Hyena(NT)*

253 ***Flora***
28 ***Mammals***
18 ***Snakes***
16 ***Lizards***
5 ***Amphibians*** ***2*** ***Turtles***

Species protected in this reserve:

Indian Wild Ass *(EN)*
Flamingo *(NT)*
Great Indian Bustard *(CE)*

Tribes and Special Practices:

Rabari, Maldhar, Paradhi, Charan, Ahir, Koli (Agariya), Mutwa, Meghwal, Pagadiya

Most tribes practice the traditional Virdas system of digging shallow wells into salt plains to access fresh water pockets beneath saline layers. The Agariya tribe specifically, are traditional salt workers who extract salt from saline desert soil. They rely on manual labor and natural solar heat, conserving energy and maintaining the fragile desert ecology. Their operations contribute significantly to India's salt production, especially in the Little Rann region. *(source: Compendium on Biosphere reserves)*

flora, fauna & the people

Kachchh Biosphere Reserve is composed of two major ecosystems called Great Rann of Kachchh (GRK) and Little Rann of Kachchh (LRK). The reserve mainly covers Kachchh Desert Sanctuary (in GRK) and Wild Ass Sanctuary (in LRK). The reserve also covers parts of the finest grassland of Asia called "Banni".

Great Indian Bustard (Ardeotis nigriceps)

14. Seshachalam Hills

Biogeographical Zone: Eastern Ghats
Location: Seshachalam hill range in Eastern Ghats encompassing parts of Chitoor and Kadapa districts of Andhra Pradesh
Designation: 2010

Area: 4756 km²
Core: 750
Buffer: 1865
Transition: 2140

Major Threats

- Felling & Smuggling of Red Sander
- Forest Fires
- Cattle Grazing
- Poaching

Key Flora: *Green Dammar Tree(VU), South Indian Olibanum(NT), True Indigo(LC), Jamun(LC), Red Sandal Wood(EN)*
Key Fauna: *Slender Loris(NT), Mouse Deer(LC), Golden Gecko(NE), Civet Cat(LC), Ibex(LC)*

***1756** Flora*
***54** Birds*
***23** Mammals*
***31** Snakes **6** Lizards **5** Geckos*

Species protected in this reserve:

***Red Sandalwood** (EN)*
***Slender Loris** (NT)*

Tribes and Special Practices:

Chenchu, Yanadi

The Chenchu tribe (left) harvests wild honey using sustainable methods. They avoid collecting honey during breeding seasons and protect bee larvae, which ensures the survival of bee colonies and forest pollination. This eco-friendly practice supports biodiversity and generates income from forest produce. (source: SOAS Digital Archives – Chenchu Practices)

flora, fauna & the people

The hills are also known as Venkatachalam. The ranges were formed during the Precambrian era (3.8 billion to 540 million years ago). Minerals contained in these hills include sandstone and shale interbedded with limestone. The ranges are bounded by the Rayalaseema uplands to the west and northwest, and the Nandyal valley to the north. Tirupati, a major pilgrimage town, is located here.

Slender Loris (Loris tardigradus)

15. Nilgiri

Biogeographical Zone: Western Ghats
Location: Parts of Wayanad, Nilambur, Silent Valley in Kerala, Mudumalai, Siruvani Hills in Tamil Nadu, and Nagarhole, Bandipur in Karnataka
Designation: 1986 | UNESCO (MAB-WN): 2000

Area: 5520 km²
Core: 1240
Buffer: 3574
Transition: 706

Major Threats
- Extensive Felling
- Developmental Projects
- Monoculture Plantation
- Agriculture & Grazing
- Forest Fires

Key Flora: *Agarwood(CE), Black Dammar(VU), Wild Jack(LC), Quarrelsome Tree(NE), Kokum (LC), Wild Coconut(NE), Peacock Chaste(LC)*
Key Fauna: *Elephant(EN), Tiger(EN), Leopard(VU), Malabar Squirrel(LC)*

***3500** Plants (1500 endemic)*
***550** Birds*
***300** Butterflies*
***100** Mammals*
***30** Reptiles & Amphibians*

Species protected in this reserve:

***Lion-tailed Macaque** (EN)*
***Nilgiri Tahr** (EN)*

Tribes and Special Practices:

Cholanaikan, Kurichain, Toda, Badaga, Kotha, Kurumba, Irula, Paniya, Lingayath

The Toda tribe (left) practices traditional buffalo dairying, which is deeply interwoven with their spiritual beliefs and environmental stewardship. Their livelihood depends on the preservation of the Shola grasslands—unique montane ecosystems that serve as significant carbon sinks. The Todas avoid mechanization and overgrazing, thereby maintaining the ecological balance and biodiversity of the grasslands. (source: ResearchGate – Shola Grasslands and Pastoralism)

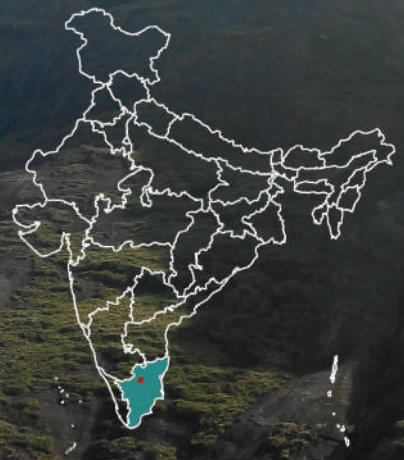
flora, fauna & the people

The Nilgiri Biosphere Reserve, a global biodiversity hotspot, represents a tropical forest biome at the crossroads of Afro-tropical and Indo-Malayan regions. It hosts diverse and threatened ecosystems, including lowland rainforests, montane forests and grasslands, moist deciduous forests, and dry scrublands.

The Asian Elephant (Elephas maximus)

16. Agasthyamalai

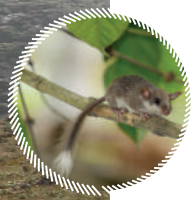
Biogeographical Zone: Western Ghats
Location: Parts of Thirunelveli & Kanyakumari districts of Tamil Nadu, Thiruvanathpuram, Pathanamthitta & Kollam districts in Kerala
Designation: 2001 | UNESCO (MAB-WN): 2016



Area: 3500 km²
Core: 1135
Buffer: 1445
Transition: 920

Major Threats

- Heavy Population Pressure
- Hydroelectric Schemes
- Expansion of Agriculture
- Roads & Townships
- Grazing
- Encroachment
- Collection of NWFPs



Key Flora: *Rudraksha Tree(NE), Gaub Tree(LC), Wild Dhaman(NE), Black Plums(LC)*
Key Fauna: *Lion-Tailed Macaques(EN), Bengal Tiger(EN), Nilgiri Marten(VU), Malabar Spiny Dormouse(DD), Great Pied Hornbill(VU)*

***2000** Flora (325 Endemic)*
***350** Birds*
***89** Reptiles*
***79** Mammals*

Species protected in this reserve:

***Indian Elephant** (EN)*
***Nilgiri Langur** (VU)*

Tribes and Special Practices:

Kani

The Kani tribe (left) in the Agasthyamalai Biosphere Reserve possesses traditional knowledge of Trichopus zeylanicus, known locally as Arogyapacha. This plant became the basis of the herbal formulation "Jeevani". The tribe entered into a benefit-sharing agreement that ensured royalties went towards their development and welfare, establishing a global model for ethical bioprospecting and protection of indigenous intellectual property. (source: SWIPO – Kani Benefit Sharing)

flora, fauna & the people

Agasthyamala Biosphere Reserve has peaks reaching 1,868m above sea level. It is also a unique genetic reservoir of cultivated plants, in particular cardamom, jamune, nutmeg, pepper and plantain. Three wildlife sanctuaries, Shendurney, Peppara and Neyyar, are located in the site, as well as the Kalakad Mundanthurai Tiger Reserve.

Lion-tailed Macaque (Macaca silenus)

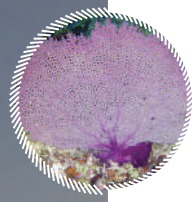
17. Gulf of Mannar

Biogeographical Zone: Coastal/Marine
Location: Gulf of Mannar (India) extending to Kanyakumari
Designation: 1989 | UNESCO (MAB-WN): 2001

Area: 10,500 km²
Core: 21 islands (depth upto 6.4m bayside and 9.5m seaside)
Buffer: Depth upto 20m and coastal areas

Major Threats

- Habitat Fragmentation
- Thermal Power Plant
- Mining
- Untreated Sewage
- Silting & Erosion
- Multiple Stakeholders



Key Flora: *Corals, Mangrove, Bantigue(LC), Common Sea Fan(NE), Oval Leaf Seagrass(LC)*
Key Fauna: *Sea Cow(VU), Shark(EN to CR), Hawksbill Turtles(CE), Humpback Dolphin(VU), Green Sea Turtle(EN)*

***3600** Marine Flora Species*
***280** Sponges*
***160** Polychaetes*
***103** Echinoderms*
***92** Corals **22** Sea Fans*
***35** Prawns **17** Crabs **7** Lobsters*

Species protected in this reserve:

***Sea Cow** (VU)*
Coral Reefs

Tribes and Special Practices:

Marakeyars, Mukkuvar

In the Gulf of Mannar, the Mukkuvar tribe (left), especially women, are engaged in sustainable seaweed cultivation. They grow species like Kappaphycus and Gracilaria, which are known to sequester large amounts of carbon dioxide from the marine environment. This activity mitigates ocean acidification and enhances local biodiversity. It also provides economic opportunities in pharmaceuticals and cosmetics, empowering women and strengthening coastal resilience. (source: ScienceDirect – Seaweed Cultivation and Carbon Sequestration)

flora, fauna & the people

The Gulf of Mannar endowed with three distinct Coastal ecosystems namely coral reef, seagrass bed and mangroves is considered one of the world's richest region from a marine biodiversity perspective, is known for its unique biological wealth and is a store house of marine diversity of global significance.

The Hawksbill Turtle (Eretmochelys imbricata)

18. Great Nicobar

Biogeographical Zone: Island/Coastal
Location: Southernmost part of Andaman, and Nicobar Islands
Designation: 1989 | UNESCO (MAB-WN): 2013

Area: 885 km²
Core: 705
Buffer: 180
Transition: 159

Major Threats
- Developmental Projects
- Habitat Loss

Key Flora: *Andaman Vanilla(NE), Cyathea Albosetaceae(NE), Ongetoyongo(NE), Andaman Knema(NE)*
Key Fauna: *Nicobar Megapod(VU), Serpent Eagle(LC), Nicobar Tree Shrew(DD), Crab-Eating Macaque(LC), Saltwater Crocodile(LC), Turtle, Phython(LC)*

***113** Fish*
***71** Birds*
***26** Reptiles*
***14** Mammals*
***10** Amphibians*

Species protected in this reserve:
***Nicobar Megapode** (EN)*
***Giant Robber Crab** (DD)*

Tribes and Special Practices:
Shompen, Nicobarese Tribes

The Nicobarese tribe of the Great Nicobar Biosphere Reserve crafts traditional canoes using selective logging, which promotes natural forest regeneration. These canoes are essential for fishing and transportation, and the controlled use of timber helps protect the mangrove and coastal forests that are vital for storm buffering and biodiversity conservation. (source: Earth Island Journal – Nicobar Canoes) (Left: women of the Andamanese tribe)

flora, fauna & the people

Great Nicobar is the southernmost island of the Nicobar Islands Archipelago. It harbours a wide spectrum of ecosystems comprising tropical wet evergreen forests, mountain ranges reaching a height of 642 m (Mt. Thullier) above sea level, and coastal plains.

The Serpent Eagle (Spilornis cheela)

Marine Marvel

THE GULF OF MANNAR

Case Study #1

The Gulf of Mannar Biosphere Reserve, Tamil Nadu

Nestled at the southeastern tip of India in the coastal state of Tamil Nadu, is the Gulf of Mannar Biosphere Reserve (GMBR). Established in 1989, GMBR is a UNESCO recognised marine national park—the first in south and south Asia. The gulf lies where the Bay of Bengal meets the Indian Ocean, and is one of the most biologically diverse regions in India. Situated in the Indian part of the gulf between India and Sri Lanka, it covers an area of about 10,500 square kilometres and comprises of 21 islands on the eastern coast from Rameswaram to Kanyakumari (Cape Comorin). Being situated in the Indo-Malayan realm, it represents one of the world's richest regions from a marine biodiversity perspective.

This Biosphere Reserve supports about 3,600 species of plants and animals—ranging from primitive to higher life forms—making the area one of the richest biodiversity coastal regions in India. GMBR hosts 117 species of coral, over 450 of fish, including four varieties of seahorses, 641 species of crustaceans including 38 crab and two lobster varieties, four different types of sea turtles, 160 species of birds, and 11 types of mangroves. The Gulf of Mannar is characterised by four distinct eco-systems; namely sea grass, coral reefs, mangroves and islands. The sea grass beds are extensively distributed amongst the islands and provide a safe haven for the globally threatened Dugong (*Dugong dugon*), which uses these as a vital breeding ground. Whale Shark *(Rhincodon typus)*, Green Sea Turtle *(Chelonia mydas)*, Hawksbill Turtle *(Eretmochelys imbricata)* and the Indo-Pacific Humpback Dolphin *(Sousa chinensis)* also swim these protected waters.

There are about 120 species of corals in the Gulf of Mannar that are evenly distributed along the shelves of all 21 islands. They form the basis of a very elaborate and functional ecosystem, which supports a host of other ecosystems. Coral reefs provide shelter to a great variety of algae, sponges, molluscs, worms, echinoderms, common shrimps and fish etc. Vegetation on the islands is not uniformly distributed and is generally made up of some mangroves and a variety of thorny shrubs such as Acacia, Capparis, Tamarix, Thespesia and Vitex. While mangroves are found on a majority of the islands, they are not particularly tall as they are regularly exposed to lashing winds during the monsoon season, as well as fairly regular cyclonic activity.

The GMBR is blessed with an abundance of estuaries, beaches, coral reefs, salt marshes, mangroves and many small island ecosystems, each of which supports a wealth of marine resources. This translates not only to the natural protection of the coastal environment but also directly benefits the local population. The local community is made up of mostly Marakeyars, generational fisher-folk who reside in the Biosphere Reserve's buffer zone. Following largely artisanal fishing methods—only ten per cent use mechanised trawlers—they commonly rely on traditional fishing vessels like vallams, masula boats and dugout canoes.

Although GMBR, is classified as a marine national park and is also recognised as a UNESCO World Heritage Site, it is not immune to the challenges faced by other Biosphere Reserves. Habitat destruction, over-harvesting of marine resources, illegal coral mining for use in construction, smuggling of corals for ornamental purposes and localised land-based sources of marine pollution are some of the main threats that this Biosphere Reserve confronts.

In order to address these challenges, the Gulf of Mannar Biosphere Reserve Trust (GOMBRT) was established in 2002. Under the GOMBRT, four community-based eco-tourism projects were set up that have created more than 250 green jobs. In addition to this, over 250 Eco-Development Committees and close to 2,000 womens' self-help groups that engage nearly 20,000 local women were created. Community-operated plastic management programs have also been implemented. Over a nine-month period, between June 2022 and February 2023, over 21 tonnes of plastic waste was collected at community-run plastic checkpoints. Eleven kilometres of rural roads that provided employment opportunities to the local community, were constructed by using nearly 1.5 tonnes of shredded plastic. Microcredit at subsidised rates is providing livelihood options through the creation of products like palm jaggery and artisanal palm-leaf items.

Fig. 11: Mr Jagdish Bakan, Director of the Gulf of Mannar Biosphere Reserve in Tamil Nadu (GOMBRT), India and 2023 laureate of the UNESCO Michel Batisse Award for exemplary biosphere reserve management.

Historical and Cultural Significance of Gulf of Mannar Biosphere Reserve:

The coastline along the Gulf of Mannar was once part of the ancient Pandya Empire. Legends link the Pandya kings to the Moon God, *Soma*, bestowing upon them the title *Somavamsis* or descendants of *Soma*. This divine association added to their prestige and authority. Another common legend suggests that three brothers, *Pandiyan, Cheran, and Cholan,* ruled jointly before parting ways to establish separate kingdoms—the Pandyas, the Cheras and the Cholas respectively.

At its zenith, the Pandya Kingdom encompassed parts of modern-day Tamil Nadu, Kerala, and even extended into Sri Lanka. This vast territory reflects their immense military strength and administrative capabilities. The early Pandyas were also known for their maritime prowess. They built and operated large fleets of ships to trade with neighbouring islands like Sri Lanka, the Andamans, further east to the Malayan Peninsula and even connecting with the Roman and Greek empires as early as the 4th century BCE. The ancient Greek ethnographer Megasthenes refers to the Pandyas in his writings, which date back to the same period. These trade links were reciprocal, with Roman traders regularly visiting the eastern coast—where the modern day Biosphere Reserve is located—in order to procure spices, textiles, precious stones—even today the area is known for its pearl fishing—and exotic birds and animals like peacocks and monkeys, in exchange for gold. The port of Tuticorin was a well-established salt trading centre and remained so for many centuries.

The Pandya dynasty also finds mention in the *Ramayana*, where *Sugreeva*, directs the *vaanar sena* or army of monkeys to go to the south to find the *kavaatam* or capital city of the Pandyas on their journey to Lanka. Towns like Rameshwaram and Dhanushkodi are also mentioned in the epic, are major pilgrimage sites drawing devotees from all over India.

Fig. 12: Copper coins from the rule of Jatavarman Sundara Pandya I (1251 - 1268 AD) depicting marine life.


Mountainous Majesty
NANDA DEVI
Case Study #2

Nanda Devi Biosphere Reserve, Western Himalayas

Nestled high in the Himalayas, the Nanda Devi Biosphere Reserve (NDBR) was the second Biosphere Reserve to be designated by the Indian Government in 1988, after the Nilgiri Biosphere Reserve in 1986. Dominated by the second highest mountain in India—the towering 25,646 feet (7,817 metre) high, Nanda Devi peak—NDBR represents a unique combination of mountain ecosystems that include traditional agro-ecosystems, mixed temperate and sub alpine forests and meadows as well as glaciers. In recognition of its uniqueness, the NDBR was included in the World Network of Biosphere Reserves (WNBR) by UNESCO in 2004. The Valley of Flowers National Park, which falls in the NDBR, is renowned for is endemic alpine flowers and natural beauty. Its gentle landscape forms the perfect foil to the rugged mountain wilderness of the surrounding peaks, leading to both the Nanda Devi National Park and the Valley of Flowers National Park being declared UNESCO World Heritage sites in 2005.

The Nanda Devi Biosphere Reserve is home to a large diversity of flora and fauna native to the west Himalayan biogeographic zone, including a significant number of highly endangered species. The elusive Snow Leopard (*Panthera uncia*), the Himalayan Musk Deer (*Moschus leucogaster*), Bharal or Blue Sheep (*Pseudois nayaur*) and a host of other species call this 6407-square kilometre expanse home. Altitudes in the Biosphere Reserve range from between 5,905 (1,800 metres) and 25,646 feet (7,817 metres) above sea level, providing a wide spectrum of elevations and habitats. For instance, some

areas in the northern extreme, present Himalayan cold-desert characteristics while others offer more temperate features. The Core Zone is a completely protected area, with nearly 80 per cent of it under perennial snow and glaciers. The remaining 20 per cent consists mainly of forests, alpine meadows, locally known as *bhugiyaals* and wastelands.

There are approximately 50 villages that fall in the vast over-5,000 square kilometre buffer zone that surrounds NDBR. Human activities are confined to the Buffer and Transition Zones. Indigenous communities—belonging mainly to two ethnic groups, Indo-Mongoloid or Bhutia and Indo-Aryan—have resided here for generations. While they are mostly agrarian, engaging in activities like marginal subsistence terrace farming; bee keeping, sheep and cow rearing are also common occupations. These communities are also partly dependent on the available natural resources for food, fodder, fuel, timber, fibre and for medicinal purposes. The incredible natural beauty of the region has made it popular with trekkers, naturalists and pilgrims who visit the many holy shrines that dot the area. Seasonal eco and religious tourism also takes place in a regulated manner keeping in view the conservation needs of the reserve. This has led to the rise of home-stays and lodges, providing yet another source of livelihood for the local communities.

Sadly though, the pressures and challenges faced by other Biosphere Reserves have not escaped Nanda Devi Biosphere Reserve. The prime concerns are climate change and rising global temperatures that are causing the glaciers located here to retreat and melt at alarming rates. Biodiversity depletion, biological invasion, growing human population, imposition of conservation policies that include anti-poaching laws that have led to the growing incidence of crop damage and livestock loss, land degradation and hydrological imbalances caused by the construction of dams and other hydro projects are among the other key issues.

Fig. 13: An elderly Kumaoni woman working in the fields.

Historical and Cultural Significance of Nanda Devi Biosphere Reserve:

The state of Uttarakhand is often referred to as *Dev Bhoomi* or Land of the Gods. It is home to many of Hinduism's holiest shrines like Badrinath and Kedarnath. The Nanda Devi temple, located in Almora town in the Kumaon region, is hugely revered and is believed to be approximately 1000 years old. Uttarakhand is also home to Hemkund Sahib, an important pilgrimage site for Sikhs, making the state religiously significant for both the Hindu and Sikh communities.

Nanda Devi is worshipped in both the Garhwal and Kumaon regions of Uttarakhand, and is believed to be an incarnation of the Goddess Durga. She is considered the patron goddess of the Himalayas, embodying both its gentle and fierce aspects. Translated from the Sanskrit words *ananda* meaning bliss and *devi* or goddess, the name literally means 'The Goddess Who Brings Bliss'.

Nanda Devi—the second highest mountain in India and the 23rd highest in the world—is a symbol of pride for the state of Uttarakhand. Situated in the western Garhwal Himalayas, Nanda Devi's religious and cultural significance has made it an integral part of Uttarakhand's natural beauty, culture and ethos.

In Hinduism, Nanda Devi holds a prominent place. Many ancient texts like the *Shri Devi Bhagwat Purana, Skanda Purana, and Durga Saptashati* reference Nanda Devi. In these

Fig. 14: The Nanda Devi Temple in Almora, Uttarakhand.

scriptures, she is worshipped in various forms or *avtaars* such as Parvati, Uma, Sati, and Gauri. Copper inscriptions dating from the 10th century CE that were discovered at the Pandukeshwar temples in the Chamoli district of Garhwal, carry vivid descriptions of the goddess' beauty. As patron goddess of the area, Nanda Devi is worshipped through the several festivals and rituals that are associated with her.

The Rajjat Yatra Of Nanda Devi:

The Rajjat Yatra of Nanda Devi is one of the most important festivals associated with Nanda Devi. It involves a challenging pilgrimage that covers a distance of over 200 kilometres, starting at Nauti village near Karnaprayag and culminating at the glacial lake of Roopkund, both in Chamoli district.

Usually falling between the months of August and September, the pilgrimage takes from 18 to 20 days to complete, with the trail traversing large sections of the Nanda Devi Biosphere Reserve.

An ancient tradition in the Garhwal region, the yatra occurs once every 12 years, to celebrate Nanda Devi's return from her marital home in Kailash, for a short visit to the home of her parents. To welcome her—a scaled down version called the Nanda Lok Jat, takes place annually—villagers from all over Garhwal, take out a procession to greet her. A special ram with four horns leads the procession representing the goddess. At the end of the journey, the ram is released, symbolising Nanda Devi's return to her people.

Fig. 15: A Rajjat Yatra procession.

Gurdwara Hemkund Sahib:

Gurdwara Hemkund Sahib, also located in the Chamoli district of Garhwal, is a Sikh pilgrimage site that falls within the Nanda Devi Biosphere Reserve. It is significant for its location on the banks of Hemkund Lake and its connection to Guru Gobind Singh, the 10th Sikh Guru, who is believed to have meditated there. There is some suggestion that an ancient shrine existed in the time of Guru Gobind Singh (1666-1708), as it finds mention in the *Dasam Granth*, a sacred Sikh text that is attributed to him. However, the geographical location of Hemkund Sahib remained hidden for nearly two centuries, until it was discovered in 1884, by Pandit Tara Singh Narotam, a renowned Sikh scholar living under the patronage of Maharaja Narinder Singh of Patiala.

The present day gurdwara was constructed as recently as the 1960s by engineers from the Indian Army. Hemkund Sahib is inaccessible from October through April because of snowbound paths and glaciers. Pilgrims start to arrive from early May after the thaw begins, to start repairing the damage done to the walking track by the long winter months. This voluntary service is part of the tradition of *kar seva* or selfless service, a concept, which forms an important tenet of the Sikh faith. Since overnight stays at the gurdwara are not permitted, pilgrims have to trek back to Ghangaria, the last human settlement the same day itself. The roughly 10-kilometre round trip follows a trail that passes through dense forests and meadows, and includes a section through the Valley of Flowers National Park that is part of the Nanda Devi Biosphere Reserve.

The Hemkund Sahib Gurudwara in Chamoli district, Uttarakhand


Eden of the East
KHANGCHENDZONGA
Case Study #3

Khangchendzonga Biosphere Reserve, Sikkim

Khangchendzonga Biosphere Reserve (KBR) is located in the eastern part of the Hindukush Himalaya in the northeastern state of Sikkim. Amongst a few of the world's highest mountain eco-systems, KBR is dominated by the magnificent Mount Khangchendzonga which stands at a towering 28,169 feet (8,586 meters) above sea level. Mount Khangchendzonga is India's highest mountain and the world's third highest peak. From its lowest height of about 4,000 feet (1,220 meters) and upwards, KBR displays a vast range of topographical features; from fertile plains, densely forested valleys, lakes and glaciers to spectacular snow-capped mountains. The Biosphere Reserve which was initially notified by the Government of India in the year 2000, and was subsequently re-notified in 2010; covers an area of close to 3,000 square kilometres. Of this, nearly 1,800 square kilometres forms the Core Zone.

Khangchendzonga Biosphere Reserve is an excellent example of an independent mountain ecosystem, having its own glacial system and several peaks. It is believed that the Core Zone alone boasts of over 150 glaciers and 73 glacial lakes. Of these, one of the most prominent is the Zemu Glacier—a huge turbulent glacier that is 26 kilometres long and at its widest spans 300 metres. There are also several well-known, high altitude crystal lakes. Some of these, like Green Lake, Nir Pokhari, Mujhu Pokhari, and Lhunak Tso, make the landscape of Khangchendzonga Biosphere Reserve characteristically unique.

KBR spans three countries—India, Nepal and Tibet (China)—making it perhaps the largest trans-boundary wildlife protected area in the Himalayan belt. Falling within the Sikkim Trans-Himalaya cold desert steppe, KBR has a good representation of Tibetan wild animals such as the Great Tibetan Argali *(Ovis ammon hodgsoni)*, and the Tibetan Wild Ass or *Kiang (Equus kiang)*. It provides a safe haven for many International Union for the Conservation of Nature (IUCN) listed Scheduled I species, including six types of cats; the Leopard *(Panthera pardus)*, Clouded Leopard *(Neophilis nebulosa)*, Snow Leopard *(Panthera uncia)*, Leopard Cat *(Felis bengalensis)* etc. Musk Deer *(Moschus moschiferus)*, Red Panda *(Ailurus fulgens)*, Serow *(Capricornis sumatraensis)*, Himalayan Tahr *(Hemitragus jemlahicus)*, and the Himalayan Black Bear (*Ursus thibetanus*), are among KBR's more prominent residents.

The Core Zone of KBR is also the origin of many river systems: The Teesta, Rangit and the Rathong Chu emerge from the glaciers present in the Core Zone. These highland watersheds provide fresh water to thousands of people living along and downstream of these rivers. Agricultural activities in the Transition Zone of KBR is hugely dependent on this water source, enabling the widespread farming of cash crops like rice, potatoes and spices like black cardamom and ginger etc.

The prime concerns for KBR are climate change and rising global temperatures that have an impact on the altitudinal gradients within the reserve and the sensitive ecological niches, which provide critical habitat for several endangered species. Since KBR is a trans-boundary Biosphere Reserve, coordinated interventions by the three stakeholder countries, that align with environmental and individual national goals is imperative.

Another unfortunate fallout is rather ironic. While KBR has been identified as having great potential for eco-tourism activities; its growing popularity is becoming a cause for concern. Excessive waste generation, pollution, imposition of conservation policies that include anti-poaching laws that have led to the growing incidence of crop damage and livestock loss, overcrowding, and gathering of wood for fuel, together are undermining the very biodiversity that Biosphere Reserves are meant to protect. As is the case with many Biosphere Reserves, innovative management of the Buffer Zone, that also supports traditional livelihoods and the equitable sharing of benefits from the park, at the same time, is essential in order to prevent unsustainable development and inappropriate land use by the local communities.

Historical and Cultural Significance of Khangchendzonga Biosphere Reserve:

Sikkim's history dates back from its existence as a small Buddhist kingdom founded in the 17th century CE and ruled by the Namgyal dynasty; to its integration into the Union of India in 1975, becoming its 22nd state. Phuntsog Namgyal, the first Chogyal or spiritual and temporal head, established the Kingdom of Sikkim in 1642, paving the way for the Namgyal Dynasty rule that lasted for over 300 years. Lepchas—or "ravine folk"—were the original inhabitants of Sikkim. The Bhutia community—of Tibetan origin—migrated to this

Fig. 16: A painting depicting Zhabdrung Ngawang Namgyal (1594–1651), a teacher of the Drukpa Kagyu school of Tibetan Buddhism.

region much later. Sikkim's culture and religion are deeply intertwined with Tibet and Bhutan, with Tibetan Buddhism being a significant influence. The presence of a large ethnic Nepali population also contributes to cultural linkages with Nepal. Sikkim boasts historical sites like Rumtek Monastery, the Rabdentse Ruins, and the Coronation Throne of Norbugang. Sikkim is considered a very sacred spot for Buddhists, as it is believed that in the 8th century CE, Rimpoche Padmasambhava, travelled to Sikkim and blessed the land.

Lepchas and Buddhists regard Khangchendzonga as a sacred mountain. These indigenous communities also worship the many natural formations—caves, rivers, and lakes, which occur here. This forms a rich tapestry representing a unique example of co-existence and exchange between different religious traditions and ethnicities, constituting the basis for Sikkim's community identity and unity.

The word Khangchendzonga loosely translates to "the five treasures of great snow" and refers to the five summits, each of which is believed to house sacred elements such as gold, turquoise, salt and other precious minerals. The name stems from the Tibetan words *kang* or snow; *chen* or great; *dzondzo* or *dzongpha* which translates into treasure or wealth; and *nga* which means five.

Much folklore and myth is also associated with Khangchendzonga. Both the Lepchas and Bhutias believe in the concept of a "hidden land" or a place of eternal life. Khangchendzonga, is sacred to both Buddhists who conceptualise it as *Beyul*; and to Lepchas who refer to it as

Mayel Lyang—ma is the word for hidden, *yel* means eternal and *lyang* is land. They believe that the mother goddess, *Na-zong-nyo* makes her home, somewhere in the frozen upper regions surrounding the peak.

Fig. 17: Pang Lhabsol, a vibrant and sacred festival celebrated to honor Mount Kanchenjunga, the guardian deity, protecting the land of Sikkim.

It is widely believed in both Lepcha and Bhutia folklore, that the mountain is guarded by a spirit called *Dzö-nga*—a type of demon or *rakshasa*—that roams its slopes, personifying the dangers awaiting those who climb it. An account dating back to 1925 refers to the sighting of a strange bipedal yeti-like creature by a British geological expedition. When the locals were questioned about it, they referred to it as the "Kangchenjunga Demon". Khangchendzonga is considered an extremely treacherous mountain to climb and many expeditions prove unsuccessful. It is believed that spirits reside atop Khangchendzonga's peak, and out of respect for these spirits, climbers and expedition teams, have often stopped short of the actual summit.

Another myth revolves around Sikkim's state bird, the Blood Pheasant (*Ithagnis cruentus*), locally known as *Chillimey* or *Semu*. It is believed that a Blood Pheasant guided the Rangit River along its course as it flowed from its source on the southern face of Khangchendzonga. Following the bird, the Rangit finally reached its confluence with the Teesta, which in turn, was guided by a snake from the northern slopes of the sacred mountain. According to Lepcha folklore, the two rivers Rangit and Teesta are lovers, who united in the confluence; giving birth to the first Lepcha people. The sacred meanings of these stories and practices have been integrated with Buddhist beliefs and constitute the basis for the syncretic Sikkimese identity.

Snapshot

Forest Landscape Transformation & Management in India's Biosphere Reserves

Before 1700s
(Pre-Colonial Era)

Indigenous Stewardship & Ecological Balance

- *Forest landscapes were intimately interwoven with the cultural, economic, and spiritual lives of tribal and forest-dwelling communities.*
- *Management was community-based, rooted in local ecological knowledge systems and guided by seasonal rhythms and sacred natural sites.*
- *Present-day Biosphere Reserves like the Nilgiris, Pachmarhi, Achanakmar, and Dihang-Dibang were diverse, ecologically intact systems, maintained through practices like shifting cultivation (jhum, conservation of sacred groves, controlled harvesting of forest produce.*

1700 – 1947
(Colonial Era)

Exploitation & Displacement

- *Forests were converted into a colonial economic resource. Extraction of timber, especially teak and sal, was intensified for railways, construction and export.*
- *The introduction of Indian Forest Acts (1865, 1878, 1927) consolidated state control and dismantled customary community rights.*
- *Forests within regions that would later become Biosphere Reserves (e.g., Great Nicobar, Similipal, Sundarbans) were subjected to logging and conversion to monocultures, forced displacement of forest-dependent communities, criminalization of subsistence activities (fuelwood collection, grazing, cultivation)*
- *This period marked the systematic erosion of traditional ecological governance.*

1947 – 1970
(Post-Independence)

Nationalization & Developmentalism

- *Forests nationalized, and their use prioritized for nation-building—irrigation projects, agriculture, mining, and resettlement schemes.*
- *Many forest regions faced extensive deforestation and ecological fragmentation, even those with significant biodiversity (e.g., Agasthyamalai, Nokrek, Gulf of Mannar).*
- *Tribes and forest dwellers remained excluded from forest governance.*
- *Conservation initiatives, such as creation of national parks and wildlife sanctuaries, were introduced but often followed an exclusionary model, leading to further displacement.*

1970s

Emergence of Environmental Movements & Conservation Ethos

- *The Chipko Movement (1973) and growing ecological consciousness triggered a rethinking of forest use and access.*
- *India's alignment with UNESCO's Man and Biosphere (MAB) Programme (1971) marked a conceptual shift toward integrated conservation.*
- *Discussions began around designating Biosphere Reserves—areas that balance biodiversity conservation with community livelihoods.*
- *The idea of zoning (Core, Buffer, Transition) was introduced to preserve sensitive habitats, sustain local economies and allow research and education.*

1980s

Birth of the Biosphere Reserve Network in India

- Nilgiri became India's first BR under the MAB Programme in 1986.
- This marked a significant move from exclusion to coexistence-based conservation.
- Recognized the role of tribal communities (e.g., Todas, Kotas, Kurumbas) as stewards of high-biodiversity regions.
- Other BRs established during this phase like Nanda Devi, Great Nicobar, Nokrek.
- Forest management became interdisciplinary, involving ecological monitoring, sustainable tourism and environmental education.

1990s

Participatory Approaches & Cultural Revival

- National Forest Policy of 1988 encouraged community involvement in forest regeneration and protection.
- Joint Forest Management (JFM) schemes extended to buffer zones of several BRs, especially in Achanakmar, Similipal, and Pachmarhi
- BRs began focusing on eco-development (alternative energy, income-generating activities), documentation of traditional knowledge systems, revival of sacred groves and ethno-forestry practices.
- Tribal cultures and ecological knowledge were increasingly seen as assets rather than obstacles to conservation.

2000s

Legal Empowerment & Community-Based Management

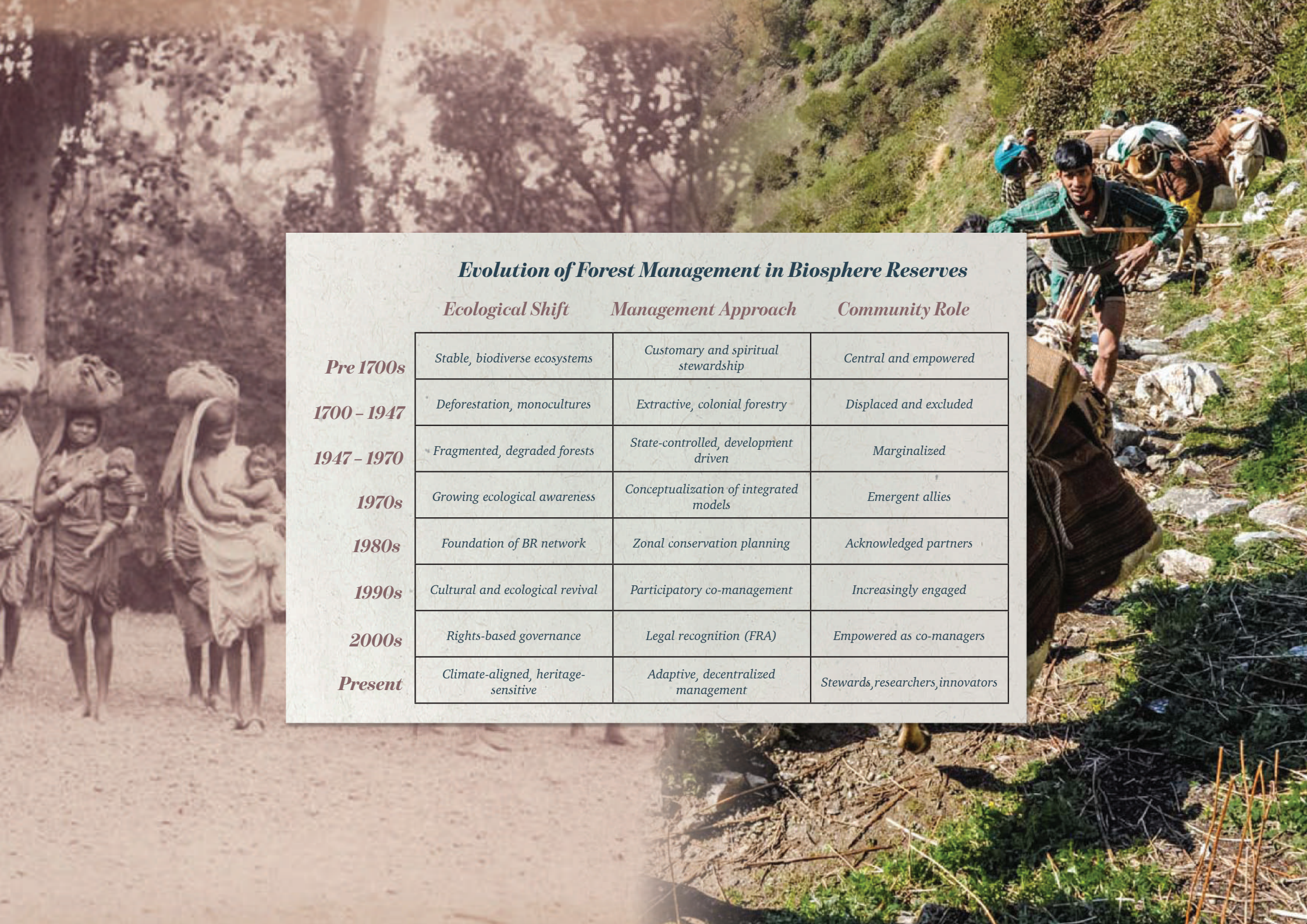
- The enactment of the Scheduled Tribes and Other Traditional Forest Dwellers (Forest Rights) Act, 2006 was a watershed moment.
- Historical injustices recognized and legal rights restored to inhabit, cultivate, and manage forest lands, including those within BRs.
- BRs such as Achanakmar-Amarkantak, Agasthyamalai Khangchendzonga
- and began incorporating Community Forest Resource rights into their governance.
- Management strategies became rights-based, decentralized, aligned with livelihood security, conservation goals, and cultural preservation
- Eco-tourism, sustainable NTFP trade and agroforestry expanded in the transition zones.

2010 – Present

Climate Resilience & Cultural Integration

- BRs have become climate-smart conservation landscapes contributing to carbon sequestration, watershed protection, biodiversity corridors.
- Focus areas include agroecology, wildlife corridor management, and community-led forest monitoring.
- Reintegration of traditional festivals, ritual landscapes, and oral ecological calendars into landscape governance
- Participatory research and citizen science are empowering youth and tribal knowledge holders in reserves like Sundarbans, Dihang-Dibang, Cold Desert Biosphere Reserve.
- BRs are now sites of adaptive, polycentric governance blending policy, tradition and science.

Reference: Bharucha, E. (2017). Changing Landscapes: The Cultural Ecology of India. New Delhi: HarperCollins Publishers. ISBN: 9789352641062



Evolution of Forest Management in Biosphere Reserves

	Ecological Shift	Management Approach	Community Role
Pre 1700s	Stable, biodiverse ecosystems	Customary and spiritual stewardship	Central and empowered
1700 – 1947	Deforestation, monocultures	Extractive, colonial forestry	Displaced and excluded
1947 – 1970	Fragmented, degraded forests	State-controlled, development driven	Marginalized
1970s	Growing ecological awareness	Conceptualization of integrated models	Emergent allies
1980s	Foundation of BR network	Zonal conservation planning	Acknowledged partners
1990s	Cultural and ecological revival	Participatory co-management	Increasingly engaged
2000s	Rights-based governance	Legal recognition (FRA)	Empowered as co-managers
Present	Climate-aligned, heritage-sensitive	Adaptive, decentralized management	Stewards, researchers, innovators

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