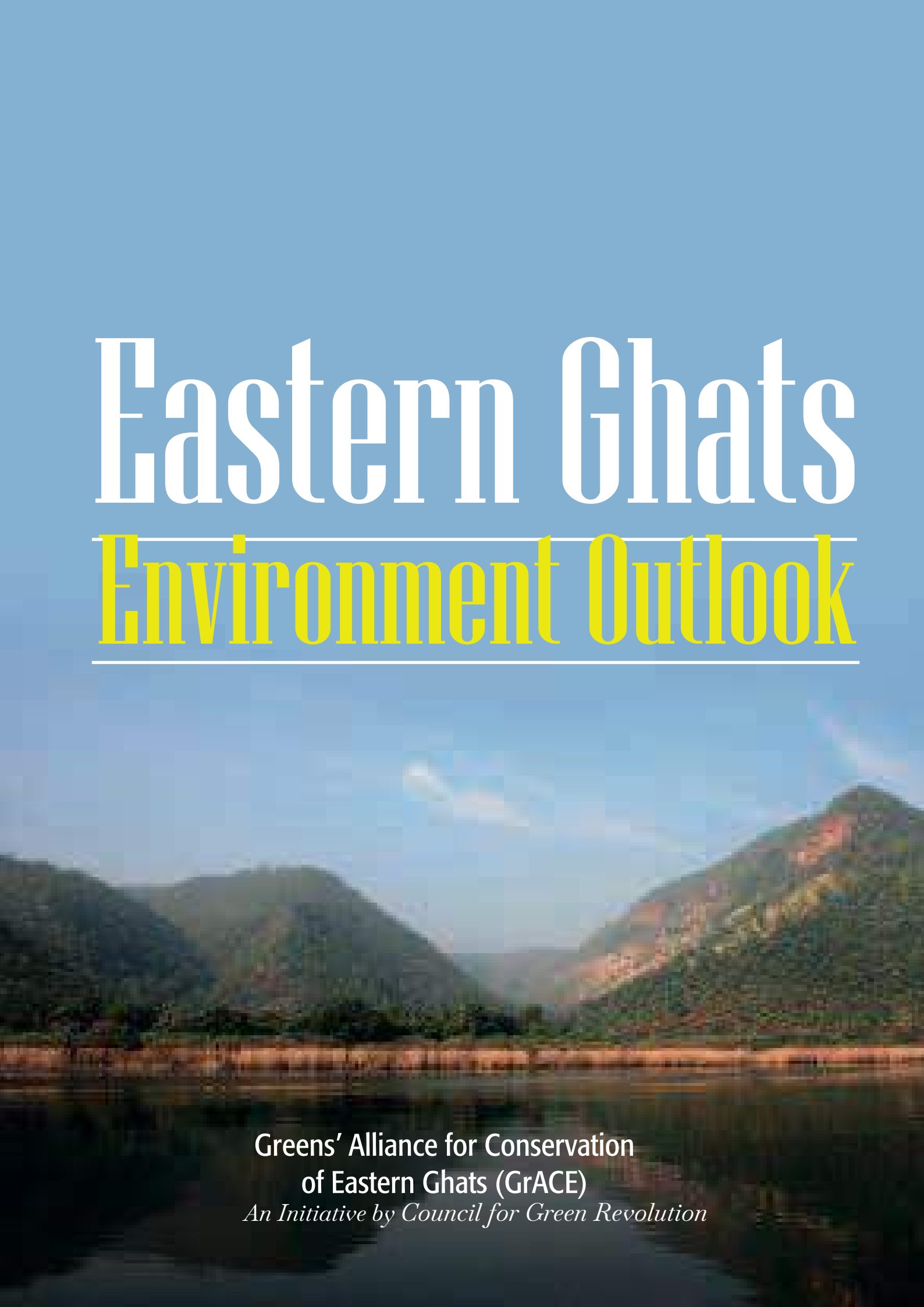
Eastern Ghats
Environment Outlook



Greens' Alliance for Conservation
of Eastern Ghats (GrACE)
An Initiative by Council for Green Revolution

A stream making its way through hillscape near Bheemuni Kolanu, Nallamalai

Eastern Ghats Environment Outlook

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S. Jaipal Reddy, India
(1942 -2019)
Conferred "Best Parliamentarian Award"-1998,
Committed to Democracy, Environmentalism and a source of Inspiration

"Environmental justice is going to be a long and laborious process; it will not be a series of romantic crusades like the struggles in the past for justice for the impoverished, or freedom for colonised nations. And yet, this will be more crucial for the future of humankind than any in history"

- *S. Jaipal Reddy in his book 'Ten Ideologies...'*

Dense thickets of moist deciduous forests of Ananthagiri hills ranges, Northern Andhra Pradesh

Tropical vegetation over cliffs in Nallamalais

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A gushing hill stream of Mahendragiri hills, Southern Odisha

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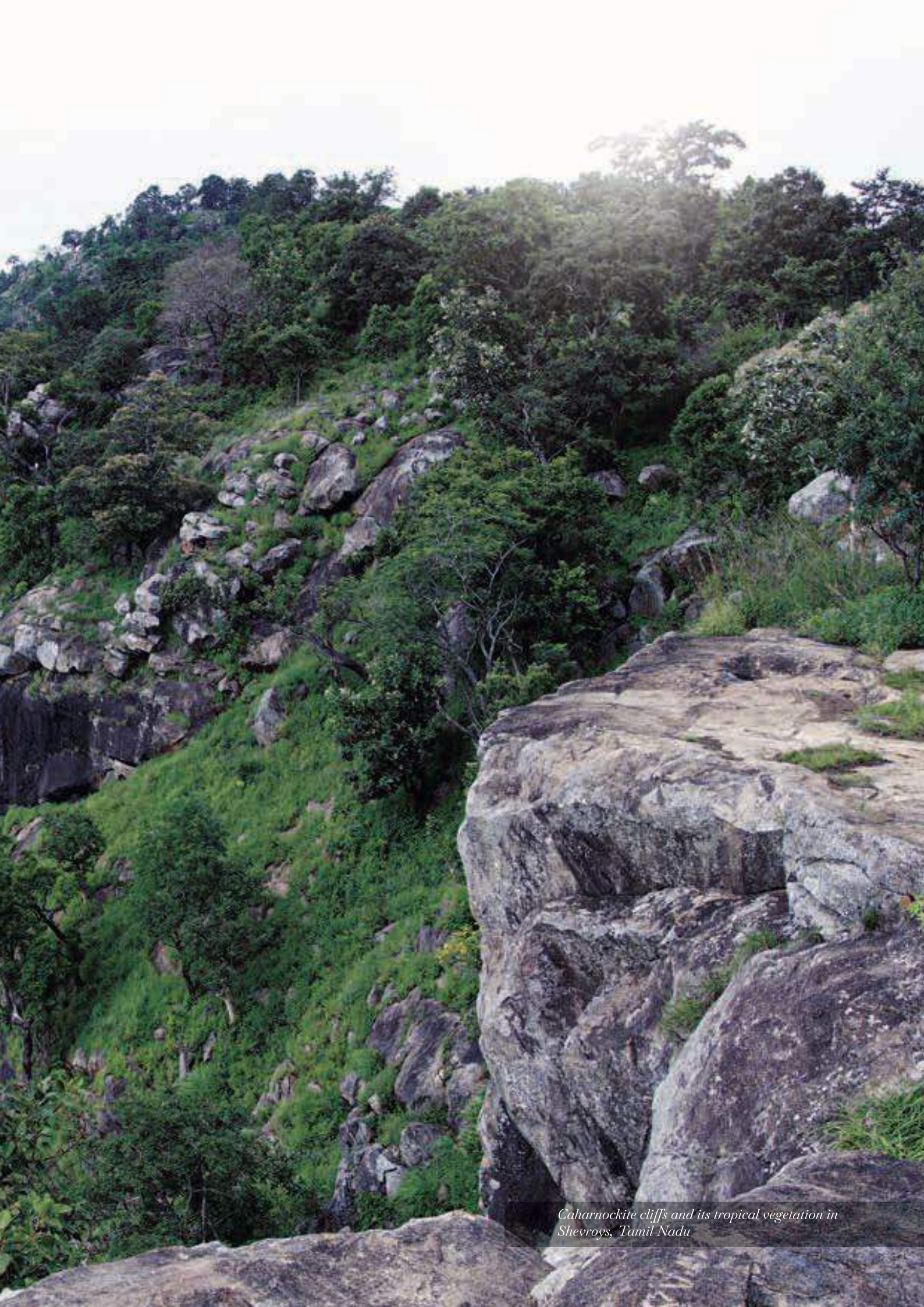
"Going to the Mountains is Going Home"
John Muir



Caharnockite cliffs and its tropical vegetation in Shevroys, Tamil Nadu

Cascading green valleys of Nallamalai

Preface

Dileep Reddy

Adorned with a mosaic of ecosystems, the Eastern Ghats, also known as the Malyadris, which encompass five states in Indian peninsula is endowed with rich heritage of natural resources, scenic splendour, habitat for rich wildlife and home for many primitive tribal communities is no way inferior to the grandeur of magnificent Himalayas and the Western Ghats. However, the status of Eastern Ghats has not been treated on par with the former two.

These ancient hill ranges are facing immense pressures from demographic, economic, social and cultural changes over the last few decades. A massive citizen-led conservation effort is required to safeguard Eastern Ghats.

In order to highlight the importance of Easte rn Ghats and its ecosystems, to expose the threats it is subjected to, therein emerged Greens' Alliance for Conservation of Eastern Ghats (GrACE) at Hyderabad, Telangana (formerly in combined state of Andhra Pradesh), with an intention to lay a firm foundation and ideal platform to lead a conservation movement which needs support from various sections of stakeholders and all the concerned citizens.

GrACE envisages massive awareness, knowledge sharing, policy-advocacy to bring in the needed focus for the protection of invaluable recourses, biodiversity and facilitating sustainable development in the region. Therefore to elicit support and involvement of people as the first step, GrACE since its founding 2011, with the support of Council for Green Revolution organized three regional conventions and two national conferences in the universities situated along the region, besides heading an expedition through all the five Eastern Ghats states and enrolled hundreds of activists. Nearly a decade of interface with the experts and as a result of direct interaction with people living across the region are reflected in this report while stressing up the need for conservation of resources that economically and socially beneficial.

I hope and wish the efforts which have been translated into this book will help and further consolidate the commitment of those who all want to work for the protection of Eastern Ghats present and in the future.

Foreword

Prof. K. Purushotham Reddy

The UN appointed World Commission on Environment and Development (WCED) in its report, Our Common Future in 1987, listed five major issues at the global level. These are: The depletion of ozone layer, global warming, loss of bio-diversity, desertification and nuclear threat. The world is now changing in ways our forefathers could never have imagined. The last century was a witness to an intense global debate centered on the ever intensifying environmental crisis as a result of rapid growth of population, decreasing natural resources and unsustainable 'developmental' practices and India is no exception. The resources of the prime eco-regions such as Himalayas, Western Ghats and Eastern Ghats are being plundered crossing the resilience capacities.

The situation in Eastern Ghats today demands a concrete conservationist action to halt ecological destruction and enable its renewal, rejuvenation of the ecosystems. The Richness, vulnerability, indispensability of the ecosystems of Eastern Ghats have to be widely known. There is a need to share the plight of these hills and its people and virtues of conservation therein.

The conservation and sustainable development in the region requires massive awareness, holistic environmental perspective, vision, positive policies, instruments, robust institutional structure, and proactive participation of local communities. This publication has been an effort to bring massive awareness and understanding towards goods and services rendered by these systems of hill ranges and the benefits to the people living over here.

This outcome of a stupendous task will catalyze transformative ideas and summon political will to ensure a healthy and sustainable future of the region. I fervently hope that the Eastern Ghats becomes one of the nation's foremost conservation priorities and the hills would become a showcase for conservation and sustainable development.

Outlook

K. Laxma Reddy

K. Leela Laxma Reddy

The wonderful nature evolved over eons on our planet has been degraded in the last three centuries (*the minute fraction of evolutionary scale of earth's natural history*). Both the ruling elite and the people have become indifferent towards natural environment.

Vital signs and warnings from a teeming number of scientists from all corners of the planet are ignored. Stephen Hawking, an eminent scientist warned that "if the situation continues like this, we the humans, in near future, have to find another planet to live". We are not sure whether there is any other livable planet in this universe. We can only safeguard our planet if we stop the inexorable pressure on earth resources. It is our moral responsibility to pass on our planet healthy to the coming generations.

All the ancient scriptures such as Vedas, Upanishads, Puranas, Itihasas direct us to live in harmony with nature. Many primitive and ancient civilisations lived in a symbiotic relationship with the background ecosystems. If we all show care and respect Mother Nature will ever protect us. The great souls like Mahatma Gandhi, Abdul Kalam reiterated the ancient wisdom that the wellbeing of humankind rests on the resilience with nature. If we ignore this, we have to pay a price.

Like many prime ecosystems, Eastern Ghats have been subjected to heavy pressures by the juggernaut of development projects and population tide over time. Addressing the ecological concerns today, require proactive action from all sections of society and Earth leadership. The hills, rock formations, biodiversity, rich resources and integrity and respect of the indigenous communities of the Eastern Ghats require such solidarity of many voices and positive, creative action.

Council for Green Revolution took this into the cognizance of the need of wider societal participation for the conservation of Eastern Ghats and instrumental for evolution of GrACE to carry out focused work. Many concerned citizens and organizations came together and made strides to bring focus to the cause. And the time has come to share all the glimpses, concerns and measures for restoration and conservation of the fragile Eastern Ghats.

We appreciate the committed effort of the team and eminent people who guided the journey of GrACE and publication of an Eastern Ghats Environment Outlook. We hope the publication contribute to the wider social consciousness, steer governments into a more vigorous conservation course for the protection of Eastern Ghats. We believe that the future of these hills would be safeguarded to maintain its integrity. We also hope that this publication will be a useful reference book for conservationists, environmentalists, policymakers and all concerned citizens.

Overview

Dr. K. Thulsi Rao

Dr. N. Sai Bhaskar Reddy

C. Umamaheswar Reddy

Eastern Ghats, the discontinuous range of mountains situated along the east coast of India is an important physiographic unit of the subcontinent with immense bio-geographic, environmental, socio-economic, cultural and spiritual significance. The hills are richly bestowed with biodiversity, geological formations and home to different tribal communities. Furthermore, it is important for the variety of ecosystem services, it provides, for its local and regional population of this part of the country. Its forests are a crucial carbon sink. Populations from a wide variety of origins have occupied this territory since time immemorial.

Eastern Ghats are fragile, due to it's fragmented distribution and heavy anthropogenic pressure. Population growth in the region, profligate exploitation of resources and myopic development projects are exerting enormous pressures on the ecosystems of these hills. Alarming deforestation, haphazard mining, rapid land use changes, aggressive invasion of alien species, fires, unrelenting hunting and poaching, over grazing, construction of dams, roads, transmission lines, canals, temple tourism, urbanization, industrialization, pollution etc., are resulting in the loss of biodiversity and ecological imbalance in the hills. The heavy footprints of humans in the hills, over the last century, causing irreparable damage to its ecosystems. Many concerns and questions come to the fore. What is the status of these unique ecosystems and is its future? How can we safeguard them from the ongoing onslaught?

Several peoples' movements, academic and scientific publication have projected the Western Ghats and Himalayas into limelight for conservation. Similar efforts have to be put in place to restore the pristine glory of Eastern Ghats. These hills are like neglected orphans. There is no comprehensive policy for the protection of these hills, which are crucial for sustainable development of the region. States sharing this rich, yet fragile ecosystem have developed certain strategies for conservation and sustainable development, but it's not sufficient and requires subtle changes in governance. The situation calls for immediate attention to conserve these hill ranges. There is no prominent unifying work which creates a holistic environmental perspective and vision for Eastern Ghats.

The above concerns have compelled us to take up the protection of Eastern Ghats as common issue, to wage collective struggles for its sustainable future. Article 51-A (g), in The Constitution of India says *"It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures." Hence the report* ***"The Eastern Ghats Environment Outlook".***

Long and complex natural history of Eastern Ghats, its ecosystems

services, intrinsic values, and the human history entwined with these hill ranges has yet to be fully understood. Much of the scanty, scattered scientific knowledge is dwelling only in the academic research realm and departmental documentation. Spatial and temporal peregrination of Eastern Ghats region provided snapshots of the ecosystems and plight of its people. This publication is prepared with all the available and accessible information. A wider literature review, desk work, consultations, conventions, conferences, focused group discussions, media reports and reconnaissance expeditions preceded the preparation of the book. In spite of the data limitations sectorally, geographically, work was guided by the insights of scientists, academicians, journalists, activists, conservation groups, officials, ecologists and other concerned citizens. This book tries to capture the profiles, ecological significance, vital signs, the principal driving forces, various pressures, potential impacts, existing governance framework pertaining to Eastern Ghats. Intended not only for policymakers and scientist, the book is brought out for every concerned citizen.

Located between 11^0 03' to 22^0 03'N and 77^0 02' to 87^0 02'E, the Eastern Ghats run about 1700 km in a north-east to south-westerly direction in peninsular India through the states of Odisha, Andhra Pradesh, Tamil Nadu and small parts in Telangana and Karnataka. The region covers about 75,000 Km^2 Elevation of these range reaches up to 1672 mts (Deomali in Koraput). Major peninsular rivers i.e., Mahanadi, Godavari, Krishna, Penna, Cauvery pass through the Ghats and these hills also form catchment to several streams.

The ecosystems of the hills are home to a great variety of species of flora and fauna and are an important area of endemism. The hills harbor tropical forests, grasslands and associated aquatic habitats brimming with a wide range of flora and fauna including endemic and endangered species. Approximately 2600 plant species occur in the ecosystems distributed over these hills. Hundreds of mammals, birds, amphibians, reptiles, fishes and innumerable insects thrive in the hills.

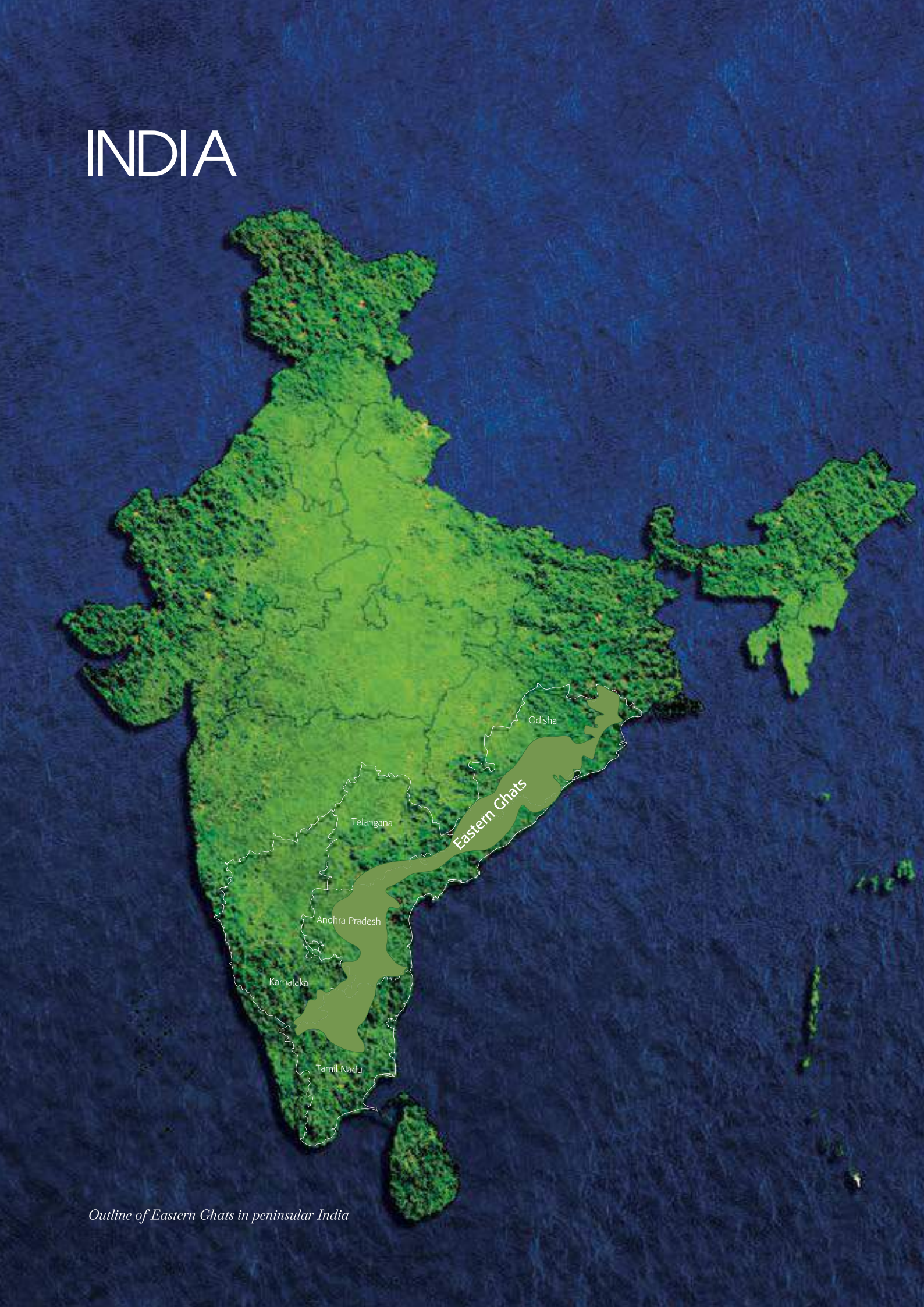
Eastern Ghats is a water tower, carbon sink, perennial food basket; spiritual and cultural space and provide a wide range of forest products, medicinal plants and it is a gifted gene reservoir. The natural heritage of the hills include its dramatic and scenic landscape featured with unique rock formations, hill stations, valleys, caves, streams and waterfalls etc. Eastern Ghats are dotted with several ancient pilgrim centers, Buddhist sites, tribal gods, sacred groves and pilgrim trails etc.

The region has been an important geo-strategic location in the subcontinent with its abundant mineral deposits, dam sites, forest resources, pilgrimage, tourism, and transport corridors etc. Rapid population growth and the ever increasing demand for its resources causing deleterious pressures on Eastern Ghats. A major part of the forest resources like timber and other non-timber produce have dwindled over the last century. The hill slopes, its plateaus are extensively cultivated by both shifting and regular cultivation. Plantations replaced a significant portion of vegetation on hilltops. Its valleys are submerged with large and medium dams taking away large areas of ecosystems and displaced lakhs of native people. Dry deciduous forests of Eastern Ghats are highly vulnerable to forest fires. Urbanization is eating away vast areas of the hill space.

The Eastern Ghats has lost its prime deciduous forest canopy. What we see today in these hills are the dismal remnants of once glorious and diverse primordial tropical forests. Studies reveal that the Eastern Ghats have lost half of its vegetative cover over the last century and a threefold increase of fragmented patches shows the alarming loss of the forest. Many floral and faunal species have become vulnerable.

About 5 million tribal people belonging to nearly 100 different groups make their home in Eastern Ghats. The stark and sad contrast is that these hills with rich mineral deposits and ecosystems are also home to most impoverished people. The conflicting interests between huge numbers of varied stakeholders, over the region's resources, resulted in a constricting situation for native people. Ensuring the wellbeing of humans, while protecting the Eastern Ghats is a challenging task in today's rapid pace for 'development'. Decades of tribal initiatives such as Integrated Tribal Development Agencies (ITDA) and recent enactments of The Provisions of the Panchayats (Extension to Scheduled Areas) Act, 1996 (PESA), and The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 have a long way to go, to positively impact peoples' lives here.

INDIA



Outline of Eastern Ghats in peninsular India

The region hosts wildlife sanctuaries, biosphere reserves and Ramsar convention sites. However, large part of Eastern Ghats wilderness has yet to be covered under conservation umbrella. The ambition of participatory conservation has to go a long way. Restoring Eastern Ghats requires sincere conservation efforts, as per globally accepted standards evolved over time. The synoptic view of the environmental situation in Eastern Ghats gives a grim picture. It requires big-time changes in governance. The report discusses the overall status in nutshell and suggests a score of recommendations of which the few important are as follows here.

1. *The Government of India shall set up* ***National Trusteeship Council (NTC)*** *on the lines of UN Trusteeship Council for protection and restoration of common property resources like forests, grasslands, wilderness areas, mountains, rivers, coastal marine ecosystem, islands, oceans etc.*

2. *To create Autonomous* ***Eastern Ghats Protection Authority****, for effective implementation of conservation measures and for sustainable development of the region.*

3. *To bring it to the knowledge of UNO to declare parts of potential patches of Eastern Ghats as* ***World Natural Heritage Site.***

4. *India shall truly implement climate change mitigation strategies like* ***Reduction of Emissions from Deforestation and Forest Degradation (REDD+).*** *As a signatory to Paris Accord, we should showcase the restoration of damaged mountain-forest ecosystem of Eastern Ghats as a success story (after restoring the Eastern Ghats to its original health).*

5. *India as a leading member of UN, must implement with all sincerity, all the global accords to which India is signatory such as* ***Earth Summit, UNFCC, CBD, UNCCD, CITES, SDGs etc.***

6. *The Government of India shall present every year our* ***Natural Resources Balance Sheet.***

7. *Enact a* ***comprehensive land use policy*** *to ensure its sustainable management.*

8. *We demand a* ***Policy for Protection of Mountains*** *for providing a comprehensive guidance for the conservation of mountain regions of India and its sustainable development.*

9. *Government of India must expand the existing conservation areas by notifying new wildlife sanctuaries, biosphere reserves, wildlife corridors, and community and conservation reserves. GrACE demands for the quick notification of all the pending proposals for Protected Areas and eco-sensitive zones.*

10. *GrACE strongly recommends that MoEF shall revisit the moves to bypass both PESA and FRA in clearing "linear" projects such as roads, pipelines, canals etc., which are short, sighted and will run counter to the Ministry's obligation under Article 48A of the Constitution and the various environment and forest laws.*

11. *Conduct transparent Environmental Impact Assessment, Strategic Environmental Analysis, Social and Environmental Management Plans before taking up any project in the hills.*

12. *With the PESA and FRA coming into force, the joint forest management should not be allowed to override the intent of FRA. MoEF, in consultation with the Union Ministry of Tribal Affairs and the States should revisit the rationale of the JFM and the modalities of enforcing PESA and FRA.*

We believe that this publication will inspire and contribute to the decisions and proactive steps to halt and reverse the degradation in Eastern Ghats.

Eastern Ghats, Andhra Pradesh

1

Territory and Characteristics

Older than the Himalayas and Western Ghats, the Eastern Ghats are a range of ancient discontinuous low mountains that spread along the east coast of the Indian peninsula. Popularly known as 'Malyadris', the Eastern Ghats sustain a mosaic of ecosystems and comprise lush green forests and grass lands that range from semi-evergreen patches to moist and dry deciduous, thorny scrub and tropical grasslands. The Eastern Ghats are adorned with many seasonal and perennial meandering streams with sparkling waterfalls that cascade over ancient geological formations of Cambrian origin. They are abode to ethnic people and also to varied flora and fauna. Roaring tigers, trumpeting tuskers, fleeing deer, flying squirrels, talking myna and dancing peacocks make up part of the enthralling vignette of the Eastern Ghats.

Situated between 11° 03'N to 22° 03'N and 77° 2'E to 87° 2'E, the Eastern Ghats run about 1700 km in a north-east to south-westerly direction on the eastern part of peninsular India between Bay of Bengal and Deccan plateau. The average width of these hills range from about 200 km in their northern part, whereas in their southern extension, it is about 100 km. The Eastern Ghats stretch across the five Indian State I.e., Odisha, Andhra Pradesh, Telangana, Karnataka and Tamil Nadu.

Unlike the Western Ghats, the Eastern Ghats form as groups of discontinuous hill ranges featured with escarpments, tors, plateaus, basins and gorges. The elevation of the hills reaches up to 1672 mts (at Deomali peak located in Koraput district, southern Odisha). Simlipal range in northern Odisha is considered as the northern limit of these hills, while the southern-most and western-most extent touches the Nilgiri hills at Tamil Nadu and Karnataka border. The confluence of Eastern Ghats with Western Ghat ranges is the Moyar river valley between the Sigur plateau and the Talamalai plateau (MoEF, 2011).

The geographical extent of the Eastern Ghats is about 75,000 km^2 with distribution in Odisha (25 %), Andhra Pradesh (40 %), Telangana (5%), Karnataka (5%) and Tamil Nadu (25 %). In Odisha they are spread over 19 districts, i.e., Mayurbhanj, Keonjhar, Balasore, Jaipur, Angul, Dhenkanal, Cuttack, Khurda, Nayagarh, Phulbani, Boudh, Kalahandi, Gajapati, Ganjam, Rayagada, Nawrangpur, Koraput, Malkanagiri and Kandhamal. In Andhra Pradesh they form parts of all its 13 districts; Srikakulam, Vizianagaram, Visakhapatnam, East Godavari, West Godavari, Krishna, Guntur, Kurnool, Prakasam, Nellore, Cuddapah, Anantapur and Chittoor. In Tamil Nadu, they are spread in 15 districts; Vellore, Erode, Salem, Namakkal, Dharmapuri, Tiruvannamalai, Tiruchirapalli, Puddukkaottai, Villupuram, Chengalpat, North Arcot, South Arcot, Coimbatore, Dindigul, Krishnagiri. Small parts of the middle Eastern Ghats extend in Telangana, i.e, Nalgonda, Nagar Kurnool (Part of erstwhile Mahabubnagar district), and Khammam districts. A small portion also lies in Chamarajanagar district of Karnataka where these hills meet with the Western Ghats.

Plateaus of Bastar, Telangana, Karnataka and uplands of Tamil Nadu lie to the western part of these ranges and on their east lies the coastal plains. Its various hills are known locally by various names e.g., the Deomali hills, Gandhamardan, Mahendragiri (Odisha); Anantagiri, Nallamalai, Veligonda, Seshachalam (AP); Kolli hills, Javadi hills (TN), Bilgiri Rangana hills (Karnataka) etc.

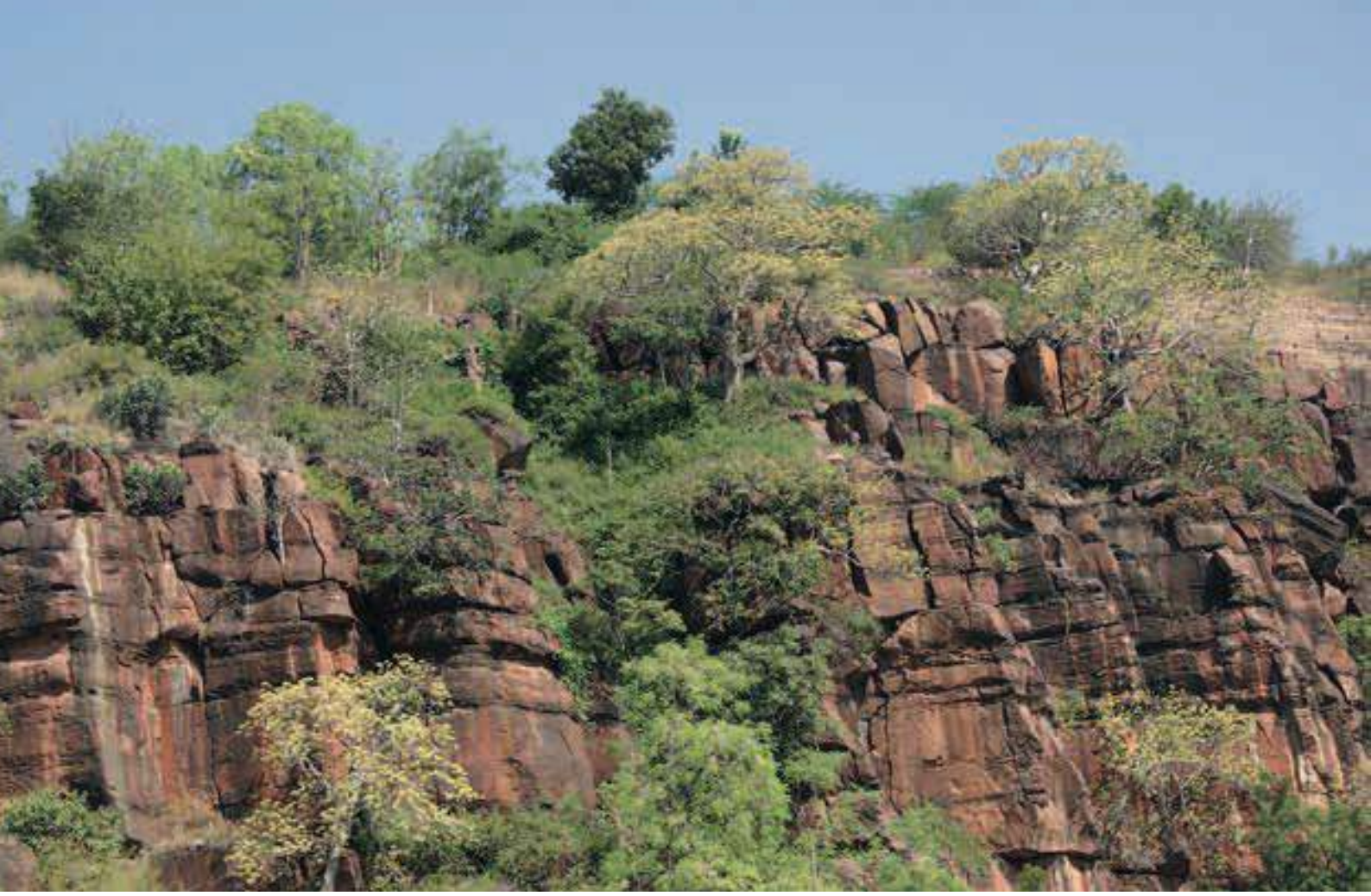
The ranges are dissected by easterly bound major rivers i.e., Mahanadi, Godavari, Krishna, Penna and Cauvery. These mega streams that flow through the Ghats form large estuaries at their confluence with the Bay of Bengal. Many small and medium-sized streams originate from the Eastern Ghats catchment.

Geographically, the Eastern Ghats are divided into three major regions: Northern, Central and South Eastern division.

"Environment is where we all live; and development is what we all do in attempting to improve our lot within that abode. The two are inseparable"

- Gro Harlem Brundtland.

Distribution of major hill ranges of the Eastern Ghats			
Division	**State**	**Hill range**	**District**
Northern Eastern Ghats	Odisha	Simlipal	Mayurbhanj
		Garhjat hills	Sundargarh, Sambalpur, Deogarh, Jharsuguda, Baragarh, and Kendujhar
		Gandhamardan	Bolangir, Bargarh & Sambalpur
		Kandhamal	Phulbani, and Kalahandi
		Niyamgiri	Kalahandi & Rayagada
		Deomali	Koraput
		Mahendragiri	Gajapati
Central Eastern Ghats	Andhra Pradesh & Telangana	Palakonda, Antikonda, Burrakonda, Patapatnam, Mandasa, Sompeta	Srikakulam, Partly Koraput and Phulbani
		Saluru, Mandasa, Peddakonda, Duggeru, Kurupam, Galikonda, Sunkarimetta, Madgole hills -Anantagiri, Chintapalli-Sapparla-Gudem -Marripakala ranges	Vizianagaram & Visakhapatnam
		Gurthedu, Addatigala, Rampachodavaram, Maredumilli and Bison hills	East Godavari
		Polavaram & Papikonda ranges	West Godavari
		Kondapalli	Krishna
		Kondaveedu	Guntur
		Nallamamlai	Guntur, Kurnool, Prakasam, Nalgonda,Nagarkurnool, Wanaparthy, Cuddapah
		Yerramala, Palakonda and southern fringes of Nallamalai	Cuddapah
		Veligonda	Nellore
		Seshachalam, Lankamala, Nagari and Kambakkam ranges	Chittoor and Cuddapah
Southern Eastern Ghats	Tamil Nadu	Kambakkam	Vellore
		Javadi	North Arcot
		Gingee	South Arcot
		Shevroy and Kalrayans	Salem
		Kollimalai, Bodamalai, Nainamalai	Namakkal
		Chitteri	Dharmapuri
		Melagiri	Dharmapuri and Krishnagiri
		Pachamalai	Tiruchirapalli
	Karnataka	Bilgiris	Chamarajanagar



Quartzite formations of Nallamalais

Geology

Older than the Western Ghats and the Himalayas, the Eastern Ghats have a complex geological, ecological and anthropological history. The genesis of these mountain ranges relates to the formation and division of the Rodinia, the ancient supercontinent and the evolution of Gondwana supercontinent. The Eastern Ghats are 'tors' of geological antiquity and older than the Himalayas and Western Ghats. These Ghats are not formed of one particular geological formation but consist of rocks varying in origin and structure according to the location (Meher-Homji, 2001). This fractured and relatively low mountain range running down much of eastern peninsular India, generally strike in Northeast and Southwest direction parallel to the East coast. These hills are bordered in the north by Singhbhum Craton and west by Bastar and Dharwar Cratons. The major direction of fold axes of the Eastern Ghats is NE-SW from Mahanadi valley to Krishna valley, where it turns to the South and SSE and goes into the sea, to bend back again it emerges near Chennai city. From here, rocks characterizing this unit proceed in a general WSW direction to the Nilgiri Mountains. The average elevation of these ranges is about 600 mats above mean sea level and rarely exceeding 1200 mts. The northern parts of Eastern Ghats show continuous hills with dissected ridges. The central Eastern Ghats show broken and very much dissected due to degradation. The Southern Eastern Ghats are also discontinuous. The Northern Eastern Ghats consists of domal structures with Lateritic fashions. They have risen to above 1000m. The central Eastern Ghats are relatively less in Altitude and risen to above 600m. The southern Eastern Ghats are have raised to more than 1000m. The Eastern Ghats are comprised of a wide variety of geological formations ranging from the oldest Dharwar schists to the recent Pleistocene formations (Alluvium). The hill ranges mainly consists of an intensely deformed and metamorphosed assemblage of meta-sedimentary, granulites and Granite-Charnokite complexes. The dominant meta-sedimentary rock units are Khondalites and Gneisses. It is opined that the Khondalites and Charnokites were formed at some depth and that the whole Eastern Ghats belt was uplifted at a later date, bringing these high-grade metamorphic rocks to the surface. Calcareous rocks occur as rare layers or lenses except for the northwestern margin where larger extents exist. Marbles are known only from a small area to the north of Visakhapatnam.

The Gondwana grabens of Pranahita-Godavari and Mahanadi, which follow NW-SE Dharwarian trends, are filled with the Gondwana sediments of Upper Carboniferous to Lower Cretaceous age. The Middle Eastern Ghats; Nallamala and Palakonda, Veligonda ranges are occupied by Cuddapah and Kurnool systems. These rocks include limestone, sandstone, slates and shales.

Eastern Ghats, based on geological features are divided into four sections i.e., the ranges north of the river Mahanadi in Mayurbhanj and its neighboring region. Second part lies between Mahanadi and Godavari dotted with soaring peaks like Deomali (1672 mts), Palamkini (1516 mts), Niamgiri (1516 mts), Mahendragiri (1501 mts), and Sambarikonda (1527 mts). Charnokites and Khondalites compose this mountain tract. The third portion situated between the Krishna river and to the eastern flank of Cuddapah basin. The hill ranges in this part includes Nallamalais, Veligonda, Palakonda and Seshachalam hills whose average elevation is 750 mts. Quartzite and slate formations predominate here. The last section falls between Chennai and the Nilgiri hills where they meet with Western Ghats. Important ranges in this part are Javadi hills Gingee, Kalrayan, Pachamalai, Shevroys, Kolli hills (Sudhakar Reddy, 2007).

The extension of Dharwar formation is seen along Anantapur, Prakasam, Nellore, Mahabubnagar, and Guntur districts in AP and Telangana. The Dharwar formation contains important minerals like mica, gold, and copper. In the hills of Odisha, the Dharwar rocks are absent, but mica, quartz, quarzites and schists are common and resemble those of the Dharwars (Krishnan, 1956).

Conical hills, sloping plateaus and broad, confined valleys are the geomorphological features of the area. The Eastern Ghats host many upper plateaus. In between Godavari and Pennar rivers, the Deccan plateau is noticed in the form of upper and lower plateaus. The plateaus are more in central Eastern Ghats of Nallamalai hills due to rapid denudation. Deomali ranges (Koraput plateau), Anantagiri (Araku), Nallamalai (Amrabad plateau), Shevroys (Yercaud) form sizable plateaus. Javadi, Mahendragiri, Kalrayan, Kollimalai hill ranges have small to medium-sized plateaus. These are the prime tourist destinations of Eastern Ghats.

Khondalites make up the hills. The lower slopes and valleys are made up of Charnockites. Bauxite of Eastern Ghats occur generally on gentle to moderately sloping plateaus.

Khondalites are mostly seen in the districts of Kalahandi, Koraput, Rayagada of Odisha and East and West Godavari of AP and Salem in Tamil Nadu. It forms on the top of the hills, where it is covered by laterite or bauxite and gives rise to reddish soils. The Charnockites, mainly Hypersthene Gneiss in nature are seen near Koraput, Rayagada in Odisha, Krishna and Prakasam districts in Andhra Pradesh. This formation is rich in high-temperature minerals like graphite and manganese along with smaller occurrences of marble. Products of weathering include oxidized ores of manganese and bauxite.

The rock formation of Cuddapah resembles the Gondwanas and Vindhyas, but is older. These hill regions consist of limestone, sandstone and shales with granite intrusions. Cuddapah rocks, being very hard, promote very poor forest growth. In parts of Koraput, Sambalpur, Guntur, Mahabubnagar, Kurnool and Cuddapah districts, Purana formations are found. These rocks contain limestone, sandstone, shales, phyllites and slates whereas the lower Gondwana region contains coal seams along with sandstones and shales. The coal seams are being exploited at Kothagudem, Yellandu and Khammam regions of Telangana.

The upper gondwanas consists mostly of shales and sandstones extending along Godavari river. Laterites appear in Nellore and Visakhapatnam districts. Alluvium occurs in the Krishna and Godavari floodplains. Ultramafic rocks also occur in minor proportion and comprise mainly of chromite and platinum group of minerals. Chromitite is the rock rich in chromite. Kondapalli in AP and Sukinda in Odisha are the two well-known chromite-bearing ultramafic sequences (Krishnan, 1949).

The economically important minerals of the Eastern Ghats are bauxite, limestone, chromite, graphite (Koraput, Visakhapatnam), feldspar (Koraput and Visakhapatnam), corundum (Godavari), manganese, magnesite (Salem), steatite (Nellore), mica (Nellore, Visakhapatnam and Ganjam), manganese (Ganjam, Koraput and Visakhapatnam), molybdenite (East Godavari), and coal (Khammam). Asbestos, barite, iron ore, tungsten, gemstones and semi-precious

stones like ruby, chrysoberyl, cats eye, moonstone, diopside, apatite, alexandrite, zircon, sillimanite, garnet and tourmaline are also found in Eastern Ghats. The charnockites , khondalites, granites and quartzites are used as building materials. The famous Konark temple, the Puri temple and several other ancient structures were built with charnockites.

Soils

Soils are one of the most important ecological building blocks of Planet Earth. Red soils, black soils and alluvial soils are found in the Eastern Ghats. The black soils are clayey and rich in lime and are found along the Mahanadi, Krishna, Godavari and Penna rivers. The deep black soils are found in Nallamalais, Veligonda and Seshachalam hill ranges. In Southern Eastern Ghats, mixed and black soils are found. Red soils are found along Mahendragiri, Papikonda, Simhachalam, Arumakonda, Chandragiri, Turiakonda, Rampa hills, Nallamalais, Palakonda, Seshachalam, Kolli and Shevaroys. Alluvial soils are characteristic of the coastal and irrigated regions of river systems. The rivers Godavari, Krishna and Pennar have developed prominent deltas filled up with alluvial soils. Laterite is formed because of alterations on surface of the rocks due to meteorological conditions. It occupies large areas of Gajapathi, Rayagada, Ganjam, Koraput, Sambalpur, Srikakulam, Visakhapatnam, West Godavari, East Godavari and Nellore districts.

Climate

The Eastern Ghats fall in tropical monsoon climate zone. Higher altitudes are with humid climate and semi-arid climate prevails all over the region. Average temperatures in January are between 20^0 C and 25^0 C. It goes up to 44^0 C in hot summer season. In winter the temperatures fall to 20^0 C. Eastern Ghats region receives most of the rainfall from south-west and north-east monsoon. The annual precipitation ranges from 1200 mm – 1500 mm in the northern part and 600 mm – 1000 mm in central and southern region which indicates sub-humid and semi-arid climates respectively. The coastal plains experience heavy rains from cyclones. Humidity ranges from 65-75 %.

Land use

Forests occupy a large part of the hill space. Farming takes next spot for land use after the forest cover and the plantations. Mining, dams, habitations, roads, etc., are the other significant land use variables in these hill ranges. Shifting cultivation is practiced, and in addition, due to intensification of conventional agriculture, fertile areas are cultivated. Apart from shifting cultivation, intensive agriculture is increasingly practiced over the last few decades.

Fringe valleys formed by eroded soils of hills support agriculture - Nallamails

Hill Ranges

Odisha

Simlipal: The name of the hills owes to the abundance and blooms of semul (red silk cotton trees) in the area which covers about 2750 km^2. This wilderness is blessed with thick forest cover dominated by Sal trees. The average elevation of these ranges is 900 mts. The area is crowned with the peaks like Khairiburu (1178 mts), Meghasani (1158 mts). Many streams like Budhabalanga, Khairi, Salandi, Palpala originate and flow in this wilderness and they form many cascades and falls before entering the surrounding low lands. Barehipani (217 mts) and Joranda (181 mts) are the prominent waterfalls of Simlipal.

Garhjat Hills: These ranges are a northward prolongation of the Eastern Ghats formed by a low lying hills. The northern ranges fall into Chotanagpur plateau while the southern part is an extension of the Eastern Ghats. These ranges spread over the district of Sundargarh, Sambalpur, Deogarh, Jharsuguda, Baragarh, Kendujhar in Odisha. The average height of the range is about 900 mts. Rivers like Brahmani, Mahanadi, Baitarani and Subarnarekha drain the area. The hills are covered with semi-evergreen and dry and moist deciduous forests. Malayagiri and Manakamacha are the important peaks of these ranges.

Khondmal Hills: These hills cover entire Phulbani district. It is an inaccessible highland with narrow valleys. Daringabadi is a famous hill station which is in these hills at a height of 915 mts above sea level.

Mahendragiri Range: The Mahendragiri-Singharaju hills, situated near Parlakhemundi in Gajapati district is located about 175 km from Berhampur in southern Odisha bordering Andhra Pradesh. This range is comprised of Devagiri hills in West Singaraja and Mahendragiri in the East, Udayagiri and Ramgiri hills in the North, Narayanpur and Gandahati hills in the South. The range is spread about 2,000 km^2 and is dotted with over 25 small and big hills with the highest peaks being Mahendragiri (1,501 mts), Singaraju (1516 mts) and Devagiri (1392 mts). Mahendragiri hills are comprised of mainly granite and magnetite rocks. The annual rainfall here is about 1550 mm.

Deomali Range: Deomalis forms the part of Koraput district of Southern Odisha. The range has the tallest peak of Eastern Ghats with an altitude of 1,672 mts situated at Doodhari village, Pottangi Panchayat, which is 35 km from Koraput. These hills are rich in biodiversity, mineral resources such as bauxite, limestone and gemstones. The hills also glisten with many springs and brooks, deep valleys. The hills are inhabited by tribes, such as Khondhs, Parajas, Bhumia, Malis and Bhotias.

Gandhamardan: These hills lie between 20º 42'N to 21º 00'N and 82º 41'E to 83º 05'E in the northwest of Bolangir and southwest of Baragarh district, Odisha. The important peak here is Gandhamardan with an elevation of 990 mts. The hills are endowed with a treasure of medicinal plants and abundant bauxite reserves. It is an undulating terrain with elevations ranging from 320 to 1220 mts and is aligned in north-east and south-west direction. Annual rainfall ranges from 750 mm to 1600 mm. It is an important floristic centre of the Eastern Ghats hosting moist deciduous vegetation (Sahu *et al*, 2010).

Deomali (1672 mts.) the higest peak in Eastern Ghats

Niyamgiri: The Niyamgiri range is situated in the districts of Kalahandi and Rayagada in Odisha. It is richly endowed with the finest quality bauxite reserves of India. These hills have one of India's most pristine forests in the interiors and is home to Dongria and Kondh tribes. Highest peak in the hills attain an altitude of 1509 mts. It is a sacred mountain for the tribals.

Andhra Pradesh

Anantagiri Ranges: Anantagiri was once a summer retreat for the Maharajas and is located near Araku Valley, making it a tourist attraction. There are huge waterfalls, ravines and gorges. The river Muchkanda, originates from these hills and flows along with several

Nallamalais in Telangana

small streams. The hills of Anantagiri are called the Badrinath of the South because of the sacred lake of Bhavanasi. The famous Borra Caves are very close to Anantagiri which is the tallest peak here at an altitude of 1168 mts.

Rampa Hills: Situated at a distance of 60 km from Rajahmundry in East Godavari District with an area of approximately 2000 km^2, Rampa hills were a part of the Madras Presidency and are known for their forests and their trade in timber. Rampa forests have also been prominent for their Non-Wood Forest Produce (NWFP). The area under Rampa Munsibdar, in the past, was described during the British regime as 'Rampa country', this later formed the Rampa Chodavaram taluk of East Godavari district in Andhra Pradesh. Chodavaram, the headquarters of Rampa Country, is bound on the south and west by the river Godavari. Forests account for nearly 80 % of the Rampa area, the rest is under shifting and settled cultivation.

Kondapalli: The hill range of Kondapalli (16^0 37' N, 80^0 32' E) is situated in Krishna district of Andhra Pradesh. Spread over an area of about 120 km^2 this range is mainly made up of charnockites. The khondalites form the basement gneisses and are intruded by the charnockites, which are themselves earlier than the pyroxene granulites and pyroxenites (Rao, 1978). Ruins of a fort built by Musunuri Nayaks in 14th century lies to the West of Kondapalli village.

Nallamalais: The Nallamalai hill range lies between 15°30' - 16°30' N and 78°30' - 80°10' E. the range forms the central portion of the Eastern Ghats situated in Guntur, Kurnool, Prakasam, Cuddapah, Nellore and Chittoor district of Andhra Pradesh and erstwhile Mahabubnagar and Nalgonda districts of the state of Telangana. They spread over 7,640 km^2, and run north-south 430 km between the Krishna and Pennar rivers, parallel to east coast. Palnadu basin forms the northern boundary and it merges with the Seshachalam hills in the south. Being an ancient mountains system, the hills have undergone a relentless erosion over eons. The ranges are dotted with peaks such as Bhairani Konda (1100 mts, Gundla Brahmeshwaram (1100 mts) near Cumbam town of Prakasam district. The other peaks above 800 mts are Mantikonda (910 mts) Durgappakonda (907 mts) Katalakonda (863 mts) and Gundlakonda (851 mts).

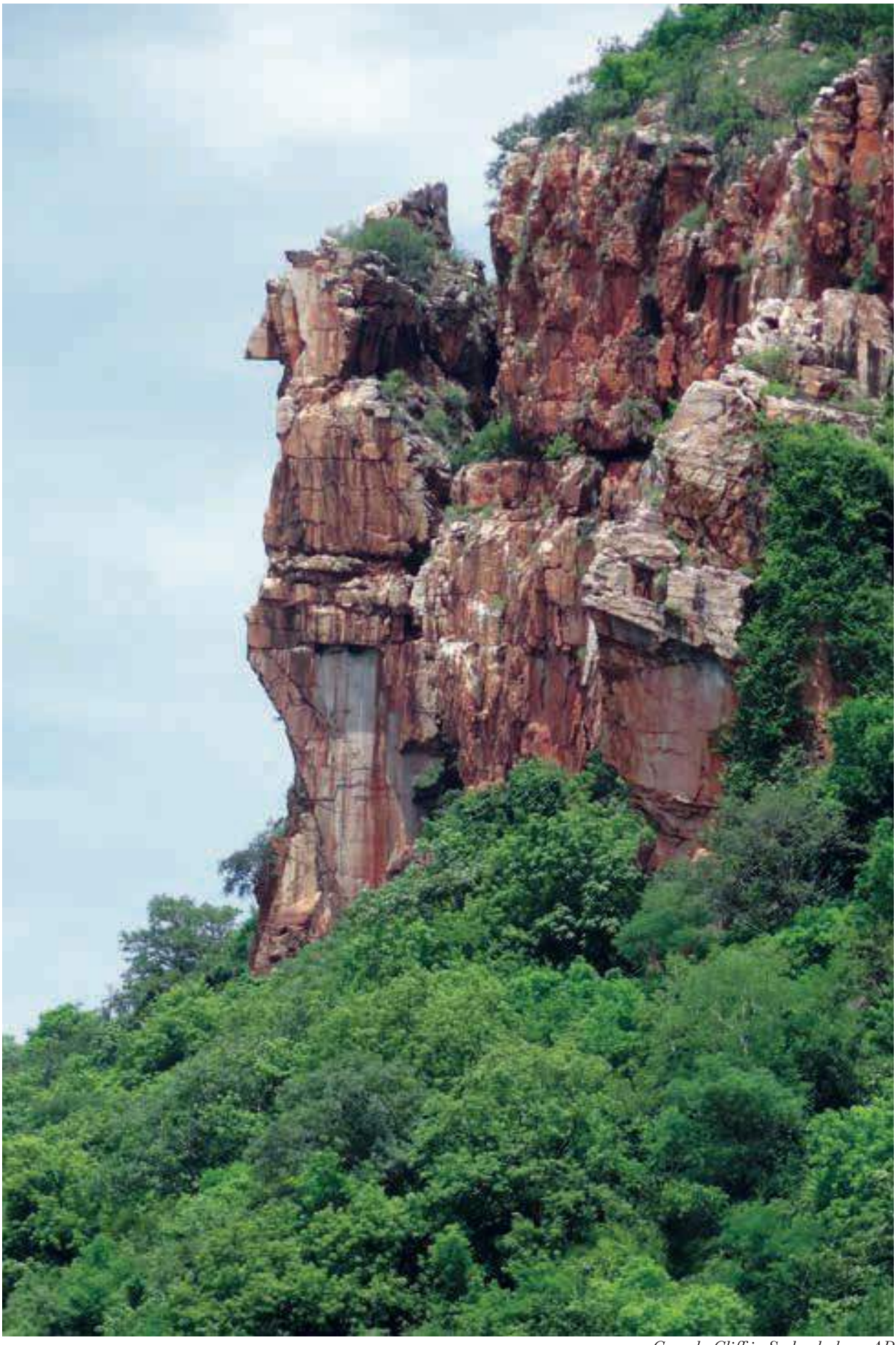
Kondapalli hills

Yerramala: These low hill ranges are situated in Kurnool district of Andhra Pradesh. The Yerramalais run east-west dividing Penner and Krishna river basins. They also extend into Cuddapah district along Penner basin. The hills have several natural, cultural sites such as Belum caves, Yadiki caves, Yaganti caves and temples, Gandikota gorge, Kalva Bugga, Kolimigundla, Tadipatri, Orvakal formations, Kethavaram rock art, Banaganapalli and Owk.

Palakonda: These hill ranges run south-east to north west in Anantapur and Cuddapah of southern Andhra Pradesh extending up to Tirupati. The elevation of these hills averages about 600 mts and the highest peak is located at Buttedu (933 mts). The hills were said to be formed during Cambrian period. For epochs, these hills have been eroded by the Penner and its tributaries. The hills are made up of quartzites and also found with slates. Punchu and Cheyyeru, Chitravati and Papagni which are tributaries of Penner drain the area. The streams between the two parallel ranges Palakonda and Veligonda are extensively dammed for irrigation.

Veligonda: This hill range, which trends north-south, forms the eastern flank of the Eastern Ghats, is strongly folded and faulted. The Veligondas are assumed to have been formed during the Cambrian period. They are relicts of ancient mountains that were eroded and dissected by numerous streams. Rivers pass through the hills in narrow gaps, usually marked by rapids. The Veligondas reach an elevation of 750 to 900 mts. The narrowness of the corridors through the hills has allowed the streams to be dammed at many places.

Lankamala: The Lankamala hills are located in Cuddapah district and spread over approximately 500 km^2. It is difficult to distinguish the Lankamala from the extension of the Nallamalais in the north and the Palakondas in the south. Only a depression separates this area from the former and the Pennar River from the latter. These hills are situated between 78° 45' - 79°10' E and 14° 25' - 14° 45' N. The highest altitude measured on this range is 975 mts.



Garuda Cliff in Seshachalam, AP

Seshachalam: The Seshachalam hills are an important hill range in southern Andhra Pradesh. The Seshachalam hills extend over 8000 km^2 and their general trend is east-southeast with steep slopes in its northern and southern portions. The origin of these hills date back to Precambrian period and they are comprised of sandstones, shales and limestone. Many longitudinal valleys divided the hills in the range. The uplands of Rayalaseema lies to the west and north-west of Sheshachalam and valley of Nandyal to its north. Elevation of the ranges reaches up to 1310 mts. Sandy loamy soils occur in granitic terrain in the region. The hills are blessed with hundreds of waterfalls like Talakona, Gundalakona and Gunjana. (Razia Sultana, 2010). Tribes like Yanadis live in these hills and famous pilgrim centre Tirumala is part of these hills.

Telangana

Amrabad ranges: Amrabad plateau and the hill ranges situated to the north of Krishna river in Telangana have prominent biodiversity regions and spiritual centres.

Tamil Nadu

Javadi Hills: These hills form the southeast portion of Eastern Ghats in the state of Tamil Nadu. The area lies between latitude of 12° 12′ - 12° 52′ N and longitude of 78° 35′ - 79° 10′ E. Running about 70 km, with a width of 25 km these hills cover an area of about 1860 km^2.

These ranges are situated in southwestern part of Vellore district and northern part of Thiruvannamalai district. The topography of Javadi range is predominantly rugged. The outer slopes are steep and for the most part rocky. The central and southern parts of the range form an undulating plateau. The average elevation is approximately about 800 mts. The hills have a few flat-topped peaks, amongst which the Anjeevarajan malai (1200 mts) is the highest (Ravipaul, 2003) A special feature at the top of these hills is that the plateaus extend for approximately 10 km. The highest peak in this range is Kumbukudi (1273 mts). The hills are inhabited by tribes such as Malayali, Irula and Kurumans.

Javadi Hills

Gingee Hills: Formed with jagged peaks, bare rock and boulders, these hills are located in Gingee taluk of Villupuram district. They run about 22 km south-westwards from Gingee town.

Sirumalai: The Sirumalai (Chinnamalai) group of hills lie in four districts of Tamil Nadu, i.e., Tiruchirapalli, Dindigul, Karur and Sivagangai. It is situated between 77°33′ and 78°15′ E and 10° 00′and 10°39′ N and covers an area of 200 km^2. They are located at a distance of 25 km from Dindigul and at about 80 km from Madurai. The hills are part of 6E biogeographic province of Deccan peninsular zone, and have the biome of tropical dry deciduous forests. With an altitude of about 1600 mts, the tallest hill in Sirumalai is called Silver Hill and it is located near Agathyapuaram.

Karanthamalai: Karanthamalai or Perumalai are picturesque hills ranges in Dindigul District, Tamil Nadu. Perumalai hills lie adjacent to Sirumalai and the natural vegetation comprises dry deciduous forests. Puravi Eduppu is a popular festival beseeching the rain gods for their mercy and subsequent rainfall. This place has reserved forests laced with numerous streams and is also home to bison and a variety of birds and small animals.

Kollimalai: Kolli hill range in Namakkal district is located about 86 km south-east of Selam district and lies in between 11^{0}10′ - 11^{0}27′ N and 78^0 18′ - 78^{0}30′ E. They extend over an area of 450 km^2, with elevations reaching up to 1500 mts. Annual rainfall here ranges from 1200 -1400 mm. The hills are covered with forests and streaked with several streams.

Pachamalai: Pachamalai hills are also known as the Pachais are low mountain ranges located in central Tamil Nadu. Situated between 11° 09′ to 11° 27′ N and of 78° 28′ to 78° 49′ E. These hills stretch over the northern border of Tiruchirapalli district and extend into the adjoining Salem and Perambalur districts. The hills cover an area of 530 km^2 and altitudes range up to 1072 mts. Pachamalais are separated from the Kollimalais by the narrow Thammampaty valley. Rivers in the Pachamalai hills include the Sweta and Kallar. Waterfalls include the Koraiyar, Mangalam Aruvi, and Mayil Uthu falls. The Veera Ramar Dam is located on the Kallar River in the hills. The vegetative area is

Kolli hills, Tamil Nadu

distributed into 35 reserved forests. The soil of these hills ranges from loam to clay-loam and is generally reddish brown to dark yellowish brown in colour.

Shevroy: These hills are located between 11°45′ and 11°55′ N and 78°10′ - 78°20′ E in the southwest portion of the Eastern Ghats largely spreading in Salem district and covers an area of 470 km^2. The elevation of the hills reaches up to 1620 mts (Solaikaradu). The name of the hills owes to a local deity, Servarayan. The hills are made up of Archaean Charnockites and also with granitic gneiss (Krishnan, 1956). Brown calcareous soils are found on the hills. Some of these hills host plateaus from 1,200 - 1,500 mts. Yercaud is an important hill station of South India situated on the plateau of Shevroys. These hills run parallel to the lower Chitteri – Kalrayan hills, and in close northern proximity to Kolli and Pachamalais. Mettur hills lies to the west of Shevroys. These hills have coffee plantations and a sanitarium. These hills are home to the tribes of Malayali, Irula and Kurumans.

Kalrayan Hills: These hills extend between 11°38′ and 12″°l′ N and 78°37′ and 78°51′ E. The hills range in height from 600-1200 mts and extend over an area of 1100 km^2. Kalrayan hills, Pachamalais, Javadi and Shevroys divide Cauvery River basin in the south from the Palar basin in the north (Kadavul, 1999). These hills span over a number of districts in Tamil Nadu, extending northeast from Salem district. Kalrayans forms a boundary between the Salem and Villupuram districts. The northern section of the Kalrayans are referred as Chinna ("little") Kalrayans, and the southern part is called Periya ("big") Kalrayans. The Chinna Kalrayans average 820 mts in height, while the Periya Kalrayans average 1200 mts. Major streams in the area include Manirnukhtar, Gomukhi and Mayura. Scrub forest is found up to 400 mts, whereas deciduous vegetation can be seen between 400 and 800 mts. Sholas, unique stunted evergreen vegetation of higher altitudes can be found on isolated plateaus of these hills.

Chitteri Hills: These hills situated between 78°15′—78°45′E and 11°44′—12°08′N and extend over an area of about 660 km^2 in Dharmapuri district of Tamil Nadu. They are formed as a compact block of many hills, ridges and ravines. The ranges run in northeast and southwest directions, enclosing narrow valleys such as Kallar, Varattar, Kambalai and Anaimaduvu. Elevation of the hills reach up to 1266 mts at Bottumalai peak. The eastern side of the hills runs parallel to the Kalrayans and it is separated by Kallar valley. The western side is adjacent to Shevroys and is separated by Manjavadi ghat road. The northern end of Chitteri is the Tirthamalai (sacred hill), a lone hill block standing 980 mts high. Tirthamalai consists of well-exposed steep and sharp ridges running up to nearly three-fourths of its height and is rich in magnetic iron beds. Chitteri hills are mainly formed by the gneisses or granitic rock groups. Magnesite occurs in the reserved forests of Morappur and Uthangarai. The western side of the Kottapatty valley contains an extensive spread of talc schist. Shallow reddish-loamy soils with gravel and boulders are found on the hills. Patches of saline and alkaline soil are common in low lying areas, which are well indicated by the presence of Phoenix species (Natarajan, 2002). The

vegetation of the hills is a varied mix of evergreen, semi-evergreen, riparian, dry mixed deciduous, dry deciduous scrub and the southern thorn scrub types (Champion and Seth, 1968). The Chitteri hills are inhabited by Malayalis, Irulas and Kurumans.

Palamalai: Situated near Coimbatore, this offshoot of Eastern Ghats is geographically contiguous to Bilgirirangana hills and they extend to meet Western Ghats at Neelgiris. Arulmigu Palamalai Aranganadhar Thirukkovil temple is located on Palamalais.

Mettur Hills: The hills are located in the confluence region of the district of Erode, Salem and Dharampuri in Tamil Nadu. Famous pilgrimage centre Male Mahadeshwara is located 40 km from here. Mettur dam is constructed on Cauvery.

Melagiris: These hills are located in Krishnagiri and Dharmapuri districts. The ranges form the catchment of rivers like Cauvery and Chinnar. Bound by the river Cauvery on the west these hills have an expanse of about 1300 km^2. The hills host a rich floristic and faunal diversity.

Karnataka

Biligirirangana Hills: Also called as BR Hills, these ranges are situated in southeastern Karnataka at its Tamil Nadu border in Erode district. These hills are spread over Yelandur, Kollegal and Chamarajanagar talukas of Chamarajanagar district of Karnataka. They form a contiguous wilderness with Satyamanagala, forest in Erode district on the south. Bilgiriri Ranganatha temple is located on the hills. They are formed of charnockite rocks with whitish color, giving the hill its name (in Kannada Biligiri means 'white hill').

"Eiher, air, fire, water, earth, planets, all creatures, directions, trees and plants, rivers and seas, they are all organs of God's body. Remembering this, a devotee respects all species"

- Srimad Bhagavatam

Honnemetti, in Biligiri Rangana hills, Karnataka

Rusul cheruvu in the foothills of Nallamalais

Water Resources

Rivers

Major rivers of peninsular India i.e., Mahanadi in Odisha, Godavari, Krishna and Penner in Andhra Pradesh and Telangana and Cauvery in Tamil Nadu cuts through different ranges of these ranges. In addition, many streams, small and big originate and criss-cross this hilly watershed. As the hill range forms a catchment region, several streams steep down forming hundreds of falls and cascades in the Eastern Ghats. The rivers and rivulets show profound influence on the economy, socio-cultural, and spiritual space in the region.

Wetlands

Wetlands are the transitional zones between aquatic and terrestrial ecosystems and are considered as ecotones. There are many coastal ecosystems such as wetlands, estuaries, mangroves, lagoons etc., that lie between the hill ranges and Bay of Bengal. According to MoEF, (2010), Odisha has 560 coastal wetlands. According to Envis (2011) Andhra Pradesh has 259 coastal wetlands covering an area of 18,552 km^2 , including 88 manmade water bodies and Tamil Nadu has about 773 wetlands. Chilika, Kolleru and Pulicat are the prominent wetlands in the region.

Streams of Eastern Ghats Catchment	
State	River
Odisha	Shabari, Tandava,Mahendratanaya, Rushikulya, Vamsadhara, agavali (Langulya) Brahmani, Suvarnarekha, Vaitarini, Salandi, Salia, Budhbalanga, Jamira, Kolab and Bahuda.
Andhra Pradesh	Machkund, Sileru, Indravati, Vegavathi, ampavathi, Swarnamukhi, Paleru, Kundu, Sagileru, Gosthani,Tammileru, Sarada, Gundlakamma, Papaghni, Chitravathi,Cheyyer,Gunjana
Tamil Nadu	Vellar, Ponnaiyar, Amaravathi, Vaigai, Varaha, Palar, Swetha and Thambaraparni.

Chilika lake is one of the important wetlands and the largest coastal lagoon of India. It is spread over 1,100 km^2 in the districts of Puri, Khurda and Ganjam in the state of Odisha. This brackish lagoon is situated at the mouth of Daya river on the cost of Bay of Bengal. It also has the distinction as the second largest coastal lagoon in the world. The water spread of this brackish lake fluctuates about a variation of 1160 and 900 km2 during the monsoon and summer respectively.

Mountains in a Changing World

The Food and Agricultural Organisation(FAO) of the United Nations highlighted that the importance of the mountain ecosystems is equal to and as important as other ecosystems of our planet while agreeing with the thoughts of the conservationists.

Mountains occupy one-fourths of the world's land area (Kapos *et al.*, 2000) and is home to about 12 % of the world's population (Huddleston *et al.*, 2003). In addition about 14 % of world population lives in the vicinity of mountains (Meybeck, Green, and Vo¨ro¨smarty 2001).

Mountain societies not only include remote, impoverished and deprived people and communities but also affluent tourists and denizens of urban areas in close proximity to the cities – including megacities such as Rio De Janeiro, Visakhapatnam, Cape town, Mexico City, Janeiro etc. Mountains are important for nearly half of global population through their ecological services such as water, energy, crops and forest products. They are the important centers for biological and cultural diversity, religion, recreation, and tourism (Messerli and Ives 1997).

The importance of mountain ecosystems was emphasized in the Rio Conference of 1992. About 10% of the humans on earth directly depend on the resources of mountain areas such as water, forests, agricultural products and minerals. A significant 40% more who live in the areas of lower watersheds indirectly depend on mountain resources. About 60-80% of world's freshwater resources are provided by the mountains. Mountains host about 25% of terrestrial biodiversity. They are the vital genetic resources for local crops and livestock. They make up to 60% of all Biosphere Reserves and 30 % of all World Heritage Sites and attract about 15-20% of global tourism.

These figures demonstrate the global significance of mountains. Until a few decades ago, mountain space was a matter of attention for only a few scientists, development professionals, policy makers and mountaineers. In 1992, through the United Nations Conference on Environment and Development (UNCED), held in Rio de Janeiro, the concerns and conscience on mountains were pushed into world stage through inclusion of a chapter in Agenda 21, the plan for action endorsed by heads of most of the nations (Price 1998; Stone 2002).

About 90% of people in mountain regions are from developing countries. These Mountain people are among the world's deprived where a majority lives below the poverty line and 1 out of 3 are vulnerable to food insecurity. The many fold manifestations in mountain areas such as deforestation, predatory mining and tourism, unsustainable farming and population growth can endanger livelihoods, accelerate erosion and desertification, cause loss of biodiversity and trigger disasters such as floods and landslides. Mountain ecosystems are extremely vulnerable to climate change – and consequences, such as rapid glacier melting, are far-reaching and potentially upsetting. For ages, local people lived in harmony in nature with traditional knowledge and showed an amazing resilience of fragile ecosystems of the mountains, but their voices are hardly heard (FAO, 2016).

Chapter 13 - Agenda 21 of Rio Conference says "Managing fragile ecosystems: sustainable mountain development includes two "programme areas" 1) generating and strengthening knowledge about the ecology and sustainable development of mountain ecosystems; 2) promoting integrated watershed development and alternative livelihood opportunities. For the first time, mountains were accorded comparable priority in the global debate about environment and development with issues such as global climate change, desertification, and deforestation. In 1998, the UN General Assembly reemphasized the importance of the world's mountains by declaring the year 2002 the International Year of Mountains.

Godavari River bisecting the Papikonda range in Andra Pradesh

Deciduous vegetation of Nallamalais

2

Ecosystems and Biodiversity

With about 7% of the described species of the world, India stands as one of the rich countries in terms of biodiversity. The country lies within the Indo-malaya eco-zone and houses two of the 34 biodiversity hotspots around the world. The Eastern Ghats constitute an important bio-geographic region of India, stretching over bio-geographic provinces of 6A to 6E. They give rise to characteristic ecosystems and associated floral and faunal assemblage along the hill ranges from north to south. These hills form an amazing mosaic of forests, riverine, wetland, grassland, and coastal ecosystems. A characteristic blend of vegetation, climate, topography and geology evolved the biogeography and ecosystems of the region and it boasts an amazing variety of flora and fauna consisting of endemic and endangered species. To date, new species are being discovered in the region.

Fauna and Flora of Eastern Ghats			
Group	No. of species India	% of world species	No. of species in Eastern Ghats
Mammals	350	7.6%	100
Birds	1224	12.6%	425
Amphibians	197	4.4%	99
Reptiles	408	6.2%	100
Fishes	2546	11.7%	155
Flowering plants	15000	6%	2600

Source: Indira Gandhi Conservation Monitoring Centre (IGCMC)

Vegetation over a hill in Nallamalai, BR Hills, Karnataka

Vegetation profile

The floral diversity in India is mainly concentrated in the five biodiversity-rich regions of the Eastern Himalayas, the Western-Ghats, Northeast India, Andaman & Nicobar Islands and the Eastern Ghats. Unlike the other four, the Eastern Ghats are not properly recognized for their richness due to lack of adequate studies. However, these floristically significant areas exhibit an exceptional concentration of endemic species. This region primarily harbors tropical deciduous vegetation which represents species of high economic, ecological, nutritional and medicinal value.

Based on the available literature, the number of flowering plant taxa occurring here is approximately 2600. A total of 149 liana species representing 31 families and 90 genera are present in the Eastern Ghats (Saxena and Brahmam, 1994 & 1995; Mathew, 1991; Sharma *et al.*, 1984). Of these, 20 species (*13%*) were reported as the endemic of Indian peninsula and 7 (*5%*) species fall into 'rare and endangered' category. Approximately 184 species of ferns and fern allies are reported from the Eastern Ghats. The ranges harbor 190 species of orchids under 54 genera, largely occurring in Odisha (Raju *et al*., 2008). The five endemic orchid species in the Eastern Ghats are *Bulbophyllum panigrahianum, Eria meghasaniensis, Habinaria panigrahiana, H. panigrahiana var. parviloba,* and *Liparis vestita sub sp. seidenfadensis.* Rare orchids in the Eastern Ghats are *Bulbophyllum macraei, Diplopora championi, and Goodyera fumata.*

The jungles in Eastern Ghats harbor many medicinal plant species, NWFP and food species, fodder grasses, plants of horticultural interest, fuel wood trees etc.

The Eastern Ghats are home to Red Sanders *(Pterocarpous Santalinus)* and Sandal wood *(Santalum album)* which are known for their exceptionally high economic value. The Eastern Ghats region is bestowed with agricultural diversity including a range of cultivars of paddy, millets, pigeon pea, cowpea, hyacinth bean, rice bean, niger, brinjal, cucurbits, yams, banana, mango, custard apple, ginger and turmeric etc. Above 150 species of wild cultivars are reported from the region.

A tree branch festooned by epiphyte in semi ever green forest in Southern Eastern Ghats

The divergent climate, soil, biotic and altitudinal, topographical aspects of the Eastern Ghats have resulted in the evolution of its forest types. In a random look, the vegetation of these hill ranges comprise an array of forest categories such as tropical dry deciduous, mixed dry deciduous, moist deciduous, dry evergreen forests, scrub or thorn forests, riverine forests and small patches of semi-evergreen and evergreen forests, scrubs and grasslands. According to Sandhya Rani and Pullaiah (2002) vegetation of Eastern Ghats falls into nine broad categories as follows

Tropical evergreen forests occur in Valleys of Shevroys in Tamil Nadu southern Eastern Ghats, small patches in Lakshmipuram area in Visakhapatnam, Andhra Pradesh with predominant tree species such as *Cinnamomum zeylanicum, Elaeocarpus serratus, Ixora notoniana, Meliosma microcarpa, Symplocos laurina, Toona ciliata* etc.

Tropical semi-evergreen forests distribute in Moist valleys of Simlipal, Atai, Mahendragiri, Banguru forests and parts of Ganjam and Koraput districts, Sapparla, Dharakonda, Galikonda, Minumuluru, some areas near Ananthagiri, Nulakamaddi, Maredumilli in northern Eastern Ghats and Tanjavanam and Shevroy hills of southern Eastern Ghats, patches in Bilgirirangan hills. The tree species found here are *Michelia champaca, Mangifera indica, Artocarpus lakoocha, Dillenia pentagyna, Firmiana colorata, Bridelia tomentosa, Xylia xylocarpa, Mesua nagassarium, Polyalthia cerasoides, Macaranga peltata, Pittosporum napaulense, Phoebe lanceolata, Murraya koenigii* etc.

Tropical moist deciduous forests show three sub-categories. **Northern sub-tropical deciduous forests (Sal forests)** occur in Districts of Kalahandi, Kandhamal, Boudh, Ganjam, Koraput and Srikakulam and northeastern border area of Vizianagaram districts with tree species such as *Shorea robusta, Syzigium cumini, Xylia xylocarpa Haldinia cordifolia, Terminalia coriacea, Pterocarpus marsupium, Anogeissus*

latifolium, Albizia procera, Madhuca longifolia, Phyllanthus emblica, Lagerstroemia parviflora, Schleichera oleosa, Cleistanthus collinus, Buchanania lanzan, Dillenia pentagyna, Diospyros melanoxylon, Mallotus philippenensis, Careya arborea, Litsea glutinosa Syzigium operculatum, Elaeocarpus tectorius, E.robustus, Aphanamixis polystachya etc.

Southern Indian tropical moist deciduous forests (non-sal forests) occur in Rampa Agency, Maredumilli in East Godavari district, parts of West Godavari district, small patches of Nallamalais, Talakona and some parts of Seshachalam hill ranges of middle and southern Eastern Ghats. Tree species found here are *Terminalia alata, Xylia xylocarpa, Anogeissus latifolia , Dillenia pentagyna, Pterocarpus marsupium, Mangifera indica, Dalbergia latifolia, Terminalia chebula, Sterculia urens, Mitragyna parviflora, Albizia odoratissima, Bridelia airyshawii, Schrebera swieteniodes, Careya arborea, Grewia tiliiolia, Polyalthia cerasoides, Kydia calycina, Semecarpus anacardium* etc. Southern tropical moist deciduous riverine forests are confined to small areas along banks and the dried river beds all over Eastern Ghats in Odisha, Andhra Pradesh, Telangana, Tamil Nadu, and Karnataka. The common species in this category are *Terminalia arjuna, Pongamia pinnata, Tamarindus indica, Anogeissus acuminata, Barringtonia acutangula* and also mixed with characteristic species on the sandy and rocky bouldered river beds such as *Homonoia riparia, Tamarix ericoides, and Syzygium heyneanum.*

Tropical dry deciduous forests are classified as teak bearing and non-taking bearing. The **teak bearing** forests occur in northern and middle Eastern Ghats of Andhra Pradesh and Telangana. Tree species here are *Tectona grandis predominates* and other species associated are *Anogeissus latifolia, Pterocarpus marsupium , Terminalia chebula, Terminalia bellirica, Garuga pinnata, Bridelia airyshawii, Cassia fistula* etc. Non-teak bearing forests are found in Seshachalam hill ranges, North Arcot of southern Eastern Ghats. Trees here are *Pterocarpus santalinus, Shorea tumbuggaia, Syzigium alternifolium, Boswellia ovalifoliolata*, prominent in some areas and mixed with other species like *Terminalia pallida, Shorea roxburghii, Phyllanthus emblica, Anogeissus latifolia, Terminalia paniculata, Terminalia alata, Chloroxylon swietenia, Dolichandrone arcuata, Wrightia tinctoria, Vitex altissima* etc.

Mixed dry deciduous forests are of two types. Northern mixed dry deciduous forests have a restricted distribution in Sukinda - Rebna, Keonjhargarh area, Nigirda - Llung area (Mayurbhanj district), and parts of Angul, Kalahandi, Ganjam and Koraput districts of Orissa. The tree species found here are *Shorea robusta, Boswellia serrata, Terminalia alata, Bombax ceiba, Hymenodictyon excelsum, Pterocarpus marsupium, Sterculia urens, Alangium salvifolium,, Mallotus philippenensis, Cassia fistula* etc.

Southern mixed dry deciduous forests occur in drier parts all over Eastern Ghats. Species found here are *Anogeissus latifolia , Chloroxylon swietenia, Diospyros melanoxylon, Gardenia gummifera, Albizzia odoratissima, Hardiwickia binata, Pterospermum xylocarpum, Helicteres isora, Xeromphis spinosa, Flacourtia ramontchi* etc.

Lush green kolli hills

Dry savannah forests are found all over Eastern Ghats and common species are *Phyllanthus emblica, Terminalia chebula, Pterocarpus marsupium* etc.

Scrub forests are also found all over Eastern Ghats and the tree species found here are *Acacias, Capparis sepiaria, Ziziphus mauritiana, Ziziphus oenoplia, Ziziphus xylopyrus, Euphorbia antiquorum, E. tirucalli, Flacourtia sepiaria, Xeromphis spinosa,* and are associated with non-thorny drought resistant species like *Dolichandrone falcata, Wrightia tinctoria, Dodonaea viscosa, Cassia fistula* etc.

Tropical dry evergreen forests are confined to Cuddapah, Sriharikota and Mamandur valley in Seshachalam hill ranges in Southern Eastern Ghats

Tropical dry evergreen scrub jungles are limited to Saidapet division and Madurantakam in Tamil Nadu.

About 145 species of endemic plants including 44 Red Data Book (RDB) species are from Eastern Ghats. The areas rich with endemics are Ganjam – Koraput range in Odisha, ranges in Visakhapatnam district (including Araku Valley and Madugula hills), Nallamalai (AP & TG), Seshachalam; Shevroys and BR hills. Majority of the endemics confine to a limited area unlike in the Western Ghats where endemic are distributed and are common all over the hills. The

estuaries of the Mahanadi, Godavari, Krishna and Cauvery rivers host patches of mangrove vegetation. Local tribes depend on a variety of medicinal plants that occur in Eastern Ghats, (Sudhakar Reddy *et al.,* 2007).

Sacred groves

Sacred groves are patches of vegetation protected by local communities for being the sacred residence of local deities and are sites of religio-cultural rituals. They vary from few acres to few square kilometers in size. They are invaluable storehouses of biodiversity and ecologists say that these groves are a repository of gene pools and act as reservoirs of biological diversity because these have been protected since ancient times, and act as "climax forests" that harbor a variety of flora. These groves, amid degraded terrain, can be seen in many parts of Koraput and Kalahandi districts in Odisha (Panigrahi, 2006).

Sacred groves represent the only surviving examples of climax vegetation in many parts of India. It has been estimated that the total number of sacred groves in the country is estimated between 100,000 and 150,00 and about 14,000 such groves have been reported from all over India, which are home to rare fauna, and rare flora, both in rural and also in urban settings. Sacred groves are called by different names in different states - Kovikaadugal in Tamil Nadu, Pavitraskhetralu in Andhra Pradesh and Jahera, Thakuramma in Odisha.

According to Swain *et al.*, (2008) Eastern Ghats region has more than 1200 groves in which 713 are from Andhra Pradesh and about 235 groves recorded from the hills of Tamil Nadu. About 322 groves are reported from Odisha. In present times, sacred groves are facing various threats. Not only commercial interest but the influences of modernization and cultural changes are causing the disappearance of these groves. Economic forces, change in the values and life styles have greatly contributed to the fall of sacred groves. Large-scale land conversion is taking the toll of these groves. Though sacred groves have been recognized to be a rich repository of ecological, cultural and sociological history; they are ignored by governments (Panigrahi, 2006).

"Very little has been published regarding sacred groves in India, but they are, or rather were, very numerous…These... as a rule, are not touched by the axe, except when wood is wanted for the repair of religious buildings"

-D. Brandis (1897), First Inspector General of Forests of India.

Gosthani river seen from Borra Caves

Bamboo Temple, Koraput, Odisha

Bamboo Temple

Adivasi's famous place of worship, the Kanta-baunsiani (Thorn-Bamboo Goddess) is located in Damanjodi of Koraput district in Odisha. Unlike in other temples, there are no idols or temple structures, walls or fences here. The Kunta-baunsiani is worshipped in the form of bamboos. Adivasis have syncretic beliefs and their pantheon has both the common Hindu gods and their own. The gods and goddesses are always attributed to various natural phenomena, objects, trees, animals etc. These bamboos are revered as holy, not only by the aboriginals but also by other people as well.

Tiger in Nallamalais

Fauna

The combination of diversified ecological niches and environmental factors provides a habitat to a variety of faunal species. The Eastern Ghats are known to have a wide variety of mammals, reptiles, birds, amphibians, fishes, insects and other creatures. The Eastern Ghats are unique in its biotic attribute with charismatic and endangered fauna like tigers, elephants, gaurs, leopards, etc. Following is a brief description of the faunal diversity in the Eastern Ghats.

Mammals

About 100 species of mammals make their home in the Eastern Ghats. The noteworthy carnivores of Eastern Ghats are tiger (Panthera tigris), Indian Leopard *(Panthera pardus),* leopard cat *(Felis bengalensis),* jungle cat *(Felis chaus),* fishing cat *(Felis viverrinus),* rusty-spotted cat *(Prionoilurus rubiginosus),* jackal *(Canis aureus),* Bengal fox *(Vulpes bengalensis),* striped hyena *(Hyaena hyaena),* Indian wild dog *(Cuon alpinus),* Indian ratel *(Mellivora capensis),* common grey mongoose *(Herpestes edwardsii),* ruddy mongoose *(Herpestes smithii),* golden jackal *(Canis aureus),* Indian pangolin *(Manis crassicaudata),* and smooth-coated otter *(Lutrogale perspicillata)*

Herbivores and insectivores in these hills include the elephant *(Elephas maximus indicus),* blackbuck *(Antilope cervicapra),* Sambar deer *(Rusa unicolor),* spotted deer *(Axis axis),* barking deer *(Muntiacus muntjak),* four-horned antelope *(Tetracerus quadricornis),* Indian gazelle *(Gazella bennetti),* Indian bison *(Bos gaurus),* wild boar *(Sus scrofa),* Indian crested porcupine *(Hystrix indica),* mouse deer *(Tragulus meminna),* nilgai *(Boselaphus tragocamelus),* slender loris *(Loris lydekkerianus),* Indian hare *(Lepus nigricollis),* Indian hedgehog *(Paraechinus micropus),* common grey mongoose *(Herpestes edwardsii)* Indian mole-rat *(Bandicota bengalensis),* Asian palm civet *(Paradoxurus hermaphroditus),* small Indian civet *(Viverricula indica),* Madras treeshrew *(Anathana ellioti),* Asian house shrew *(Suncus murinus),* Indian crested porcupine *(Hystrix indicia),* Indian gain squirrel *(Ratufa indica),* Indian flying squirrel *(Petaurista petaurista),* sloth bear *(Melursus ursinus).* Primates of Eastern Ghats include Rhesus macaque *(Macaca mulatta),* Bonnet macaque *(Macaca radiata),* Hanuman langur *(Presbytis entellus),* tufted grey langur *(Semnopithecus priam).*

Some of the bats of the Eastern Ghats are naked-rump tomb bat *(Taphozous kachhensis),* Egyptian

Cheetal herd in Satkosia Tiger Reserve, Odisha

tomb bat *(Taphozous perforates)*, lesser wooly horse-shoe bat *(Rhinolophus beddomii)*, leaf-nosed bat *(Hipposideros lankadiva)*, Tickell's bat *(Hesperoptenus tickelli)*, wrinkle-lipped bat *(Tadarida plicatus)*, Hardwicke's rat- tailed bat *(Rhinopoma hardwickei)*, Malay false vampire *(Megaderma spasma)*, Indian false vampire *(Megaderma lyra)*, Rufous horse-shoe bat *(Rhinolophus rouxi)*, bi-coloured leaf-nosed bat *(Hipposideros bicolor)*, Dormer's bat *(Pipistrellus dormer)*, Kelaart's pipistrelle *(Pipistrellus ceylonicus)*, Indian *(Pipistrellus coromandra)*, pygmy pipistrelle *(Pipistrellus mimus)*, Schreiber's long fingered bat *(Miniopteris schreibersi)*, Indian painted bat *(Kerivoula picta)*, Indian flying fox *(Pteropus giganteus)*.

Bat in a cave, middle Eastern Ghats

Gaur (Indian Bison), BR Hills, Karnataka

Elephant herd, Satkosia reserve

Sambar, BR hills

Malabar Giant Squirrel, Srisailam

A Blackbuck from Nallamalais

Reptiles

Eastern Ghats is home to 100 reptile species including rare/endangered species such as golden hill gecko, the Indian monitor lizard, the python and the only species of uropeltid snake and burrowing limbless skink. Noteworthy lizards include the endemic skinks such as *Sepsophis punctatus, Barkudia melanosticta and Barcudia insularis* which are confined to the northern Eastern Ghats and coastal plains in northern Andhra Pradesh and Odisha. Many venomous and non-venomous snakes are also found in the Eastern Ghats. A popular snake of south India, the king cobra *(Ophiophagus hanna)* found in a small area Salur in Vizianagaram district of Andhra Pradesh. The flying lizard, striped coral snake, tree snake, etc. are some of the other reptiles of the Eastern Ghats. Unique species of crocodiles and turtles are also present in the northern rivers and riverine valley tracts of the Eastern Ghats

Golden gecko: Long considered extinct, it was rediscovered in 1986. The golden gecko had been previously known only from Seshachalam and Veligonda ranges and from the district of Arcot in Tamil Nadu. Though now categorized as a species of Least Concern, the IUCN notes that its habitat faces several site-specific threats. Zoologists argue that the golden gecko's conservation status needs to be revisited, as its existence is under threat from new development projects.

Jeypore ground gecko: The Jeypore ground gecko (*Geckoella jeyporensis*) was rediscovered in 2010 after 130 years when first noted and described by a British colonel Richard Henry Beddome in 1877, but was not seen later, was presumed extinct. The gecko's range is small, estimated to be living in just 20 km^2 of forest in Deomali and Galikonda ranges, the only localities from where *Geckoella jeyporensis* is definitely known. Its habitats have been extensively converted to coffee plantations, and subject to grazing and fuelwood collection pressures, as well as mining and social forestry activities. The species calls for immediate protection and surveys in the region are needed to determine its occurrence beyond the present range.

Golden gecko, Seshachalam

"19% of the world's reptiles face extinction due to habitat loss and overharvesting, according to a recent study by the Zoological Society of London and the IUCN's Species Survival Commission. Additionally, global reptilian biodiversity has fallen by 58% since 1970. Rapid decline in reptile biodiversity is a strong warning sign of a planet in peril. The Ecological footprint – which measures our use of goods and services by nature – indicates that we're consuming at a very high rate. If the status of affairs continues, biodiversity and the natural world, including the life support systems as we know them, will collapse"

- Marco Lambertini (WWF, 2016)

Hill Mina, Satkosia Tiger Reserve, Odisha

Winged denizens

Eastern Ghats are known for its avifaunal richness. Varied habitat types of these hills ranging from moist evergreen forest to dry scrub jungles supports a variety of bird species. Ornithological surveys across Eastern Ghats have listed nearly 425 species belonging to 57 families. Out of eight important locales identified in Eastern Ghats, five are from Andhra Pradesh i.e., Horsley hills, Sri Lanakamalleswara wildlife sanctuary, Sri Venkateswara wildlife sanctuary, Sri Penusula Narasimha, Nagarjunsagar-Srisailam Tiger reserve, Kaundinya. In Odisha state, Sunabeda and Simlipal are the two prominent bird sites and Melagiries has been listed from Tamil Nadu (Balachandran, 2016). The Jerdon's courser *(Rhinoptilus bitorquatus)* an endemic of a restricted range was thought to be extinct! however, it was rediscovered from Sri Lankamalleshwara sanctuary. Another endemic and critically endangered species of Eastern Ghats is the 'Blewitts owl'.

Hornbills are arboreal birds dwelling in the canopies of the jungles in the tropics. They are considered as important propagators of forest vegetation, noted for their frugivory and seed dispersal. They are considered as 'keystone' species, 'flagship' birds and one of important indicators of the health of forests. Out of 54 species in the world, nine are found in India. Four species are known in southern India and are confined to the Western and Eastern Ghats. Hornbills are confined to primary forests, since they require huge trees with large girths for nesting. The old growth forests in peninsular India have been subjected to various anthropogenic disturbances, which directly affect the survival of the birds such as hornbills and also some species of small vertebrates. Conservation of hornbills would lead to the conservation of the ecosystem. Localities with untouched forest patches of Eastern Ghats are used by hornbills. Indian grey hornbill is found almost all over the Eastern Ghats. Malabar pied hornbills are found in Papikonda wilderness and a few spots of northern ranges in Andhra Pradesh (Balasubramanian, 2007).

Amphibians

About 99 species of amphibians belonging to 23 species, 11 genera and 5 families were reported from different areas of the Eastern Ghats (Kaushik *et al.,* 2014). The species include the Gunther's toad *(Bufo hololius)* pond frogs *(Euphlyctis),* cricket frog *(Fezervarya)* bull frogs *(Hoplobatrachus),* burrowing

Openbill Storks, Koraput (Odisha)

frogs *(Spaerotheca),* balloon frogs *(Uperodon),* small-mouthed frogs *(Microhyla)* and tree frog *(Polypedates)* Endemic ones include the golden-backed frogs *(Hylarana sp),* bush frog *(Raochestes terebrans)* and *Geganeophis Orientalis* and an *Ichthyophis*. Some of the noteworthy findings in Eastern Ghats include the litter frog, stream frog, and the bush frog.

Fishes

Rivers, streams and wetlands provide aquatic habitats for fishes in the Eastern Ghats. About 155 species of fresh water fishes of 10 orders, 28 families, and 75 genera reported from the region. Common fishes dominating population are Cypriniformes (76 species), Siluriformes (29 species), Cyprinidae (70 species) followed by Bagridae (11 species) (Rema Devi *et al.,* 2007).

Poecilotheria Nallamalaiensis, Tarantuala from Nallamalais

Insects

A myriad number of insects are found in Eastern Ghats. Out of 1500 butterfly species reported form India; nearly 150 species are recorded from Eastern Ghats *(*Gunathilagaraj*, 1998).* There are 9 species of tarantulas found in India and three species of tarantulas are found in the Eastern Ghats. *Poecilotheria nallamalaiensis* is a new species of tarantula discovered in the world for the first time and given the name of "nallamalaiensis" as its species name, after the region. It is a long-legged hairy mygalomorph found only in the Nallamalai forests and is grey in color with cross stripes on the legs. *Poecilotheria regalis* is the most beautiful of the tarantulas. Peacock blue tarantula *(Poecilotheria metallica)*, rediscovered in Nallamalai and in Seshachalam forests, is a critically endangered species.

Mudpuddling of Butterflies (Cepora nerrissa), Melagiri, TN

Spotlights of biodiversity

Simlipal wilderness has the distinction as a national park, tiger reserve and a biosphere reserve which also forms part of an elephant reserve in Mayurbhanj district of Odisha. Simlipal hill ranges form part of the Similipal-Kuldiha - Hadgarh elephant reserve. This wilderness spreads over 2750 km^2 constitute a range of vegetation from dry deciduous to moist semi-evergreen forests and harbours a rich variety of flora and fauna. This wild space is home to about 99 tigers, 400 elephants, gaurs, chausingha etc. About 55 species of mammals are reported from Simlipal. 258 species of birds are reported from this area (Alfred *et al.*, 2001, Ramakrishna *et al.*, 2006; ZSI, 1995). Of 110 species of reptiles found in Odisha, 60 species are known to occur in Simlipal, notably the Tricarinate hill turtle. It is home to birds such as the hill myna, grey hornbill, Indian pied hornbill and Malabar pied hornbill. This area harbors 94 orchid species.

Gandhamardan, the historic hill range is known as a treasure trove of medicinal plants. Local people and ayurvedic practitioners use these as natural medicine and also eke out a livelihood from the collection and selling of these herbs to companies. The usage of nearly 200 species of medicinal plants was recorded from Gandhamardan, (Brahma and Saxena, 1994). Uncontrolled mining, land use changes and over-extraction is causing the depletion of the medicinal wealth of these hills.

Mahedragiri hills are rich in biodiversity and medicinal plant wealth. semi - evergreen to moist and dry deciduous forests of Mahendragiri considered as the transitional zone between floral elements of southern India and Himalayas. The ecosystems and its biodiversity provides sustenance and livelihood to the Saura and other tribal communities in the area. Moist deciduous forests on the upper reaches of hills are dominated by Sal *(Shorea robusta)* in association with T*erminalias, Adina, Toona, Syzygium, Bichanania, Cleisanthus, and Anogeissus sp.*

Kondapalli range, the small hilly terrain hosts the last remnants of pristine forests in Krishna district, Andhra Pradesh. Wild animals like leopards, wild dogs, jackals, wild boar and wolves make this confined wilderness their home. Kondapalli toys which are chiseled from local light softwoods (Tella Poliki) and painted with vegetable dyes are famous all over the world. These hills today face heavy pressure from urbanization, quarrying and other activities. This small wilderness and its precious softwood is facing heavy pressure for over the last few decades.

Nallamalai wilderness in middle part of Eastern Ghats has been considered as one of the biologically rich hills. Faunal diversity is abundant with over 80 species of mammals, 303 species of birds, 64 species of reptiles, 20 amphibians, 55 fishes, 89 species of butterflies, 57 species of moths, 45 species of coleopteran, 30 species of Odonata, 13 species of bats, four species of primates, and numerous others. Amrabad plateau in Nallamalais used to hold maximum number of

Pale-capped pigeon or purple wood pigeon (Columba punicea) was once common throughout occur in scattered populations in Southeast Asia but now is only spotted in the Eastern Ghats in Odisha and included as vulnerable in the IUCN Red list.

tigers. Dr. Salim Ali in his famous book "The fall of the sparrow' writes that the "highest concentration of tigers ever seen in India" was at Amrabad plateau. The Nagarjunasagar- Srisailam and Amrabad Tiger Reserves which together accommodates nearly 80 tigers are spread over these hills divided by Krishna river. Dominant vegetation here consists of Terminalia, Hardwickia and Pterocarpus (Thulsi Rao, 2007). Ongole cattle and the Nallamala Poda cattle are the products of Eastern Ghats ecosystem.

Eastern Ghats region is endowed with unique grasslands scattered on the hills and their vicinity. *Chrysopogon fulvus Heteropogon contortus, Eremopogan fovelatsus, Aristida setacia and Dactyloctenium* are the common grasses of Eastern Ghats. These grasslands also harbor vegetation of *Acacias, Balanites roxburghii, Cordia myxa, Cappais, Prosopis sp., Azadirachta india, Cassia fistula, Diosyros chloroxylan, Carissa carandas and Phoenix sylvestris.*

Great Indian bustard, Rollapadu

Rollapadu is a small but unique grassland situated in the southwestern part of Nallamalais in Kurnool district of Andhra Pradesh. Covering an area of about 6 km^2 this unique dryland ecosystem was notified as a sanctuary in1988 with an aim to protect Great Indian Bustard (*Ardeotis nigriceps*) which is a critically endangered bird. Once common on the dry grassland and scrub plains of the subcontinent of India, today however, only 250 individual birds are estimated to be surviving. About 132 species of birds are reported from here and another important and endangered bird species, the Lesser Florican is found here. The other birds spotted at Rollapadu besides the bustard and the florican include Indian roller, Myna species, short-toed snake eagle and migratory birds of winter such as waterfowl, bar-headed geese, demoiselle cranes and greater flamingos. The grassland also is a home for foxes, jackals bonnet macaques, jungle cats, sloth bears and black bucks (Negi, 1993). During monsoon Indian coursers are spotted around the sanctuary. Hunting and loss of habitat threaten the survival of bustard which shares the habitat such as of blackbuck. The increase in the numbers of blackbucks in the area has been assumed as one of the factors for the decline in the numbers of the bustard and the floricans here. The over foraging of grasses here resulted in the decline in grasshoppers and locusts on which the two bird species depend largely for feeding. The rise in blackbuck population has been causing the loss of nesting sites for this ground-nesting bird. The linking of the Alganur tank with the Telugu Ganga Canal has caused a rise in the levels of groundwater, changed farming practices around the area and wrought changes in the ecosystem and flora (Mathew, 2007). The raids of Blackbucks into surrounding farmlands is leading to the anger of people there against the sanctuary. Grazing of cattle in and around the sanctuary affected breeding of the bustards (Rao and Javed, 2005 & Sabarwal & Vasant, 2003).

Lankamala is Spread over an area of 470 km^2 in Cuddapah district in Andhra Pradesh this hill range hosts Sri Lankamalleswara Wildlife Sanctuary. This is the only habitat for Jerdon's courser, a critically endangered bird. The vegetation here is dry deciduous, thorn mixed, dry evergreen scrubs, etc. About 1400 plant species are found here including many species of rare and endangered medicinal plants. Predominant species of economic and medicinal value found in this region are Red sanders (*Pterocarpus santalinus*), *Pterocarpus marsupium,* and *Santalum album*, a valued and endangered tree species is found here. Wildlife commonly sighted here are panther, sloth bear, cheetal, sambar, chowsingha, chinkara, nilgai, wild boar fox etc.

Jerdon's courser *(Rhinoptilus bitorquatus)* is a nocturnal bird endemic to the Eastern Ghats. The bird was discovered by the surgeon-naturalist Thomas C. Jerdon in 1848 and was thought to be extinct until its rediscovery in 1986. Now the birds is sighted only in Sri Lankamalleshwara sanctuary. The birds lives in a habitat of sparse scrub forest with patches of bare ground in the sanctuary. The vernacular name of the bird is Kalivi kodi because it relishes Kalivi fruits abound in the area. It remains critically endangered due to loss of habitat. Population estimates for the bird ranges between 50 and 249. The construction of the Somasila dam led to the residents of 57 villages being relocated into the region where the courser was rediscovered. Rising human population, agricultural activity, increased livestock pressure, firewood extraction and extensive quarrying threatens its habitat.

The realigning of the Telugu Ganga canal (a scheme to supply water to the city of Chennai) from the original proposed plan protected the species habitat, not only maintaining a contiguous flow but also prevented infiltration of moisture into the dry land area. This was a wise action on the part of the government. It needs many attempts to bring the 'aspects of possibility of conservation and sustainability' to the notice of the ministry concerned. GrACE is attempting to bring such aspects to the knowledge of scientists, decision makers and the community to protect such invaluable assets of the country through this report.

Jerdon's courser, Lankamala

Seshachalam hills are part of 6E bio-geographic province of Deccan peninsular zone and have the biome of tropical dry deciduous forests. These hills host Sri Venkateshwara National Park and are home to a number of endemic species including the famous red sanders and slender loris. The area was declared as a Biosphere reserve in 2010. This is the first biosphere reserve in Andhra Pradesh, 17th oldest, and 9th largest in India.

Red Sanders (*Pterocarpus santalinus)* is endemic to the restricted localities in Kurnool, Cuddapah and Chittoor districts of AP in the southern Eastern Ghats. It is one of the costliest woods of the world. Its reddish color and use in herbal medicine resulted in heavy demand. High demand and soaring prices for its wood in China, Japan and other East Asian countries tempt smugglers for illegal felling. IUCN listed the species as endangered because of over-exploitation. The species is also listed in appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), which means that its export is granted if the trade is not detrimental to the survival of the species. Felling, smuggling and clash between labourers employed by smugglers is a day to day reality in Seshachalam and neighboring areas.

The Seshachalam Cycas *(Cycas Beddomi)* is a relict

Red sander tree, Seshachalam

flora native to India, which occurs in a small area in Seshachalam hills of southern Andhra Pradesh. This species is found in dry, hot scrublands in the hills. Though the plant is resistant, its seeds and seedlings are vulnerable to fires of the grasses in its habitats. The male cones of the plant are collected for use in Ayurveda medicine to cure rheumatoid arthritis and muscle pains. Due to overexploitation for medicinal uses and external factors like fires and land use changes, there is a gradual decline in the species population. The species is now critically endangered as per IUCN.

Shevroys is considered as biotic hub of Southern Eastern Ghats in Tamil Nadu. The vegetation of these hills varies considerably with elevation. The foothills harbor scrub vegetation. Dry and mixed deciduous forests occur between 400-1200 mts and evergreen forests between 1200-1600 mts. The hills still contain few patches of primeval forests. The slopes on upper reaches and peaks house many flora and faunal species. Shevroys forms an important link

Cycas Beddomi, Seshachalam

to diversities of biota in this region. The bamboos grow up to an altitude of 1000 mts on these hills.

The famous hill station Yercaud nestles on the hills. An orchidarium was established here by Botanical Survey of India. The hills have large scale plantation of coffee and oranges along with bananas, pears and jackfruit.

Fauna of the hills include gaur, sambar deer, spotted deer, Indian pangolin, jackals, hares, foxes, mongoose, civets, giant squirrels and reptiles including endemic ones such as *Hemiphyllodactylus aurantiacus, Calotes calotes, Calotes rouxii, Mabuya beddomii* and shield tailed snake, *Uropeltis elioti*, and *Uropeltis shorttii* (which is found only in Shevroys) the *Python molurus, Macropisthodon plumbicolor, Calliophis beddomei* and *Trimeresurus gramineu*. The hills also has endemic species of amphibians such as *Hylarana sp., Raorchestes sp., Fezervarya sp.* Several bird species like whistling thrush, racket-tailed drongo, peacock shama, oriental leaf bird and Indian grey hornbill are found in this habitat.

The biotic elements of this hill show likenesses to those occur in Western Ghats. The celebrated Neelakurinji or Kurinji (*Strobilanthes kunthiana*)which blooms only once in 12 years occurs in the sholas on the tops of these hills. This floral highlight is found in high terrain of Western Ghats and only on Shevroys of Eastern Ghats. The Nilgiris, which means 'the blue mountains', owe their name to the periodic purplish blue blossoms of Neelakurinji. The Paliyan tribal people in Tamil Nadu use the blossoming and periodicity of these flowers to calculate their age. In classic Tamil literature, the Neelakurinji is described in the mountainous landscape where it blooms. The habitat of this unique plant is threatened by plantations, construction and other land use shifts.

Pachamalais means green In the Tamil language,.The vegetation in these hills is greener than some of the other hills in the region. The forests are of the evergreen and mixed deciduous type. The major crop grown here is tapioca apart from paddy, ragi, maize, lablab, beans, gingelly, horse gram, red gram, etc. Vegetables such as tomato, brinjal and beans are extensively grown. Jackfruit is a popular seasonal agriculture product here. Other fruit trees grown here are guava, cashew, mango and lime oranges, making it one of the high agri-horticultural productive areas.

Neelakurinji blossom, Shevroys, TN

Kollimalai hills are heterogeneous in vegetation owing to its elevation gradient. The foothills are found with scrub vegetation while with increasing elevation occur dry deciduous, mixed deciduous and evergreen forests. Tropical evergreen forests occur in notable patches on upper slopes, hilltops. This forest patches display moderately high plant diversity, with dominant evergreen flora, featured with multi-layered canopy where the trees reach up to 30 mts and make up dense crowns. Epiphytic moss, ferns, lichens, aroids and orchids adorn the tree branches and also show the abundance of Epiphylls. The floor of the forest is usually moist and humid and covered with dense ground vegetation (Chittibabu, 2002). Between 900 mts and 1300 mts on these hills patches of evergreen 'sholas' are found including the famous Ariyur Shola. It is said that the Kolli hills harbor largest extent of evergreen or shola forest in entire southern Eastern Ghats. The hills have several coffee plantations, estates, orchards of fruits trees and farm fields. Coffee, tea, jackfruit, pineapple, spices like pepper, rice and millets are grown here. Wildlife found here are sloth bear, barking deer, slender loris, Indian pangolin, jackals, mongoose, palm civet etc. Many reptiles crawl here including endemic lizards such as *Hemiphyllodactylus auarantiacus, Calotes calotes* and snakes belonging to *Uropeltidae,* the endangered *Python molurus*. Many bird species are found in these hills.

Sirumalai hills harbour dry deciduous forests in its lower slopes and with moist and wet deciduous forest in upper reaches and along riverine valleys. The vegetation is dominated by terminalia, shorea, *magnolia champaka*. Lianas and orchids form part the overall vegetation composition. Coffee plantations occupy a large part of the upper reaches of the hills. Wildlife found here includes the endangered species like slender loris, sambar deer, sloth bear, Asian palm civet, Indian hare, jungle cat and Indian pangolin. Birds such as Indian peafowl, Asian koel, Indian grey hornbill, including endemic blue-winged parakeet are found here. Reptiles found here are threatened species such as the *Python molurus,* Indian star tortoise and snakes such as Indian cobra, Russell's

viper, common krait and the endemic bamboo pit viper and the less-known striped coral snake *Calliophis nigrescens*. Lizards such as the Bengal monitor, Indian Chameleon, flying lizard *(Draco dussumieri), Calotes calotes*, *Ophisops minor*, and Cnemaspis geckoes are found here. Sirumalai shield tail snake *Uropeltis dindigalensis*, which is endemic and unique species of the hills occurs nowhere else. Amphibians include rare and endemic species such as *Hylarana Indirana, Zakerana brevipalmata* and bush frog *(Pseudophilantus wynaadensis).* Myriad forms of lesser-known insects and moths add to the exuberance of life on the hills.

Known for their special flavor, long shelf life and perennial produce, hill bananas are unique to Tamil Nadu. Called Virupakshi and Sirumalai, these varieties are grown on Sirumalai, Kolli and Palani hills along with coffee and pepper in plantations. Hill bananas are highly susceptible to Banana bunchy top virus (BBTV) and climate change, habitat changes impacts the plants and local economy.

Hill bananas at a market on Kollimalai

Melagiris is known for its elephant herds and has two elephant corridors. The wilderness shares its edges with Bannerghatta National Park in the northeast and Cauvery Wildlife Sanctuary in the south. The forests of these hills stretch to BR Hills and Sathyamangala reserves and up to the Nilgiri biosphere. As these hills are situated in a region that straddles Western and Eastern Ghats, these forests form a vital link in the elephant corridors of South India. The forests of the hills have vegetation that ranges from mixed types such as thorn scrub, dry tropical riverine, dry deciduous, mixed deciduous, dry evergreen, and semi-evergreen types. The hill is home to a diversified fauna.

Biligiri Rangana Hills are known as vital southern biotic link The ecosystems of the hills form part of the south Deccan plateau dry deciduous eco-region. An amazing mosaic of heterogeneous habitats have evolved in this small area owing to wide variation in climate and altitude. The hills host nearly all the vegetation types of the ecoregion, such as scrubs, deciduous, riparian, evergreen, sholas and grasslands. Scrub forests to tall deciduous forests are found at lower elevations while stunted shola forests and mountain grasslands occupy higher altitudes. Situated at a contact point of Eastern Ghats with Western Ghats, the hills are blended with the ecological elements unique to both these mountain ranges. About 800 species of plants occur here, with a close affinity to the Western Ghats. This wilderness junction forms a wildlife corridor between the Western and Eastern Ghats which links the largest populations of Asiatic elephants and tigers in South India. The hills are also home to gaur, sambar, chital, barking deer and four-horned antelope. Carnivores include

Grizzled gaint squirrel of Melagiris

Hardwickia binata, Southern Eastern Ghats, TN

tigers, leopard, wild dogs, lesser cats, and sloth bears. Among arboreal mammals, two species of primates and three species of squirrels including the giant flying squirrel found here.

Sholas of Eastern Ghats are unique forest types that occur in valleys, amid rolling grassland in the higher mountain regions of South India. They are described as patches of stunted evergreen tropical and subtropical moist broadleaf forests of high altitudes on Western and Eastern Ghats. Sholas are characteristic to the Nilgiris and occupy small to big pockets of Kolli hills, Kalrayan hills, Shevroys and BR hills. Shola and grassland mosaic has been described as climax vegetation where the scope for the expansion of vegetation is inhibited and influenced by climatic conditions such as frost or soil profile. Forest historians also postulate that they may have resulted from anthropogenic activities such as clearing and burning for pastures and shifting cultivation. Peculiar in many ways, the sholas of southern-most Eastern Ghats are located usually at hill tops between 750 to 1649 mts. They are evergreen and district high abundance of latex / resinous rich woody plants. The presence of these unique forests which shows the likeness of sholas on Western Ghats can be considered as special habitats.

Shola patches on BR hills, Karnataka

Native Cattle

Ongole Cattle (*Bos Indicus*) is one of the 37 pure cattle breeds of India. It is recognized as the most beautiful and superior cattle from India. The species evolved in a small area (150 km^2) in the basins of Gundlakamma and Paleru rivers that originate from Nallamalais in Prakasam district of Andhra Pradesh. Ongole cattle are known for their toughness, rapid growth rate, and natural tolerance to tropical heat and disease resistance including resistance to foot and mouth and mad cow disease. These bulls have become prime cattle stock in many far off countries such as Brazil, USA, Netherlands, and many other countries in south and east Asia.

Ongloe bull

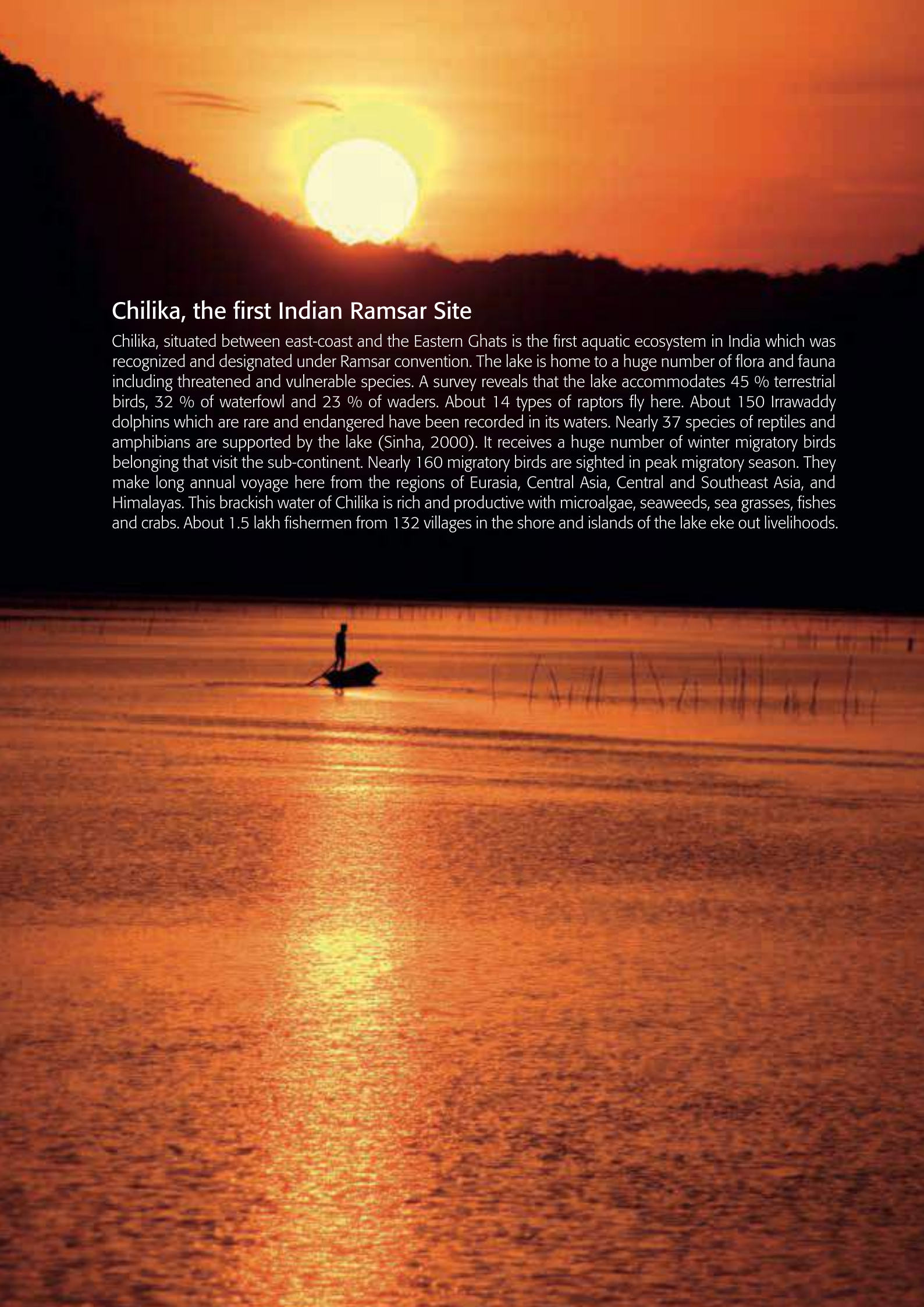
Mannanur Cattle Also called as the Thurupu cattle, and Nallamala Poda, the breed evolved in Amrabad plateau of Nallamalai in Nagarkurnool district of Telangana. It is yet to be recognized as a distinctive breed by the National Biodiversity Authority (NBA). This cattle which was tamed by locals has the capacity to cope with harsh climatic conditions and evade any wild animal attack by sensing danger from as far as 2 km away. Moreover, these cattle are also known for their capacity to work on fields for up to 12 hours continuously and the ability to identify water sources from far distances away. The original range of land and its ecosystems which gave rise to the native stocks have changed over the last few decades. It is essential to take measures to safeguard their native habitat to protect them in-situ.

Punganuru Cattle These dwarf cattle, from Punganur area in Chittoor district of Andhra Pradesh, is among the world's smallest humped cattle breeds. The breed is famous for its milk which contains high fat and rich medicinal properties. The cattle are revered as a species of auspicious and godly powers. Highly drought resistant, the breed can survive largely on dry fodder. It is not officially recognized as a breed since there are only a few animals remaining. The Punganur breed is facing an imminent threat of extinction, with only a few hundred animals remaining. The policy of bettering Indian cattle breeds by in-breeding with foreign breeds has had a drastic impact on the survival of local breeds such as Punganur cow. Committed and concerted efforts are required to save these unique cattle from the possibility of extinction.

Mannanur Cattle

Punganuru cow

"Without the biosphere that made us what we are, in which we evolved we are not fully human" -E.O. Wilson.



Chilika, the first Indian Ramsar Site

Chilika, situated between east-coast and the Eastern Ghats is the first aquatic ecosystem in India which was recognized and designated under Ramsar convention. The lake is home to a huge number of flora and fauna including threatened and vulnerable species. A survey reveals that the lake accommodates 45 % terrestrial birds, 32 % of waterfowl and 23 % of waders. About 14 types of raptors fly here. About 150 Irrawaddy dolphins which are rare and endangered have been recorded in its waters. Nearly 37 species of reptiles and amphibians are supported by the lake (Sinha, 2000). It receives a huge number of winter migratory birds belonging that visit the sub-continent. Nearly 160 migratory birds are sighted in peak migratory season. They make long annual voyage here from the regions of Eurasia, Central Asia, Central and Southeast Asia, and Himalayas. This brackish water of Chilika is rich and productive with microalgae, seaweeds, sea grasses, fishes and crabs. About 1.5 lakh fishermen from 132 villages in the shore and islands of the lake eke out livelihoods.

Godavari meets the Bay of Bengal throug Coringa mangrove

Mangrove vegetation in Coringa

Mangrove vegetation in Coringa

Mudskippers, Coringa

Fishing Cat, Coringa

Coringa Wild Life Sanctuary

The Coringa is an estuarine sanctuary is encased by the waters of Bay of Bengal and river Godavari at its confluence and forms wetland habitat of distinct character of ecological, biological, cultural and scenic value. Coringa is situated in East Godavari District of Andhra Pradesh. It is located 12 km south of Kakinada which is a fast developing industrial center and an emerging recreation destination. Characterized by tidal/mangrove forests of the Godavari estuary, having specific biological and geological characteristics, it is the second largest mangrove formation in India. Enriched with deltaic alluvial soils, detritus matter, mud flats loaded by the perennial flow of the river Godavari and adjoined by mangroves, the Coringa Wildlife Sanctuary is residence to many winged denizens and their trophic counterparts down through the food chain. Flora and fauna of this sanctuary along with the habitat constitute a unique ecosystem. This sanctuary also acts as a prolific zone for shrimp, shell, fin-fish etc. Flora and fauna occurring in the mangrove forests have the special ability to tolerate various degrees of salinity.

Eastern Ghats meet into bay of Bengal at Visakhapatnam

3

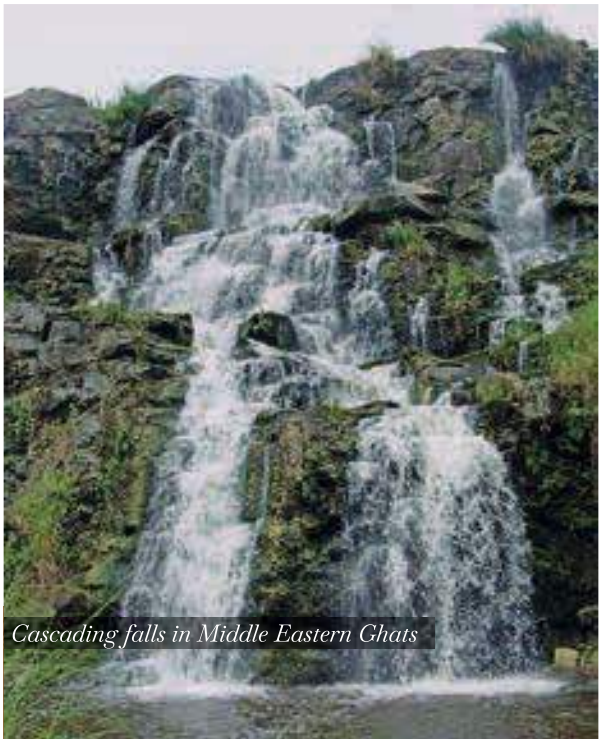
Ecosystem Services & Heritage Values

The Eastern Ghats which rise and stand in contrast to its surrounding plains are endowed with a variety of resources and unique biodiversity. These hills are reservoirs of gene pools, sites for wildlife habitat and biodiversity conservation, forest products, water towers, perennial food baskets, mineral provinces, sacred, touristic and recreation destinations. The ecosystem goods and services of these hills play a critical role in the welfare and sustainable development of the region as well as in the preservation of its ecological and cultural lineage.

Ecosystem services are defined as the goods and services produced by the interplay of biotic and abiotic components of the corresponding ecosystems. This ecosystem metabolism helps to mediate energy and material flows which contribute many ecological services and goods to the entire organisms include humans. Ecosystem goods include food, fibre, resin and drugs derived from medicinal plants. Some of the exemplary and essential roles played incessantly by mother nature are soil formation, buffering pH, decomposition, carbon sequestration and balance of gases in the atmosphere, stabilization of climate and mitigation of climatic change, nutrient cycling, assembly of community and succession (healing ecological damages), water and air filtration, flood and drought control, regulation of water supply and services such as of recreation, aesthetic and religious values (Planning Commission, 2006). Mountain ecosystems provide a wide range of goods and services Korner & Ohsawa, (2005), EC (2009) have listed them into four broad categories as described here…

Provisioning services supply the goods themselves. Examples include the extractive resources that primarily benefit lowland populations (water for drinking and irrigation, timber, and so on); Ecosystem production (agricultural production for local subsistence and for export; pharmaceuticals and medicinal plants; and non-timber forest products).

Regulating services includes occasions such as protection from flooding and the outbreak of disease. Examples include the biodiversity, watershed and hazard prevention, climate modulation, migration (routes and barriers of transport), carbon storage.



Cascading falls in Middle Eastern Ghats

Cultural services include the splendor and stimulus of nature. Examples include Spiritual role of mountains, biodiversity, recreation, cultural and ethnological diversity.

Supporting services helps the growth of vegetation and production. Examples include soil formation, photosynthesis, nutrient cycling.

Nearly 30 % of the earth's land surface is covered with forests. The forests make up ideal habitats for plant species, provide food and shelter for a wide range of animals. They play a crucial role in the global water and carbon cycles, in maintaining air quality and in checking soil erosion. Above half of the world's terrestrial biodiversity is found in tropical jungles (The Royal Society, 2003), These ecosystems are considered as a 'giant eco-utility' that serve from local to global scale with essential goods and services such as climate, water, food and energy security as well as human health and livelihoods. 28 % of global forest cover is found on the mountain and play a key role in storing and sequestering the carbon (FAO, 2011), which is increasingly recognized as the most important ecosystem services essential in mitigating climate change. People in and around the forest depend on it for fuel wood, construction timber, fodder, shade, fruit and many other products. The ecosystem services rendered by the Eastern Ghats have not fully been ascertained.

The diversity of life on earth is considered as insurance system offered by Mother Nature. Diversity secures the functioning and integrity of systems from collapsing which becomes evident under environmental adversities such as storms, droughts, fires, pest outbreaks, and the spread of pathogens or invasive species. Such biodiversity plays a role in the survival of people and their wildlife in Eastern Ghats region. With a range of flora and fauna, endemic and endangered species, the Eastern Ghats, in contrast to its surrounding regions is an important genetic reservoir which is crucial to the regional ecological balance.

Mountains are endowed with biological richness. Sharp variation and gradient of its life zones and habitats on mountains present unique flora and fauna and cultural features. Hence, the mountains are recognized as important sites for conservation of biodiversity. About one-third (32%) of all protected areas, small to big, are in mountains which includes 88 World Natural Heritage Sites and 40% of all

UNESCO declared Man and Biosphere Reserves. The total number of Mountain Protected Areas is 21,400, which all make together an area of 5,996,075 km^2 (Chape *et al.*, 2008). Over the last five decades there has been six to eight-fold increase in the extent of protected areas and mainly it happened in mountain areas, expanding from 9% of total mountain space as protected area in 1997 to 16% in 2010. This shows the increased cognizance of biodiversity of mountains and its conservation as a global responsibility.

The Eastern Ghats, standing superior in biodiversity to its surrounding regions nurtures a wide range of life forms. These hills host several protected areas including national parks, biosphere reserves, and sanctuaries and there is imminent need and scope to bring a large part of its space into conservation and protection.

Non-Wood Forest Produce

Ecosystems provide many types of goods and products other than timber. Non-Wood Forest Produce (NWFP)include numerous varieties of products that are harvested from trees in the jungles and its undergrowth. The produce commonly harvested are fruits, vegetables, nuts, spices, medicinal plants and fodder (Bagoora, 2012; FAO, 2011). The local people in the Eastern Ghats have good knowledge about the forest and the wide range of its produce and thereby make good use of its resources for domestic purposes and as income sources. Local people in the Eastern Ghats eke out livelihoods, earn income, and meet day to day household consumption needs from nearly 100 varieties of NWFP and 250 species of medicinal plants. The major sources of income are bidi leaves (*Diospyros melanoxylon*), bamboo (*Dendrocalamus strictus*), gum and resin (*Sterculia urens*), Mohua (*Madhuca indica*), oilseeds (*Pongamia pinnata, Azadirchta indica*), essential oils from Santalum album, lemongrass, eucalyptus and others. They also make plates and cups from leaves of *Bauhinia Vahlii* (Anonymous, 1997).

Women processing NWFP in Nallamali

Pastoral land

The Eastern Ghats sustain millions of local and migratory livestock from the villages. Pastoral communities move from long distances to herd their livestock in the Eastern Ghats in response to scarce pastures in their areas and also to escape drought and other externalities there. The undergrowth of grasses on the hills sustain a huge number of cattle and small ruminants as well.

Livestock foraging in Amarabad upper plateau

"The Earth receives an insult and offers its flowers in response"
- Rabindranath Tagore

Perennial food basket

Native communities of the Eastern Ghats and its surrounding areas depend on a wide variety of forest food such as fruits, tubers, edible plants, honey and small game etc. Approximately 150 species of plants, largely trees, shrubs, herbs and lianas provide wild edible fruits in the Eastern Ghats. Apart from these, many varieties of local crops are raised here through shifting cultivation in hill slopes and along mountain springs. About 121 types of food from a small area of wilderness in Eastern Ghats of Odisha show the vitality of the background ecosystems in sustaining the local communities. New research points to the resilience and strength of tribal food systems and disprove the view that it is inherently backward. Several of these forest-based foods have been found to be rich in nutrition, economic and viable with multi-dimensional benefits.

The importance of forest-based food increases during adverse weather such as frequent drought conditions. The forests of the Eastern Ghats provide fallback supply of food and fodder in times of adverse conditions such as droughts, personal, environmental, or economic crisis. Hence, its role in fighting hunger and malnutrition is likely to increase due to climate change. In these times of modern communication and improved transportation, the economically important food products from these hills enter into local and global markets.

In Eastern Ghats, the need for protecting the remaining natural source of food is more than ever. There is a need to study thoroughly, recognize and respect the importance of the knowledge that tribal communities possess when it comes to accessing and using these diverse forest-based foods.

Many communities in the hills depend on forest land and its soil nutrients for cultivation and food production to subsist. The insect populations such as bees play an essential role in pollination and subsequent production of crops raised by the farmers in and around the forests (Ricketts *et al.*, 2004). The availability of food is tied to survival and the health of natural forests and their rich biodiversity as well as the protection of tribal rights. Unfortunately, both these factors have been adversely affected in several places. The policies of replacing natural forests with man-made plantations of commercial species and conversion of forest for other uses alienate local communities and deprive them of several nutritious foods. The ongoing research also shows that if forests are managed mainly with a commercial perspective, they start diminishing. One can only hope that recognition of natural forests as an important source of food security and sovereignty will lead to more careful and community-friendly, food-security enhancing policies.

The policy of the government which has seriously affected the food supply of the Konda Reddis in this area (Eastern Ghats) is the granting of the right to fell mango trees in the forest to the Godavari Plywood factory set up in Rampachodavaram. The supply of kernels of mango stones which are a main source of food for the Reddis during rainy season is dwindling due to the felling of this fruit tree on a large scale (Haimendorf,1982).










Water towers

Mountains play a crucial role in capturing, storage and purifying the precipitation and letting it into the low lands around (Gret - Regamey *et al.*, 2012). The mountain catchment thus contributes runoff to streams and rivers that carry water downstream. Additionally, the precipitation is captured and stored as groundwater, released through springs, and also stored in vegetation (FAO, 2002). The term "water towers" indicates the highlands (generally at least 200 mts above its surrounding plains) and which are blessed with annual precipitation between 750 mm and 250 mm runoff thus, standing as important water sources for populations beyond their immediate delineated boundaries (UNEP, 2010). The vegetation on the forests with its trunks and roots represents sponge, regulating the flow of water in the catchment (both surface and groundwater) into river systems, helps in regulating flood and drought cycles (Chivian, 2002). Many studies show that there is a marked difference in stream longevity and water quality between forested and non-forested watersheds. The forests also influence the rainfall in the vast area of its region by recycling the water vapor back into the air. The Eastern Ghats are part of the natural water infrastructure of peninsular India and are essential to the water balance in the region. The forests act as a huge storehouse of monsoon rainfall, feeding streams and rivers with regulated flows and base flows. Thus, the forests of the Eastern Ghats ensure a great amount of regional and local water security. Trees of the forest hold soil and protect it from erosion. The streams that originate in these hills are also crucial linking lines of biodiversity with the surrounding ecosystems.

The springs that cascade down the hills are essential for the survival of the upland population and the surrounding region. Tribals cultivate hill rice and other staples along the spring courses and get their drinking water and bathing water from these. They catch fish in these waters and revere them as sacred waters. The streams originating in the Eastern Ghats sustain the economy and livelihood in large areas of its foothills region. They feed thousands of tanks in the surrounding region. They are also crucial biological interfaces between the Eastern Ghats and its surrounding ecosystems.

Cumbum Lake: Also known as Gundlakamma lake, a huge historic and scenic water body is located between 15°33'57" N latitudes and 79°4'10"E latitudes in the margins of Nallamalai hills near Cumbum town in Prakasam district in Andhra Pradesh. The tank, one of the oldest man-made lakes of Asia, was constructed on Gundlakamma river, a stream that originates from Nallamalais. The lake's existence goes back to mythological times. It is said that the sage Jamadagni constructed this dam at the opening between two hills of the Nallamalai range. The documented records of history say that an anicut (dam) was built in 15th century AD by the Gajapati kings of Odisha during their reign in the region then. Later the dam was renovated by Princess Varadharajamma of Vijayanagar dynasty. The lake now is 7 km long and about 3.5 km wide which submerges many small hills making them islands in the lake during its full tank level. The tank irrigates a command area of 10,300 acres.

"Wealth of the plains is dependent on the health of the hills"

- Anonymous.

Ancient Cumbum Lake nestled between hills in Nallamalais, AP

Agro forestry

Agroforestry refers to the combined activities of cultivating trees along with crops for their produce. These include services such as nutrient transfer, microclimate moderation and soil stabilization. Trees outside forests in the mountain regions in human habitations and farmlands also support the local people (FAO, 2011; FAO, 2010). People in the Eastern Ghats have followed this practice for centuries in patches; however, now it has become essential in changing scenarios of population and pressures on existing forest vegetation.

Climate balance

The ecosystems in tropics are crucial for climate balance on local to global scale and for adaptation in times of adversities due to impacts of climate change. Unspoiled primeval tropical forests sequester vast quantities of carbon dioxide (CO2) and act as important 'carbon sinks'. These forests also cool the earth's surface by evaporating huge volumes of water and creating clouds that reflect sunlight back out to space (Betts *et al*., 2007; Bonan, 2008). Forests can reduce the incidence of flood events by slowing down the passage of water over the land surface (van Dijk and Keenan, 2007). Being an essential buffer for local weather patterns, any changes in its integrity disrupts the temperature and rainfall patterns and further cause local impacts of climate change (Deo *et al*., 2009, Voldoire and Royer, 2004). The Eastern Ghats are important in maintaining the regional climate balance. Its survival is essential to cope with climate change shocks and implications.

Health security

Tropical forests are important sources of medicinal plants which are used by local communities and required by pharmaceutical firms around the world. Unspoiled forests can break the spread of contagious diseases. Heavily deforested areas have a risk of 300-fold increase in malaria, compared to densely forested areas and it is essential to maintain intact forest, taking into the reality that about 40% of the world's population lives in malaria-infested regions (Yasuoka and Levins, 2007). Nutrition from forests, its micro-climate, vistas, cultural and spiritual spaces add manifold to the health of people. Health of the forest is intricately linked to the health of humans in many ways.

The Eastern Ghats are abundant in medicinal plant wealth. The hills harbor over 1000 medicinal plants of which 250 species are reported to be of economic importance. The forest itself is an important dispensary and health center. Every plant can be a medicinal species. The health service provided by the Eastern Ghats ecosystem has neither been fully ascertained nor quantified. Apart from the medicinal plants, the serenity, freshness, the forest food, mineral rich springs, the tranquility, sporting, recreational, spiritual space it offers is invaluable. Like in the epic times, these wilderness areas are increasingly considered as sanctuaries of solace for physiological and social wellbeing.

Chenchu children hugging a tree in Nallamalais

Gloriasa superba, Nallamalai

Pollination

75% of principal crops in the world and about 80% species of flowering plants depend on animal pollinators. Honeybees, among all the species of bees, are the most effective pollinators. Honeybees thus are essential for global food security and biodiversity. Over 70% of the crops cultivated in the world are pollinated by honeybee species. Beside honeybees, bird species, bats and small vertebrates play their part in this most important ecological function.

The Common Tiger (Danaus genutia)

The Eastern Ghats region is blessed with a huge number of honeybee species which contribute to the local biodiversity and tribal food and economy. The species of honey bees are *Apis Dorsata*, *Apis Fabricius, Apis Cerana, Apis Melifona sp*., and *Apis Florea* etc., which serve as crucial pollinators, providers of nutrition to the tribes and people in the surrounding regions. Their survival is essential for the maintenance of local biodiversity and agricultural production. Destructive loss of canopy trees, disturbance of the rock formations, over-extraction of honey in the areas are affecting the honeybee population in the Eastern Ghats. Many bat species, birds, insects and mammals play a part in the pollination in and around Eastern Ghats and their existence is also essential to the ecological integrity and food security in the regions.

Most of the world's biodiversity is coincided with rural poverty, heavy reliance on natural resources, and in many areas with weak governance. Yet, development and economic sectors overlook the vital role of biodiversity for the livelihoods and economic progress of poor people. The ecosystem services, security and resilience that support development not yet properly understood and under-valued. The role of the ecosystem services become crucial in the times of surmounting climatic and ecological insecurity. Turning the tide of degradation of the ecosystems and meeting the demand of ecosystem services requires "significant changes in policies, institutions, and practices that are not currently underway" (MA, 2005).

Amrabad plateau is perched on the Nallamalai range to the north of Krishna river in Telangana with an average elevation of 576 mts. The plateau was covered with dense forests and high grass. Farhabad view point, Mallapur Penta, Mallela Thirtam, Maddi Madugu, Saleshwaram and Loddi Mallayya are some of the important tourist destinations. Umamaheswaram is known as the northern gateway (Uttara Dwara) for the ancient pilgrim trail to Srisailam.

Scenic heritage

The scenic splendor of the Eastern Ghats is apparent in its dramatic landscape of hills, deep valleys, gorges, escarpments, cliffs and rock formations and plateaus on the hills. The terrain hosts spectacular caves, canyons and hundreds of waterfalls that add beauty to the mountain slopes.

Daringbadi: It is a hill station in Odisha state. Widely known as "Kashmir of Odisha', the hill station is situated at a height of 915 mts in Kandhamal district. It is a beautiful spot surrounded by thick forests with wild animals and is a popular summer resort. It is also famous for its production of superior quality organic turmeric and coffee plantations.

Araku Valley is located at about 110 km from Visakhapatnam in Andhra Pradesh. The valley is perched at 1300 mts above mean sea level and spreads over 36 km^2. Galikonda, with its summit at 1,500 mts, is the tallest peak in the area. The Anantagiri and Sunkarimetta Reserved Forests which are part of this valley with its semi-evergreen moist deciduous forests are rich in biodiversity and mineral wealth.

Yercaud: It is a popular and picturesque tourist hill station of south India situated in the Shevroy hill range in Tamil Nadu at an altitude of 1515 mts. The Servarayan temple to which the hills owe its name is the highest point near this hill station with its peak having 1,623 mts. A lake is surrounded by forest gave the name to this hill station. Coffee, oranges, bananas, pears and jackfruit are grown extensively in the surrounding hills.

Lambasingi is an emerging hill station near Chintapalli in Visakhapatnam district of Andhra Pradesh. The temperature in this place drops to as low as 2°C during winters.

Scenic Araku valley

Darinbadi hill station, Odisha

Yercaud lake on Shevroys

Lambasingi, the emerging hill station in AP

"We live in a wonderful world that is full of beauty, charm and adventure. There is no end to the adventures we can have if only we seek them with our eyes open"

- Jawaharlal Nehru

Caves

The caves in the Eastern Ghats are not only mere geological and tourism sites, but also have spiritual, ecological, evolutionary, archeological and socio-cultural history as pre-historic man lived in these caves. They provide shelter to bat species, birds, animals, insects and micro-organisms. Villagers near the caves collect the droppings of fauna in it and use it as fertiliser in their fields.

Borra caves: These caves are located in Ananthagiri hills near Araku valley in Visakhapatnam district of Andhra Pradesh. The caves were discovered in 1807 by William King George representing the Geological Survey of India. Apart from tourism, this place is also known for its religious and spiritual importance. Local tribes living in the area (Jatapu, Porja, Kondadora, Nookadora, Valmiki and others) narrate many legends about the caves. The common legend says that name of the caves such a way that a cow grazing on the roof of the cave fell 60 mts down into its hollows from hole called "Borra" ' which means a hole in the local language. The cave has a massive opening of 100 mts width and 75 mts high. The Gosthani river drains the cavern area. Stalagmite and stalactite formations are found in the caves and a small temple is also seen.

Belum caves: The caves are located in Yerramalai hills in Kurnool district of Andhra Pradesh, and are known to be the second largest caves in Indian sub-continent after Meghalaya Caves. At about 100 kms from Kurnool town, they were discovered by H.B.Foote in 1854. These sub-terranean caves have 3 cavities and central one makes the main entrance to the caves. Belum Caves have long passages, spacious chambers, fresh water galleries and siphons. At a descent of 20 mts near the entrance the cave takes a horizontal path with a length of 3229 mts.

Borra caves

Akkamahadevi caves, Srisailam

Akkamahadevi caves: These natural caves in Nallamalais are located at 10 km from Srisailam pilgrim centre on the northern banks of Krishna river. This cave appears to have got its name Akkamahadevi from a ascetic, lyricist and philosopher, who worshipped Lord Shiva and did penance in this cave. The cave also has another wonder with a 200 x 16 x 4 feet natural arch that stands splendidly without any support. The caves have magnificent rock formations.

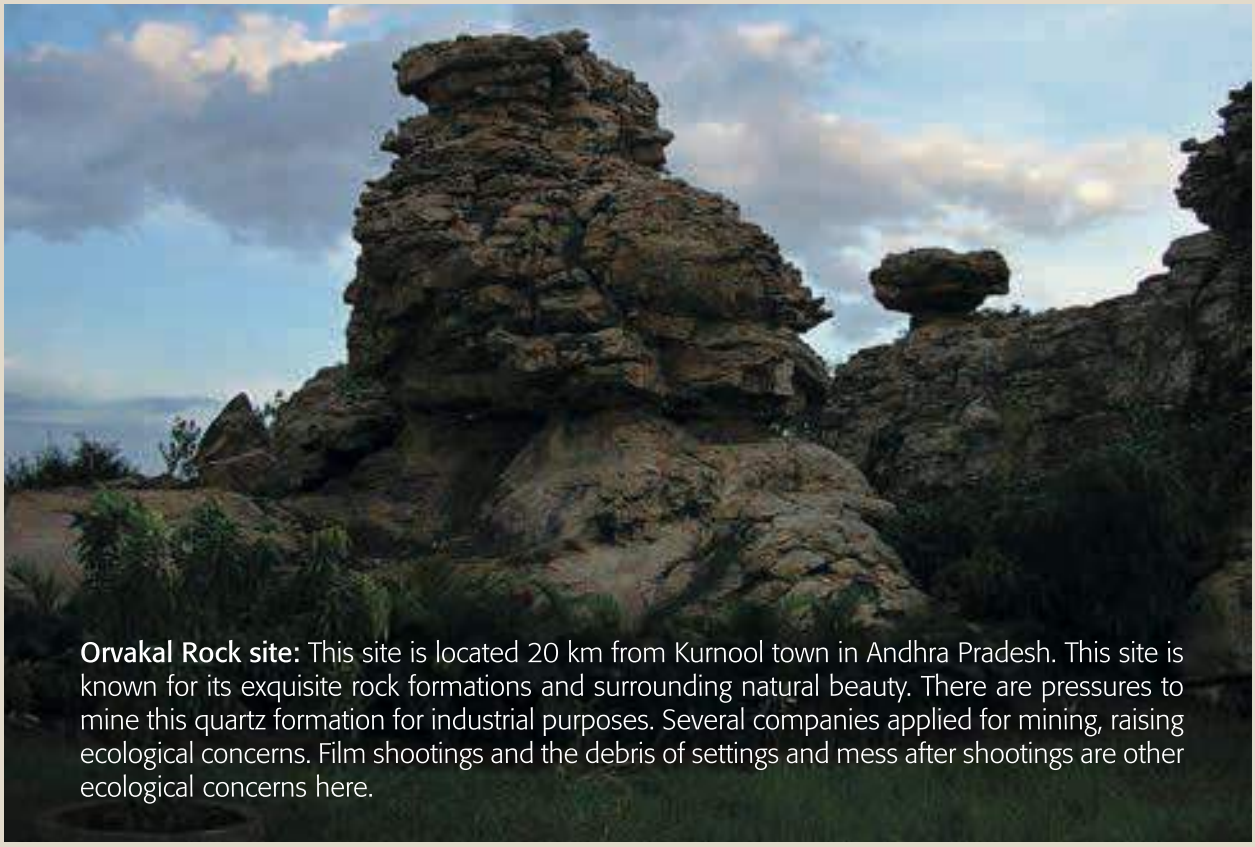
Yaganti caves: This cave, with its temple, has religious and spiritual importance. These caves are located in the Yerramalais, about 100 km from Kurnool in Andhra Pradesh. According to Hindu literature, sage Agastya performed his penance for Shiva in this cave. Sri Potuluri Veera Brahmendra Swami, a famous philosopher, expounded 'kala gynanam' (time and future prophecy) in this cave.

Yaganti Caves

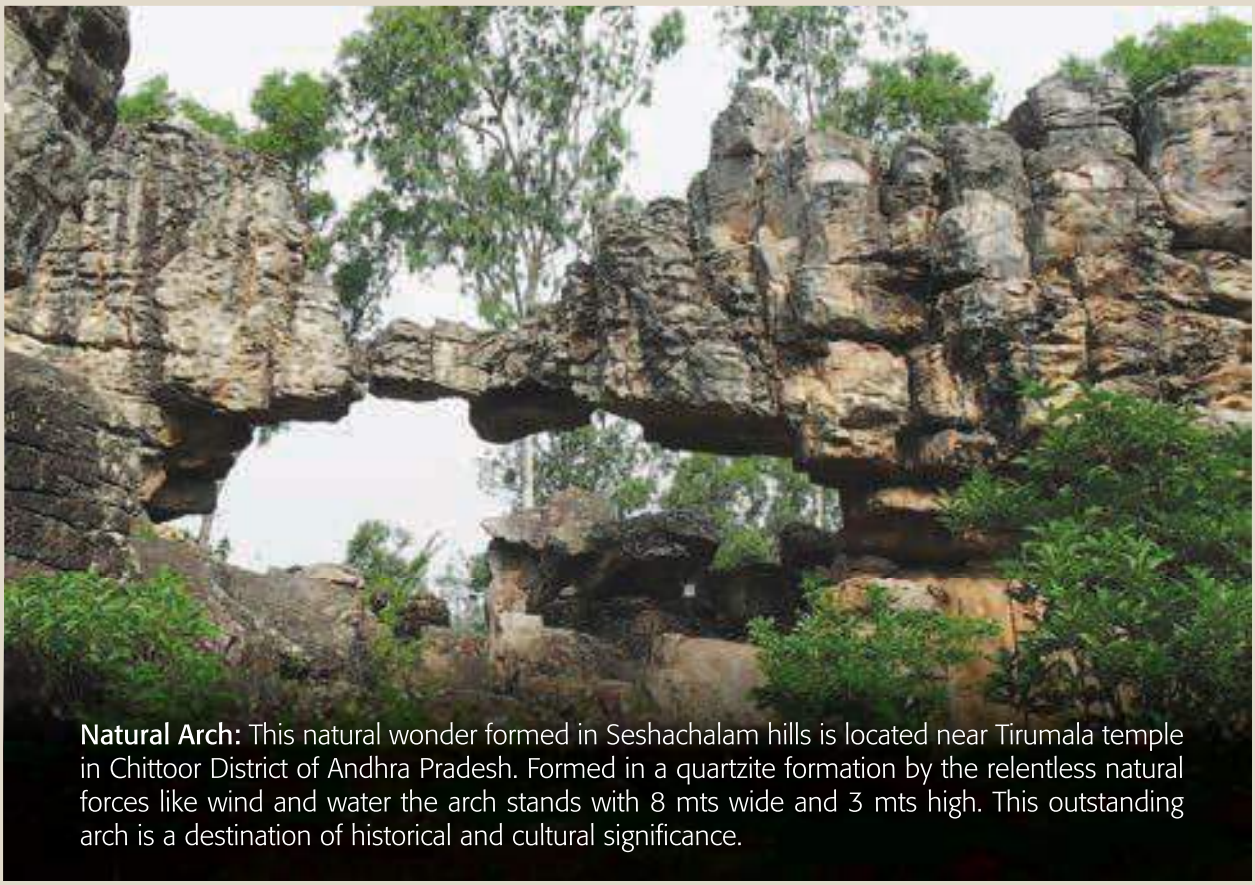
Bears cave: This cave on Shevroys is considered one of the abodes of Lord Murugan. Considered to be home to bears, this huge natural formation is hence named after the bears. The main site of the cave is 7 feet below the ground and it has a deeper gorge. Local legends say that the cave leads up to the cave situated in the Shervaroyan temple. It is also said that the cave was a hideout and an escape route for Tipu Sultan during a war.

Bears cave

Rock Sites



Orvakal Rock site: This site is located 20 km from Kurnool town in Andhra Pradesh. This site is known for its exquisite rock formations and surrounding natural beauty. There are pressures to mine this quartz formation for industrial purposes. Several companies applied for mining, raising ecological concerns. Film shootings and the debris of settings and mess after shootings are other ecological concerns here.



Natural Arch: This natural wonder formed in Seshachalam hills is located near Tirumala temple in Chittoor District of Andhra Pradesh. Formed in a quartzite formation by the relentless natural forces like wind and water the arch stands with 8 mts wide and 3 mts high. This outstanding arch is a destination of historical and cultural significance.

Penna canyon: The river which cuts through Veligonda and Palakonda reminds one of the vistas of the Grand Canyon. There are vertical cliffs precipitating to the river bottom and its surrounding ecological and agricultural landscape can be a potential eco-tourism site.

Satkosia gorge: The mighty Mahanadi River makes a passage through a narrow gorge for about seven kilometers in Eastern Ghats near Tikarapada, 60 km south of Angul town in Odisha. "Sat – kosh" in local language means seven miles, hence this gorge is called Satkosia. A wildlife sanctuary of 795.59 km2 is spread around this gorge.

Papikonda: The valley Offers a breathtaking vistas with verdant hills, sparkling waters of Godavari river, wildlife and tribal villages. This long spectacular valley is located between Bhadrachalam in Telangana and Rajahmundry in Andhra Pradesh. The Papikonda region is dotted with many temples, sacred sites and groves, and scenic spots, making it an important destination for touristic, spiritual and cultural experiences.

Krishna gorge: The long and deep Krishna gorge which passes through Nallamalais in the middle of the Eastern Ghats is one of the nature's wonder. The long spread of backwaters of Nagarjuna Sagar and Srisailam are becoming popular river cruise spots.

Water falls

There are hundreds of small to medium water falls in the Eastern Ghats. Springing down from the mountain catchments, the streams form beautiful falls and cascades. In Tamil Nadu the Eastern Ghats glisten with many falls such as Agaya Gangai (Kolli), Kiliyur (Shevroys), Mangalam Aruvi, Mayil Uthu and Koraiyar cascade (Pachamalai), Periyar falls (Kalrayan hills). In Andhra Pradesh there are falls such as Pudur Megan falls, Talakona, Kailasakona, Kaigal / Dumukurallu falls (Seshachalam), Ubbalamadugu (Kambakkam range), Kailasakona (Tirupati), Ethipotala, Tadimada, Katiki (Anantagiri). In Telangana part of Nallamalais there are Mallela Thirtham and Saleswharam in Nallamalais. In Odisha, there are splendid falls such as Gandahati (Mahendragiri), Duduma (Deomali), Joranda, Berehipani (Simlipal).

Eco-tourism is promoted around the world as a 'responsible travel to natural areas' aiming to meet the requirements of both the conservation of nature and development of local people. There is ample scope for responsible eco-tourism in the Eastern Ghats owing to its scenic landscape and wilderness. The revenue thus generated can be utilized for the preservation of the natural wonders of the hill ranges.

Mallela Thirtham falls on Amrabad upper plateau

Historical and cultural heritage

The Eastern Ghats region has its own unique place in the pages of human history in India. The hills of the Eastern Ghats have been supporting populations, societies, and cultures in this region for a long time. With the development of communities, kingdoms, legacies and their confluence of devotion and spiritual practices, the Eastern Ghats holds a special place in the history of this sub-continent.

Several paleolithic sites, rock temples and cave shelters excavated by archeologists in the jungle and cliffs all over the hill ranges show the presence of humans and their settlements since long in the Eastern Ghats region. The anthropological history of the Eastern Ghats goes back to stone-age culture evidenced by micro and megalithic sites of the tribes in the hills (Sanapati and Sahu, 1966). Paleolithic sites revealed by Krishna Shastri (1982) in Amrabad, Chandravgu near Mannanur in Nallamalais and many other locations in Andhra Pradesh and Telangana reveals a long presence of human societies in the area. Numerous megalithic sites in Biligiri Rangana Hills have been discovered from within and in the immediate vicinity of the hills, testifying to the presence of indigenous people in these regions also for a long time.

Considered as one of the most important prehistoric sites in India, Ketavaram site was discovered 100 years ago by Bruce Foote, a British officer. The site is located in Yerramalais in Kurnool District of Andhra Pradesh. Huge numbers of stone tools found here are believed to be the contemporary to Indus Valley civilization. Many of the figures at the Indus area have also been seen at Ketavaram. The pictures on the rock walls show the lifestyle of pre-historic man. The animals in the pictures drawn are deer, stag, antelope, hyena, rabbit, reptile and frog. The painting of hunting dance among these pictures is considered as proof of an early belief system. This shows that before setting out for hunting they performed many rituals praying to the tribal gods for a bounty. Many historians and archaeologists have described the site as a treasure wherein pre-religious beliefs could be found in the populations living in the surrounding villages. They call for in- depth research before the continuity is broken and modernisation takes over in the societies in the region. Activities such as quarrying around the caves are a concern for archaeologists, historians and environmentalists.

This region, since the early ages, has been the stage for empires, ethnic groups and cultures. Ancient

Prehistoric rock paintings, Ketavaram, near Kurnool, AP

civilizations, kingdoms and dynasties that flourished and ruled here, faded and are now part of the annals of south Indian history. Several monuments, mythology and epics, artifacts, traditions and inscriptions speak of innumerable legends about the many peoples, cultures and empires that have come and gone in the region since prehistoric times. Any study of the Eastern Ghats would be incomplete and erroneous if its historical and cultural aspects are not delved into and its past magnificence is not brought out..

Epigraphists have discovered thousands of inscriptions in the temple complexes of the region which display the history of more than a thousand years. Most of the inscriptions are in Sanskrit, Telugu, Odia, Tamil and Kannada languages. Ikshwaku, Shatavahanas, Chalukyas, Cholas, Pallavas, Vijayanagara, Eastern Ganga, Reddy, Kalinga, Gajapathis, Kakatiyas, Qutb Shahi dynasties and the British reigned and established kingdoms here in Eastern Ghat region. There are several forts in this region built by those dynasties, that though not extensive in size, are highly strategically located in the region. The table lists some of the forts in the Eastern Ghat region.

In the recent historical past, the Eastern Ghats region was also a hotbed of Indian independence struggle. Some of these hills have witnessed tribal resistance to British rule. The Rampa rebellion in northern Eastern Ghats, chenchu rebellion in Nallamalais are examples of freedom seeking communities. Uyyalawada Narsimhareddy of Kurnool district and Alluri Sitarama Raju of Rampa hills in East Godavari district displayed courageous and noteworthy struggle and in the process sacrificed their lives rebelling against colonial rule.

History has provided many artifacts and structures that are deeply entwined with the regional identity of the people of the Eastern Ghats. The population here grew at the intersection of different cultures, languages, castes, clans and religions. This led to development of many regional and micro-cultures. Numerous such historic relics have been lost in the last century due to treasure hunts, farming and development activities in the areas across Eastern Ghats. These valuable historical treasures need immediate attention for preservation.

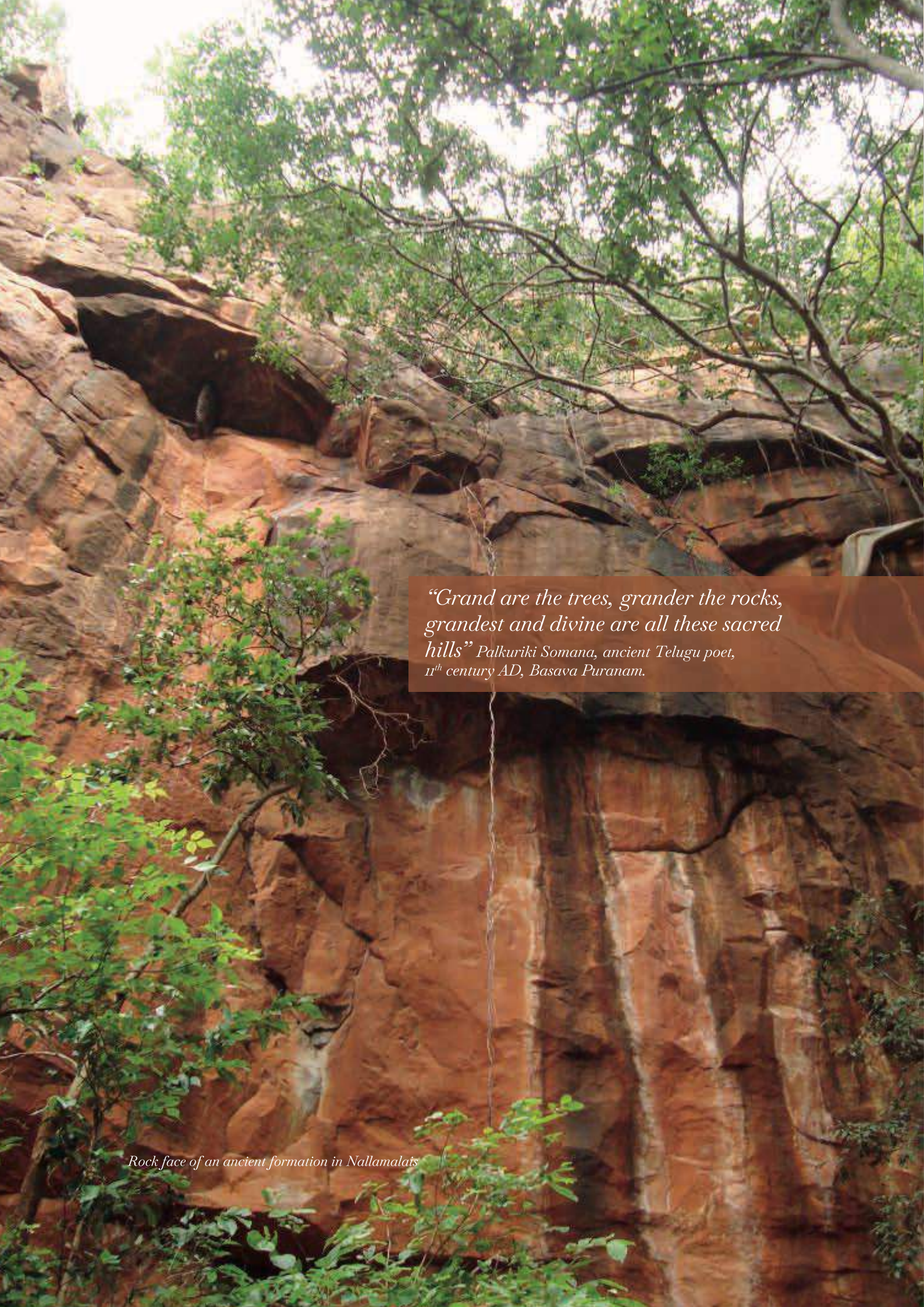
Forts in the Eastern Ghats

Name of the fort	Location, Hill range	Dynasty	Age
Gajapati	Gajapati	Gajapati	15th Century
Kondapalli	Kondapalli	Musunuri Nayaks	14th century
Kondaveedu	Kondaveedu	Reddy kingdom	14th century
Chandra Gupta	Nallamalai	Chandragupta	2nd Century
Prataparudra	Nallamalai	Kakatiya	13th century
Udayagiri	Veligonda	Vijayanagara	14th century
Gandikota	Erramala	Pemmasani	12th century
Chandragiri	Sheshachalam	Vijayanagara	11th century
Gingee	Gingee Hills	Chola	9th century

A fort on Gingee hill

Victory pillar of Sri Krishnadevaraya on Simhachalam, near Visakhapatnam

Kondaveedu fort



"Grand are the trees, grander the rocks, grandest and divine are all these sacred hills" *Palkuriki Somana, ancient Telugu poet, 11th century AD, Basava Puranam.*

Rock face of an ancient formation in Nallamalais

Seshachalam, a view from foothills in Tirupati

Sacred mountain space

The hills of the Eastern Ghats are of great spiritual and cultural significance. The hills of Mahendragiri, Gandamardhan, Simhachalam, Indrakiladri, Srisailam, Seshachalam, Shevroys, Kolli, Karantamalai and many other hills in the region have a significant place in the spiritual history of India. Many caves, rocks and streams in the hills are of spiritual significance as well. There are several anecdotes of hills in the mythology of India. Following is a brief look at some of the ranges of the Eastern Ghats which have epic and spiritual importance.

There are several ancient temples, tribal deities, Buddhist centers, monasteries and sacred groves all over the Eastern Ghats. Odisha has Mahendragiri, Puri, Kalahandi, Rayagada and Jaugada. There are many places of sacred spaces in Andhra Pradesh such as Tirumala, Srikalahasti, Ardhagiri Kanipakam, Kadiri, Ahobilam, Mahanandi, Yaganti, Penchela kona, Srisailam, Amararamam, Mangalagiri, Indrakeeladri, Pattiseema, Annavaram, Simhachalam. Telangana part of these hill has Umamaheshwaram, Saleshwaram, Loddi, Maddimadugu and Tamil Nadu has Namakkal and Annnamalaiyar. In Karnataka, Biligirirangana temple is located in the southernmost Eastern Ghats. Perhaps some of the oldest pilgrim trails in the world are located in the Eastern Ghats. Since ancient times, it has been a prominent sacred place in peninsular India. Such is the gravity of these hills that several old pilgrim trails led souls from far-off regions towards these spiritual centers in search of soul fulfilling experiences, Solace health and well-being.

Numerous settlements with a variety of traditions of tribes with people speaking different languages like tribal dialects, Odiya, Telugu, Tamil, Kannada and others live along these hills. The unique heritage includes many forts, sacred groves, ancient pilgrim trails, temples, landmarks filled with folklore, interesting lifestyles and legends. These sites surely deserve UNESCO's World Heritage recognition.

Mahendragiri is an important spiritual and archeological hill space in Odisha. There are many ancient temples on this range such as Kunti temple, Bhima temple, Yudhisthir temple, Parshuram temple, Hanuman temple. Ancient literature, epigraphy and historical account have an extensive reference of Mahendra mountain. Ancient poets like Kalidas, Sarala Das and Radhanath Ray vividly mentioned this hill range in their classical works. It is a sacred Buddhist site also. It is an important unit of the seven Kulagiris or principal mountains of India. A large number of devotees throng here during Sivaratri festival.

Gandhamardan Legends abound on the antiquity of this hill range. Mythological legend says that this is a piece of mountain with sacred medicinal properties carried by Lord Hanuman from Himalayas on his shoulders to save the life of Lakshman. Mahabharata's famous guru and sage Drona's name is also

associated with this hill. It was a site of Buddhist culture. Many ruins on the hills testify its historic past. Hiuen T'sang, the famous Chinese traveler made a visit to the campus of Buddhist University of Parimalgiri here and praised the splendour of the mountain. Nrusinghanath temple is located on the northern slope of the mountain and Harishankar temple is on its southern slope.

Nallamalais The shrine of Lord Mallikarjuna, picturesquely situated in the hills at Srisailam in Nallamalais in Kurnool district of Andhra Pradesh is considered as one of the most ancient 'kshetras' or holy places of India. It is one among the seven Jyothirlinga and Astadasha Shaktipeetas of India. Adi Shankara, the great saint of 8th century AD was believed to have meditated for an year under "Trifala Vriksham" (3 species of Ficus growing together) in the temple complex of Lord Mallikarjuna. This saint is also said to have meditated in Paladara-Panchadara, a sacred grove and spring located in the jungle near the temple. There are hundreds of sacred, spiritual sites, including groves, springs and pilgrim paths scattered over Nallamalais making it a mystic, ancient spiritual space. The Siddhas of Nalamalai, who are the followers of Lord Shiva wandered here. Apart from spiritual places such as Lord Mallikarjuna Swamy temple at Srisailam, the hills have ancient temples like Umamaheshwaram, Maddimadugu, Saleshwaram, etc. Once it hosted the largest buddhist university at Nagarjuna Sagar. Much of the remnants submerged under the Nagarjuna Sagar Reservoir water. Some of them are retrieved and preserved at Nagarjuna Konda (an island in the Nagarjuna Sagar Reservoir). Acharya Nagarjuna who lead this university is known to have been a great alchemist in those days.

Lankamala has many old shrines such as those of Nityapoojaswami, Gopalaswami, Kailasaswami and Matchalanka devalayam in the interior of the range, apart from temples like those at Siddavatam which are at its foot making it obvious that the hills were

Srisailam temple, Nallamalais

Yaganti temple, Kurnool district

Ahobilam, middle Eastern Ghats, AP

Biligiri Ranganatha Temple at BR hills, Karnataka

A village temple at kolli hills

more frequented in the past than they are now.

Seshachalam with Tirumala and Tirupati, is a major Hindu pilgrimage destination. This religious destination has seven sacred hills namely, Anjanadri, Garudadri, Narayanadri, Neeladri, Seshadri, Venkatadri and Vrishabhadri. The whole Seshachalam range is dotted with many temples, sacred spaces, groves and springs.

In Tamil Nadu, hills like Kollimalai, Shevroys, Arunachalam and other ranges have historical and mythological significance in Tamil classic literature. Puravi Eduppu is a popular festival praying to the rain gods for their mercy. This festival is celebrated in honor of Karanthamalai Aiyanar in Tamilnadu, who is believed to be the protector of rural villages and their families. Large terracotta horse statues are offered to the deity during the festival days.

The legacy of Buddha

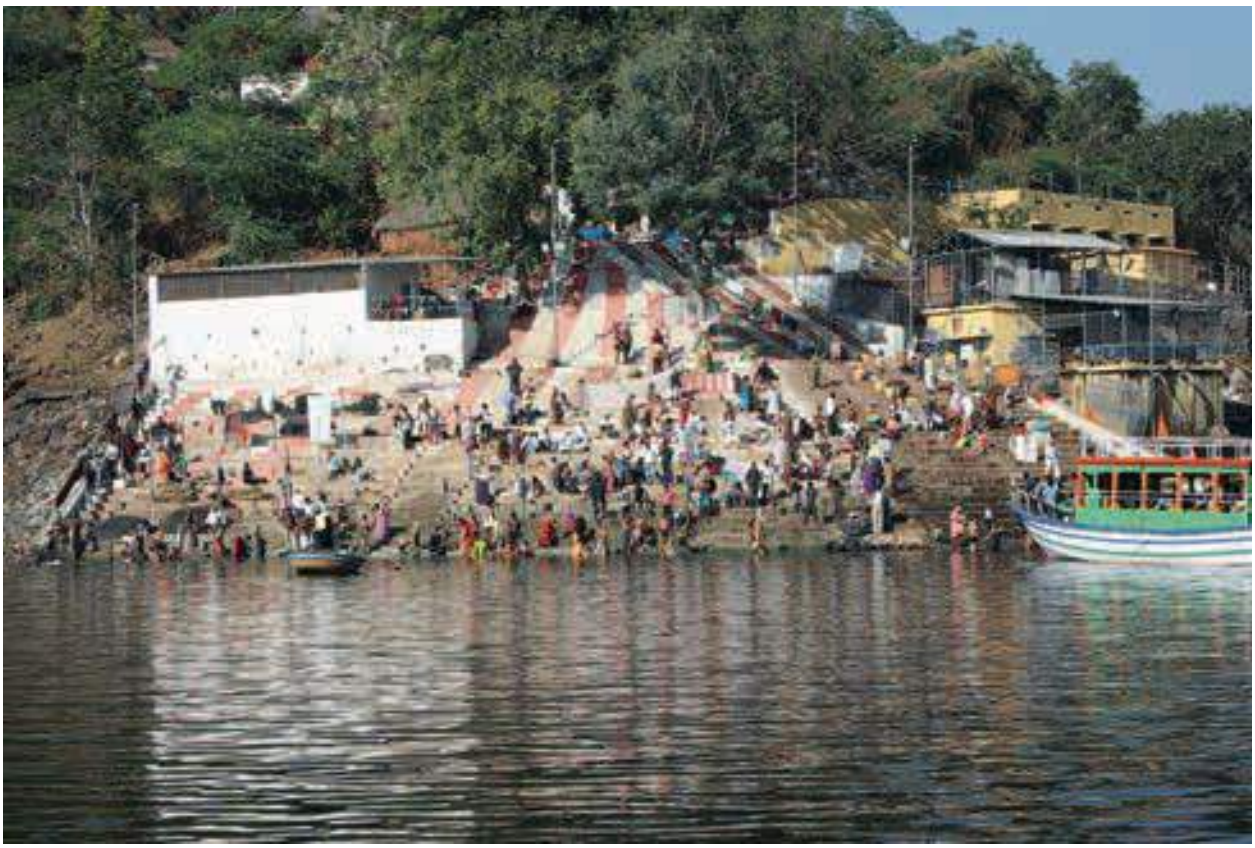
Buddhism flourished in the Eastern Ghats region. The ruins of Nagarjuna University can be seen at Nagarjunakonda. This ancient seat of learning was started by Nagarjuna, the great Buddhist scholar of the Mahayana stream in 150 AD. He is known for his treatise on alchemy and Mritha Sanjeevani (the recipe for eternal life). In Odisha, the Buddhist sites are at Ratnagiri, Lalitgiri and Udayagiri. Andhra Pradesh is dotted with many Buddhist sites such as Nagarjunakonda, Amaravati, Guntupalle, Kapavaram, Bojjanakonda, Bavikonda, Thotlakonda, Pavuralakonda, Ramatheertham, Salihundam while Nagarjuna Sagar is situated in Telangana state.

Buddhist stupa at Thotlakonda, Visakhapatnam

Relics of Buddhist heritage on Nagarjuna konda island in Nagarjuna Sagar reservoir

Pilgrims on their way through an ancient trail in the hills for annual visitation to a cave temple of lord shiva deep in the nallamalis

Sweet Guttation water from the vast maze of roots join flows in rock strata and form springs that emerge at cliffs and hill slopes are considered the sacred waters and also some traditional folk medicinalists collect it for their practice



Pathala Ganga bathing ghats on Krishna river, Srisailam

Umamaheshwaram, a temple perched in the cliffs of Nallamala, a northern gateway to Srisailam overlooking the vast Deccan plateau. It is a halt and entry to Nallamala on ancient pilgrim trial to Lord Mallikarjuna, deep in the hills

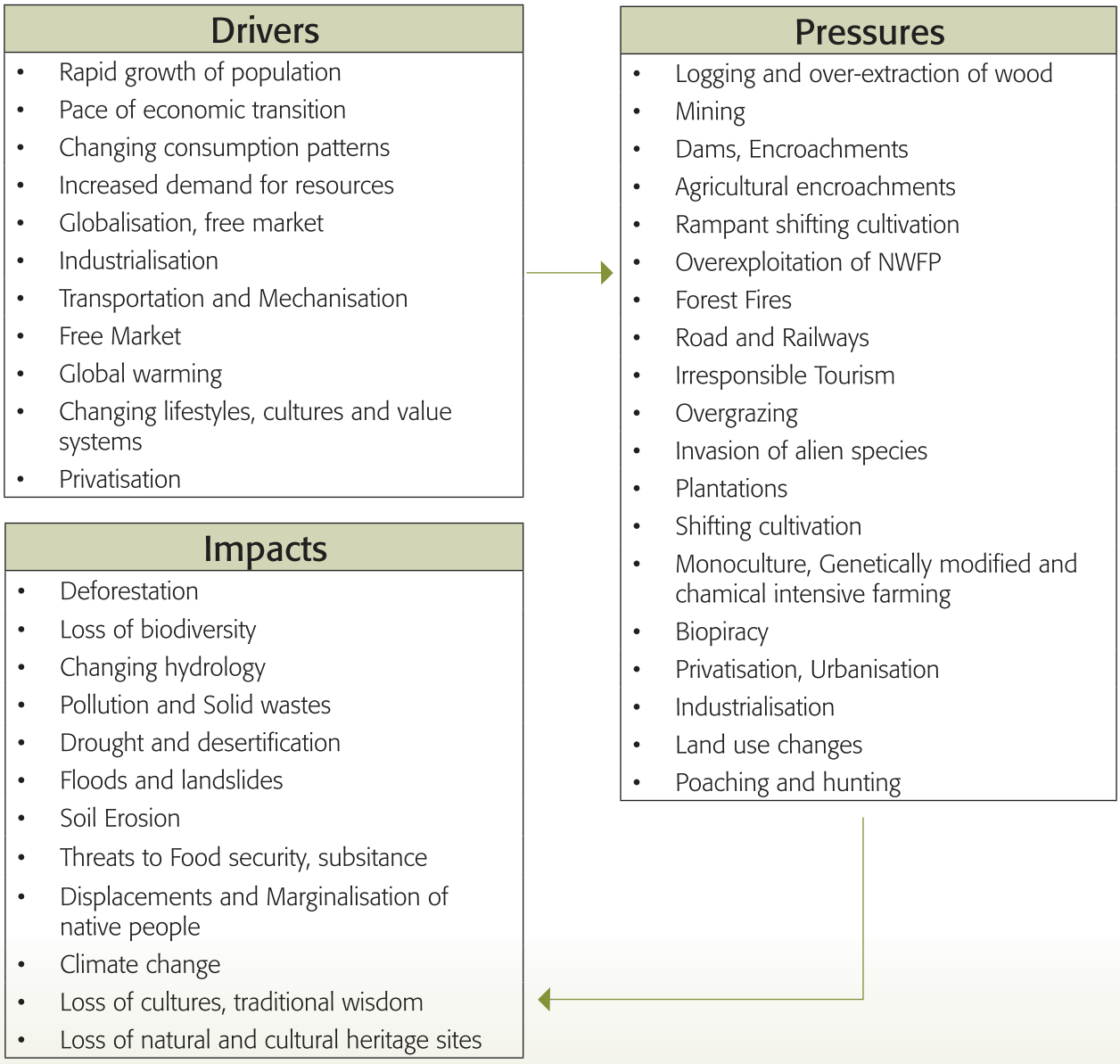
Northern Eastern Ghats, AP

4

Imperiled Eastern Ghats

The Eastern Ghat ecosystems are degrading at a pace unprecedented and have become like islands surrounded by dense human population and thrashed by the forceful waves of changes. A nearly five-fold increase in population over the last century has caused immense pressure on the ecosystems in the region. At the same time, these ecosystems and people are bearing the brunt of inconsiderate development, large-scale projects, mining and many other human interventions. Some of the major environmental issues, their drivers and the impact that have a bearing on the region's present and future are in the indicative chart followed by brief narratives on each issue.

The Path of Environmental Perils in Eastern Ghats



"And isn't it a bad thing to be deceived about the truth and a good thing to know what the truth is? For I assume that by knowing the truth you know things as they really are"

- Plato

Forest Felling

Widespread tree felling until 1980, was the main factor for the degradation of forests in India. The legal extraction authorised by the government include the selective logging, extraction of bamboo, thinning of teak plantations and removal of dead and fallen trees, which have caused the loss of forests. In addition, large-scale illegal felling happened and continued all over the wilderness including Eastern Ghats. The felling also caused by charcoal that can be sold as a commodity. The cleared land is used as pasture, plantations and human settlement. Unrelenting deforestation without sufficient reforestation has resulted in damage to habitat, biodiversity loss and aridity. Wastelands replaces verdant and healthy eco-regions.

Even after decades of the enactment of the National Forest Policy in 1988, which made a very significant shift from commercial concerns to focus on the ecological role of the forests, the devastation of forests continues. The forests have lost their prime canopy in the last few decades. Illegal felling of trees occurs throughout the hill ranges where high-value timber is distributed. Teak, Sal, Red Sanders, Sandalwood, Pterocorpus and other species have dwindled over the last few decades. Ever increasing demand and value for wood products has led to the widespread illicit felling of forests. Smugglers carry sophisticated arms, which make the work of forest protection risky. The forests in Cuddapah, Kurnool, Chittoor are classic cases where the lure of precious red sanders is causing regular encounters. The 1980s saw the proliferation of sawmills accelerating the toll of trees. Charcoal making was rampant in the hills and it is found to be continuing in some pockets. At least 25% of smuggled wood is the raw material for carpentry. Most of the wood used by carpenters is illegally bought from the smugglers.

The local people use small wood for a variety of purposes, such as construction of houses and making agriculture implements. An estimate states that about 1,000 m^3 of small wood is needed for making agricultural implements in the 50 fringe villages. The total wood requirement for both the housing and agricultural implements is estimated to be about 2,150 m^3 per annum. Fuelwood provides a major source of energy for cooking as well as for small-scale industries in India. A study says that fuelwood meets about 40% such energy needs of the country. Studies reveal that the consumption of fuelwood in India is alarming with about five times higher than its sustainable collection from the jungles. All the scenario applies to the Eastern Ghats also.

Once dense and tall, the swaths of terminals fell to the aggressive onslaught of the 80's, the young trees need protection from further assaults to regain the lost woods

At the edge collapse, a tree ready to fall evokes the plight of Eastern Ghat ecosystems

Pedaling logs on bicycles in Nallamalais

NWFP overharvest

Local people largely depend on NWFP, such as fodder for cattle, land for agriculture apart from wood from the jungles. The substantial and increasing scale of dependency on mountains affects its habitats and its ecological integrity. Scarce alternative sources of livelihoods push rural people to exploit the resources of forests.

Collection of non-wood forest items is one of the major sources of sustenance and income for the local people. They collect food, fodder fibre, medicines, gum etc. from the jungles. Illegal cutting and transportation of bamboo trees for commercial purposes is rampant. Non-scientific cutting of bamboo leads to unhealthy culm and clump formation. Lakhs of people are dependent on collection of Adda leaves and leaf-plate making or both for their sustenance. In an attempt for easy and increased procurement of Adda leaves, many a time the supporting tree on which the climber twines, are being felled. Beedi leaf collection supports people in the surrounding villages for two lean months of April and May. The negative aspect is that the collectors light fire to the bushes to get new shoots which spreads into the dry forest, starting forest fires. Illegal and unscientific extraction of goods such as gum karaya tree (*Sterculia urens*) adds to the woes of the forest. *Vernonia anthelmentica* which wildly occurs in restricted patches is also an economically important species that can be conserved and exploited. Rampa hills and Anantagiri ranges, once considered as most productive areas have lost their NWFP to a serious level. Similar situation is prevailing all over Eastern Ghats.

Huge loads of adda leaves are taken from forest in Ananthagiri

Gandhamardhan is a classic case for the rampant collection of medicinal plants. For the last few decades there has been an increased collection and trampling of these areas rich with medicinal plants which have caused a severe ecological disturbance. Hundreds of species in the hill ranges across Eastern Ghats are found to be vulnerable due to over-exploitation. At times, local weeds may also be important medicinal plants and instead of ploughing or weeding the ground for crops, tribal farmers must be encouraged to evaluate the value of existing natural plants.

Invasive alien species

The major threat to biodiversity has been the loss of habitat; followed by the invasion of alien species (CBD, 1992). The greatest threat to today's biodiversity is faced by the movement of animals, plants and other organisms around the world. More than half of the animal extinctions have resulted from the introduction of species into ecosystems either deliberately or accidentally (Clavero and García, 2005). The invasion cast economic loss or burden (Pimentel *et al*., 2005). Natural flora is affected or suppressed by the invasion. These species compete with the native flora for nutrients and space and never go along with the natural cycle of ecosystem but disrupts it. Sudhakar Reddy *et al*., (2007) reported 61 species of invasive plants from the Eastern Ghats region.

Lantana camara, is native to the American tropics. It is a strong light-demanding plant and is a fast-invading species, which increases the risk of forest fires. The species is found in the hills of Nallamalai, BRTR, Anantagiri and Mahendragiri. *Prosopis juliflora* is native to central and South America. This destructive species is widespread in the Eastern Ghats. *Parthenium hysterophorus* known as Congress grass is native to Central and South America. They invade all over and cause loss of yield and affect livestock and human health. The plant produces allelopathic chemicals that suppress crop and pasture plants. It also frequently causes pollen allergies. Duckweed (*Eichhornia crassipes*), commonly known as water hyacinth, is an aquatic plant native to the Amazon basin and is a menacing species outside its native range. The weed was observed in several water bodies in the Eastern Ghats region. This species blocks sunlight and depletes oxygen levels thus damaging the ecology of the water body and its aquatic life.

Prevention/eradication of invasive alien species is the need of the hour to safeguard native biodiversity of the Eastern Ghats. The governments should aim to reduce this threat to biodiversity, by addressing prevention on a war footing, along with control and eradication of invasive alien species. Priority should be given to the identification of species and its pathways of invasion, control and eradication. Complete removal through mechanical methods is most appropriate to address invasive species removal. These efforts should be sustained continuously for a period of three to four years until the invasive species are removed completely. These species should be removed before flowering. Native species should be promoted by mosaic plantation. There is a need to adopt strategies to curtail pollution especially that which causes heavy metals toxicity and nutrient overloads. A monitoring and control centre should be established with taxonomists, ecologists, foresters, environmentalists and local communities. Sensitizing and capacitating BMCs, EDC, and NRM committees can bring results.

Lanthana Kamara, an aggressive invasive

Lantana Vimukth Eastern Ghats

As is applied in the middle Eastern Ghats the following strategy can be adopted all over Eastern Ghats for the eradication of Lantana. It is a hard species to remove and requires the following measures (1) The large lantana bushes have to be cut and removed from the site. (2) Lantana spreads by runners/stolon roots horizontally. Even if the bush is cut, these runners help these weeds to establish again. Therefore, it has to be cut or removed by uprooting the whole length of the runner. This can be done after rains when it sprouts. This practice and should continue for at least three continuous years. We can declare the mission as "Lantana Vimukth Eastern Ghats".

Dams

There were fewer than 300 large dams in India in 1947. By the year 2000, the number had gone up to over 4000. Half of these dams came up between 1971 and 1989. As stated already, the valleys and narrow gorges of major peninsular rivers cut through the Eastern Ghats and have become favorable sites for dam construction. These projects provide benefits such as downstream flood control, store floodwater, irrigation, drinking water, power generation, recreation, fisheries etc., in the region. However, on the flip side, they also affect the local ecosystems and the local population adversely. They cause submergence of large areas, displacement of locals, stop ecological flows in rivers, urbanization, increased wastes and pollution that lead to disturbance of the local rock and soil formations and biodiversity in the serene hill tracts. Upstream catchment disturbance and consequent sedimentation prevents a dam from reaching full capacity whether it is to generate electricity or to serve as an irrigation project.

The dams and projects have their impact on the ecosystems under their reach. The irrigation in the command of the project erases entire regional wilderness into monotonous irrigated expanse leading to the collapse of biodiversity there. Considerable vegetation cover is cleared under long linear maze of transmission lines passing through the hills. At least seasonally, they become barriers to wildlife. Any new proposals and plans for large projects in the hills are not at all ecologically and socially viable.

India had a spell of maximum forest loss between 1950 and 1980 before the Forest Conservation Act (1980). During this period, approximately 5 million hectares of forest was allotted to various development and commercial projects. In 1980, the Forest Conservation Act (FCA) came with an objective to check the diversion of forest land for non-forestry purposes. The Act mandates that state governments are prohibited from diverting forestlands for non-forestry purposes without prior approval of the central government. In spite of all these legislations, the rate of degradation is increasing. This can be clearly seen in the Eastern Ghats.

Large Dams in Eastern Ghats

River	Location	State	Dam	Year	Submerge (km^2)
Kolab	Deomalis	Odisha	Upper Kolab	1985	122.00
Brahmani	Malayagiri		Rengali	1985	378.40
Krishna	Nallamalai	Telangana	Nagarjuna Sagar	1974	285
Krishna	Nallamalai		Sirishailam	1984	616
Godavari	Papikonda	Andhra pradesh	Polavaram	under construction	600
Penna	Palakonda & Veligonda		Somasila	1989	212
Kaveri	Metturu & Palani hills	Tamil Nadu	Metturu	1934	153.5

Source: CWC (2017)

Srisailam Dam across Krishna river in a gorge in Nallamala

Letter of Mrs. Indira Gandhi, the then Prime Minister of India, to all the Chief Ministers of our country, October 1980

Dear Chief Minister

"You referred to the Central Forest (Conservation) Act stating that it came in the way of irrigation and other developmental projects. You also said that it makes the Adivasis feel like strangers in their home, which is the forest. If the Adivasis knew about the content and implications of this Act I am sure they would welcome it for its aim is to preserve forests not to destroy them. But what logic can we give that the Law meant to avoid indiscriminate felling of trees will encourage it? It is indeed unfortunate that our forests have been so thoughtlessly cut down with no thought of renewal. This has endangered our survival without which even development or irrigation projects would be meaningless. Social Forestry should be geared to the needs of the local people. In the few cases here the Centre may have intervened to prevent the use of forests for non-forest uses it is wholly to ensure that good forest wealth is not destroyed for short-term gains. Also, the State Governments were being persuaded to look at equally viable alternatives, which were less destructive of forest Wealth. The Ministry of Agriculture is being asked to expedite the process of consultation."

Indira Gandhi, Prime Minister of India

A quarry defacing the landscape in Yerramalais, AP

Mining

Eastern Ghats is endowed with rich and a wide range of mineral deposits like bauxite, manganese, graphite, chromite, iron, barytes, sulphides, apatite, mica and radioactive minerals. In addition, there are occurrences of feldspar, quartz, quartzite and commercial granite. Beach placer minerals are garnet, ilmenite, rutile, sillimanite, magnetite, zircon and monazite. Koraput, Gandhamardan, Niyamgiri, Araku, R.V. Nagar, Gudem, Papi hills are some of the mining hotspots in the Eastern Ghats. These minerals contribute to the nation's economic prosperity and growth. However, unwise mining poses severe challenges to the ecosystems and local population.

Inexorable exploitation of minerals from the hills debilitating the eco systems and indegenious people

The land of Odisha is known for its rich and wide range of mineral wealth. About 16.92% of the total reserves of the country are from this state (Atia Arzoo and Kunja Bihari Satapathy, 2016) and stands important in production. Majority of the minerals in the state occur in the Eastern Ghats. The mineral reserves in Odisha with respect to chromite, nickel ore, graphite, bauxite, iron ore, manganese and coal are estimated to be 97.37%, 95.10%, 76.67%, 49.74%, 33.91%, 28.56% and 27.59% respectively of the total deposit of such minerals in India,

Bauxite: India is blessed with huge resources of bauxite distributed in different states of the country. Out of these deposits, the bauxite resources found in the Eastern Ghats especially in Odisha and Andhra Pradesh are known for their quality and quantity. More than 95% of the bauxite reserves of Odisha are in the southern and western part of the state i.e., Koraput, Rayagada, Kalahandi, Bolangir districts which are in the Eastern Ghats. Koraput with its vast deposits is the major bauxite-producing district in Odisha, which accounts for more than 95% of the total production of the mineral in the state. Poverty, health and environmental degradation from mining are the concerns in the present day Eastern Ghats of Odisha. Unplanned excavation of Bauxite leads to disruption of hydrology of the hills and water balance in the area, The bauxite caps of the hills, which act as a sponge and storage of water that feed several springs and streams are under degradation from mining and other activities.

Iron: The state of Odisha accounts for about 33% of the total iron ore deposits of India. Keonjhar district in Eastern Ghats is a hotspot for mining of iron ore. A third of India's hematite (ore rock of iron) deposits are found here.

Gandhamardan in this district is one of the biologically

Huge pit of Iron ore in Odisha

rich mountains and a treasure of medicinal plants. This hill range is home to large numbers of tribal population. Since 1970 mining has been carried out hereby Odisha Mining Corporation (OMC) In 2013, a commission headed by Justice Shaw remarked on the illegalities in OMC's operations here including

Rock quarry deep in the Papikonda

the mining of over 1.2 million tonnes of ore from 2000 to 2006 without required forest clearance. Forest department filed cases in the district court. In January 2015, OMC applied for forest clearance (1,590 ha) to expand production to 9.2 million tonnes per year. This proposed area for expansion of 1,400 hectares of forest has seven adivasi villages. The OMC plans to exploit over 300 million tonnes of ore in the next three decades. The annual value of the ore is estimated to be 2000 crores per year. The irony is while the wealth of the hills is thus carried away, nearly 60% of Keonjhar's population is still below poverty line (Outlook, 2016). The future of this epic and unique mountain range, its biodiversity, medicinal plant wealth, the survival are at question.

Gem Rush: Northern Eastern Ghats of Andhra Pradesh is blessed with semi-precious gemstones like alexandrite, chrysoberyl, cat's eye, aquamarine, ruby, moonstone, zircon, sillimanite, garnet, tourmaline. Rush for gemstones and its illegal mining is a serious issue in Araku, Thuraiguda, Littiguda, Narsipatnam, Madugula, Addathigala, Eleswaram, Dharakonda and many other places, where potential gem-bearing pegmatites and its secondary deposition of colluvium are present (Kasipathi *et.al.*, 1998). The main stones found are chrysoberyl (cat's eye) and alexandrite or alex as well as moonstone. Alexandrite is the most valuable of all the mined stones here. Most of these stones are used in making jewelry and have astrological value. No mining rules, regulations or safety measures are followed in the mad rush to unearth these semi-precious stones. Strip mining, burrowing and rat-hole mining have been active. There are incidences, where the entire topsoil cover was mined out, leaving a barren area up to the base parent rock level. All the vegetation in such areas is lost (Araku, Maschapuram). Due to carelessness when dealing with hard rock units and unsafe practices of illegal mining system and cave-ins, the resultant death toll was around 200-250 in a 13 year period (Kasipathi, 1993). The main losers are ignorant rural illiterates and tribal sections along with their families with the patronage of gem merchants. The chase for the precious stones is not only hazardous to people but also detrimental to local ecology and hydrology, soil and geological formations. The impact on below ground fauna in the area is not known.

Barytes from Cuddapah district, granites and slates are mined in the hills of Prakasam district in Andhra Pradesh. Laterite is excavated in vast areas of hills in northern Andhra Pradesh and Odisha. There are apprehensions by environmentalists and activists that not only is the laterite being heavily plundered, but also in this guise, huge loads of bauxites and other minerals are being looted. Feldspar, quartz, oth minor and major minerals and building materials

Magnesite mine at Shevroys

are extensively mined in the Eastern Ghats. In the near future, we may not see some hillocks that existed previously due to predatory quarrying and urbanization.

For the last few decades, the Eastern Ghats have been extensively probed for uranium and other strategic minerals. These areas are ecologically sensitive remote and with a population of impoverished tribal people. The evil effects of Jaduguda in Jharkhand alerted the people in other areas.

A plan for exploitation of uranium near Peddagattu, in Nalgonda district in Telangana resulted in the Movement Against Uranium Mining (MUAP) in 1987 and the project was scrapped. People and

conservationists are apprehensive and in stiff opposition to proposed uranium mining in the core tiger reserve on Amrabad plateau in Nallamalais in Telangana.

The impacts of mining and processing on ecosystems and tribal communities here are a serious concerns. Large forest areas are cleared for mining, transport and processing. Perennial streams originating in the hills provide water for irrigation, drinking, fishing, bathing, cattle needs, and are of spiritual and mythological importance in tribal beliefs are drying up in the summers now. Mining activity has generated large amount of debris, wastes and pollution loads. The mine tailings, fly ash pond and the red mud ponds situated on top of the hills are an environmental hazard to the tribals in the hills and to the lowland people as the heavy monsoon rains wash the effluents into the agricultural lands and streams below. The ecological, social, hydrological, public health, historical and cultural consequences of rampant mining and quarrying require in-depth study, appropriate policy measures. The situation warrants a comprehensive mining policy that includes all dimensions of sustainable development. Prohibition of mining from protected areas, eco-sensitive zones, stopping illegal mining and over-extraction of the mines; 'polluter pays' principles, bio-regeneration of the mine site should be strictly adopted in order to safeguard the Eastern Ghats ecosystems. Fair share of benefits to locals from resource extraction has to be ensured.

"Earth provides enough to satisfy every man's needs, but not every man's greed."
-Mahatma Gandhi

Sand mining in Cauvery river

One of the frequent forest fire in Seshachalam

Forest Fires

According to the Forest Survey of India (2015), forest types such as tropical thorn, tropical dry deciduous and subtropical broad-leaved vegetation are highly susceptible to forest fires. Dry deciduous forests are more prone to fires, and the month of March is when the forests are most vulnerable to fires. More than 90 % of forest fires are caused by humans and land use pattern determines the incidences of the fires. The causes of fires are natural and anthropogenic. Satendra and Kaushik, (2014) have charted out the various causes of forest fires. According to the list, lightning, volcanic eruptions, friction of sliding stones, boulders, bamboo and tree branches cause occasional fires by nature. Predominantly, the fires are caused by humans either accidentally or deliberately. The accidents include the collection of NWFP, residue burning, warding off wild animals, smoking and throwing the burning bidi or cigarettes, campfire, sparks from automobiles, prescribed uncontrolled fires, tapping of resins etc. The deliberate causes listed are shifting cultivation, flushing growth of tendu leaves to have good growth of grass and fodder, rivalry with forest department or personal vengeance, clearing paths by villagers, encroachment of forestland, obscuring illicit felling and rituals/traditions/customs.

Forest fires diminish plant biomass, which in turn may disturb long-term productivity of the vegetation (Frost, 1996). Fires impair the regeneration of vegetation, induce soil erosion, ecological changes, disturbance of habitat and wildlife patterns, cause, health problems to local people. Forest fires release carbon dioxide and noxious gases such as carbon monoxide, methane, hydrocarbons, nitric oxide and nitrous oxide which trigger global warming and depletion of the ozone layer. Biomass burning may also cause the rise of methyl bromide, an ozone-depleting substance. (Manjula, 2012).

According to FSI (2009), out of 29 fire-prone districts of India, 8 are from the Eastern Ghats hill ranges. The table below shows the list of Eastern Ghats districts with high incidences of fires.

Another study in the year 2014, shows that the maximum areas burnt were recorded in Odisha, followed by Andhra Pradesh. Tamil Nadu, Telangana and Karnataka were also listed in the vulnerability list. The study adds Chittoor and Kurnool of Andhra Pradesh, Vellore and Dharmapuri of Tamil Nadu and Chamarajanagar in Karnataka in addition to the places in the 2009 list.

The situation calls for a concerted effort in order to effectively manage fires in the Eastern Ghats. Community participation, adaption of best practices and recommendations such as of FAO can be helpful in fire management in the Eastern Ghats.

Eastern Ghats districts with high incidences of fires

District	State	Forest fire spots Nov 2006-June 2007	Forest fire spots Nov 2005-June 2006
Koraput	Odisha	466	469
Phulbani		353	425
Ganjam		280	240
Kalahandi		238	192
Khammam	TG	222	236
Cuddapah	AP	199	250
Prakasam		186	221
East Godavari		177	195

We abuse land because we regard it as commodity belonging to us. When we see land as community to which we belong, we may began to use it with love and respect

-Aldo Leopald

Some call it specter and other social fronts call it as a traditional means of sustenance since ages, the shifting cultivation prevails and widespread in northern Eastern Ghats, a scene from Deomalis, Koraput, Odisha

Shifting cultivation

Shifting cultivation, also called as 'slash and burn', a traditional farming practice in tropical forests, is prevalent in south and southeast Asia. This ancient system of farming is believed to have originated around 7000 B.C in the Neolithic times (Borthakur, 1992). This practice is commonly known as Jhum in India. It follows rotational cycles and includes annual cropping, horticulture, perennial tree crops and animal husbandry (Thruppetal, 1997). Fields are prepared using axes, adzes and fire and cultivated for a brief period and then left fallowed for a longer one. The cultivation involves a cycle of clearing and burning vegetation, planting, weeding and fallowing. Burning and clearing vegetation creates a temporary niche for plants with nutrient rich ash. After the nutrients are depleted, the field is left fallowed and "shifted" to another plot in the forest to begin the cycle again. (Barrau 1958; Conklin, 1957, 1974; Dove 1985).

According to the World Bank, the extent of shifting cultivation may be about 10 million hectares and is practiced by several million people from 16 states in India. According to reports, Odisha has the largest area under shifting cultivation. The practice is most prevalent in Koraput, Malkangiri, Nabarangapur, Ganjam, Gajapathi and Phulbani districts in Odisha state, Visakhapatnam and East Godavari in Andhra Pradesh and Khammam district in Telangana. The effects of shifting cultivation are devastating on the environment and ecology of these regions. The 15–20 years cycle of shifting cultivation on a particular land has reduced to two or three years now. Large-scale deforestation, soil and nutrient loss, and invasion of alien species, loss of biodiversity, and denudation of hilltops are the changes wrought by shifting cultivation. Shifting cultivation was an evolutionary precursor to the modern agricultural practices in the region. However, due to its scale of ecological destruction, it can be currently seen as a pressure on the Eastern Ghats ecosystems. Alternative livelihood and food security schemes need to be promoted in the areas of prevalent shifting cultivation. Until the genuine needs of the local people are met, they are bound to frustrate all the conservation initiatives. Effective biodiversity conservation in these areas require a pragmatic approach, which would take into account fulfillment of daily requirements of the local communities and provide alternative secure livelihoods. Such an attempt would not only refrain people from overexploiting the resources, but also would motivate them to conserve it. Native economically viable perennial horticulture plantation can be taken up in the areas impacted by shifting cultivation.

A Patch of hill cleared for Shifting cultivation on Mahendragiri

Overgrazing

Livestock rearing is an important economic activity among the rural communities in India, which has the largest cattle population in the world. According to a survey by Forest Survey of India, 78% of our country's forests are affected by grazing including protected areas (67% of national parks and 83% of wildlife sanctuaries). There has also been a significant increase in livestock population in recent years.

Forests have become the major source of grazing and fodder due to the decline and fall of pastures in the country. Grazing impacts forest cover, increases soil erosion and depreciates soil quality, deprives pastures for wild fauna and delays forest regeneration and growth. The village folk around the hills drive their cattle into the forests every year at the onset of monsoon and the beginning of the first cropping season for a period of six months. The number of of migrations increases with drought and intensified cultivation in the low lands. Ever increasing cattle population and uncontrolled grazing strain all the ecosystems of the Eastern Ghats. Most of the hills in all the Eastern Ghats have become virtually the grazing lands. Lopping of trees and goat forage of vegetation are also the concerns. An ecologically and socially viable grazing policy is the need of the hour to save the Eastern Ghats. Such a grazing policy may create a win-win situation for ecosystems and the regional livestock dependent people. Controlling the increasing cattle population in forests and introducing grazing restrictions should be mandatory in ecologically sensitive and endemic species zones.

Millions of small ruminants graze in Eastern Ghats

Huge number of cattle graze in Eastern Ghats

Cofee plantation in Araku

Plantations

Monoculture plantations were introduced in India during the colonial rule. British forest officers promoted teak plantation for the needs of their empire. Subsequently coffee, tea, bamboo, eucalyptus and other economic species of plantations were introduced in pristine ecological reaches including the Eastern Ghats. Block plantations such as cashew, casuarina, eucalyptus have been promoted in the last few decades. There are trails for the last few years in Eastern Ghats to promote Apples also.

Barbara was a pristine Sal forest in Odisha. It was a prime tiger habitat. Over 108 species of birds, including some rare ones make Barbara their home. Teak plantations were taken up in this virgin Sal forests by the then foresters during the last century. *Coffee* is endemic to Africa with two main species commercially grown: Arabica *(Coffea arabica)* and Robusta *(Coffea robusta).* The global "Coffee Belt" extends across mountainous regions from 30° N to 30° S where rainfall, temperature and sun exposure are ideal for growing coffee (Hitimana *et al* 2012). Hill ranges such as Koraput, Gudem, Tirumala, Shevroys, Kolli have extensive coffee plantations. according to National Coffee Board (2017) Nearly 1lakh ha of coffee plantations are spread over the hilltops of various hill ranges in Eastren Ghats.

Mineral-rich bedrock of the Eastern Ghats houses a variety of trees including shrubs and herbs in a three-tier vegetation structure. Experts also opine that a three-tier forest is necessary for the Eastern Ghats due to the sloping nature of the hills. Seasonal herbs such as Hyptis and Ocymum are extremely eco-friendly, not only do they help to bind the soil, but they also absorb rainwater and help in the generation of

Cashew plantations replace forests near Chodavaram in Visakhapatnam

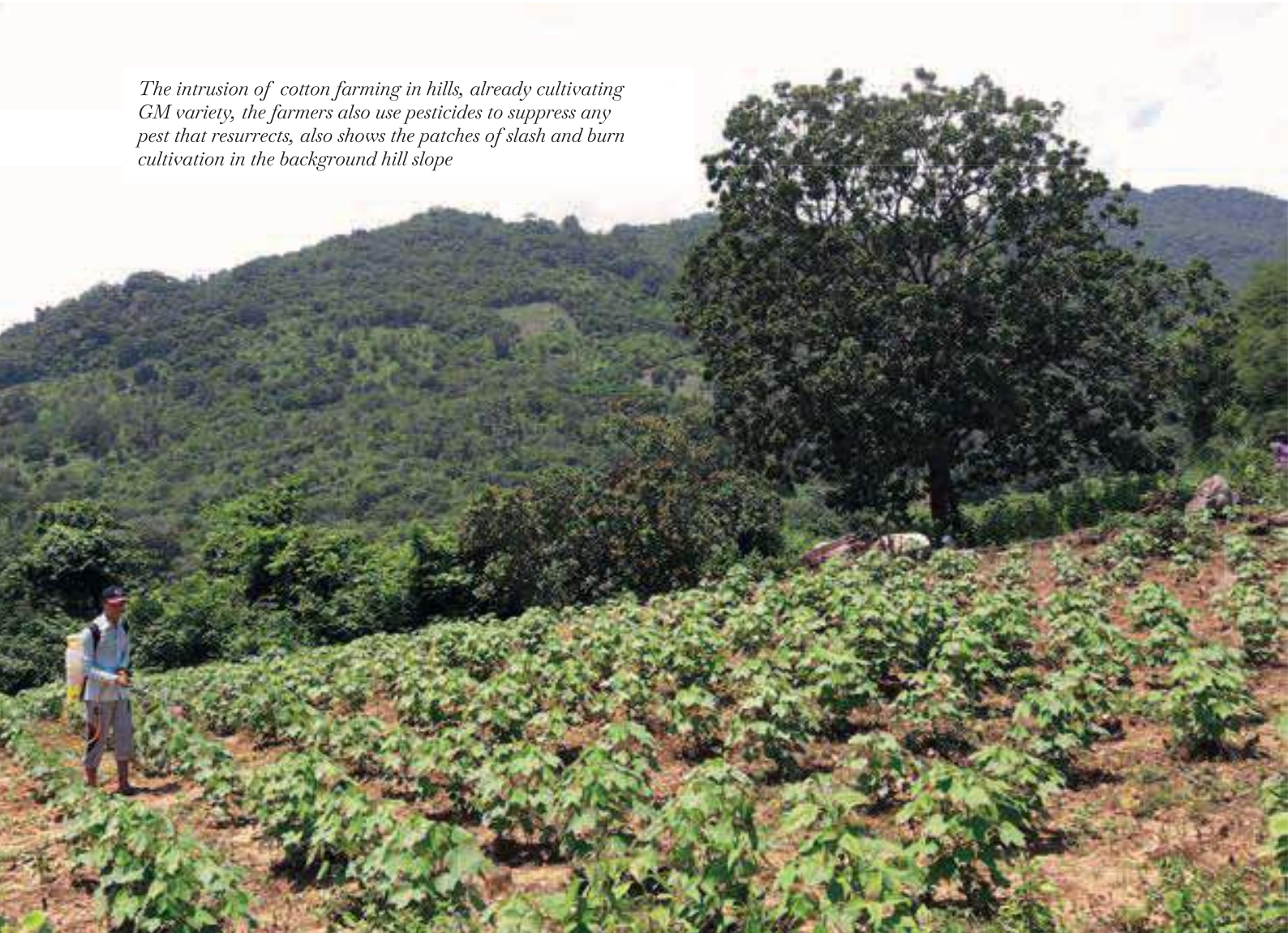
organic matter on the forest floor. Due to the climate favorability, species of different climatic zones can thrive in the Eastern Ghats. Introduced, non-native species and block plantations pose a challenge to the survival of seasonal native plants. Over the decades, establishment and expansion of several block plantations of eucalyptus, timber, cashew, casuarina in Eastern Ghats have caused the disappearance of endemic species like native basil, fida, justicia, borreria and merremia. The native species help in soil conservation, maintenance of moisture level. They produce organic matter and fix carbon. Experts caution that the introduction of imported species in a specific and sensitive ecosystem must be done carefully, keeping in mind their compatibility with the native ecosystem (Nayak, 2010). The present conditions suggest discouraging monoculture plantations unless it is inevitable and will help local ecosystems and it's people. Wherever essential, mosaic of economic plantations of native species can be taken up in degraded areas and in private lands and leased lands of the Eastern Ghats. Quarrying, pesticide and weedicide application and other ecologically and socially unfriendly activities should be strictly banned in existing plantations.

The degradation of the ecological base of India into a wasteland began under British rule. This has continued after independence by the governments. The common property resources such as grazing lands, forests, mountains, rivers, ponds, lakes, coastal zones and increasingly the atmosphere have witnessed ruthless assault and plunder *(CSE, 1984)*

Agricultural encroachments

The increasing population, corresponding demand for food and fodder, have been pushing the people to convert forestland to farmlands. All over the Eastern Ghats, this is the reality of the day. Violation and encroachment of forest boundaries is a major challenge today. Exact figures are not available for the cumulative deforested area resulting from forest encroachments, it is stated that large tracts of land in the forests are converted for other uses. People started farming paddy and commercial crops where tall trees stood and medicinal plants once grew naturally. The forest-based sustenance of locals is gradually shifting to monoculture with chemical input farming. As is the case in other regions, genetically modified crops are extensively cultivated and introduced in the Eastern Ghats. The southern Eastern Ghats has large areas of private lands making this wilderness into industrial farms. Many hill ranges are facing the aggressive foray of farms into the wilderness precincts.

"More damage has probably been done to the Earth in the 20th century than in the whole of humanity's earlier history"
Jacques Yves Cousteau



The intrusion of cotton farming in hills, already cultivating GM variety, the farmers also use pesticides to suppress any pest that resurrects, also shows the patches of slash and burn cultivation in the background hill slope

a

b

c

Temporal change in forest cover over the last two decades clearly seen through the eye in the sky the farm fields encroached upon forest, near Palutla, Yerragondapalem in Prakasam district in the core of Nallamalais.

a) The terrain covered with forest patches three decades ago.

b) The same terrain changed to intensive farmland by 2018.

c) Many trucks ply through deep forest carrying cotton and other produce from farming in the area show in the above images.

Crops and plantations occupy the slopes of Kolli hills

The expansion of Visakhapatnam city engulfs and creep up the hills

Urbanization

Urbanization is taking place along the Eastern Ghats in a rapid way corresponding to the growth of transportation network, industrialization, mining, tourism, dams, pilgrimage, and development corridors. In Odisha, Bhubaneswar, Similiguda, in Andhra Pradesh Visakhapatnam, Vijayawada, Amaravati, Guntur, Nandyal, Cuddapah, Sri Kalahasti, Nellore, Chittoor and in Tamil Nadu, Vellore, Erode, Ooty, Coimbatore, Dindigul, Salem, Madurai, Tiruvannamalai, and in Karnataka Chamarajanagar are emerging and fast growing urban centres in Eastern Ghats region.

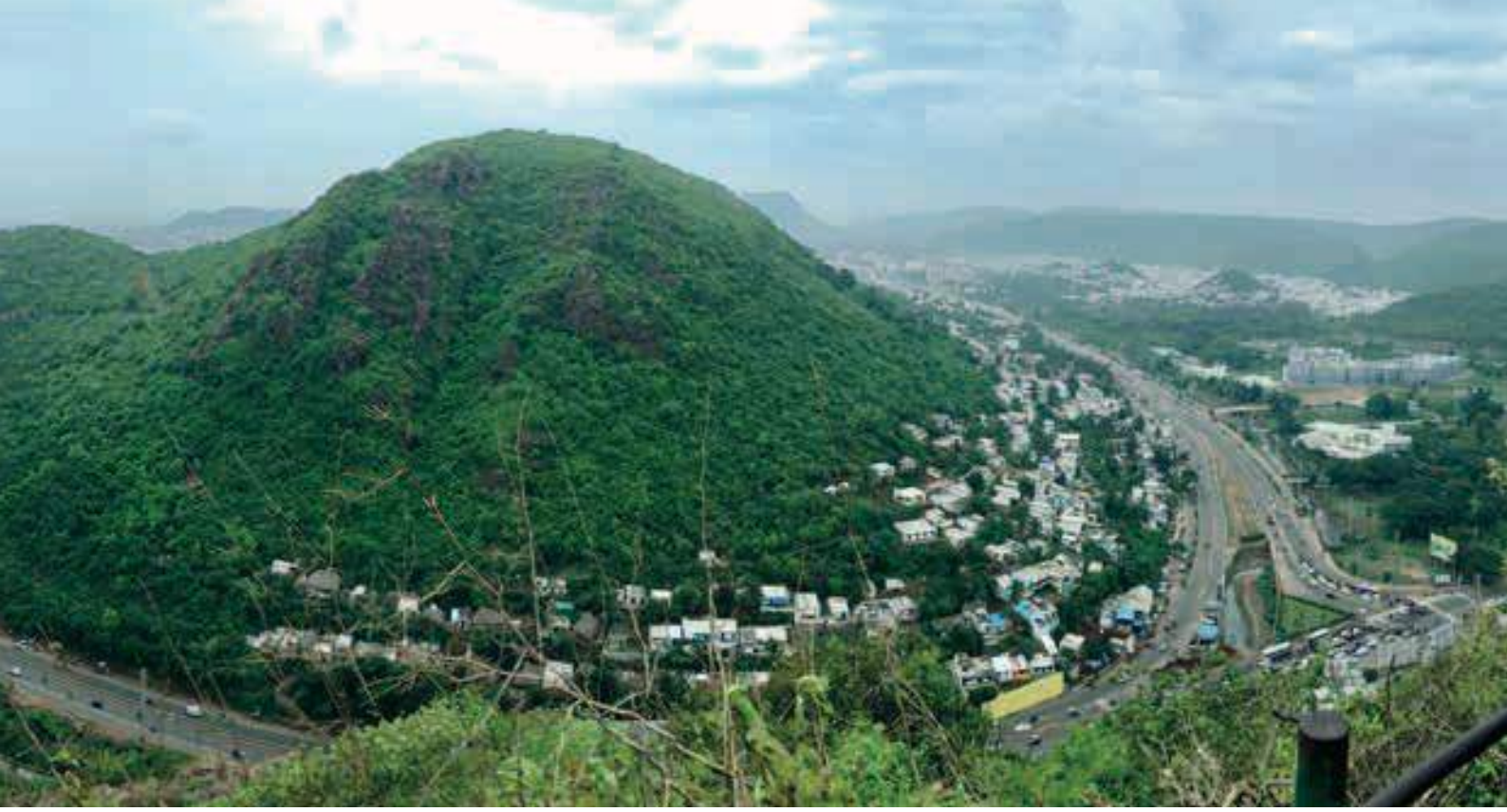
The hills of Visakhapatnam are under severe stress from urbanization. Similarly, the expansion of pilgrim towns and tourist centers are devouring large swaths of hill space. The newly proposed capital city region in the state of Andhra Pradesh is also projected to be a mega city. The future of Kondapalli hills located adjacent to Vijayawada is a big question.

Kondaveedu hill of Guntur district in Andhra Pradesh is almost on the brink of disappearance due to large scale quarrying. Similar issues surface when we scan through the geographic and demographic profile of the region.

Increasing population with changing lifestyles have brought on severe pressure on scarce land resources which in turn encourages people to acquire forest lands and subsequently urbanize the virgin landscape. Changes in land ownership and short-term quick profit goals are a concern in the expanding areas of urban centres. The region requires a sustainable and smart urban vision, which merges and coexists with the background ecosystem.

It is essential to take all the regional development plans of the states and master plans from small habitation to megacities in the region to consider far-sighted urban planning. It should promote smart and sustainable urban development that will suit to its native environment. Natural areas such as streams, lakes, specific habitats, geological formations, biodiversity spots and sacred groves should be legally secured from land use changes. Special Economic Zones should not be permitted in eco-sensitive areas. Governments should promote location specific green buildings in all human settlements in Eastern Ghats. No invasive species should be promoted for ornamental, landscape or gardening purposes and locals should be educated on the subject as a precautionary measure in the region. No piece of land whether mountain, plateau, plain, water resource should be privatized in the Eastern Ghats to protect the sustainability of ecosystems.

Smart Cities A city can be defined as 'smart' when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic development



and high quality of life, with a wise management of natural resources, through participatory action. (Caragliu and Nijkamp, 2009).

Smart cities are an emerging concept of urban vision all over the world. However, quite often it is misinterpreted, confining to the extensive use of modern information technology and expansion of urban infrastructure. A smart city is defined when its metabolism and structure shifts to efficiency, to wise management of available natural resources including land, effective infrastructure planning, application of knowledge and technology tools, policies, participation in order to fuel sustainable and safe, productive urban development, for a good quality of life and for the wellbeing of the people. Such urbanism which exerts minimal pressures on the hinterland and its ecosystems are ideal for the urban areas in Eastern Ghats region.

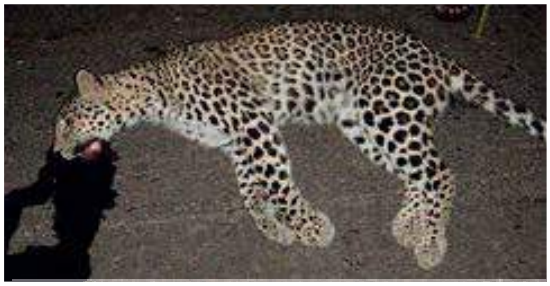
The change in urban sprawl in the last two decades revealed by the satellite images over Visakhapatnam city

Roads and motor rush

Over the last few decades, there has been a significant increase in road network and vehicle movement in the Eastern Ghats hill ranges. The roads took considerable amount of hill space, which was a pristine ecological precinct. This is in the context of the number of vehicles plying through the Eastern Ghats due to various reasons. Increased numbers of tourists, pilgrims, urbanization, mining and other activities in the region have increased automobile rush through the hills. The vehicular flow significantly increases during festival and tourist seasons. Additionally, heavy polluting vehicles also ply through and operate during the execution of all development projects. Further, mining and related activities add to the degradation by regular movement and operation of heavy equipment and vehicles. The increased vehicular movements are causing road kills, pollution, accidents, poaching, littering, fires and other threats. The tree species in the Eastern Ghats are sensitive to pollution, so there is a threat to the existence of a healthy forest. It is necessary now to avoid new major roads and railway lines roadway construction in critical and fragile ecosystems unless until it is highly essential and then only in compliance with the strict requirement of Environmental Impact Assessment (EIA), with Social and Environmental Management Plan. It is essential to create a network of road bridges and tunnels on existing highways and other roads to enable wildlife

Age old Trees were cut to widen a highway near Simlipal, Northern Odisha

and people to cross safely. Intensive campaign on conservation along roads leading into the Eastern Ghats should be taken up to reduce the negative impact of tourists, pilgrims etc.

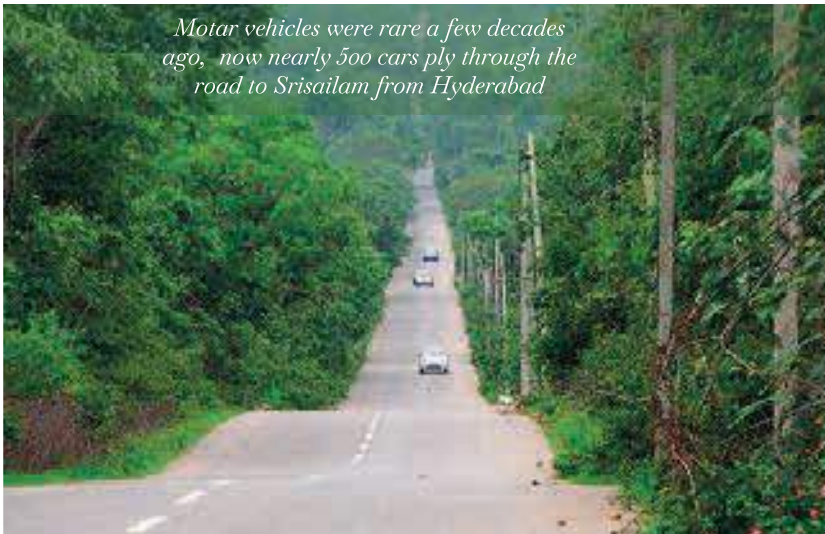


Leopard killed by traffic in middle Eastern Ghats

Railway track between Nandyal and Giddalur through Nallamalai

Road expansion in Mahendragiri wilderness

A new road formed through Papikonda forest



Motar vehicles were rare a few decades ago, now nearly 500 cars ply through the road to Srisailam from Hyderabad

Industrialization

Industrialization and urbanization have generally proceeded together in developing economies. (Spence *et al*., 2009). The Eastern Ghats region is targeted for large scale-investment in urban, industrial and coastal infrastructure, which poses a grave risk to its fragile balance of ecosystems. Major industrial areas in the region are Bhubaneswar, Visakhapatnam, Vijayawada, Tirupati, Nellore, Chennai, Vellore, Madurai, Salem, Erode and Damanjodi (Koraput).

Seeking rapid economic expansion, the states are looking at the Eastern Ghats region to meet its land, water and mining needs. This applies more development pressures on the already besieged Eastern Ghats. Large areas of hills are given to private enterprises as realty as in urban centers like Visakhapatnam.

The Vizag–Chennai Industrial Corridor (VCIC) is a part of the East Coast Economic Corridor Development Plan. VCIC raises concern over Eastern Ghats ecosystem. The corridor includes Chennai-Kolkata National Highway and rail route, and seven non-captive operational ports. Four proposed industrial nodes are Visakhapatnam, Kakinada, Amaravati, and Yerpedu-Srikalahasti. What will be the implications of these mega projects, which run through the region is not yet known. A thorough environmental impact assessment of each one of these projects with their cumulative effects has to be carried out in right earnest in a transparent manner.

For the health and survival of the Eastern Ghats ecosystems, prohibition and phasing out of polluting industries is required. Wherever necessary Government shall promote CDMs and low carbon green economy. Green economy as defined by UNEP is the one that improves wellbeing and equity of human society, while considerably reducing environmental footprints, challenges faced by ecosystems (ten Brink *et al*., 2012). Implementing the green economy approach may offer new opportunities especially since the Eastern Ghats are an important source of vital ecosystem services and natural resources.

Tourism and pilgrimage pressures

The hills, once serene and revered as sacred spaces, are now affected with litter, solid waste, sewage flows, groundwater depletion, deforestation, forest fires, soil erosion and reckless energy consumption. Once known for their calmness and cleanliness, pilgrim centers are now busy commercial destinations. Many religious destinations scattered along the hills draw millions of devotees to the hills. Increased tourism without proper regulation has led to pollution and environmental degradation. The fragile Eastern Ghats now require responsible tourism and pilgrimage. Apart from despoiling the serenity of the hills, the flow of devotees and tourists raise concerns about illegal medicinal plant trade, biopiracy, etc. and is also a threat to the flora and fauna in the area.

It is time to initiate measures to reduce the impacts of exponentially growing tourists and the pilgrim influx into the Eastern Ghats. There is a need to assess the carrying capacity of the hill ranges and promote far-sighted eco-tourism. Responsible eco-tourism is emerging all over the world. The landscapes of the Eastern Ghats are unique and the right place for promoting conservation education to the public, pilgrims and students. To seek local support for wildlife conservation and to impart conservation education to the visitors, eco-tourism programmes need more planning and careful design. Strict regulations for waste management, traffic and water use at tourist and pilgrimage sites is essential to retain the serenity of the hills. Governments must encourage multi-stakeholder partnerships to enable the welfare of local people and preservation of nature's integrity there.

> *"One does not sell the earth upon which the people walk."*
>
> *- Crazy Horse*

Poaching

Despite heavy measures to curb poaching, this illegal activity has been widespread in the Eastern Ghats as revealed from the cases booked. Local people do hunt small animals and sometimes use electrocution to kill animals. This is done when herbivores tend to damage their agricultural crops. Hunting for recreational purposes is happening clandestinely even after decades of wildlife protection enactments. The modernization of transport and weaponry is causing considerable harm to wildlife across the hill ranges.

A hunter with dogs and guns carries a monkey hunted in Papikonda

Narcotic cultivation

Narcotic cultivation is a challenge in the remote hilly areas of the Eastern Ghats. There is no exact estimation on the extent; however, there are reports of its cultivation from all over the region. It is cultivated in a very clandestine and organized way. The districts of Visakhapatnam and East Godavari in Andhra Pradesh, Angul, Deogarh Boudh, Gajapati, Rayagada Kandhamal and Sambalpur in Odisha, Dindigul, Theni, Dharmapuri in Tamil Nadu are reported to have a high incidence of cultivation and supply of narcotic crops.

Narcotic cultivation in the remote hilly areas of the Eastern Ghats

The activities of the rest of the world have begun to impact life in even the remotest parts of the Eastern Ghats in recent times. To catch up with the world's economic pace, governments are promoting rapid industrialization and commercialization of the region. Emerging issues include the illegal transport of species listed by the Convention on International Trade in Endangered Species (CITES), foray of genetically modified crops, bio-piracy etc. Land fragmentation, ownership changes has also been a concern as the priorities of new ownerships change to economics over environmental concerns. New infrastructure projects cause habitat and species loss in the region. We are all aware of the chaos of climate change which is trans-boundary in nature and global in scale and will affect every corner of the world.

Climate change

Climate change and its regional/local manifestations such as floods and droughts and biodiversity loss are the major concerns of our times. Studies have shown that the forests of the Eastern Ghats are at considerable risk. Climate change may affect temperatures, rainfall and water tables, biodiversity, and may increase forest fires and outbreak of pests (India's Second National Communication to UNFCCC). The communication document says that the vulnerability areas spread all over India. However, their concentration is marked to be higher in Eastern Ghats. The average annual temperature and microclimate has a bearing on the physiological activity of the flora. High temperature and humidity act as limiting factors of pollination. The fragile Eastern Ghats may have adverse effects in the case of drastic climate change scenarios.

A special category of negative climate change impacts in the region are strong cyclones like Hud Hud, with growing catastrophic impacts on settlements and forests. Existing industrial and urban infrastructure built a while ago will be under severe pressure due to aggressive calamities manifested by global warming. The calamities may cause mishaps such as dam bursts and may manifest further consequences. These impacts may vary from local to regional scale. Research and monitoring, as well as adequate policy measures and their application play an important role in the mitigation and adaptation of climate change in Eastern Ghats region which is surrounded by high density of population and dotted with several dams, urban areas etc.

Biopiracy

Commercial exploitation of naturally occurring biochemical or genetic material, particularly by obtaining patents that can restrict its future use is taking place in many areas of wilderness across continents. This practice denies fair pay to the locals who protected and managed the resource and may cause overexploitation, which threatens the survival of the species. Environmentalists express concerns over the possibility of bio-piracy in the Eastern Ghats. Detailed studies, policy work and monitoring are the need of the hour to prevent any loss and damage to the local genetic base of the Eastern Ghats.

Many scientists are worried about the effects and impacts of climate change on fragile eco-system of Eastern Ghats

How would the bio diversity face the climate change is a big dilemma today. A dragon fly from Nallamalais

Slopes in Kalryan hills are affected by deforestation and farming encroachments

Impacts

Deforestation and fragmentation

Intensive human use of forests over the centuries and aggressive onslaught in recent decades has mostly eliminated the deciduous canopy of the Eastern Ghats. Only vestiges of the once dense and verdant forests remain. The situation is so grave that some forests survive only on inaccessible terrains or in enclaves on protected sites.

For example, the Mahendragiri terrain is ecologically disturbed due to anthropogenic activities. The vegetation cover in the hills has become very thin except in the valleys. Another example is the appearance of woodland savannahs in many regions of the hills, mostly because of biotic interference. They are scattered throughout the area, covered with stunted tree species. Senior experts and people in the area confirm that the Nallamala was covered with the largest expanse of intact forest in South India apart from the Western Ghats. They recount that this forest was teeming with rich wildlife until the 1970s. Once lush semi-evergreen forests on Kolli hills are being increasingly cleared for farming.

According to a recent study by Reshma *et al.*, (2017) the forest cover of Eastern Ghats has decreased by almost 32,200 km^2 between 1920 and 2015. The findings of the study say that the overall forest cover, spread over 43.4% of the Eastern Ghats in 1920, reduced to 27.5% by 2015 and reveals that Mahabubnagar district of Telangana and Gajapathi district in Odisha have lost much of green cover on their part of Eastern Ghats. The study also reports the imminent threat of mass extinction of endemic plants in the Eastern Ghats. "In 1920, the habitat was intact and continuous for both endemic and Rare, Endangered and Threatened (RET) species" mentions the study. This is crucial because endemic species were found to thrive in less fragmented and less disturbed landscapes. The study finds it that the RET species have already lost 11.4 % of their primary habitat while the total number of forest patches increased from 1,509 in 1920 to a massive 9,457 in 2015. Most of the forest areas including protected areas are virtually reduced to a simple green patches resembling mere urban-suburban parks or plantations.

The ecological disturbances and deforestation in fragile Eastern Ghats, the impact will be severe and directly or indirectly affect the surrounding plains. Soil erosion causes quick surface run-off in the mountain slopes and foothills affecting the lands and rendering them fallow, which in turn intensifies the pressure on the hills for subsistence. Soil erosion causes floods. Deforestation induces flashfloods during rains and shortens the volume and times of flows in springs and streams.

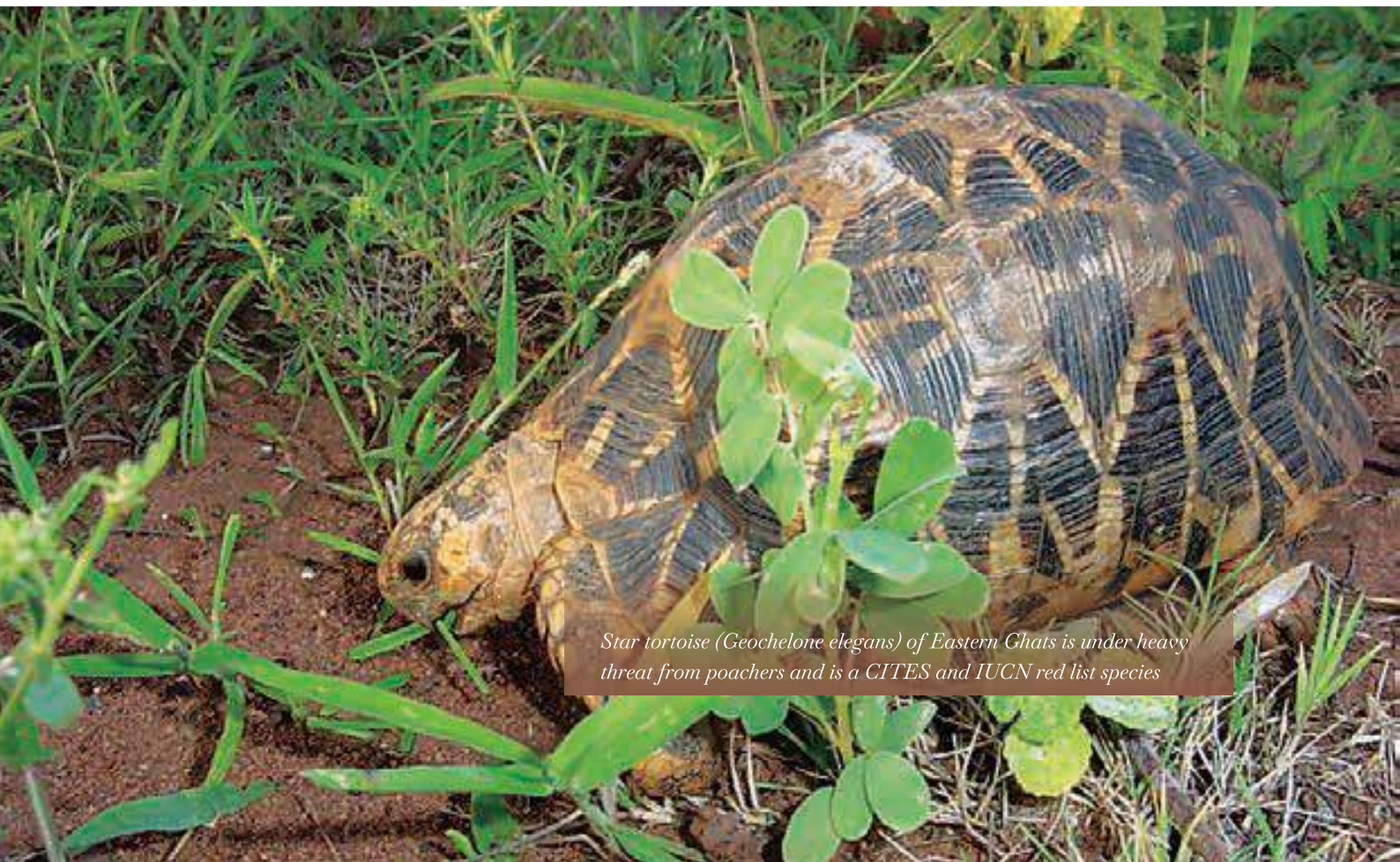
According to MoEF, a minimum of 66% of forest cover should be maintained for the ecological stability of hill ranges. However, the alarming deforestation and conversion call for intensive, concerted efforts to restore its green growth. Best practices have to be promoted while mobilizing the resources from REDD+, CDM, CAMPA etc. Following is an inspiring case study of how communities renewed of mountain forests and its watershed in Kenyan highlands

Endangered biodiversity

Land use, land cover changes, degradation and pressures faced by wilderness in the hills are a deepening threat to biodiversity in Eastern Ghats, pushing many species to the brink of extinction.

Much of the northern sub-tropical forests, also called coastal Sal forest, which are found in Ganjam district, are lost over the last century to heavy logging in the area. Similarly long stretches of moist deciduous riverine forests which were laced along banks and the dried river beds which also helped as faunal corridors are lost. The northern and middle eastern Ghats of Andhra Pradesh which constituted a valuable timber species fell to the plunder since British times. Parts of the middle Eastern Ghats such as Seshachalam ranges and hills in North Arcot of southern Eastern Ghats and its adjoining areas are distributed with valuable endemic species like red sanders which face a heavy threat from smugglers. The distribution of dry savannah and scrub forests which are found almost in all regions of the hills shows the intensity of biotic interference on Eastern Ghats region.

Plant-based industries like plywood never knew the value of rare and endangered flora. Rhizomes and tubers and many other species are threatened by agricultural encroachments, excessive tilling. Fires, hoofs, heavy grazing and roaming of cattle causing the loss of forest and its regeneration. Reports estimate that about 40 plant species from the region have been listed in IUCN-Red Data Book. Some critically endangered flora includes *Cycas beddomei, Pimpinella tirupatiensis* and *Boswellia ovalifoliata*. Some rare and endangered flora include *Angiopteris evecta, Ceropegia candelabrum, Cyathia gigantea, Dioscorea hamiltonii, Entada rheedii, Pterocarpus santalinus* and *Shorea talura* and *Strobilanthes flyposens* (Subba Rao, 1998). Caryota urens, a shrub species, is threatened by forest fires. aggressive invasion of alien species like Lantana camara, Parthenium hysterophorus, Croton bonplandianum and Eupatorium odoratum jeopardize the biodiversity of Eastern Ghats. Overexploitation for medicinal, ornamental, and scientific purposes causing the depletion of Orchids in Eastern Ghats. Other important threats to the Orchids are habitat destruction, changes in microclimate, and shifting cultivation (Subbarao, 2005). Man-made fires on Sirumalai hills have destroyed medicinal plants and threatened the fauna habitat. The sacred groves of the Eastern Ghats are facing threat from urbanization, and other activities like overgrazing and excessive firewood collection. Construction of temples and buildings are reducing the extent of groves. Invasive species *Chromolaena odorata, Lantana camara* and *Prosopis juliflora* has been another challenge faced by the groves (Madhukumari, 2016).



Star tortoise (Geochelone elegans) of Eastern Ghats is under heavy threat from poachers and is a CITES and IUCN red list species

Habitat destruction has been identified as the most important threat to the loss of biodiversity (MA, 2005). The Eastern Ghats is a gifted gene bank, which has a great bearing on the region's biodiversity especially supporting and interacting with the adjoining Deccan terrain in the west, central Indian forests in the northwest, Chotanagpur plateau in the north and the huge number of wetlands along the east coast and the Western Ghats in the south-west. There has been a constant interface and flows of faunal and floral species in the long evolutionary history of the region. Only in the last few centuries dense human-scape and the agricultural landscape around these hills is creating ecological barriers. A few decades ago, most of these regions were remote. Now, due to rapid infrastructure growth and many-sided development activities in the hills such as projects, the region faces a heavy human interface. The past few decades have seen the aggressive hand of man and his heavy footprint causing the devastation of the ecosystems in the region.

Small areas of wilderness, which are scattered, islanded by human activity, face the collapse of its ecosystems. The fragmentation and landscape level barriers pose the shrinkage of rangelands and consequently, increase the threat of massive inbreeding, affecting all the interacting ecosystems. It is essential to take lessons from conservation areas such as Ngorongoro in northern Tanzania and other wild lands where the inbreeding and its causes were fairly documented. Inbreeding reports of Gir Lions, and reduced robustness of Gaur because of fragmentation and isolation of habitats are also warning signs in India. There is an imminent need to take measures to stop fragmentation of habitats and to revitalize the lost corridors to enable the movement of fauna over vast rangeland. Governments should implement the plans shelved for habitat corridors.

Though the large mammals like tiger and the elephant have recovered from the extinction in the area due to species conservation initiatives launched in 1970's, the lucrative demand for hide, teeth, bones of tiger, ivory from elephants have always keeps them on highly vulnerable to poaching and hunting. In Srisailam-Tiger reserve it was reported that the tiger numbers dwindled to 30 in 1990 from 80 in the preceding decade.

Many species in the Eastern Ghats have been listed under rare, endangered, or threatened status. Rare category avian fauna reported from the area include *Pelecanus phillippensis, Gallus gallus, Pavo cristatus, Ardea cinerea, Choristis nigriceps* and *Tockus birostris*. Endangered mammals are such as *Loris tardigradus, Panthera tigris, Tragulus meminna* and *Bos gaurus*. Herpatofauna under rare and threatened are *Microhyla ornata, Chamaeleon zeylanicus, Varanus bengalensis, Crocoylus porosus* and *Crocoylus patustris* (Subba Rao, 1998). The rarity and vulnerability of species like Golden Gecko, Jeypore Ground Gecko shows the ecological decline in the areas of Eastern Ghats. Changes in forest fabric such as the removal of boled trees affect hole-nesting birds. Also, the removal of the dead trunks for wood and fuel deprive the feeding of many bird species, which depend on the small insects, and worms in decaying wood. Field study reveals that some species of butterflies have become extinct and honeybees are threatened too.

Castalius rosimon (Common Pierrot)) from Nallamalai

Honey collection by destroying bee combs is invariably bringing down the populations of pollinators affecting the fertilization rates of plants. If we do not act today and protect our forest cover, the implications would be serious as pollination itself could be affected. This means that food production would be drastically affected in the long run. Heavy pesticide usage around the hills has been said to affect the bat species and birds, which depend on insect populations in the region.

Empty forests

The term 'Empty forest' was first introduced by Kent H. Redford in 1992, which refers to the ecosystems that are void of large mammals. These forests may appear dense and healthy with large, grown trees, and as excellent habitat, but show the absence of all large mammals. The fact shows the effects of anthropogenic pressures on an ecosystem. Vikram Aditya, (2015) observations indicate the symptoms of empty forests in Papikonda and other ranges in northern Eastern Ghats with a conspicuous lack of mammals and large birds. Frequent occurrence of fires leading to regeneration of unpalatable grass, hunting, overgrazing, forest fragmentation, possible inbreeding and diseases may have been the reasons for such symptoms. To ascertain prime causative factors, the intensity and extent of the situation in Eastern Ghats requires wide and in-depth study.

"Many have construed our dear kinship with the other animals as an affront to human dignity. But any one of us is much more related to Einstein and Stalin to Gandhi and Hitler than to any member of other species. Shall we think more or less of ourselves in consequence? The discovery of a deep connection between human nature, all of human nature, and the other living things on Earth comes not a moment soon. We are helped to know ourselves. In acknowledging our ties of kinship, we are forced to reconsider the morality(as well as the prudence) of our conduct wiping out another species every few minutes, night and day, all over the planet. Over the last few decades we have caused the extinction of something like a million species-some providing new foods, some desperately needed medicines, but all unique DNA sequences, tortuously evolved over four billions of years of the evolution of life and all now lost forever. We have been faithless heirs, squandering the family inheritance with little thought for the generation to come. We must stop pretending we're something we are not. Somewhere between romantic, uncritical anthropomorphizing of animals and an anxious, obdurate refusal to recognize our kinship with them-the later made tellingly clear in the still –widespread notion of "Special" creation-there is a broad middle ground on which we humans can take our stand"

- Carl Sagan and Ann Druyan

Woods stand green and dense, however infrequent siting of wildlife indicates the signs of empty forest in Papikonda and other ranges in Northern Eastern Ghats

Human - wildlife conflict

A carcass of a tiger kill (cattle) poisoned by a villager to exterminate the tiger when it comes and feeds on the left over hunt

Due to ever-increasing human presence, degradation, shrinkage and confinement of ecosystems in the Eastern Ghats, there are increased instances of human-animal conflicts, which have become challenges for conservation and well-being of people in the region. Crop damage by wild animals and cattle lifting by predators are the main reasons for conflict between the wilderness and the people. Though compensation is paid to villagers, there are chances of retaliatory actions. A Participatory Rural Appraisal exercise (PRA) done in Nallamali hills shows that 30 - 35% of the crops are eaten or destroyed by wild animals. About 70-75% of the damage was caused by wild boars, chital (15%) and sambar (10%). Tiger and panther attacks on the livestock are not a rare phenomenon. The compensation amount paid to the loss of cattle was a meager sum and it was paid only to those killed outside the ecosystem. This tendency has led to an antagonistic attitude among the grazers whose cattle were killed on a regular basis within the forests. Injuries to humans and rarely deaths do occur due to attacks by Tiger and panther. Such incidences, coupled with inadequate compensation, creates antagonism. Sloth bears, wolves and leopards are the other animals that cause injuries.

The elephant habitats in Eastern Ghats are subjected to human pressure due to monoculture plantations, mining, encroachments, poaching and process of developmental activities utilizing forest resources (Kar and Lahiri, 2002; Talukdar and Barman, 2003).

All these adverse conditions have contributed to the man-elephant conflict in many parts of Odisha (Sukumar, 1989; Swain and Pattnaik, 2002). Incidence of man-elephant conflicts is now on a large canvas because of the changing and expanding pattern in elephants' movement. These situations cause human causalities, damage to houses, crops, and sometimes-retaliatory action by the affected people to eliminate the depredating animals. The conservation and well-being of our 'National heritage animal' declared by the Govt. of India in the future also depends on the commitment and concern of the people of Odisha and our country as a whole (Kuntia and Mohanty, 2012). Similar issues with elephants have been reported from Srikakulam, Vizianagaram and Chittoor in Andhra Pradesh and Tamil Nadu.

The departments responsible should devise robust management strategies, using an integrated approach that combines fiscal (e.g. monetary compensation), social (e.g. community mobilization and awareness) and technological (e.g. planting of chilli along the periphery of agricultural fields) interventions.

Deforestation induce erosion of vital soil base and diminish land productivity, a forest frontier in Chittore district

Land degradation

Deforestation and human activity induce gradual soil erosion in the hills. This will have after effects such as losing valuable forest soil, siltation and sedimentation of the water bodies, streams and dams in the region. A huge quantity of soil is also carried into the sea. There is a need for continuous and multitude of activities to check the degradation and erosion of the hills. There is an imminent need for holistic Land Use policy for the Eastern Ghats and land management strategy with a multi-disciplinary and coordinated approach based on the carrying capacities and classification of the Eastern Ghats mountain landscape. Otherwise the degradation will continue. Emerging practices such as Payment of Ecosystem Services (PES) are there to deal with the challenge.

Plumetting ground water levels in the region

Kerala Floods, Lessons to Learn

Expert Panel report headed by eminent ecologist Madhav Gadgil which was submitted to the union government in 2011, fore-warned about the disastrous cumulative effect of degradation of equilibrium in Western Ghats. The devastating Kerala floods that happened between 8-21 August 2018 is a sad example and an eye-opener. About 400 lives were lost and a million people were affected. Deforestation, urbanization, mining and irresponsible tourism and many other forms of human activity and the climate change aggravated the effect of an downpour. If we don't learn from such disasters, the people in the Eastern Ghats also will have to pay a heavy price.

Fading natural and cultural heritage

Eastern Ghats, in addition to supporting a rich biodiversity also holds natural, historic, ethnic and cultural heritage and traditional knowledge which forms a "genus loci", the locations distinctive cultural essence and heritage. There is no detailed inventory and data on cultural, historical, archeological sites and their status in the Eastern Ghats.

Though the Kethavaram and several other rock paintings, inscriptions, archeological sites, forts and structures have survived the fluctuations of nature for many millennia, they might not survive in the future. Same is the case with many other historical, archeological and cultural heritage. Development activities, pollution, mining, quarrying and other interferences can destroy historic sites. There is no consolidation of traditional knowledge and customs, and not much information about the status of the languages of vulnerable primitive tribal groups and other societies.

Current development patterns in the Eastern Ghats region are leading to a loss of cultural heritage, traditional knowledge, livelihoods, practices and values. The traditional knowledge is coded, as in the texts of traditional systems of medicine; or is non-coded, which is oral and undocumented. Constitutional amendments direct local bodies to safeguard local knowledge. A comprehensive documentation and promotion of traditional knowledge systems of the region should take place, which will contribute, to both the conservation and the sustainable utilization of biological resources. Conserving the tribal languages and distinct lifestyles and cultures and establishing a heritage centre can be some important contributions towards this. The locals actively working and wisdom holders are to be incentivized to ensure that they continue to be equal partners in protection. Seed banks have to be created in all the villages to protect agro-biodiversity in the region. In this all the historically and culturally significant mountains of the Eastern Ghats should be declared as UNESCO Cultural Heritage sites.

A natural arch in Akkamahadevi cave

broken sculpture of Nandi, the bull mount of Lord Shiva at Umamaheshwaram

Ruins in Chandragiri fort

Historical remains such as this in Nallamalais are being destroyed with various reasons

River basins and Eastern Ghats environment

What happens in the upstream impacts down stream. As we know, four major rivers and a few medium-sized rivers cut through the Eastern Ghats, bringing along the water, sediments, pollutants and more. The wide swathe of the basin collection passes narrow gorges and valleys and so the water regime in the region is impacted by the upstream in the west. In addition, what happens on the hills impacts the immediate surrounding region. The following is a brief look at the major watercourses that affects the water environment in the Eastern Ghats region as extracted from central water commission reports.

Brahmani-Baitarani: The majority of the basin is covered with agricultural land accounting to 52.04%, followed by forests with 34.36% of the total area being predominantly deciduous vegetation followed by the evergreen and scrub category. Deforestation is rendering the ecosystems damaged. As derived from land use and land cover of year 2005-06, 28,505 ha of land is under gullied and ravinous area, thus is a wasteland. This class is prominent in central lowland area of Gumla, Sundargarh and Pashchimi Singhbhum districts. This shows the active erosion of the basins soil cover.

Middle lower reaches of the basin have significant urban areas. Sundargarh, Anugul and Keonjhar districts shows active mining activity and this land use class occupies about 12,000 ha of land of the basin. The Brahmani - Baitarni river basins hold extremely rich mineral resources. Consequently, many industrial units including the famous Rourkela Steel Plant as well as a number of fast growing townships are located here. According to the studies made by CPCB, the water quality status of Baitarani river and its tributaries are below the desired class. In summertime, the water in the Brahmani River is held in deep gorges and potholes. The river becomes incapable of washing down the pollutants, which are discharged into it from the nearby industries, towns and villages. A greater part of the Brahmani river, below Panposh, is highly polluted. There are increased loads of pesticides in the farmland and irrigated overflows.

Mahanadi: Major part of the basin is covered with agricultural land accounting to 54.27% of the total basin area. The area under forests with deciduous forest covers 28.73%. Deforestation and urbanization are taking place at a fast pace in the basin. The population in parts of the basin lying in northern plateau and hilly areas has a relatively large number of scheduled tribes.

Godavari: 59.57% of the basin is covered with agriculture and forest area forms 29.78% of the basin. The total population in the basin is about 60.48 million. East Godavari, West Godavari, Nagpur, Pune, Rangareddy and Visakhapatnam districts have higher population density as compared to the other districts of this basin. Nagpur is the most important urban centre in the basin. Other important towns are Nasik, Aurangabad, Warangal, Rajahmundry, Akola, Amravati, and Ahmednagar. The industrial and mining potential of the Godavari basin is high. There are more than 441 towns, 58072 settlements and 33 cities in the basin. As a result, the river is prone to pollution all over its course. In Telangana there are towns with industries and mining are Godavarikhani, Mancherial, Ramagundam, Burgampahad, and Bhadrachalam. The sources of pollution are domestic and industrial wastewater from the large cities in Maharashtra, Towns like Mancherial, Ramgundam, in Telangana, Rajahmundry and Kovvur in Andhra Pradesh.

Krishna: As per 2001 census, the total population in the basin is about 66,341,683. The major cities in the basin are Pune, Hyderabad, Vijayawada and Bhadravati complex in Karnataka. The basin has the highest proportion of agricultural land with about 75.86% of the total area and a small area of 10% of the basin area is covered by forest. Wasteland covers around 7% of the total basin area and water bodies cover around 4% of the basin area.

An island in Krishna river at Alampuram

Bhadravati in Karnataka and Patancheru-Bolaram near Hyderabad in Telangana are the critically polluted areas identified in the basin area of Krishna. For Bhadravati, the major source of water pollution is the wastewater generated from industries besides the untreated sewage of the town, which is being discharged into Bhadra. In the Patancheru-Bolaram area in Telangana the effluent generated by industries is the main sources of water pollution. The city's sewage and industrial effluents are discharged into the Musi river, a tributary of Krishna.

Penna: Major part of the basin is covered with agricultural land accounting for 58.64% of the total area, with forest covering 20.37% of the total area. The basin has 4.96% of area covered by water bodies. The wasteland covers about 14.47% and built-up land covers 1.56% part of the basin. According to Census 2001 report, the basin has a total population of 102,43,715. The density of population in the Upper Pennar basin is much higher than in the lower basin region. Deforestation, land degradation, mining, desertisation are the major environmental concerns in the basin.

Cauvery: Land use pattern shows agricultural land is dominant in this basin occupying 66.21% of the total, followed by forests, which occupy 20.50 %. The land use pattern of the basin has witnessed a change in the last few decades. The fast growing population aided with modern technology has led to rapid change in the land use pattern of the basin. The effect of such an unwise change is well reflected in the forms of ecological imbalance and land degradation through soil erosion. The forest area has been decreasing due to encroachment for agricultural purposes. The horizontal growth of settlements in the last few decades due to rapid growth of population and the resultant growth of other developmental activities are also leading to a slow but continual change in the land use pattern at different scales.

The city of Bengaluru is partly situated in the basin. Industrial towns of Coimbatore, Tiruchirappalli, Salem and Mysore are also located in the basin. Textile, cement, mineral and metals factories are the main industries in this basin. The effluents of human settlements, both domestic and industrial, are causing pollution in the basin. Farm chemicals from the upper half of the basin are adding to the deterioration of the water quality.

Where Have Gone Our Ethics ?

Ethics denotes the rationality towards the highest level of survival for the individual, the race, the group, humankind and the other dynamics of life taken up collectively. They are the essential reasons of individual and collective conscience and tools of survival. They guide for long-term survival with least destruction. They provide optimum solution to any problem and optimizes the range and number of benefits and beneficiaries. Ethics avoid the unwise solution, which is harmful and affects high number of entities or dynamics. It is a rational thing and activity, which enables an optimum survival of larger number of members with least confrontation; damage (Hubbard, 1965).

Modern societies and communities in human history seemed to be losing ethical ground. As a result, the world is increasingly witnessed to challenges such as conflicts, environmental degradation and so on. The spiritual, philosophical outlook of the world is fading. The modern, civilized and learned men distanced themselves from the nature with profligate intentions and selfish and short-term benefits. We lost symbiotic relationship and resilience with our background ecosystems. Unlike our ancestors, we don't see the divinity in nature. We lost the spiritual lenses and ethical shield. Erosion of morality, ethic and ultimate reason gave root to the present day problems. Let us all have philosophical lens towards nature in Eastern Ghats. Its protection is part of ethical and moral obligation to mother earth. Let us respect the integrity of Eastern Ghats ecosystem its wild beings and, its people.

Image source: SOAS

Cauvery through Mettur hills in Tamil Nadu

A Saora woman and her child at Mahendragiri highlands in Odisha

5

Indigenous People

Eastern Ghats forms part of an important tribal region of India. The hills are home to millions of indigenous communities of primitive origin. For them, Nature has been a caring mother and revered deity. Lived in harmony with nature for ages, they now in bewilderment, curiosity and apprehension stare at the changes sweeping around and across their lands and cultures. A compassionate and impartial look is required to enable their peaceful progress and sustainability of this ancient tribal homeland.

The Eastern Ghats is one of the major tribal regions of India. Approximately 5 million tribes live in the area and many of them are primitive in origin. The tribes in the Eastern Ghats, like elsewhere, lived in a symbiotic relationship with their background ecosystems with a distinct lifestyle, specific to their tribe. They believed that nature, mankind and the spiritual world are all inter-connected. They worshipped spirits of nature and many deities. Their background ecosystems have a strong imprint on their socio-economic, cultural pattern and lifestyles. All their cultural features, customs, religious rites, taboos, legends and food habits are determined by their surrounding natural world. A council of elders oversees the social control of the tribe. Their elder children continue the lineage of the council of elders. However, there are many instances where any sensible person could also be a part of the council and this traditional council is responsible to resolve the disputes.

Various tribal groups of the Eastern Ghats follow different stages of economic activity and development such as food collection, hunting, gathering and fishing; shifting cultivation; pastoralism and settled cultivation. The Eastern Ghats provide a wide variety of resources such as timber, small wood and non-wood products, fibres. Nearly 100 varieties of NWFP and 250 medicinal plants provide sustenance to the tribes in the Eastern Ghats. They collect varieties of wild fruits, roots, tubers, honey, small game and edible leaves etc., for consumption. For income as well as domestic purposes, they collect a range of items such as gum, tamarind, myrobalans, nuxvomica, honey wax, mohwa flowers, chironji, soap nuts, broom-sticks, lemongrass. Their knowledge of traditional medicine is amazing. Agriculture is also an important subsistence for the tribals. Shifting cultivation is a major practice in the hills where they raise a variety of cereals, millets, pulses, beans, tubers, fuel, fodder, medicinal plants and roofing material.

Odisha is an important tribal state of India. According to 2011 census, the state holds 8,145,081 tribal population which constitutes 22.1% of the total population of the state. This is 9.7% of the total tribal population of the country. About 62 types of tribal communities live in the state. The important groups among them are Khonds, Gond, Santal, Saura, Kolha, Shabar, Munda, Paroja, Bhutada, Bhuiyan, Kissan, Oraon, Bhumiya, Bhadadi, Kharia, Binjhal, Koya, Saunti, Gadabas, Mirdhas and Juary. With 17.1% of the total ST population, the Khond is the most populous tribe in the state. Gond tribes follow

A soliga women and child in BR Hills

Highland women folk in Odisha

Ancient instincts still linger, a tribe in Odisha lighting a fire in primitive manner

with 9.6% and six other tribes namely, Santal, Kolha, Munda, Saora, Shabar and Bhottada along with Khond and Gond make together 64.2% of the total ST population of the State.

There are 35 tribal communities in the Eastern Ghats of Andhra Pradesh. Some of them are Andh, Bagata, Bhill, Chenchu, Dhulia, Gadabas, Gond, Goudu, Yanadis, Yerukala, Jatapus, Konda Kamara, Kattunayakan, Kolam, Konda dora, Konda kapu, Konda reddy, Khond, Kotiya, Koya, Kulic, Mali, Manne Dora, Nooka Dora, Naikpod, Nayak, Pradhan, Porja, Reddi Dora, Rona, Savara, Thoti and Valmiki.

Tamil Nadu has nearly half a million tribal communities in its part of Eastern Ghats. They are 3 types: Sholaga, Uraly and Malayali (Anon, 2009).

The tribes of Eastern Ghats are vulnerable and are victims of poverty, social exclusion and discrimination. They are malnourished, anemic and susceptible to tuberculosis, malaria, and many other diseases. There are no proper medical facilities in these hills. Poor literacy levels, exploitation by money lenders, lack of access to awareness of welfare schemes surmount their woes. Migration has increased in recent years and cases of human trafficking and HIV infections are increasing in these tribal lands.

Until a few decades ago the hills were in the periphery of major development areas and located remotely from most leading/major markets. Due to its geo-strategic importance as a region with mineral deposits, dam sites, forest resources, pilgrim centers, tourism, eastern transport corridor, there have been forays of nefarious activities in the hills. The rich forest resources dwindled; there came mines, dams, plantations and many human interventions. The tribals are in the midst of conflicting interests between governments, corporates, and neighboring lowland societies and militants. The life and prospects of the tribes have not changed but these instances are having an adverse impact on their very survival.

Tribals from the hills who are the most underprivileged and under-represented seem to be reeling under neglect. Priority was not given to study the status and essential needs of the people there. Furthermore, the rights and sovereignty of the native population is not earnestly addressed. The last few decades of armed conflict staged in the hills of the Eastern Ghats and their implications to the ecology and human society of the hills is not fully known. The problems were at their peak during the 1990s.

Maximum amount of Iron produced in India comes from the Keonjhar district in Odisha state alone. The district has a large area under forests (39%) which is also an important tribal land (45% of total district population). About 31,256 ha of land in the district is officially under the activity of mining. The quantum of illegal mining is not available. Above 60% of its tribal population are the poorest of the poor. Angul, the biggest coal-producing area in Odisha has 45% of its area under forests and a huge number of tribals with reeling poverty. Khammam, the largest coal producer in Telangana also has 45% of its area under forest with a huge number of tribes (CSE, 2008). The ironies of the area is this land of bounty is a land of impoverished and vulnerable people. Another fact is that this biologically rich terrain is mined without considering the ecological and social costs.

The establishment of protected areas and initial prevention of traditional stakeholder use had significant negative impact on different ecosystem resource users. Those traditionally dependent on the resources of the ecosystem for their livelihood have had their previous economic strategies severely disrupted by the new restrictions. Landless households and women along with the peripheral residents who depend on the resources of wilderness for both subsistence and income supplements were most affected by the protected area restrictions.

A case study in Amrabad plateau in Nallamalais points to some drawbacks in relocation and rehabilitation. Project Tiger Directorate was of the opinion to shift all the core villages in a phased manner to declare some of the areas as national parks. The first phase has been successfully launched to relocate the "Peddacheruvu" village along with small gudems of Pangidi.

The responsibility of the rehabilitation was not vested with the Project Directorate. Due to the non-compliance of total rehabilitation and non-fulfillment of the commitments made before relocation, the Chenchus went back to their old habitation. Now they are not willing for any more relocation outside the ecosystem.

Integrated Tribal Development Agencies (ITDA) were established. During Fifth Five Year Plan period (1974-78) to implement livelihood and development interventions, infrastructure development in tribal areas and to stand against exploitation of tribals. They are established in areas where ST population is 50% or more of the total. Andhra Pradesh and Odisha have opted for an Agency model known as

ITD Agencies (ITDAs). There are about 22 ITDAs in Odisha, 8 in AP, 10 in Tamil Nadu and 2 in Telangana in the Eastern Ghats region. With the bifurcation of Ministry of Social Justice and Empowerment in 1999, the Ministry of Tribal Welfare was established by the Government of India aiming at integrated Scheduled Tribes (STs) in the country. Prior to the formation of this Ministry, different ministries at different points handled tribal affairs.

The Provisions of the Panchayats (Extension to Scheduled Areas) Act, 1996 or called widely as PESA was brought by the Government of India on 24 December 1996. The act provides authority to traditional Gram Sabhas for self-governance in the Scheduled Areas of India. PESA directs to promote decentralized self-governance, which can administer minor forest produce, minor minerals, small water bodies, selection of beneficiaries, and sanction of projects. PESA was hoped to create a new paradigm of development in which tribals can have a say and strong voice in decision making.

PESA was not empowered and equipped to function effectively. Devolution of powers and required financing are yet to take place at the desired levels. The office of the Governors in states with scheduled areas was given wide powers for the welfare of the Adivasis. However, most governors did not discharge their constitutional responsibility, resulting impoverishment and suffering of tribal population. Eminent experts too have expressed concerns and commented on the non-implementation of PESA. Shri B D Sharma, former Commissioner for Scheduled Castes and Scheduled Tribes, wrote in his letter to the President of India that the "ruling elite are not prepared to go by the spirit of PESA. It remains virtually unimplemented in all states." The Planning Commission described PESA as being rudderless.

The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, in short called RoFR act recognizes the rights of forest-dwelling communities to land and other resources while including provisions for making conservation more effective and more transparent.

Environment includes people. Indigenous communities lived resiliently, standing like sentinels and saviors of the ecosystems. By notifying large tracts of forestlands as reserves, the age-old human-forest relationship changed forever. With a stroke of a pen, the British separated the Adivasis from their mother (the forest).

Conservation of the resources of the Eastern Ghats is not only crucial for the welfare of residents of the hill villages but also for the welfare of those residing in the plains that lie below. For example, mining over the hills could interfere with the local aquifers and accrual of the water resources, which in turn will reduce water inflows into rivers and rivulets that feed the plains. Non-protection of the Eastern Ghats will thus cause long-term adverse changes that will affect development downstream.

The challenge before policymakers and administrators is to meet the essential needs of the Adivasi population while ensuring the protection of forest ecosystems on a sustainable basis. It has been noticed that state governments and district administrations have failed to win the confidence of the tribals and hence we see a divide between them. Our study teams too have not noticed the desired proactive people and administration collaboration. How can we expect an ideal conservation mission or governance when the tribals are not taken into confidence and their lives are not bettered? Many such questions come to the fore when we think of a long lasting ideal conservation mission. The solution lies in ensuring peoples' participation in the protection of their forest ecosystems. The challenge before the ITDAs and state governments is to win the confidence of the people living in the forest and involve them in becoming 'sentinels and saviors'.

RoFR allocations in Eastern Ghats States

States	IFR Titles	IFR Area in acres
Andhra Pradesh	83,874	198,633
Karnataka	8,159	11,166
Odisha	383,366	583,886
Tamil Nadu	3723	NA
Telangana	99,486	818,090

CFR-LA, 2016.

The best way to conserve the forests and the rich biodiversity of the hills is to empower the local communities who are genuine stakeholders in their survival. In addition to MOEF undertaking a scheme to enhance community awareness of the scientific basis of conservation of biodiversity and the forest resources, the local Gram Sabhas should be empowered to discuss and debate the ways and means to protect the resources of the Eastern Ghats.

Predatory mining has become the major factor in damage to the ecology of the Eastern Ghats. As already stated above, the best way to address this

concern is by involving the local Gram Sabhas in decision making.

PESA enforcement, as well as FRA enforcement, had they been effective, would have helped in creating self confidence among the Gram Sabhas as the primary agents of conservation. There have been moves on the part of MoEF to bypass both PESA and FRA in clearing "linear" projects such as roads, pipelines, canals etc. Such moves on the part of MoEF are short-sighted and will run counter to the Ministry's obligation under Article 48A of the Constitution and the various environment and forest laws. GrACE strongly recommends that MOEF should revisit this aspect.

FRA provides both individual and community pattas for traditional forest dwellers. This is an important law that needs to be enforced strictly. In the case of Niamgiri hills in Odisha, when the state government tried to allow bauxite mining that would have ruined the surrounding portion of the Eastern Ghats, it was the apex court's intervention that helped the local Gram Sabhas to express their dissent and pass resolutions in accordance with PESA and FRA to protect the pristine glory of the Niamgiri Hills and its rich biodiversity. The local adivasi community perceived the immense value of the bio-resources more than the local authorities. What applied to Niamgiri should apply equally to every other region of Eastern Ghats.

The State Forest Departments have been implementing the so-called "Joint Forest Management (JFM)" scheme with a view to involve the local adivasi communities in the management of the forests and their resources. However, the scheme did not go all out to allow the local Gram Sabhas, as envisaged in PESA, to take decisions on all aspects of forest management including the choice of the species. With the PESA and FRA coming into force, the joint forest management should not be allowed to override the intent of FRA. MoEF, in consultation with the Union Ministry of Tribal Affairs and the States should revisit the rationale of the JFM and the modalities of enforcing PESA and FRA.

Nature can be well managed when the local people are involved and encouraged. Their wisdom, eco-resilience have to be regarded and encouraged to preserve nature and culture in their respective regions. For example in the Hindu Kush region of the Himalayas participatory approaches, decentralized governance for biodiversity management, and encouragement of community are widely promoted (Sharma *et al*., 2010).

Tribe carrying clay pots in Northern Eastern Ghats

1. Tribes farming in Keonjhar
2. A women processing NWFP
3. At many tribal villages illegal liquor brewed
4. Yanadi tribe in a village in Seshachalam
5. Tribal women in Odisha carrying fire wood

Chenchu family building a hut in Nallamalais

A hillscape in middle Eastern Ghats

6

Policy and Governance

Governance is a framework of policies, institutions, its processes, implementation and power. It defines who decides in what way. Its process and politics, the content and laws are all equally important. Environmental governance relates to the development and implementation of policies, strategies, laws and regulations, norms, and standards pertaining to environmental protection which includes the establishment, nurturing and operationalizing relevant institutions to supervise, execute and monitors the programmes. The Constitution of India has made provisions for environmental protection. In 1972, the Stockholm conference propelled India towards framing a governance model for environmental protection in the country. Subsequently, several legislations were made. In 1980 the Government of India established the Department of Environment which was elevated to the status of Ministry of Environment and Forests of India in 1985. Following is an outline of policy and governance in the Eastern Ghats, which influences the ecology, economy and equity in the Eastern Ghats region.

Constitutional provisions

Under section 10 (42nd Amendment) Act 1976 Article 48A directs that *"The state shall endeavor for the protection and improvement of environment and safeguarding the forests and wildlife".* Article 51-A (g) proclaims: *"It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers, and wildlife and to have compassion for living creatures"*

Legislations

Principal National Public Policies and Acts related to environment in India with relevance to the Eastern Ghats are

- Forest Act,1878
- Forest Policy,1894
- Indian Forest Act,1927
- National Forest Policy, 1952
- The Wildlife Protection Act,1972
- Water (Prevention and Control of Pollution) Act,1974
- The Forest (Conservation) Act,1980
- Air (Prevention and Control of Pollution) Act,1981
- The Environment (Protection) Act,1986
- National Forest Policy, 1988
- Hazardous Waste Handling and Management Act,1989
- Public Liability Insurance Act,1991
- National Mineral Policy,1993
- The National Environment Tribunal Act, 1995
- The Provisions of the Panchayats (Extension to Scheduled Areas) Act, 1996
- The National Environment Appellate Authority Act, 1997
- Protection of Plant Varieties and Farmers' Rights Act of 2001
- Biological Diversity Act, 2002
- Wild Life (Protection) Amendment Act, 2002
- National Wildlife Action Plan, 2002
- National Environment Policy, 2006
- The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006
- National Green Tribunal Act, 2010

Global treaties

The UN Conference on Human Environment held in Stockholm, Sweden, in 1972 made a marked difference in the conscience of international community by pronouncing that the development and the environment are indivisibly linked. The conference invigorated research on environmental issues and gave stimulus for national, regional and international environmental legislations. Thereafter many conventions and conferences were organized across the world. In 1987, the World Commission on Environment and Development through its report titled "Our Common Future" introduced the concept of sustainable development which was defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." Another largest global environmental convention known as Earth Summit held in 1992 in Rio de Janeiro, Brazil conceived two major conventions—the UN Framework Convention on Climate Change (UNFCC) and the Convention on Biological Diversity (CBD) and also initiated UN Commission on Sustainable Development. Agenda 21, another principal outcome of the summit, an action and synthesis of social, economic and environmental elements envisaging the sustainable development in 21st century (UNEP, 2012).

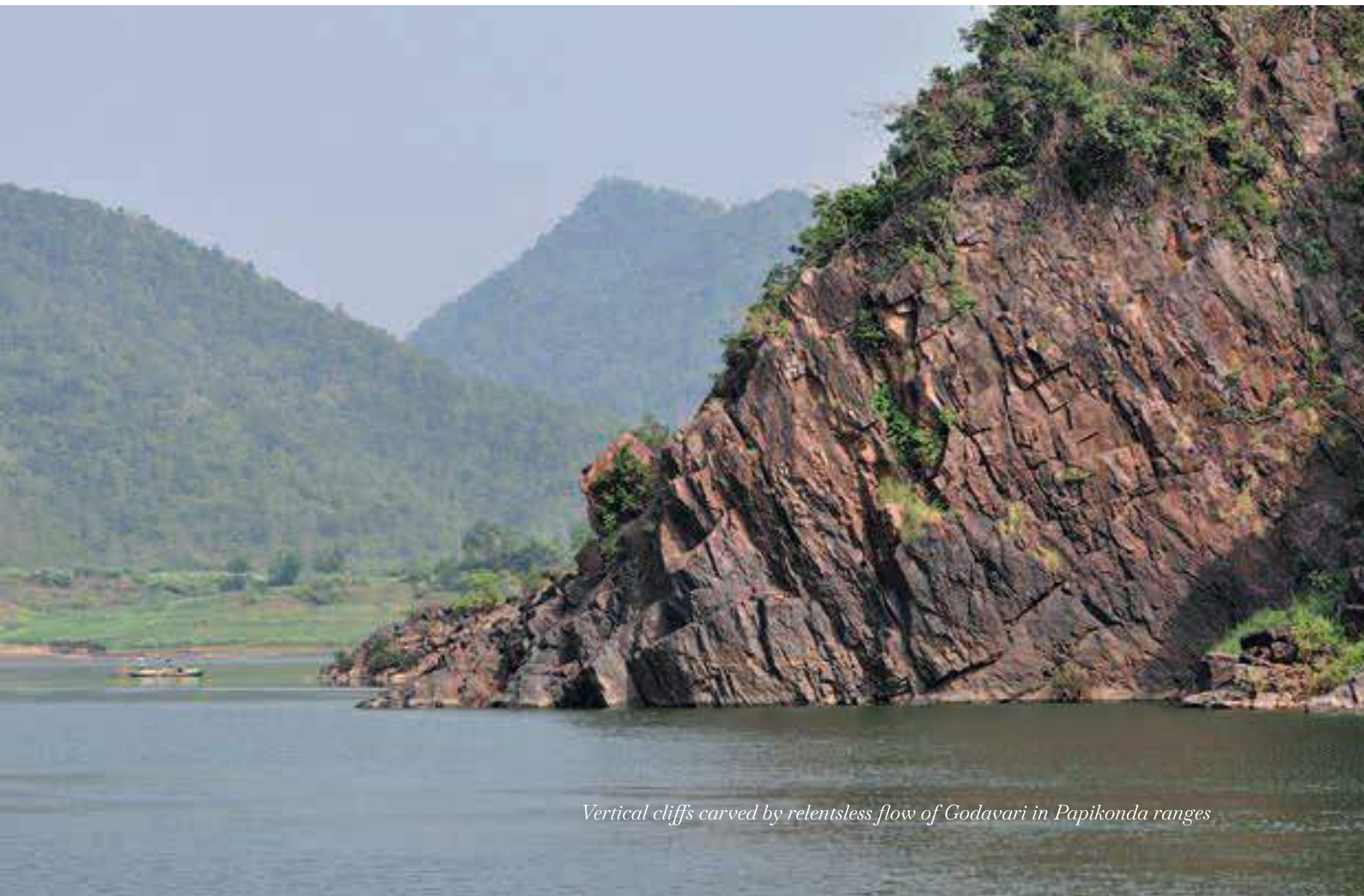
Since 1972, India has been an important participant in international environmental matters and is a signatory to several Multilateral Environmental Agreements (MEAs) such as UN Framework Convention for Climate Change, Kyoto Protocol, Convention on Biological Diversity (CBD), Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Ramsar Convention on Wetlands, The International Tropical Timber Agreement, The Cartagena Protocol on Bio-safety.

"Not even a blade of grass shall be cut without a worthy purpose"- Kularnava Tantra

Administrative framework

The 4th five-year plan for the period of 1969–74 has stated on "harmonious development on the basis of a comprehensive appraisal of environmental issues. Article 48A was added to the Indian constitution. Subsequently, this decree transferred wildlife and forests from state list to concurrent list of the constitution, thus giving the central government the power to overrule state decisions on that matter. Such political and constitutional changes prepared the groundwork for the creation of the Department of Environment and its conversion later to Ministry of Environment and Forests. In May 2014, the ministry was renamed to the current title of Ministry of Environment, Forest and Climate Change. Following the national environmental institutional structure, each state has developed its own administrative model. Each of the states in the Eastern Ghats region has its own environmental institutional structure. Following is the national and state structure for environmental governance in the Eastern Ghats.

Eastern Ghats and institutional framework		
	Territory	**Organization responsible**
India	National entity for India	Ministry of Environment and Forest and Climate Change
Eastern Ghats States	Odisha	Department of Forest and Environment
	Andhra Pradesh	Environment, Forests, Science and Technology Department
	Telangana	Environment, Forests, Science and Technology
	Tamil Nadu	Department of Environment and Forests
	Karnataka	Department of Forest, Ecology & Environment



Vertical cliffs carved by relentsless flow of Godavari in Papikonda ranges

Timeline of environmental governance in Eastern Ghats, an example from Nallamalai:

The jungle conservancy department of the British regime took control of the administration of forests in 1862. The Forest Act was enacted in 1882 and reservation of Forest Blocks started in 1883. During the period 1905-1948, management plans were made specifically to exploit the natural resources for commercial ends and not much creed was given to forest conservation. Few attempts were made for wildlife management by regulation of hunting activities. Facilities were created for sportsmen by issue of licenses. Shooting blocks were worked on a cycle of 4 Years. Department improved salt licks and water holes also. Sportsmen were encouraged to kill cattle lifters and man-eaters. After Independence, for rehabilitation and resettlement of submerged villages in Nagarjuna Sagar reservoir, large tracts of forests were de-reserved for habitation and cultivation. Until 1972, forests were worked under contract system. In 1988, a historic decision was taken to ban all timber coupes except for supplies to temple and local needs.

The Nagarjuna Sagar-Srisailam Wildlife Sanctuary was declared in 1978 to focus the management on Wildlife and Biodiversity.

Nagarjuna Sagar-Srisailam Wildlife Sanctuary attained the Project Tiger status in 1983. Till 1999, the areas were under Wildlife & Territorial divisions and thereafter the management was brought under unitary control of Field Director of the Sanctuary. In 2010, the adjoining Gundla Brahmeshwaram Wildlife Sanctuary with 1194 km^2 area was declared as extended core of Nagargunasagar Srisailam Tiger Reserve. In 2012, a buffer zone was declared around NSTR for strengthening the protection strategies. As per the A.P. Reorganization Act of 2014, the part of the Tiger Reserve located on the northern side of Krishna River became part of Telangana State and the other part of the Nagarjunasagar Srisailam Tiger Reserve located in the southern side of Krishna River became part of Residual Andhra Pradesh.

The first management plan for the area after its declaration as Sanctuary in 1978 was only formulated for the period of 15 years (1990-2005). The Management Plan envisaged seven zones of management namely, Core Zone, Interior Zone, Peripheral Zone, Visitor Zone, Aquatic Zone, Special Core Zone and Buffer Zone. The subsequent Management Plan for the period 2000-2005 focused on Holistic Habitat Management, General Protection, Fire Management, Vegetation and Grassland Management, Catchment and Watershed Management, Wildlife Inventories and Research & Monitoring.

(Source: MoEF-AP)

Protected Areas

Large scale degradation of ecosystems has made governments the world over to create and expand protected areas and conservation measures. About 13% of the world's terrestrial surface is declared as protected areas and still, there is much area and task left to be worked out for conservation and sustainable development. A protected area is defined as "a geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values" (IUCN, 2008).

The important national-level conservation mechanism in India is the designation of parks, reserves and other wilderness areas to restrict human activities in such areas. In the country, at present, there are 668 Protected Areas (PAs) declared covering an area of 1, 61,221.57 km^2 (4.90% of total geographic area). The PAs are comprised of 102 National Parks, 515 Wildlife Sanctuaries, 14 Biosphere Reserves, 47 Conservation Reserves and 4 Community Reserves excluding several Reserved Forests. Of these PAs 100 cover both terrestrial and freshwater ecosystems and 31 are marine protected areas. India also has areas declared as a part of the International Bird Area Network, which is part of the most strictly protected forests outside the protected areas. About 14000 sacred groves have also been documented from India (MoEF, 2011). The Eastern Ghats as a whole is considered a biodiversity-rich region. However, the total area covered under protected area is very less. Conspicuously Southern Eastern Ghats in Tamil Nadu are devoid of protected areas. The following tables show the protected areas in the Eastern Ghats region.

Wildlife Sanctuaries in the Eastern Ghats			
State	Wild Life Sanctuary	Area(Km^2)	Year of Establishment
Odisha	Simlipal	1,354.30	1979
	Hadgarh	191.06	1980
	Khalasuni	116	1982
	Kalaphat	147.66	1982
	Lakhari	185.87	1985
	Badrama	304.03	1987
	Nalbana Bird Sanctuary	15.53	1987
	Sunabeda	500	1988
Andhra Pradesh	Gundla Brahmeswaram	1,194.00	1990
	Sri Penusila Narasimha	1010.85	1997
	Krishna	194.81	1998
	Koundinya	357.6	1998
	Sri Lankamalleswara	464.42	1998
	Nagarjuna - srisailam	3568.09	1998
	Rollapadu	6.14	1998
	Coringa	235.7	1998
	Kambalakonda	71.39	2002
Telangana	Kinnerasani	635.41	1999
	Amrabad	2,800	2014
Tamil Nadu	Vedanthangal	0.3	1858
Karnataka	Bilgiri Rangan	540	1974

National Parks and Biosphere Reserves in Eastern Ghats			
State	Wild Life Sanctuary	Area(Km^2)	Year of Establishment
Andhra Pradesh	Sri Venkateswara National Park	353.62	1998
	Seshachalam Biosphere reserve	4755	2010
	Papikonda National Park	1012.86	2008
Odisha	Simlipal National Park	845.7	1980
	Similipal Biosphere Reserve	5569	1994

What is man without the beasts? If all the beasts were gone men would die from great loneliness of spirit, for whatever happens to the beasts also happens to man. All things are connected. Whatever befalls the earth befalls the children of the earth.....Chief Seattle

Species conservation programmes

Project Tiger: This programme was launched in 1973, envisaging a viable population of Bengal tigers in their natural habitats and also to protect them from extinction. The programme's other goal is to conserve the regions of biological importance as a natural heritage. The tiger reserves are visualized as breeding nuclei, from which surplus animals enrich the surrounding ecosystems. Tiger Protection Force was set up to combat poachers and relocation of villagers were the measures formulated. There were only 9 tiger reserves in initial years which now increased to 50 scattered over 18 states in the country. The Eastern Ghats host five tiger reserves i.e., Simlipal and Satkosia in Odisha, Nagarjuna Sagar-Srisailam in AP, Amrabad in Telangana, Bilgiri Rangana Hills in Karnataka. Sunabeda in Odisha is under 'proposal' state.

Project Elephant Project is a wildlife conservation project initiated in India in 1992 for the protection of elephants, their habitats and corridors. Mayurbhanj in Odisha is one of the important elephant reserves in the Eastern Ghats.

Eco-Sensitive Zones (ESZ)

MoEF has identified eco-sensitive areas in the Eastern Ghats with irreplaceable biodiversity that is facing imminent possibility of permanent and irreparable damage and disrupting evolutionary process of the ecosystems.

Come back, O Tigers, to the woods again, and let it not be leveled with the plain. For without you, the axe will lay it low. You, without it, forever homeless go'.....Khuddakapatha

Amrabad Tiger Reserve, Nallamala

Eco Sensitive Zones in Eastern Ghats		
Odisha	**Status**	**Date**
Kapilash WLS	Declared	17.6.2015
Chandaka Dampara WLS		9.9.2016
Balukhanda-Konark WLS		19.5.2017
Debrigarh WLS		7.6.2017
Khuldia WLS		9.8.2017
Chilika-Nalban Bird Sanctuary	Draft Notified	28.7.2017
Sunabeda WLS		13.10.2017
Kotagarh WLS		27.10.2017
Andhra Pradesh		
Sri Lankamalleshwara WLS	Declared	13.4.2017
Rollapadu WLS		15.5.2017
Rajiv Gandhi national park		15.5.2017
Sri Penisula Narsimha Swamy WLS	Draft Notified	13.1.2018
Karnataka		
Biligirirangaswamy Temple Wildlife Sanctuary	Draft Notified	5.8.2016

"Whatever breathing creatures here may be No matter whether they are frail or firm, or middle-sized, or be they short or small Or whether they are dwelling far or near Existing or yet seeking exist May beings all be of a blissful heart. Buddha in Karaniya metta sutra

A mountain path in Nallamalais

Participatory management

The role of local communities, to safeguard and manage forests and improve their livelihoods was spelled out for the first time in Indian Forest Policy of 1988 (Behera and Engel, 2006). The policy envisaged to bring about ecological balance through conservation of forests as a natural heritage. The focus was shifted from commercial consideration to ecological concerns and management of forests in a participatory manner (Balaji, 2002).

Joint Forest Management (JFM)

The proposition of participatory forest management emphasizes the need of local community's role in its management and community development from such management. The ideas call for the encouragement of local communities and the model combines state governments and locals in forest management. However, the ground reality is the spirit of JFM has been diluted. Eco-development committees (the key JFM institution model) are dysfunctional, participatory ideal is only on the paper and policy failed to encourage and draw their participation.

The many-sided lapses such as sidelining the communities from conservation management, loss of livelihoods due to imposed restrictions or displacement in protected areas have resulted in clash between local people and authorities. The animosities impede the long-term goals of conservation. Experts call for transparent, inclusive and decentralized governance, and assurance on property rights of local communities can make a difference in achieving both the interests of biodiversity and development of local communities (MA, 2005; WRI *et al*., 2005; Pimbert, 2003).

Biodiversity Management Committees (BMC)

India's Biological Diversity Act (2002) envisaging the role of citizens in biodiversity issues proposed Biodiversity Management Committees. The act says that all local bodies shall constitute a BMC within its purview to promote conservation. BMCs are mandated to facilitate documentation, sustainable use of biodiversity, habitat protection, conservation of landraces such as breeds of animals, creating a repository of knowledge on biological diversity. The important activity of BMC is to prepare People's Biodiversity Registers on local biological resources, their uses and traditional knowledge on them.

Natural Resource Management (NRM) Committees

NRM committees which form part of the Panchayat Raj Act envision the conservation and development of natural resources through the committees. Schedule-I of the Constitution of India proclaims the same. However, most of the committees are dysfunctional or non-existent. Reviving and capacitating them is an ideal and decentralized way of dealing with large areas of ecosystems.

The Forest Rights Act, 2006

This crucial forest policy resolved the rights of tribes and other forest dwellers in community management of their forests. Though expressed in an ambitious manner, the institutionalization of the idea is not clear.

The work of Elinor Ostrom, the Nobel laureate in economics emphasizes the need of well-designed community management institutions to incentivize the role of the community and for efficient forest management. This will reduce costs and burden to a large extent in management of protected areas and support to the welfare of people there (MoEF, 2011).

Experiences say that decisions in natural resource management will be effective when they focus on stakeholders participation with comprehension of the issues from locals and experts with experience at the ground level. In reality, it has been top-down approach for the last century with global conservation goals that have ignored the plight or wisdom of local communities. The importance of their role in conservation and their resilience with their background ecosystem was neither recognized nor supported. CBD) lays emphasis on their knowledge, innovations and practices relating to biodiversity and suggests community role to meet global goals pronounced by CBD and SDGs. The paradigm shift in policy and governance is the need of the hour to address conservation and development at large (IIED).

Eastern Ghats specific initiatives by the Government

Botanical Survey of India (BSI) has covered Eastern Ghats in its documentation and publication of Flora of Tamil Nadu, Flora of Nallamalais, Flora of Visakhapatnam, Flora of Nellore, Flora of Venkateshwara Wildlife Sanctuary, Flora of Araku Valley, Flora of Nagarjuna konda, Flora of Maredumilli, Flora of Medak and Flora of Chittoor District. Zoological Survey of India (ZSI) has been documenting the Fauna of Andhra Pradesh and Tamil Nadu (Nayak, 2010).

A centre of Environmental Information System (ENVIS) on Eastern Ghats was initiated in 1994 by MoEF mandating the Environment Protection Training Research Institute (EPTRI), Hyderabad a mandating the providing of scientific, technical information on Ecology of Eastern Ghats. The center publishes a quarterly newsletter and organized three national conferences on the Eastern Ghats.

Landmark judgments

There are instances of judicial intervention regarding the environment and ecosystems of the country when things went awry. There are some judicial orders on the Eastern Ghats that show the state of the matter and the urgency related to them. Here are some judgments on environmental issues from Eastern Ghats and few cases from other areas.

Silent Valley Case: In 1980, the Kerala High Court rejected a writ filed by the Society for the Protection of the Silent Valley seeking a ban on construction of a hydroelectric project there. However, undeterred campaign by environmentalists stopped the project.

Mining in Sariska: Tarun Bharat Sangh, a civil society organization filed a writ petition in the Supreme Court in 1991 to stop mining in the Sariska Wildlife Sanctuary in Rajasthan. The court directed for the banning of mining in the area. However, the mining continues in spite of the judgment.

Godavarman case: The Supreme Court of India passed an interim order on December 12, 1996, banning the tree-felling and non-forestry activity in forests throughout the country. The order says "All ongoing activity within any forest in any State throughout the country, without prior permission of Central Govt., must stop forthwith - Running of sawmills including veneer or plywood mills and mining of any mineral, being non-forest purposes, not permissible without prior approval of Central Government and must stop forthwith".

Samatha Case: Around 14 villages in Borra reserve forest area in Visakhapatnam district, the Govt. of Andhra Pradesh gave mining leases. The locals supported by Samatha, an NGO, have filed petitions against State Government and the leaseholders. The appellants argued that the proposed mining site falls in notified scheduled area and the leases violates the Andhra Pradesh Scheduled Areas Land

Transfer Regulation, 1959 and Forest (Conservation) Act, 1980. The judgment of AP High Court was in favour of the government. The appellants moved to the Supreme Court of India. On 11th July 1997, the Supreme Court reversed the judgement of High Court and gave its landmark judgement cancelling the mining lease.

Niyamgiri Case: The Niyamgiri hills are sacred to the local tribal people. Mining companies eyed the rich bauxite ore there. Dongaria Kondhs, residing there have had a decade-long fight against the mining company. The 2013 ruling of the Supreme Court said that Vedanta's bauxite mining project in the area should take the consent of gram sabhas. Out of 105 villages in the proposed mining area, 12 villages have been identified that will have direct and severe impact by the mining activity. In an environmental referendum, the first of its kind in the country, all 12 villages unanimously rejected the project. However, there's still a long way to go from saving the hill from predatory mining.

Samatha Judgment declared that the Government is also a "Person" and that: All lands leased to private mining companies in the scheduled areas are null and void. The verdict of the Supreme Court are:

- *By the Constitution [73rd Amendment] Act, 1992 .... every Gram Sabha shall be competent to safeguard and preserve...community resources". Under clause (m) (iii) the power to prevent alienation of land in the Scheduled Areas and to take appropriate action to restore any unlawful alienation of land of a Scheduled Tribe*
- *Minerals to be exploited by tribals themselves either individually or through cooperative societies with financial assistance of the State.*
- *In the absence of total prohibition, the court laid down certain duties and obligations to the lessee, as a part of the project expenditure.*
- *At least 20% of the profits as a permanent fund for development needs apart for more reforestation and maintenance of ecology.*
- *Transfer of land in Scheduled Area by way of lease to non-tribals, corporation aggregate, etc. stands prohibited.*
- *Renewal of lease is a fresh grant of the lease and therefore, any transfer stands prohibited.*
- *Transfer of mining lease to non-tribals, company, corporation aggregate or partnership firm etc., is unconstitutional, void and inoperative. State instrumentality is like APMDC stands excluded from prohibition*
- *In the absence of total prohibition in some states with scheduled Areas, Committee of Secretaries and State Cabinet Subcommittees should be constituted and decision taken thereafter.*
- *Conference of all Chief Ministers, ministers holding the ministry concerned and Prime Minister, and central ministers concerned should take a policy decision for a consistent scheme throughout the country in respect of tribal lands.*
-
- *Source:www.mmpindia.org*

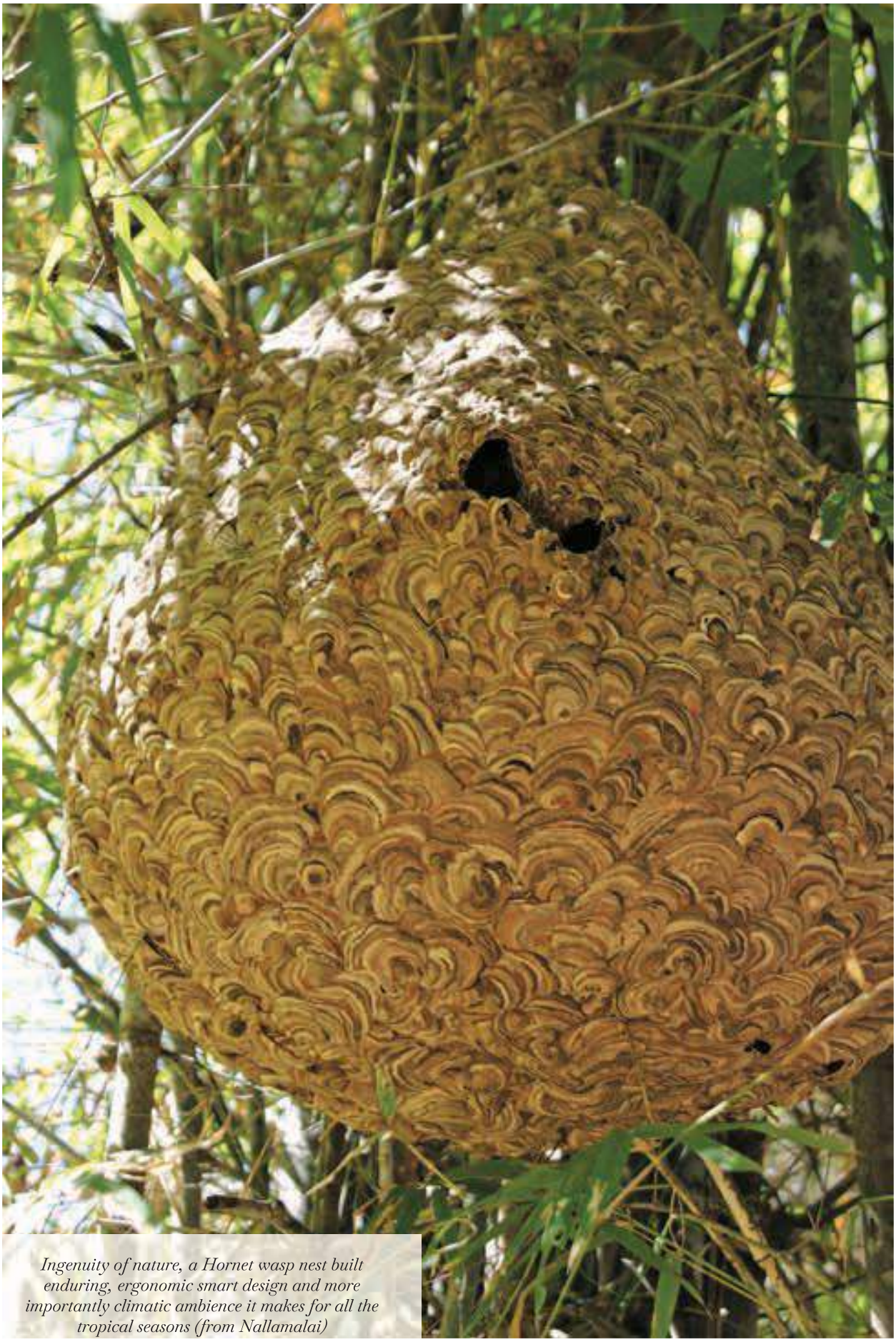
Key Rulings of Samatha Judgment

Insights

1. In spite of regulatory agencies at the state and national levels, there is no single authority that specifically handles the unique and diverse challenges of the Eastern Ghats ecosystem. Many sectoral policies related to forestry, water, agriculture, etc. incorporate mountain issues, but they are rarely tailored to the unique conditions or needs of the Eastern Ghats.
2. There is no holistic land use policy nor a policy for the protection of mountains
3. There seems to be a mere change in names and designations of the protected areas such as ESZs, biosphere reserves, sanctuaries, reserves, etc., while the physical and substantive measures are inadequate and skewed.
4. Sensitization and education of the people around the Eastern Ghats on the importance and intrinsic value of the ecosystems is very limited. There is a major traverse ahead to win the confidence of the people in safeguarding the natural heritage.
5. The participatory spirit is not yet visible in the governance of Eastern Ghats natural wealth.
6. The concerns and suggestions of National Environmental Policy have yet to be adopted.
7. Worldwide experience shows that a small number of protected areas are effectively managed. All the protected areas need to be governed effectively and equitably (Leverington et al., 2010). The same is the case with the Eastern Ghats. All the ecosystems in Eastern Ghats should be governed equally with utmost commitment.
8. Conservation focus is largely on apex and popular species, ignoring other creatures. Each organism has its own role and niche on earth. The focus should not only be on the larger and well-known species, but also on lesser-known life forms.
9. Eastern Ghats environmental and sustainable development perspective has to be established and also its significance in national development context has to be highlighted.
10. The importance of the ecosystem and habitat should be made known to all sections of people through various media, publications, posters, organizing trainings and seminars etc. Natural history museums across the region can help to raise awareness among local and regional people. Pilgrim centers, spiritual spaces, educational institutions can be ideal platforms to promote conservation consciousness in the society. Spiritual spaces in the hills can make a huge mark on people's attitudes and perception. Sensitization on responsible pilgrimage, environmental education, can create required leadership in the region.
11. Civil society groups along the region have to be strengthened for the cause of Eastern Ghats. They can play an active role in creating massive awareness, lobbying, supporting local communities in the management of ecosystems. They can play a critical role in creating political will for the cause.

What is required for the Eastern Ghats today is a holistic environmental perspective, vision, strong political will, conducive environmental policies, instruments, robust environmental institutional structure, and proactive participation of local communities for better conservation and sustainable development in the region.

> "... Mountains possess biophysical and cultural characteristics, which merit special consideration and treatment- in the matter of preservation and conservation. These include their three-dimensional nature involving steep slopes, altitudinal belts of varying ecosystem in a short distance, their different exposures or aspects and climates, and their frequent characteristics of spirituality, remoteness, inaccessibility, and great cultural diversity-islands in a sea of tamed and transformed environment".
>
> - IUCN Guidelines for Mountain Protected Areas, 1992



Ingenuity of nature, a Hornet wasp nest built enduring, ergonomic smart design and more importantly climatic ambience it makes for all the tropical seasons (from Nallamalai)

Research, Education & Communication

There is a need to gain a better understanding of the Eastern Ghat in terms of its characteristics, services, environmental stress, the effects of climate change, economic and socio-cultural aspects. This requires dedicated and long-term research. Mere academic and scientific studies won't be sufficient. The research shall provide a policy direction and management decision through sharing findings and solutions with policymakers and the public. Scientists, local experts and local communities, forest authorities and all other key stakeholders must come together to tackle the challenges through collaborative research and decision making (Price *et al.*, 2011).

To detect changes in long-neglected Eastern Ghats ecosystems, there should be robust research mechanism located in the hill ranges. Continuous and long-term research and periodic ecosystems assessment are the need of the hour rather than two to three year intermittent studies. Firstly, it should study the carrying capacities and Stock-taking of the ecological base of the hill ranges to bring out a comprehensive ecological and biodiversity inventory of the Eastern Ghats. This should be a multi-disciplinary expedition with an aim to research, generate, design, map and develop database. It should continue studies with defined goals, prioritising issues with periodic assessments. The centre should nurture local ecological experts. Dedicated policy studies can help the region a long way. The following example is of a budding institution in the Eastern Ghats, which deserves support to strengthen and grow and serve the aspirations of the nation.

It is the need of the hour to conduct a comprehensive ecological and biodiversity inventory of the Eastern Ghats and revise the "Red Book", including unique landscapes, flora and fauna requiring conservation and protection. Studies on carrying capacity are essential to guide land use and landscape-level planning. There is a need for a comprehensive environmental atlas of the Eastern Ghats, which should include ecological, social, cultural, and heritage sites; history and knowledge should be identified and mapped.

National Environment Policy (2006) and Mountains

The disastrous effects of the destabilization of hills are also mentioned categorically in the National Environment Policy (2006).

The NEP document emphasizes the vital role of mountains with its forests, catchment, genetic diversity and potential for livelihoods through tourism. It recognizes that these are fragile ecosystems in terms of susceptibility to anthropogenic and development shocks. The policy spells out the threats faced by mountains such deforestation, submergence of river valleys, pollution, defiling landscapes, degradation of human habitat, loss of genetic diversity, non-compatible plantations, glacier retreat etc. Most common causes of the impacts are pronounced as illegal logging and fuelwood collection, unwise development of infrastructure, haphazard urbanization, ignored building bye-laws, lack of sanitation systems, polluting industries, extensive mining, climate change, and agricultural chemicals.

NEP elicits the deficiencies in policies which fails to uplift the local people through afforestation and sustainable use of resources, its failure to curb agricultural chemicals, inability to enforce pollution standards, poor urban and regional planning and regulatory functions, failure in the application of environmental impact assessment; failure in mobilizing finance etc. NEP emphasizes the need to address these shortcomings through review of policies, institutional capacity building. NEP also suggests appropriate land use planning and watershed management; Best practice norms for infrastructure in mountain regions; Encouragement traditional crop varieties and horticulture, organic farming, sustainable tourism, regulation of tourist inflows into mountain regions within their carrying capacity; Particular unique mountainscapes as entities with "Incomparable Values", (MoEF, 2006).

"Sensitive ecosystems such as coastal and marine areas, mangroves, temperate and sub-alpine forests, alpine meadows, Western and Eastern Ghats etc., should be specially safeguarded."

- (Draft National Forest Policy, 2016)

Octopus view point, Nallamalais

7

Eastern Ghats Expedition

In September 2017, our team of 11 members consisting of scientists, environmentalists, observers and members of CGR went on an expedition of the Eastern Ghats for a total of 11 days. It was a great journey covering 4,400 km.

Below is an account of this journey, a record of our experiences, observations and thoughts.

The aim of this expedition was manifold –

1) To get an understanding of the ecological situation in the Eastern Ghats as it is currently.
2) To see for ourselves the beauty and intricacies of the ecosystem of the Ghats.
3) To meet with, and interact with the locals, so we know better the lives they lead and realize the importance of the ghats in their daily lives.
4) To determine the extent of damage that has been caused already by humans.
5) To get an idea of the good practices and traditional ways of living so that such practices may be extended to other areas where there is damage.

We decided to conduct the trip in two parts and explored the south and north parts of the ghats separately in order to have a clearer picture of the existing situation.

Eastern Ghats Expedition Southern Part

Day 1 - BR Hills – Shola forests – Encounter with leeches – Doddasampige tree – Sambar on the road

After spending a night on the banks of river Cauvery at Talakadu in Karnataka, we headed towards the Biligiririrangana Hills (BR Hills). By afternoon we reached K. Gudi where the forest department field office is located. The department had arranged a vehicle to go to the place where the Eastern and Western ghats meet (about 30 km away) in the Biligirangana Hills. Nine of the team members started the journey. On the way, we saw many waterfalls. The forest was thick and lush. There were a few tea estates along the way with ladies working in them. We stopped the vehicle to talk with them. One of the women was bleeding profusely, from a leech bite. Leeches were profuse in the area, she said. She also caught one of them by hand and showed it to us, it seemed like a needle walking in loops. We soon discovered that there were leeches on our vehicle, about three of our team members were bitten by them! On the way, we saw a snake basking on the roadside. We stopped the vehicle and saw that it moved into the tea plantations. We also spotted a beautiful brown eagle sitting on the branch of a tree.

As we reached the peak of the hillock, we saw the Shola forest, typical of the higher latitudes in this area. There are grasslands as well at higher elevations and the trees are in the valleys. This combination of grassland and forest makes the Shola forests. Shola forests are shaped over centuries by frost, high wind, and forest fires. At the peak the plants were short. There is a room for the forest guards and a watchtower. The guards shared that wild elephants and tigers pass by this area. In a puddle, indeed, we saw the footprints of a tiger!

On the way back, we arrived at a place where the tribals Soligas worship a big old tree called Doddasampige. This tree is located on the banks of a small stream. There are hundreds of stones smeared with vibudhi (holy ashes), the Lingas which the tribals worship and revere. It was almost dark when we walked from a distance to the holy tree.

It was a full-moon night and the forest was beautiful. We were lost in this beauty when the vehicle stopped suddenly. 100 meters ahead were two elephants grazing, their backs towards us. The driver stopped the engine, kept the lights on and we waited. The elephants were oblivious to our presence and it was only when the driver called another guard some distance away, and he came and flashed a torch-light at them that they moved into the plantations.

We saw a huge gaur near the campsite, also a huge gathering of deer and Sambar, their eyes glowing. There was the alpha male Sambar, he stood in the middle of the road and alerted other deer to move away.

Our first day was a beautiful experience.

Flagging off the expedition at CGR office, Hyderabad

Interaction with the students at Silver Jubille degree college, Kurnool

Day 2 - Bandipur National Park - Mudumalai National Park – Lantana infestation

From BR Hills, we travelled to Bandipur National Park in Karnataka. This forest area extends into forests in two different states - Mudumalai National Park in Tamil Nadu and Wayanad

Wildlife Sanctuary in Kerala. Bandipur is a popular tourist spot and people flock here, making it resemble a small town rather than a national park in a forest.

The safari was a disappointing one as we only spotted some spotted deer, peacocks, some birds, squirrels and monkeys on the way. The monkeys around the guesthouse seemed used to being fed by the tourists.

Mudumalai National Park, our next stop, with an elephant care center in it, is very close to Bandipur. We saw some wild elephants grazing at the roadside. Intentionally, as part of tourism, bushes had been cleared along the roads for people to clearly see any approaching wild animals. The elephants seem to have got used to many vehicles and people, they seem to ignore the onlookers.

It was late evening and it was the closure time for the elephant care center. Large balls of food made up of ragi, rice, jaggery are prepared and fed to the domesticated elephants. The close relationship of the mahouts (elephant caretakers) with the respective elephants was good to see. This center had a huge number of visitors. We felt that there should be limits imposed on the number of people visiting such forests.

Bandipur National Park is highly infested with the exotic Lantana Camara species. This plant with very small thorns grows up to a height of 3-4 meters and is impenetrable. It is competing with the local herbs, shrubs and bushes, not letting trees emerge. It has adapted to this ecotype and is expanding into the natural forest area. Although there were a few attempts to uproot and eradicate these, it is seen as a major threat considering the rapidness of its spread. The local flora and fauna has little relationship with Lantana Camara as part of the food chain. Nor do the people have much economic use for this species. Parthenium, another exotic species which is a small herb is also invading the forest area. The department should take necessary measures for the eradication and emergence of local ecotype species.

At night we could see many deer in the lawn around the guesthouses. The deer have learnt that wild carnivorous animals don't dare come and attack them when there are human settlements around. So it has become a daily routine for all kinds of deer to be around the guesthouses from dawn to dusk.

Day 3 - Udhagamandalam - Botanical Gardens - Urbanization

From Bandipur to Udhagamandalam (Ooty), near Coimbatore, Tamil Nadu, the temperatures dropped. With winding ghat roads, with waterfalls visible ever so often and greenery everywhere, it's a lovely drive. The Botanical Garden in Udhagamandalam, laid out in 1848, has both exotic and local species of plants. Its architect was William Graham McIvor. A place one can learn about flora bio-diversity. The fern house has 127 species of ferns. A putrefied fossil trunk that is 20 million years old is on display as a pedestal. Tree species of botanical interest such as *Hymnosporum flavum, Cordylline australlis, Cedrus deodara, Cupressus funebrils, Araucaria bidwillii, Cupressus macrocarpa, Cryptomeria japonica, Eucalyptus maculate, Eucalyptus citriodora, Salix babylonica,*

Addressing pressmeet at Bengaluru

Expedition team at Bengaluru

The team at the entry into BR hills

A souvenir of GrACE to DFO Kotagiri BR hills

The team at Honnemetti peak where Eastern Ghats meet with Western Ghats, in the adjacent photo, Dr. K Thulsi Rao explaining the landscape features of this ecosystem

Salix heterophylla, Podocarpus taxifolia, Dracena lanuginosa, Pinus patula, Rhododendron arboreum, Quercus Montana, Quercus cerris, Quercus Serrata, Quercus grilffithi, Quercus illex, Magnolia grandiflora etc., can be seen along the lawn. Some plants are more than 100 years old. Important tree species such as *Taxodium mucronatum, Pieris ovalifolia, Juniperus virginiana, Eucalyptus eugenoides, Pinus wallichiana, Photinia lindleyana, Pinus canaariensils, Ginkgo biloba, Araucaria cunninghammi and Cupressus lawsoniana* are planted all over the garden. A rose garden with three hundred varieties of hybrid tea roses, floribunda and polyanthas rose varieties is in the upper part of the garden. There are natural ponds with aquatic plants. The lawns, matching the contours of the ground, interspersed with beautiful exotic species is beautiful. There is also a nursery where saplings of various plants are sold.

We left to see Doddabetta, one of the highest peaks, another point where the Eastern Ghats and Western Ghats merge. This place was heavily crowded with

The team at botanical gradens, Ooty

Weary Sambars on roadside in Bandipur forest Karnataka

tourists and vendors selling all sorts of items. On the way to Kotagiri a town close by, there are many tea estates. Urbanization has taken its toll going by the number of concrete buildings that have come up like mushrooms on these precarious hills. Urbanization is one of the causes of conversion of forests for other purposes. Tea estates and commercial agriculture is evident everywhere. The loss of soil and biota is evident. There is a dire need to restrict urbanization in these hilly regions.

Day 4 - Kolli Hills - Arunachala Hills – Parikrama

We travelled to "Kolli Hills" which are remnants of the Eastern Ghats. This hill is like an island with its altitude, flat lands and gentle valleys. The biodiversity on the way to the top is very rich. The slopes of the hill are very steep with 50 hairpin bends on the roads on the way to the top. At the top, there are a few houses in a small village. The soils are red and lateritic. The water from the rainfall supports the crops. People were cultivating spices, vegetables, fruits and paddy. The local market was very colorful, with all types of vegetables, spices and fruits.

From the base of Kolli Hills we took the road to Arunachala Hills at Tiruvannamalai, this part of the Eastern Ghats, a complex of gneiss and granite rocks is called Arunachala and is considered very sacred. There is Lord Shiva's Temple at Tirunavaanamali, and also Ramana Maharshi's Ashram. The parikrama (circumambulation) of Arunachala Hills took a total of 3.5 hours and gave us the space for contemplation and peace.

Day 5 - Seshachala Hills - Shevroy Hills – Barren Erramalai

The team split into two, one team left for Tirupathi to cover the Seshachala Hills and the other team went to Vellore covering the Shevroy hills. The challenge in the forests of Chittoor district is the illegal smuggling of red sanders. This forest is also the last habitat for the wild elephants transecting the border between Tamil Nadu and Andhra Pradesh, in the southern part of the Eastern Ghats. Again, elephants here are seen from parts of Vizianagaram and Srikakulam Districts till the northernmost part of the Eastern Ghats.

The travel from Vellore to Kadapa district brought us to the degraded Eastern Ghats called Erramalai. These hills are rich in barites used in the oil extraction industry.

DAY 6 - The Chenchus in the forest – teak plantation from the British era -

From Kadapa, via Nandyala we reached Atmakur. With the help of EFICOR an NGO, we visited a Chenchu gudem (tribal Chenchu locality). There are a few houses constructed by the government here. This area is on the traditional path for those who go on foot to Srisailam temple. Traditionally these Chenchus are dependent on tourists and forest resources for their livelihoods. They sell goods to the visitors to the near-

A group of peaks in middle Eastern Ghats

A view from Honnemetti Peak where Eastern Ghats and Western Ghats meet

by dargah and also to pilgrims to Srisailam on two occasions in a year. We spent some time discussing with the Chenchus the wildlife and health of the forest here. Over a period of time, the Chenchus are losing their access to the forest resources due to the strict rules being imposed. But they say people from the plains exploit the forests and they are the ones victimized. Many Chenchus have taken to begging on the roads, a sight one would not find a few years ago.

There is a block of area planted with teak during British times that is still intact and being conserved by the forest department. This is the only place in Nallamalai where an intact healthy teak plantation is seen. Otherwise, almost all the teak from the Nallamalai forests is already exploited. There are two Chenchu habitations on the way from Atmakur to Shikaram via Dornala. Here the forest area is healthy and we saw many people grazing their cattle. This forest area, although famous for tigers, has many people grazing their animals.

By crossing the Krishna River, through the Nallamalai forest of Telangana, we reached the final point at Umamaheshwaram Temple. The journey of the southern part of the Eastern Ghats was completed at 9:30 pm on day 6.

Route

Southern Eastern Ghats (Telangana-Andhra Pradesh-Karnataka-Tamil Nadu). Hyderabad – Kurnool – Ananthapur – Bangalore – Cuban Park (Press Conference) – Talakadu (Mudukuthore)- Gumballi – Biligiriranganabetta – K. Gudi wilderness camp – BR hills convergence of eastern and western ghats point – Bandipore – Ooty – Doddabetta – Kotagiri – Mettupalayam – Kolli Hills – Tiruvannamalai – Vellore – Kadapa – Atmakur – Dornala – Srisailam – Uma Maheshwaram – Hyderabad (2-9 September 2017) 2,400 kilometers.

1. *Herd of spotted deer in BR Hills*
2. *A Raptor perching on a tree in Nallamalai*
3. *A waterfall emerging from a cave in the cliffs at Nilgiris*
4. *A Sambar in a Coffee plantation in BR Hills*
5. *A solitary Elephant in BR Hills*

6. Women working in a Coffee plantation between Kotagiri and Honnemetti
7. Shola patches on BR Hills
8. Kollimalai landscape, Tamil Nadu
9. A cascading jungle stream near Kotagiri

Dodda Sampige

A large *Michelia champaka* known as "Doddasampige"(from Kannada for large Champak tree: is one of several sacred groves of India of the Soliga people. This tree, in BR hills is believed to be several hundred years old and its large canopy provides shelter to a number of lingas worshipped by local communities, including the Soligas. The tree is on the banks of a river, Bhargavi. On the occasion of Maha Shivaratri, several festivities including dance and prayers are traditionally performed around a fire by the Soligas. Literally meaning The Big Champak Tree, it is believed to be more than 2000 years old, with a height of 34m and a width of 20m.

Eastern Ghats Expedition Northern Part

On 18th September, the expedition of the northern part of the Eastern Ghats Visakhapatnam with four members in the team.

Day 1 - Visakhapatnam – Mahendragiri – trees in farmlands

The city of Visakhapatnam itself is in the Eastern Ghats. To meet the demands of rapid urbanization, people are exploiting the hills for construction materials which is impacting the ecosystem there. There is rampant encroachment of the ghat areas with the government itself giving some of the lands to private people on lease. There is a strong civil movement with the public and environmentalists fighting for the conservation of the Eastern Ghats in and around Visakhapatnam.

Parts of the Eastern Ghats are visible en route to this city at Vizianagaram and Srikakulam districts. Via Narsannapeta, we saw the beautiful bluish Eastern Ghats as we went to Pathapattanam. On the way, all along the valley paddy is the main crop cultivated. There was greenery everywhere. We crossed a river to reach Parlakamundi in Odisha. These two towns are historic and in both the areas people speak both Telugu and Odia languages. The scars of mining on the Eastern Ghats for construction materials was obvious here.

Mahendra Giri Hills in Odisha, locally called as Mahendram is one of the highest peaks in Odisha and considered very auspicious.. During the festival of Shiva Ratri (the auspicious night of Lord Shiva, lakhs of people climb and worship the idol at the top. We took the path along Narayanpur, Jiranga, and Kainpur to reach Mahendragiri. All along were the beautiful tropical semi-evergreen forests of the Eastern Ghats. The tarmac road was a single winding lane cris-crossing the valleys. There are many streams along the routes. There was slash and burn and permanent cultivation practiced by the local people in the forest area. The people preserve the locally useful species such as date palms and other trees within the farmlands. The fields looked beautiful with these interspersed trees. As we started climbing towards the Mahendragiri Hills, it was even more beautiful. Though we could not reach the top, we could admire the rocky projections of the Eastern Ghats. At Barhampur at the foothill was the night halt.

Day 2 - Chilka Lake – retired defense personnel protect teak trees - Salia Reservoir

Balugaon is a town on the banks of the beautiful Chilka Lake which is a brackish water lake at the foothills of the Eastern Ghats and the Bay of Bengal. There were several fishing boats here. The Range Officer at the forest department at Balugaon gave us permission to visit the Barbara Reserve Forest. At the checkpoint of the entrance to the reserve forest we saw very thick bamboo plantations. It was very rare to see such a thick bamboo forest. Bamboo is one of the basic food of elephants and there is a considerable population of elephants in this forest As we went further into the jungle, we saw the majestic tall teak plants, some of which are more than 100 years old with very large girth. There was human interference and people are found grazing the animals inside. Military personnel who monitor these forests have their camp here. There were about 50 personnel who protected the borders of India in their active service, and now after their retirement are involved in protecting the forest area. They are armed but may not use the weapons on any violators. Teak being a high value plant, there is demand from Bhubaneswar and other neighboring areas for the timber. A tree could fetch as high as Rs. 300000 in the market.
A different route through the forest took us to Salia Reservoir, where we saw deer grazing on paddy fields. These deer come in hundreds every day. The cascading irrigation canal of the Salia reservoir was beautiful.

Day 3 - Press Conference - Mahanadi River

The Press Club of Bhubaneswar had organized a press conference where we shared our observations and spoke about the objectives and goals of GrACE. More than 20 media personnel participated and the coverage across the media was good.

After lunch, left to Angul, the route was Bhubaneshwar – Urali – Kasinda Trisulia – Banki. – Kantilo – Sidhamula – Narasinghpur – Hindol – Anugul – Pabala – Tikarpada – Anugul. This is a route follows parallel to Mahanadi River. The road was narrow and at places due to irrigation canals and habitations the route was slow. On the way we saw the wide, sandy Mahanadi River. The typha weeds and other grasses on the river bed made it even more beautiful. By night reached Angul.

The team members with retired armed personnel at Barbara reserve forest, Odisha

Day 4 - Satkosia Tiger Reserve – changed ecotype

Tikarpada Reserve Forest or Satkosia Tiger Reserve is where we see the Mahanadi enter a narrow gorge in the Eastern Ghats. The river is very deep. There is a gharial and crocodile sanctuary on the banks of Mahanadi River. Inside the forest areas, there were many cultivated areas and habitations. The forest reserve appeared very poor all along the way to Tikarpada. Along the route from Angul - Bhuban – Duburi – Jajpur road, we saw tall Sal trees.

The ecotype has changed; the teak trees have been taken over by Sal trees in this part.

From Jaipur Road left for Baripada. The route taken was from Jajur Road – Anandapur – Thakurmunda – Jashipur – Bisoi – Baripada. At Jashipur met the forest range officer of the Simlipal Tiger Reserve, and explained about the purpose of our visit. Saw the pictures of the tiger tamed by a professor. We also saw the tall Sal trees in the courtyard. From here left to Baripada. Near Baripada there was a ghat road. Stayed at Baripada and in the next day morning organized a press conference with the local reporters.

Day 5

After the press conference left to Vishakhapatnam followed the route; Baripada - Jogal – Balasore – Bhubaneshwar – Vishakhapatnam. In the midnight reached Vishakhapatnam and next day left to Hyderabad. With this journey completed the expedition on Eastern Ghats.

Northern Eastern Ghats (Odisha-Andhra Pradesh) Route from 19th to 25th September 2017, total distance 2000 kilometers.

Route

Vishakhapatnam – Vizianagaram – Srikakulam – Narsannapeta – Parlakamundi – Narayanpur – Jiranga – Kainpur – Mahendragiri – Andaanda – Jarada Gada – Chikiti – Brahmapur – Balugaon – Barbara Reserve Forest – Salia Reservoir – Balugaon – Bhubaneshwar – Urali – Kasinda Trisulia – Banki. – Kantilo – Sidhamula – Narasinghpur – Hindol – Anugul – Pabala – Tikarpada – Anugul – Bhuban – Duburi – Jajpur Road – Anandapur – Thakurmunda – Jashipur – Bisoi – Baripada – Jogal – Balasore – Bhubaneshwar – Visakhapatnam.

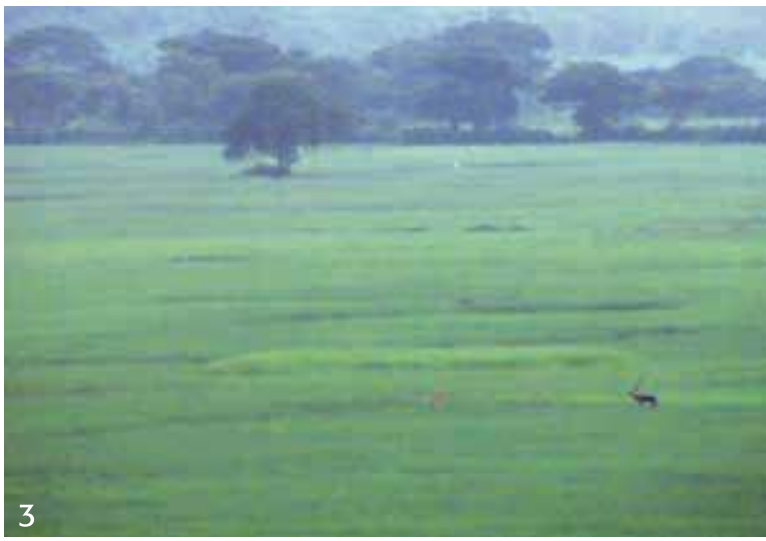
Total distance travelled for both south and north Eastern Ghats is 4400 kilometers.

Biodiversity of Odisha

Odisha is one of the richest biodiversity regions in South Asia. As per the research done in the past 2,727 species of plants were reported under 228 families and 1062 genera of which 2561 species are Indigenous and 166 species are cultivated. This includes 141 species of Pteridophytes under 41 families and 66 genera, 10 species of gymnosperms (3 Indigenous species), 124 species of orchids. Out of this 1831 species under 148 families and 747 genera are Dicotyledons and 745 species under 37 families and 247 genera are monocotyledons. Odisha is home for over 750 species of medicinal plants. Till date, 200-300 species of plants have been added to the list of angiosperms and v, bringing the total floral checklist to around 3,000.

Pressmeet at Bhubaneshwar

At the base of Mahendragiri peak



1. *A tribal boy in Odisha*
2. *An irrigation outlet cascading down from Salia dam, near Barbara forest, Odisha*
3. *Irrigated command of Salia dam was once a dense forest. However, wildlife like this blackbuck seen in the image still roams in the area. We hope the resilience of farmers here lasts forever.*
4. *Fishermen on a boat in Chilika lake, Odisha*
5. *Mahanadi at Satkosia gorge*
6. *Cattle on their way to grazing in the forest of Odisha*
7. *Eastern Ghats landscape in central Odisha*

A plunging spring in Nallamalais

8

Conclusions and Recommendations

"Only if we understand, can we care. Only if we care, will we help."

- Jane Goodall

Not many hill ranges in India, other than the Himalayas and the Western Ghats, match the heritage of Eastern Ghats in terms of biodiversity, natural resources, cultural and spiritual values. With its blessed landscapes, magnificent geological formations, brimming wildlife, and primitive human societies, these hills forms a most important geographic entity in the eastern peninsular region of the country. Dominated by tropical dry deciduous vegetation, the hill ranges hosts about 2600 flowering plant species and is home to many wild faunal species such as tigers, elephants. The ecosystems of theses hills provide a wide range of goods and services including hundreds of food items, medicinal plants. It has been an important pasture land for millions of regional livestock. The hills form an important regional water tower. It is an important sacred mountain space of the sub-continent.

The wilderness was reasonably in good shape; Forests and their associated ecosystems were intact; the landscape was unspoiled till the middle of the last century. The threats of the Eastern Ghats today, are far more complex than what we understood. Eastern Ghats wilderness today is surrounded by dense humanscape. Population pressure, insatiable gluttony for resources and the myopic development projects have disregarded the value and integrity of this eco-region and people here. Loss of biodiversity, resource exploitation, millions of impoverished tribal people, and armed discontent overlay the canvas of the present day Eastern Ghats. The total number of activities that threaten the perimeter and interiors of the hills remain unknown. The forces are predatory and the degradation is rapid. The scars of misuse and wounded landscape are seen all over the hills. Privatization of natural resources, developmental projects, including mining, urbanization, industrialization, in the past, now and in future, have the potential to destroy Eastern Ghats. Shrinking biodiversity, depleting natural resources, rampant pollution and marginalization of indigenous communities impact the economy and society at large.

The process of degradation that was unleashed a century ago accelerated since 1970s. The fabric of nature here was altered and encroached upon by humans in a large scale since then. Widespread tree felling until the 1980s and continued large-scale illegal felling caused heavy damage to the forests of Eastern Ghats. Once extensive, the canopy and deep foliage of primeval forests here is reduced to scrubs and savannas in large parts of the hills. The rich NWFP and large timber trees that have life spans measured in centuries are lost.

Plantations replaced the forests in upper reaches and slopes of the of hills whereas dams submerged valleys. Mining is prevalent all over the hills. The linear projects such as roads, power lines, canals also claimed vast areas of tree cover in the hills. By the axe and by torch, the woodlands are shrinking to the inexorable pressure. Large tracts of shifting cultivation are found even on a steepest hills. Large areas of forests in the periphery and interiors are converted to intensive settled farming, as the encroachments continues. Almost all the hill ranges of the Eastern Ghats region are highly prone to forest fires. A potential pharmacy of nature fades away by fire and smoke. The hills have become virtual grazing grounds and are resembling a ranch like appearances. The integrity and functions of Eastern Ghats ecosystems are drastically affected by the aggressive invasive species like Lantana, Propsopis, Parthenium and many other unknown species. No special data is available about the intrusion of these aliens.

Many urban centers in the regions are rapidly expanding, exerting pressures on land and other resources. The implications of the proposed East-Coast Economic corridor on the region's ecological and social spheres is yet to be understood. The existing roads experiencing heavy traffic, many roads are expanded and new roads are constructed through this wilderness. Heavy traffic causing littering and road kills. Eastern Ghats region is reported to be highly susceptible to climate change. The wildlife corridors are truncated.

Over the last century, three-fourths of the forest cover in Eastern Ghats has been lost while fragmentation has tripled. The ecosystems of the hills have lost their natural species composition, forest structure, size, scale and character. Centuries of habitat destruction and unrestrained hunting has decimated the wildlife in the hills. Poaching and game hunting continues. Biodiversity loss not only threatens the species like tigers, elephants, but also many birds like Great Indian Bustard, Jerdon's Courser and Purple wood pigeon. Similarly, the status of Golden Gecko and Jeypore Ground Gecko Native cattle breeds such as Ongole, Punganoor and Mannanur breeds are in a declining trend. We don't know yet, the exact degree of threat to the living beings of the Eastern Ghats. Habitat loss causing ever-increasing challenge of human-animal conflict. Notified Protected Areas cover a small fraction of the hill space. The forests

are scouted for inter-state organized gangs involved in poaching of tigers, leopards and tuskers.

The hills are home to approximately 5 million tribal people belonging to 60 indigenous communities. The tribes of Eastern Ghats are stifled in conflicting interests between governments, corporates, and neighbouring lowland societies and militants. The interiors are heavens for narcotics cultivation and illicit liquor. They are susceptible to epidemics and exploitation. Their lands have become sites for clandestine dumping of toxic wastes, Illegal mining, poaching and hunting including human trafficking.

The situation today is grave due to the threats and challenges to the floral and faunal elements and bio-geographic significance of the Eastern Ghats, is fast losing. The declined wilderness must be restored and the remaining pristine areas shall be preserved. In order to address the impending environmental catastrophe in the Eastern Ghats region, a comprehensive solution must be sought. Restoration needs to rescue ecosystems from aggressive human interference. The time has come, when all the local governments need to ensure that the conservation of the Eastern Ghats, regeneration of all its biodiversity, on top priority. We hope that the hills, its rock formations, biodiversity, natural resources and integrity and respect of the indigenous communities, its intrinsic values of the Eastern Ghats will duly be recognized protected forever. Through this publication we strive to bring public focus to the Eastern Ghats cause and soliciting the Government of India and state governments to recognize and preserve ecological, cultural, scientific, economic and ethnic values of the Eastern Ghats by creating an autonomous conservation authority. With a great hope and trust through this publication GrACE shares following insights to contribute to an ideal Eastern Ghats environmental vision.

Piled up pebbles wishing good luck and grace of God. Let us pile up the wishes for the wellbeing of Eastern Ghats and work towards

Remote tribal land in northern Eastern Ghats in Andhra Pradesh

Recommendations

1. *India should adopt mitigation strategies like Reduction of Emissions from Deforestation and Forest Degradation (REDD+). As a signatory to Paris Accord, we should showcase the restoration of damaged mountain-forest ecosystem of the Eastern Ghats as a success story (after restoring the Eastern Ghats to its original health).*

2. *India, as a leading member of the UN, aspiring to be a permanent member of the Security Council must implement with all sincerity, all the global accords to which India is signatory such as Earth Summit, UNFCC, CBD, UNCCD, CITES, SDGs, etc.*

3. *The Government of India must present its Natural Resources Balance Sheet before its annual financial budget.*

4. *Enact a comprehensive land use policy to ensure its sustainable management.*

5. *Demand for a Policy for Mountains for providing a comprehensive guidance for the conservation of mountain regions of India and its sustainable development*

6. *Empower local Gram Sabhas to discuss and debate the ways and means to protect the Eastern Ghats resources.*

7. *Conduct transparent Environmental Impact Assessment, Strategic Environmental Analysis, Social and Environmental Management Plans before taking up any project in the hills.*

8. *With the PESA and FRA coming into force, the joint forest management should not be allowed to override the intent of FRA. MOEF, in consultation with the Union Ministry of Tribal Affairs and the States should revisit the rationale of the JFM and the modalities of enforcing PESA and FRA.*

9. *Take up ex-situ conservation of highly endangered species like the great Indian Bustard and the Jerdons courser on the lines of Project Tiger and the Project Elephant.*

10. *Declare Mannanuru cattle as distinct breed and take measures to protect the species.*

11. *Take measures to protect and propagate the world famous Ongole cattle breed.*

12. *Protect all large and medium wetland bodies in Eastern Ghats region by declaring them as India's wetland biosphere sites.*

13. *Establish Community Reserves and Conservation Reserves between the hill complexes of Odisha, AP and Tamil Nadu.*

14. *Clusters of rich biodiversity along the Eastern Ghats need to be identified by MOEF on scientific lines and notified as protected "biospheres" under the relevant laws. We propose the following areas as biospheres 1) Satkosia 2) Gudem, Marripakala, 3) Nallamalai, 4) Kolli hills 5) Shevroys 6) Jawadi, 7) Sirumalais, 8) Kalrayan, 9) Chitteri, 10) Melagiri 11) Pachamalai and 12) Kondapalli.*

15. *Propose new wildlife sanctuaries, Chitrakonda in Malkangiri district, Berbera-Dhuanali in Khurda district, Niyamgiri in Rayagada-Kalahandi districts, Satkosia in Keonjhar district, Madanpur-Rampur in Kalahandi-Phulbani districts.*

16. *Once such biospheres and sanctuaries are identified and notified, MOEF should also notify the eco-sensitive regions around the same to make sure that no predatory economic activity is allowed to take place on its fringes that will disturb the integrity of those biospheres. GrACE also demands for quick notification of all the pending proposals for protected areas and eco-sensitive zones.*

17. *There are research studies that establish the fact that interconnectivity among the forests enhances the probability of survival of the fauna species. This aspect needs to be studied in depth for the Eastern Ghats. Hence, we propose the following vital biotic links to be declared as corridors in Eastern Ghats i.e., 1) Nallamalai, Lankamala, Yerramala, Veligonda, Palakonda, Sheshachalam 2) Nilgiris, Bilgiris, Melagiris including Sigur, Talamalai, Satyamangalam wilderness.*

18. *Establish Community Reserves and Conservation Reserves between all the disjunctured hill ranges of Eastern Ghats.*

19. *Take up King Cobra conservation programme in Salur in northern Eastern Ghats in Andhra Pradesh.*

20. *Establish Orchidariums in Simlipal, Deomalis, Gandhamardan, Niyamgiri Mahendragiri, Araku and Paderu.*

21. *Declare Coringa as Ramsar (Wetlands) convention site.*

22. *Conduct a comprehensive ecological inventory of the Eastern Ghats and revise "Red Data Book" and CITES Appendices pertaining to Eastern Ghats, including unique landscapes, varied ecosystems, flora and fauna requiring conservation and protection.*

23. *Publish Environmental atlas of the Eastern Ghats incorporating information on various ecological, social, cultural and heritage.*

24. *Employ ecologists and environmentalists in state, regional, national planning and policy institutions.*

25. *Constitute planning bodies with renowned environmentalists that specialize on the Eastern Ghats region.*

26. *Appoint Nature ombudsman for Eastern Ghats.*

27. *All the historically and culturally significant mountains of Eastern Ghats should be declared as UNESCO Cultural Heritage sites.*

28. *We call upon national government and State governments of Odisha, Andhra Pradesh, Tamilnadu, Telangana, Kerala and Chhattisgarh to prepare an action plan for protection and conservation of ecology and natural resources of Eastern Ghats.*

29. *We feel there is need to form a Research Network of Universities that are in Eastern Ghats region to work on issues and challenges of Eastern Ghats, including ecology, development and biodiversity. This Research Network, with committed funds from national and State governments should support primary research, workshop, information exchange and capacity building programmes, with the objective of developing a database of information on ecology and development, and building ideas and knowledge.*

30. *We request the National Government to develop a National Legal Framework for Eastern Ghats, including Acts, Statutes, procedures and policies, with the objective of going beyond the current Protected Areas (PA) approach.*

31. *We demand the Government of India to form a Regional Coordination Committee of States on Eastern Ghats. This Committee should have the mandate of linking and coordinating activities relating to Eastern Ghats.*

32. *We call upon civil society, related to adivasis and social communities, to form a grand alliance to bring together knowledge and action on the Eastern Ghats.*

33. *We request the Union Minister for Environment to form an expert's panel to review social, ecological, economic and political contexts of the Eastern Ghats, to develop a report that provides suggestions and recommendations for Eastern Ghats protection. This should be on the lines of Madhav Gadgil report on the Western Ghats.*

34. *We request the government to develop a Natural History Museum network, to show case the wide variety of flora, fauna and ecology of the Eastern Ghats.*

35. *We need to establish a Youth Scholarship Fund, to promote nature camps, awareness programmes and research work for young girls and boys.*

36. *We propose to promote ecological agriculture, water and soil conservation in the upland reaches of the Eastern Ghats. Rivers, streams and waterfalls in the Eastern Ghats have to be protected, and minimum water flows ensured.*

37. *Pollution has to be prevented. Urban, industrial and household toxic waste has to be reduced through changes in consumption, recycling and reuse.*

38. *MOEF should desist from bypassing both PESA and FRA in clearing "linear" projects such as roads, pipelines, canals etc., which are short sighted and will run counter to the Ministry's obligation under Article 48A of the Constitution and the various environment and forest laws.*

39. *FRA provides for both individual and community pattas for traditional forest dwellers. This is an important law that needs to be enforced strictly. Every other region of the Eastern Ghats should be protected, just as Niyamgiri.*

40. *We need to review all development projects in this region. We strongly feel that people, national and state governments and civil society, and international institutions need to come together and take up actions and programmes that are aimed at conserving the pristine ecology of the Eastern Ghats.*

In a broad sense, the term conservation is not only confined to biodiversity but also to natural resources like water, minerals, rock formations, earth features, time tested traditional wisdom, culture, lifestyles, spirituality, philosophical, intrinsic values and attitudes of people to live in harmony with nature. Hence we demand a holistic and long term, broad-spectrum conservation policy amalgamating all the aspects that the Eastern Ghats possess.

The cognizance of the status and foresighted proposals for the conservation of these hill ranges are essential, but not sufficient to see that these goals are attained. What is required now is political will and eventual action in order that effective and efficient policies might succeed. In the end it will be here, on these ancient Eastern Ghats and on the faces of its people—not in policy documents, official guidelines, academic and research publications and tourist books —that the strength and sincerity of the nation's environmental and developmental intentions will be written.

May the sky be peaceful
May the atmosphere be peaceful
May the Earth be peaceful
May the water be peaceful
May the medicinal herbs be peaceful
May the plants be peaceful
May all the devas be peaceful
May the creator of the universe be peaceful
May all be peaceful

- Yajur Veda

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Acronyms

ANU	Acharya Nagarjuna University
AP	Andhra Pradesh
AU	Andhra University
BBSR	Bhubaneswar
BMC	Biodiversity Management Committees
BSI	Botanical Survey of India
CAMPA	Compensatory Afforestation Fund Management and Planning Authority
CBD	Convention on Biological Diversity
CDA	Chilica Development Authority
CDI	Contractors Development Institute
CDM	Clean Development Mechanisms
CGR	Council for Green Revolution
CITES	Convention on International Trade in Endangered Species
CPR	Common Pool Resources
CSE	Centre for Science and Environment
CWC	Central Water Commission
Dept.	Department
DFO	Divisional Forest Officer
DrBRAOU	Dr. B.R. Ambedkar Open University
ENVIS	Environmental Information System
EO	Executive Officer
ESZ	Eco Sensitive Zone
FAO	Food and Agricultural Organization
FRA	Forest Rights Act
FSI	Forest Survey of India
GBM	Green Belt Movement
GrACE	Greens Alliance for Conservation of Eastern Ghats
HoD	Head of the Department
Hyd	Hyderabad
IAS	Indian Administrative Service
ICFRE	Indian Council for Forestry Research and Education
IGCMC	Indira Gandhi Conservation Monitoring Centre
IIED	International Institute for Environment and Development
IMMT	Institute of Minerals and Materials Technology
INDC	Intended Nationally Determined Contributions
ITDA	Integrated Tribal Development Authority
IUCN	International Union for Conservation of Nature
IYM	International Year of Mountains
JFM	Joint Forest Management
JNTU	Jawaharlal Nehru Technological University
Km	Kilometers

Km2	Square Kilometer
MEA	Mutual Environmental Agreements
MoEF	Ministry of Environment and Forests
MP	Member of Parliament
Mts	Meters
NAC	National Academy of Construction
NGO	Non-Governmental Organization
NIT	National Institute of Technology
NRM	Natural Resource Management
NSS	National Service Scheme
NTC	National Trusteeship Council
NWFP	Non Wood Forest Produce
NWFP	Non Wood Forest Product
OU	Osmania University
PA	Protected Areas
PJTSAU	Prof. Jaya Shankar Telangana State Agricultural University
PRA	Participatory Rural Appraisal
REDD+	Reducing Emissions from Deforestation and forest Degradation
RDB	Red Data Book
RET	Rare, Endangered and Threatened Species
RMNH	Regional Museum of Natural History
RPRC	Regional Plant Resource Center
RTI	Right To Information
SDGs	Sustainable Development Goals
SHRC	State Human Rights Commission
SKU	Sri Krishna Devaraya University
SPMU	Sri Padmavathi Mahila University
SVU	Sri Venkateshwara University
TN	Tamil Nadu
TSPCB	Telangana State Pollution Control Board
UN	United Nations
UNCCD	United Nations Convention to Combat Climate Change
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environment Programme
UNFCC	United Nations Framework Convention on Climate Change
UU	Utkal University
WCED	World Commission on Environment and Development
WLS	Wild Life Sanctuary
WWF	World Wildlife Fund
ZSI	Zoological Survey of India

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Annexures

Dense Foliage of Southern Eastern Ghats

Best Practices & Inspiring Stories

Subcontinent of India is bestowed with ample natural resources especially the three mountainous landscapes that sustain the people with livelihoods and employment. Unfortunately due to short-sighted economic planning, the prosperous and ecologically rich wooded country that supported the national GDP is now impoverished while the rich natural heritage there dwindling to an alarming level. The following case studies from Eastern Ghats and also few inspiring stories from the world exhibit how wise interventions and conservation models can make a big difference and bring vibrant change which can be emulated all over the Eastern Ghats wherever necessary.

Mannanur

Mannanur - a small tribal panchayat located at the entry point of Nallamalais of Telangana state, starved for water for one decade, though it has an excellent catchment available in Farhabad plateau - a hunting ground for the Nizams prior to independence that enjoyed a series of cascading chain of manmade water harvesting ponds, a classic example of harvesting of precipitation through various retention structures to increase the soil moisture of dreary dry lands of southern part of Telangana.

People were desperate, weary and lost hope as their repeated appeals could not be solved by the local authorities and the peoples' representatives because the crux of the problem could not be diagnosed due to lack of comprehensive study of the region, till the erstwhile forest department of combined Andhra Pradesh made an intervention by deputing an eco-development project officer (Dr. K. Thulsi Rao).

Equipped with technical skills with human touch, the project officer could study the root cause of the problem and designed an overall catchment development programme and revitalised the earlier structures and canals that were feeding the chain of well distributed cascading lakes and ponds (Durvasula cheruvu, Dharmasagar cheruvu, Rangapur, Chandrasagar, Nadimpalli etc,.)

This has resulted in developing the abandoned farm lands with lush green paddy crops that were kept fallow for more than a decade with a low cost of execution. This is a classic example of renewing natural resources by linking productivity and job employment of local, rural and tribal people at minimum cost.

Indireshwaram

People have rudimentary resources which cannot be useful directly. They don't have the capacity to convert them to useful products due to poverty and this situation has converted them instead to becoming poachers and fellers. With minimal intervention, their lives have changed and become a classic example of the positive effect of linking jobs and employment to the available resources.

Poverty stricken villagers, finding no other options resorted to plundering the forests for their subsistence. This made them hardy and unlawful, frequently attacking the forest staff. The eco-development project team, by finding the root cause of the problem and showing them the availability of their resource made them to realise that there are better options for survival.

In this village, located at Nallamalais in Telangana State, the lands allotted by the government were stony, with undulating terrains unfit for any kind of cultivation. The project intervention included mechanised ploughing and leveling the lands with removal of the pebbles making these unproductive

lands to be one of the fittest cultivable lands by linking to the nearby streams by construction of check dams. The women of the village expressed that they are not only happy with the crops raised but are very happy seeing their men working in their fields., before this, there was a lot of uncertainty as the men succumbed to attacks by the wild animals around or were caught by the forest police.

Sustainable NWFP Harvest

A case study recently illustrates a situation where a scientist could save some forest area from being converted to farmland. "While looking around in Nallamalai forest with a team of plant taxonomists that I was leading, I found Chenchu tribals removing some weeds to cultivate paddy on the advice of ITDA. On knowing that the weed was kalajeera (*Vernonia Antihelmentica*) I advised ITDA officials and the Chenchus about the economics of growing paddy vs Vernonia. They were astonished to know that without much effort they can earn money just by

selling what they thought was a weed as a medicinal plant. Since then our advice was put into practice" Dr. K. Thulsi Rao, Biodiversity expert and retired Forester.

Education and training on non-wood forest produce and on seedling development practices to the tribal population would bridge the gap between degradation and regeneration. Expert opinions on economic and ecologic benefits of forests must be made available. This must also be accompanied by scientific methods of NWFP extraction.

Local communities in forest protection

Chenchus as sentries of Nallamala: The Chenchus are lean, food-gathering and hunter tribe of primitive tribe, living in the Nallamalai forests of Andhra Pradesh and Telangana, spread over the districts of Mahabubnagar, Kurnool, Prakasam, Nalgonda and Guntur. They are a conservative tribal group and have not made many changes in their lifestyle nor tried to adapt to modernity. The bow and arrow and a small knife is all the Chenchus possess to hunt and live.

Once they caught a group of more than fifty Bahalias (organized tiger poachers) from central India who had come for poaching the tigers and panthers organized by Delhi based organized poaching mafia. Considering their habit of moving and walking long distances with bow and arrow in the hilly terrain, the eco-development project unit assigned them sentry job of protecting the forest and gathering the information movement of people and wildlife. Since this has yielded good results, they have been employed with uniform on regular basis with jurisdictions and base camps.

Jungle Surakhshya Samiti: Wild Odisha, a conservation organization, initiated Forest Protection with Community Support Program in 1997. The organization promoted Community Forest Protection Communities where communities are sensitized and encouraged keep an active watch and promote forest conservation through regeneration of natural vegetation by way of plantation. The following forest protection committees were set up by 'Wild Odisha' in the revenue districts of Khurda and Nayagarh- 1. Maa Paschimari Panch Mauja Jungle Surakhshya Samiti, 2. Maa Jalanjali Jungle Surakhshya Samiti, 3. Maa Duarsuni Jungle Surakhshya Samiti.

Joint Patrolling by Armed forces: Barbara was a pristine Sal forest in Odisha. It was a prime tiger habitat. Over 108 species of birds, including some rare ones make Barbara their home. Teak plantations were taken up in this virgin Sal forests by the then foresters during the last century. Aggressive logging and hunting saw the end of the tiger from its habitat by 1970s. Subsequently, to guard the valuable teak and to

Chenchu guards in Nallamala engaged by forest dept.

recover the tiger, patrol camps were established at these remote areas with a permanent detachment of forest personnel and deployment of CRPF jawans in 1980s. Three years ago with the withdrawal of the CRPF, the government employed retired armed forces personnel to guard the timber. This is the only model of joint patrolling of armed personnel along with forest department.

Agro-Eco resilience

Sustainable farming, food security, biomass utilization are essential to aid the healing of the ecosystems in the region. Following is an observation by the GrACE team in Odisha where farm and forests co-exist. Farmers in Odisha have spared the Sal forest and planted paddy in the interspaces. Also the livestock is grazed in the area in non-planting seasons. This resilience is needed all over the region where poor farmers are in need of livelihood and food security. In many countries, this practice is popular where land is stressed between farms and forest interests. It is not new and is not a recent innovation. The practice dates back to many ancient civilizations, including Maya in Guatemala. The tribes planted many types of food and fibre crops, raised poultry, livestock, hunted, and gathered the food in their forest with frugality. Such practices are the need of the hour and must be adopted all over the hills. To maintain ecological integrity and regional agro-biodiversity of the Eastern Ghats, here are further insights...

Cultivation amid sal forest, Odisha

- *Discourage chemical and energy-intensive farming, phase out chemical such as pesticides, weedicides and fertilizers*
- *Prohibit cultivation on steep slopes and wherever possible promote perennial crops*
- *Incentivize carbon sequestration, enhancement of organic carbon in the soils, protection of traditional cultivars, breeds and species*
- *Avoid monoculture and promote mixed indigenous species and native herbal medicinal plants within the village lands*
- *Curtail Genetically Modified (GM) crops*

Promote best practices from various models such as permaculture, sustainable/ecological/organic farming agroforestry, precision agriculture, restoration farming and other successful models available world over.

Ecological Research & Monitoring Laboratory, Srisailam

Ecological Research and Monitoring laboratories / Biodiversity research center is to facilitate team of scientists from various disciplines. The center was established at Srisailam in Nallamalais in Andhra Pradesh. This center offers scope for an integrated research and investigation to meet the research needs of the entire Nallamalais. Integrated Research is an amalgam of the following studies: Biosystematics, Ethno-medico botanical studies, GIS based Bioinformatics and Biomatic studies, Ecological Economics, Bioprospecting, Eco-development Studies, Conservation Biology & Eco-technological Studies. As a Learning Center the lab is providing opportunity for the staff to be trained under various faculties that come for work in this center by organizing frequent trainings to various cadres of staff to update their knowledge and skills. A central hall is designed for this purpose with all training facilities. Training Programmes are conducted for the economic upliftment of tribals, systematic trainings have been conducting on various

livelihood programmes like apiculture, leaf plate making etc. The other activities include - Monitoring of tigers and other wild animals: Great Indian Bustard: All Taxa Biodiversity Inventory (ATBI) and monitoring: Operation Blackbuck (Translocation & monitoring of *Antilope cervicapra*): Operation Indian Star Tortoise (Repatriation of *Geochelone elegans*): Publishing all research findings in various national and international scientific journals, Seminar Proceeding & Newsletters.

Biodiversity Lab, Srisailam

Refilling a water tower, a Kenyan Success Story

The Aberdares Mountains is one of the five water towers in Kenya. Its watershed influences water security as far as 700 km downstream. The Tana River which originates in the Aberdares catchment, feeds the Nairobi city, the capital of country, and its hydropower meets the needs of half of the about Kenya's electricity supply. Nevertheless, the catchment suffered a loss of its green mantle from the clearing of forests for farming and harvesting. Green Belt Movement (GBM) an environmental organization contemplated to address the ecological imbalance and taken up intensive grassroots action around the Aberdares. GBM formed women's groups and 2,000 women here have established hundreds of nurseries from which about 1.5 million native, economically, ecologically significant tree seedlings were produced in a season. They planted these saplings on and around the mountains. As a result, dozens of dried up springs were rejuvenated while providing income, wood, fruit to the local women. Moreover, it has become an ecological education and model to emulate. Initiated in 1977, GBM

Ndakaini dam on Thika river is a lifeline to Nairobi city. Thika river gets it water from Aberdares mountain catchment

Catskills catchment, Newyork, USA

facilitated the planting of 51 million trees in Kenya, which includes three of the five major mountains of the country i.e., Mt. Kenya, the Aberdares, and the Mau Complex. GBMs arduous task in this mission is exemplary. GBM encouraged planting on private lands and public lands such as premises of religious groups, schools. In this pursuit, GBM also collaborated with Kenyan army to get support to access remote areas for planting and also planting on army lands.

Annapurna Conservation Area

The Annapurna Conservation Area (ACA) in Nepal is the country's largest 7,629 km^2 across the Annapurna range of the Himalayas falling into Manang, Mustang, Kaski, Myagdi, and Lamjung districts. The area spans in altitude from 790 mts to 8,091 mts at the summit of Annapurna I. A joint initiative by King Mahindra Trust for nature conservation and World Wildlife Fund, the ACA was established in 1985 and gazetted in 1992. The National Trust for Nature Conservation, a non-governmental organization is shouldered with its management.

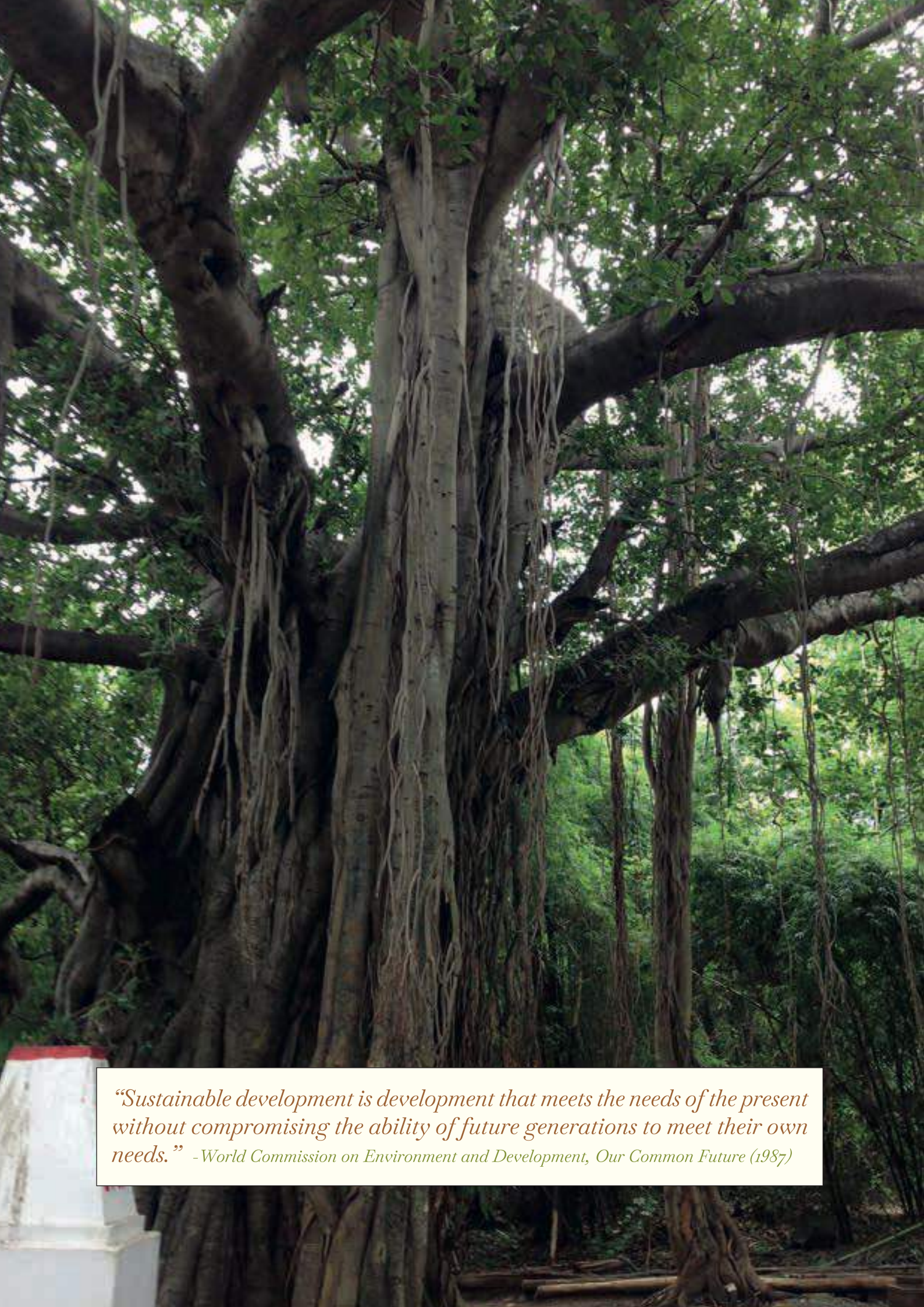
The area stands to be an example for an innovative nature preserve and for inclusive environmental management. Recognizing that there can be no meaningful conservation without the active involvement of the local population, ACA founders vested villagers with control over the natural resources of the area. The model is institutionalized with 57 Village Development Committees (VDCs) over five districts of ACA. The area is home to 100,000 inhabitants belonging to 10 ethnic groups. Saw the worst degradation in 1960-70's, the area was brought into conservation focus for last four decades. Locals are encouraged to use alternative energy sources and other conservation techniques to preserve and maintain the wilderness in their vicinity. The programme aims to stop tree felling, subsequent erosion and other side effects of environmental pressures.

Annapurna mountain ranges

The wilderness and its inhabitants benefit from conservation fee collected from trekkers and tourists. The fund directly goes to local inhabitants to manage the preserve. The money self supports the preserve and the locals and reduces the pressures on its ecology. In the initial phase, the project promoted kerosene as alternate to firewood. Alternative energy sources and fuel-efficient stoves are promoted to reduce the dependency on forest for wood. The project strives to create a model for co-operative spirit and community conservation projects.

Payment for Ecosystem Services (PES)

The valuable services that Eastern Ghats ecosystems provide are often compromised by poor land management which decreases or eliminates the value of the service. Since most landowners are not financially compensated for these services, they often make decisions that are not in the land's best interest. For example, when a person living in a mountain forest saves the trees that grow on land with steep slopes, the catchment, as well as the water that supplies communities lower down the mountain are protected. Additionally, soil erosion and the potential for a landslide to occur are prevented. unless the mountain forest-dweller is compensated for this act, it is often more profitable for them to cut the trees for fuelwood or timber or to make room for agriculture. Payment for Ecosystem Services (PES) can be a solution for addressing this problem by compensating the provider from the revenues made by charging those who benefit, while conserving. One of the important examples for PES is water supply to New York City. The Department for Environmental Protection of the city taken up a Watershed Protection Program in Catskills mountain catchment which provides water to 9 million people in the city. Residents and farmers of the catchment are incentivize and paid to protect the watershed and avoid diffuse pollution.



"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." - *World Commission on Environment and Development, Our Common Future (1987)*

United Nations Sustainable Development Goals

At a United Nations Sustainable Development Summit on 25 September 2015, more than 150 world leaders adopted the Sustainable Development Goals (SDGs). The summit followed 2030 Agenda for Sustainable Development. The new 17 goals and 169 associated targets, which follow and expand on the millennium development goals (MDGs), from January 2016 is a big leap from the eight global development goals and 18 associated targets of MDGs. SDGs demonstrate the scale and ambition of this universal development blueprint for the sustainable future of humanity on this planet with the aspirational pledge "that no one will be left behind".

Critically, they are defined as being "integrated and indivisible" and emphasize on balance of triple bottom-line environmental, social and economic. The preamble of the declaration reads "protect the planet from degradation, including through sustainable consumption and production, sustainably managing its natural resources and taking urgent action on climate change, so that it can support the needs of the present and future generations". This commitment is translated into 3 of the 17 goals that are specifically directed at the natural world:

Goal 13-Climate change: Take urgent action to combat climate change and its impacts.

Goal 14-Life below water: Conserve and sustainably use the oceans, seas and marine resources for sustainable development.

Goal 15-Life on land: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

Both Goals 14 and 15 have specific targets directed at reducing threats, securing ecosystem functions and services, and supporting the flows of benefits from biodiversity to people. Goal 15 concerns the state of biodiversity which says "Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species". Sustainable Development Goals aspire to take us towards 'the world we want' and the UN framed them as creating a "blueprint to achieve a better and more sustainable future for all"

Wooded slope in Nallamalai

Intent to Action - The Journey of GrACE

A few noteworthy activities of GrACE are mentioned below:

- Launching of GrACE at Srisailam on 5 June 2011
- Regional Convention on Eastern Ghats at Andhra University (Visakhapatnam), 19 November 2011
- Regional Convention on Eastern Ghats at Acharya Nagarjuna University (Guntur) 10 March 2012
- Regional Convention on Eastern Ghats at SRM University (Chennai) 30 July 2012
- National Conference on Conservation of Eastern Ghats at Sri Venkateshwara University, (Tirupati), 4 & 5 December 2014
- National Conference on Conservation of Eastern Ghats at Utkal University (Bhubaneswar), 16 & 17 April 2016
- Eastern Ghats Expedition (2-9 September 2017 & 18 -25 September 2017)
- Eastern Ghats Environment Outlook-2019

Greens' Alliance for Conservation of Eastern Ghats (GrACE) came into existence with the sole purpose of conserving the Eastern Ghats which cover an area close to 1700 kilometers, ranging from regions bordering West Bengal and running through the states of Odisha, Andhra Pradesh and Telangana to the areas bordering the states of Tamil Nadu and Karnataka.

To the question, "what can be done to benefit society at large?" by a senior couple who wanted to commit themselves to a great worthy cause, an environmentalist gave direction and command to an activity that has lasted a decade, laying a firm foundation for a movement the results of which may perhaps last at least a hundred years. This cause was 'the rejuvenation of degraded ecosystems by planting trees'. Intent translated into action and within months the task of planting a lakh of trees was completed, followed by another ten lakh trees being planted… this way the objective moved forward in order to accomplish planting of 10 million saplings. This cause is now continuing uninterrupted.

The birth of CGR

Many like-minded individuals from different walks of life have joined since then and supported the cause. Among them were those who had already done substantial work in several related fields and left a mark of their own, and those who gained recognition in their specialized fields came forward to commit to this stupendous task. With this in view, an association by the name 'Council for Green Revolution' (CGR) was launched and started to gradually pick up strength.

Now CGR has spread its branches wide and this movement is ceaselessly persisting in its goal of not only planting trees in large numbers but also helping them to survive. There arose this thought that there could be a broader benefit if schools, especially school students were associated with this movement. Just as CGR worked on green saplings embedded in Earth's layers … involving children meant that strong ideas about conservation of environment would be planted in young minds … the project would prove doubly beneficial. Intent translated into action as CGR coordinated with organizations such as Vandemataram Foundation which was already associated with government schools in imparting value-based education. The response being good, the movement has since been gaining in strength, gradually expanding its activities across thirteen districts of erstwhile Andhra Pradesh. It engaged in looking for persons interested in extending support for its project, ready its project plan, plant trees, examine and improve their rate of sustenance under proper care … the activities kept going on unhindered.

But, does this alone suffice? Environmental conservation means a huge task on hand! An objective multi-faceted in nature! Is it enough to confine our movement to one aspect, that of planting trees alone? If not, then what next?! This was the question that kept demanding attention ever so often. While recognizing that this alone was not enough, CGR undertook programs such as expanding awareness against the use of plastic, programs to safeguard water bodies such as tanks, organizing meetings for conservation of water; all these helped to broaden the scope of our activity. Even so, a vague feeling of inadequacy remained!

It was during a monthly review meeting and discussion about what better could be done towards environmental conservation that a novel proposal surfaced. A proposal that 'a movement could be launched to safeguard and conserve the 1700 kilometer stretch of the Eastern Ghats'. While this suggestion appealed to everyone, a doubt persisted. As an NGO was it feasible for CGR to undertake this mammoth task of preservation of the environment of the Eastern Ghats and start a movement for it? That we may encounter many a hurdle and limitations in our path to the realization of this goal came up for discussion. Despite these doubts and uncertainty, CGR arrived at a unanimous decision that anything could be achieved so long as the cause before it was worthy of consideration and started with commitment.

The birth of GrACE

The Eastern Ghats are a treasure house of unlimited forest wealth, medicinal plants and herbs, mineral wealth and other natural resources, variety of life forms, life-sustaining rivers, spiritual centers etc.,. However, exploitation by the greedy, unimpeded plunder, negligence of successive governments, inadequate planning, absence of vigilance and

control; the Eastern Ghats have in recent times been witness to a depletion of their rich natural resources and the loss has been enormous year after year. To counter this effectively CGR came upon the idea of sensitizing people to this loss of natural resources, to awaken the need for preservation of natural wealth not only for the present generation but also for generations to come! Moreover, governments have to be reminded of their responsibility.

The task ahead was clear - all those interested in this cause have to be brought together under one umbrella to form one unified force. In short, the pressing need is to protect the Eastern Ghats. How far can CGR as an NGO take this mission on its shoulders? What role do we all have in this? The discussion went in different directions. In the end, it was decided that something needed to be done even if in small measures. To this end, CGR arrived at a major decision to conduct a conference on the issue on a large scale and announce a work plan toward preservation of the Eastern Ghats. As a result, World Environment Day, i.e. June 5, 2011 was selected as the day for the conference. The conference took place successfully in the midst of the Eastern Ghats in Srisialam, a pilgrim center in Nallamala forest area. A common platform took shape under the aegis of CGR in the presence of state ministers and Chairman of Human Rights Commission and other dignitaries. The conference began soon after inaugurating a plastic-free clean town of Srisailam followed by planting of trees in the temple town and taking out a rally. But the day before, everyone engaged in exercising their minds to determine what platform could be erected to undertake the implementation of the work plan, and under what name should the organization function and such other issues. All key members brought their heads together in this exercise! We cannot possibly undertake all activities! There are too many pressing issues concerning the Ghats that were begging for attention.

Without harboring too high ambitions to take up all issues in one go, we decided to launch and offer a common platform to organizations already working in other regional centers on environmental issues as well as to those intending to take up such programs in future. Another proposal was to bring together all those people, collate their activities and work to bring the conference to a rational end; and have a common platform to begin with and conduct initiation programs for a common purpose. People needed to be educated on the Eastern Ghats, of the immense natural wealth available, and the benefits accruing from it to society. And sensitize people to the immeasurable loss caused by plundering that wealth in a haphazard meaningless manner. At this juncture various suggestions on the name to be given to this new platform came up. In the end, the title 'Greens Alliance for Conservation of Eastern Ghats' (GrACE) was chosen. The next morning GrACE began its activities from that platform in Srisailam.

Our journey begins

In a systematic manner, GrACE set down to working on its activities. Just as the mission of planting green trees was instilled in the minds of the young in schools by CGR, so also the activities of GrACE began from universities. There already existed details of some work done by organizations and persons in the areas covering Eastern Ghats. Their work needed to be recognized and an encouraging atmosphere to pursue further work was needed. Besides this there is also work undertaken by various universities in the departments of environment and biosciences by their research scholars. GrACE came upon the idea that the new generation of students need to gain deeper and wider understanding of the rich natural resources of the Eastern Ghats. With this in mind, it was decided to conduct all initial programs of GrACE in collaboration with universities. The idea was to turn those universities into platforms and invite those locals who already worked in the area to the meetings and thereby broaden the purview of GrACE. This was envisaged as this step would vastly help our strategy of planting the idea of conservation of the Eastern Ghats strongly in the minds of students, teachers and others.

We involved many people representing different departments and leading personalities as guests, hence even the media gave wide coverage to the proceedings as an event of prominence. That the matter would attract wider public attention, thereby awaken among people an awareness on the subject was the long-held objective. The first regional meeting of GrACE was conducted in Visakhapatnam with the historical Andhra University as the venue in November, 2011, with a central minister as chief guest. Consequently, the objective of expanding knowledge about the Eastern Ghats by involving teaching and non-teaching staff and students, besides giving publicity to the matter through media by involving influential role models met with success. Having received encouraging response, within a

few months another meeting was organized at Palamur University. Keeping the tenor, the next regional meeting was held at Nagarjuna University in Guntur with state minister as guest. In Venkateswara University at Tirupathi with the Chairman of Andhra Pradesh Legislative Council as chief guest, the Tamil Nadu Governor as chief guest in SRM University in Chennai, and the Governor of Odisha as chief guest in Utkal University at Bubhaneshwar, three regional meetings were held in succession. The Tirupathi and Bubhaneshwar meetings were held over two-days with multiple sessions. Experts, professors, research scholars, committed activists and other enthusiasts presented over 300 papers covering different aspects related to plant, forest, medicinal, mineral and diverse life forms and other natural resources in the Eastern Ghats. Discussions followed all presentations concerning the subject. The regional meetings attracted wide coverage in the media. Eminent activists such as Shri M.C. Mehta an advocate at the Supreme Court of India participated in GrACE meetings. The National Conference at Bubhaneshwar even saw the announcement of the momentous 'Bubhaneshwar Declaration' with important demands incorporated in it.

One other creditable activity in which GrACE played a key role right from its inception was to propagate the idea of 'Green Agenda'. By sending an open appeal to all political parties before the general elections of 2014, GrACE brought Green Agenda to the fore. By sending such open appeals about 'Green Agenda' to all leading political parties such as the Bharatiya Janata Party, Congress and Communists, GrACE demanded of them to include 'Green Agenda' in their respective election manifestoes. Holding a press meet in the country's capital New Delhi, GraCE made an open demand to all political parties. Copies of the demand to include 'Green Agenda' were also sent to key regional political parties such as Telugu Desam and Telangana Rashtra Samithi appealing to them through press meets. Multi-pronged programs related to GrACE are continuing to be held. In the initial years GrACE concentrated its attention on an in-depth understanding of the project through organizing seminars, conferences, media and press meets, rallies etc. to broaden its grasp on the subject. Bringing out brochures, pamphlets, publication of books not only aided the common public to gain knowledge but also helped this cause gain wide publicity. Along with this, certain creative literature too was generated. Many a program was taken up for publicity which brought in intellectuals as stakeholders Going a step further, to give knowledge-based involvement a fillip, besides putting up wall posters and hoardings, release of songs and lectures, it also added an audio-video projection through release of CDs and cassettes. A network comprising teachers, intellectuals and others, institutions, activist-volunteers, media, legislative bodies and officials too was visualized. Through a comprehensive database, GrACE brought out a directory carrying details about all of them. It is still continuing to organize programs wherever possible, involving public institutions and common citizenry.

The aim of GrACE is to move forward while still organizing programs at various levels for sustaining a long-lasting stable progress in the cause of conservation of the Eastern Ghats. Staying close to the parent organization 'Council for Green Revolution' (CGR), GrACE is working for extensive environmental conservation and organizing programs while remaining focused on key issues. In its nine year journey, GrACE has successfully contributed in raising awareness and understanding of the Eastern Ghats at various levels by bringing the discussions into the limelight at regional, state and national platforms. At times it has even pushed for decisions to be taken at the level of legislation. While laying stress on preparing the states and the nation on 'Sustainable Development Goals' of UN, GrACE shared responsibility in the National Green Tribunal, emphasizing the need for conserving the Eastern Ghats. On similar lines another combined state level conference was held at Ambedkar Open University in Hyderabad, the Chairman also organized a national conference in the nation's capital New Delhi. The conference was attended by the Chief Justice of India, another Supreme Court judge with the Chairman of NGT as Chief Guest. The conference saw youth attend in large numbers and receive a significant message. In the process of preparing for Sustainable Development Goals of UN, GrACE organized many seminars and conferences long before Neeti Aayog did.

Our efforts are bearing fruit

From the beginning, GrACE has been voicing its concern that in comparison to the Western Ghats, the Central government has not been giving prime focus to conservation of the Eastern Ghats and the respective state governments too have been ignoring its importance. It has to be said that the efforts of GrACE have borne fruit to a certain extent. At long last, GrACE has finally elicited a positive response from the Central government. The government

which failed to make any official announcement or mention the issue of the Eastern Ghats in the release of any document after the announcement of the National Forest Policy of 1988, after close to six years of unceasing efforts of GrACE, in 2016, made a mention of the Eastern Ghats in its National Forest Policy, underscoring the need for protecting the forest wealth of the Ghats. GrACE received this development with much thankfulness that its intent translated into action and efforts have at least borne this much result and this in itself was a positive sign of encouragement to keep our efforts moving forward. Legislative and security measures promulgated through laws, imposition of fixed governmental controls are the urgent need of the hour. GrACE has been repeatedly emphasizing this fact on every occasion. To some extent, GrACE brought this to the fore front in its Bhubaneshwar declaration. GrACE has been for some time now mulling over bringing together all the MPs representing the states wherein the Eastern Ghats are spread to conduct a national conference. The idea and aim is to highlight the severity of the problem at the highest level, present the problem to the MPs, thereby influence the Central government to take key decisions! Before putting this to practice, GrACE decided to undertake a tour of the Ghats to take a comprehensive view of all its aspects. Almost all members who had been actively involved in the movement had earlier travelled through the Ghats and examined them in their various aspects and recorded their study experience! Even so, it was decided to tour the Ghats once again afresh as a study team to look into their natural resource conditions, latest bio-diversity, living conditions of the tribal communities and study in depth all aspects that come to the fore from various angles, observe from close the positive measures followed, and make a note of the negative and disadvantageous methods and practices adopted that result in enormous loss. The idea was to hold direct talks with those who caused this depletion of natural resources, those affected by the degradation, and other influential persons who could impact the environment; and maintain a record of them all, a record in the form of photographs and videos. It was resolved to prepare a detailed report reflecting the actual conditions prevailing in the Eastern Ghats. To this end, two ten-member study teams were constituted for the purpose of touring the Ghats. First, the teams inspected the Ghats south of the Godavari for nine days. For another nine days, the team of experts covered the areas north of the Godavari and gathered necessary information. This way the teams studied the latest conditions prevailing in the Eastern Ghats. They interacted with the stakeholders and examined the work of various bodies and recorded the findings in an exhaustive report.

Jackfruit, one of the major produce from Northern Eastern Ghats

National Conference on Conservation of Eastern Ghats, at Utkal University, Bhubaneshwar, Odisha on 16th & 17th April 2016

Eastern Ghats in the state of Odisha occupy a centre stage in ecological, economic and socio-cultural development of the state. In view of the significance of the Eastern Ghats in the state of Odisha, this conference was organized jointly with Utkal University, Bhubaneswar. The themes of the conference were: Eastern Ghats ecosystems, Biodiversity and conservation, Sustainable management of natural resources, Indigenous communities, Role of civil society, Legal, policy and designing a governance framework for the Eastern Ghats. 12 guest speakers spoke in 6 technical sessions and around 50 papers were presented in the conference with good scientific interactions.

The two-day national conference on Eastern Ghats was organized at Utkal University, Bhubaneswar, with purposeful deliberations and lectures. The inaugural session was addressed by Hon'ble Governor of Odisha, Sri S C Jamir, followed by messages and insights from eminent personalities - Padmashri Prof P. Mohanthy Hejmadi, Former Vice Chancellor, Sambalpur University, Prof. A.K. Das, Vice Chancellor, Utkal University, Prof. K. Purushotham Reddy, Eminent Environmentalist, Sri. R. Dileep Reddy, Chairman – GrACE, Former State Information Commissioner (RTI-A)AP, Sri. K. Laxma Reddy, Founder, Council for Green Revolution, Hyderabad, Prof. (Mrs.) P.K. Mahapatra, Organizing Convener, Utkal University, Dr. Gunanidhi Sahoo, Organizing Secretary, Utkal University.

The Chief Guest Sri SC Jamir, Hon'ble Governor of Odisha, in his inaugural speech felt that the conservation of the ecosystems in the Eastern Ghats is a gigantic task. Although the activists, academicians, NGOs and Government departments must join hands in this noble task, the natural heritage is under tremendous pressure due to population growth. He also felt that the conservation of the Eastern Ghats is an essential agenda for governments and people to secure human life in the region. "I appreciate Dept. of Zoology. Utkal University, GrACE and CGR's efforts. The conference will pave a new pathway for environmental protection and sustainable development of our country".

Padmashri Prof P. Mohanthy Hejmadi, briefed on the biotic richness of the hill ranges and felt that there must be rigorous scientific efforts and encouragement to scientists. Prof. AK Das, VC, Utkal University emphasized research-based grassroots work as the solutions to the problem. Sri. R. Dileep Reddy, briefed on the emergence and endeavor of GrACE.

Smt. Leela Laxma Reddy expressed concern that we all have to take every bit of effort to save this living planet Earth. She felt that the Eastern Ghats hill range is one of the precious gifts of mother nature and we all have to save it.

Prof. K. Purushotham Reddy gave insights and necessary steps to protect these rich natural hill ranges. He suggested that our central government and policymakers should create a National Trusteeship Council (NTC) to facilitate protection of ecosystems like forests, mountains, rivers, coastline, grasslands, wilderness areas etc.,

A Bhubaneswar declaration was released with a charter of demands for the conservation of the hills ranges.

Poster presentations at the conference

Inaugural of the conference

A green rally on the second day of the conference

The green soldiers at University, after the conference

Bhubaneswar Declaration

We had deliberations for two days on Eastern Ghats – its ecology and status. A number of papers by erudite and committed scholars from different Universities and institutions provided lot of information and increased awareness. Based on these presentations, deliberations, and generated knowledge, we commit ourselves to the following:

1. We are deeply concerned about threats and challenges to the floral and faunal elements and biogeographic significance of Eastern Ghats, including the problems being faced by adivasis and the struggles of traditional communities.
2. Sadly, we note that already several species are lost and loss of biodiversity is now a continuous phenomenon.
3. We strongly feel that people, governments and civil society, in each of the States, Indian government and international institutions to come together and take up actions and programmes that are aimed at conserving pristine ecology of Eastern Ghats.
4. We realize that modern development, privatization of natural resources, developmental projects, including mining, urbanization, industrialization, in the past, now and in future, have the potential to destroy Eastern Ghats. We need to review all development projects in this region.
5. We call upon national government and State governments of Odisha, Andhra Pradesh, Tamilnadu, Telangana, Kerala and Chhattisgarh to prepare an action plan for protection and conservation of ecology and natural resources of Eastern Ghats.
6. We feel there is need to form a Research Network of Universities, that are in Eastern Ghats region, and also working on issues and challenges of Eastern Ghats, including ecology, development and biodiversity. This Research Network, with committed funds from national and State governments, should support primary research, workshop, information exchange and capacity building programmes, with objective of developing a database of information on ecology and development, and building ideas and knowledge.
7. We request the National Government to develop a National Legal Framework for Eastern Ghats, including Acts, Statutes, procedures and policies, with the objective of going beyond the current Protected Areas (PA) approach.
8. We demand the Government of India to form a Regional Coordination Committee of States on Eastern Ghats. This Committee should have the mandate of linking and coordinating activities relating to Eastern Ghats.
9. We call upon civil society, related to adivasis and social communities, to form a grand alliance to bring together knowledge and action on Eastern Ghats.
10. We request the Union Minister for Environment to form an experts' panel to review social, ecological, economic and political contexts of Eastern Ghats, to develop a report that provides suggestions and recommendations for Eastern Ghats protection. This should be on the lines of Madhav Gadgil report on Western Ghats.
11. We request the government to develop a Natural History Museum network, to show case wide variety flora, fauna and ecology of Eastern Ghats.
12. We need to establish a Youth Scholarship Fund, to promote nature camps, awareness programmes and research work, for the young girls and boys.
13. We need promotion of ecological agriculture, water and soil conservation in upland reaches of Eastern Ghats. Rivers, streams and waterfalls in Eastern Ghats have to be protected, and minimum water flows are ensured.
14. Pollution has to be prevented, and urban, industrial and household toxic waste has to be reduced through changes in consumption, recycling and reuse.
15. We appeal to central government and policymakers to create National Trusteeship Council (NTC) on the lines of UN Trusteeship Council for protection and restoration of common property resources like forests, grasslands, wilderness areas, mountains, rivers, coastal marine ecosystem, islands, oceans etc. NTC thus created should ensure restoration of damaged ecosystems, to pass on the same to the future generations.
16. We also appeal for *Special conservation status to Eastern Ghats on par with Western Ghats and Eastern Himalayas; To create Autonomous Eastern Ghats Protection Authority; To persuade UNO to declare Eastern Ghats as World Natural Heritage Site.*

National Conference on Conservation of Eastern Ghats at Sri Venkateswara University, Tirupathi, Andhra Pradesh on 04th & 05th December 2014

Tirpuathi is a holy town in the foothills of Sheshachalam ranges which are part of southern Eastern Ghats in southern Andhra Pradesh. The ecosystems are declared as Seshachalam Biosphere reserves by Man and Biosphere programme of UNESCO to create resilience and restore symbiotic relationship between man and nature.

The conference was organized during 04th & 05th December 2014 in association with Botany department of Sri Venkateswara University to have better comprehension of the threats and vulnerabilities to Sheshachalam hills and other parts of Eastern Ghats.

The conference was inaugurated by Dr. A. Chakrapani, Chairman, AP Legislative Council. The participation was overwhelming and the auditorium was packed to the full to listen to world-famous personalities on the subject of environment. The huge gathering was addressed by MC Mehta, Magsaysay awardee, Prof. K. Purushotham Reddy, eminent environmentalist, Smt. Leela Laxma Reddy, President CGR, R. Dileep Reddy, Chairman GrACE and Prof. W. Rajendra, vice-chancellor of SV University. A souvenir of abstracts and a book on the inventory of the flora of Chittoor were released by the guests.

The conference received about 100 papers and technical sessions and many researchers and academicians presented their papers in five thematic areas. The presentations revealed the wealth of and threats to the ecosystems which will help in drawing appropriate solutions for the protection of the Eastern Ghats.

Release of souvenir in the inaugural of the conference

Eminent scientists and academicians were part of the technical sessions. With a huge number of students, environmental activists, NGOs and policy makers it was a lively confluence of ideas and ideals for the common cause of nature and its preservation in Sheshachalam and other ranges in the Eastern Ghats. A souvenir was released and a book on flora of Chittoor was also released on the occasion by the dignitaries in the inaugural.

A green rally on the 2nd day of the conference

A massive Green Rally of about 4 km was organized in Tirupathi town from Govidarajulaswamy temple to SV Campus. Hundreds of NCC and NSS cadets, conference participants, local and university officials and students took part in the rally. Prof. L. Venugopal Reddy, Chairman, AP State Higher Education Council gave a valedictory message at the closing of the conference and he wished success to the noble cause. Sri Manoranjan Banja, IFS felt the need for a firm action plan.

About 3000 participants were present in the inaugural of the conference

Regional Convention on Eastern Ghats - 30 July 2012, at SRM University, Chennai, Tamil Nadu

GrACE organized a regional convention on the Eastern Ghats at SRM University, Chennai on 30 July 2012. Dr. K. Rosaiah, former Governor, Tamil Nadu, has inaugurated the convention. He said that the human responsibility should be promoted for the cause of the preservation of the nature and healthy environment.

Other dignitaries present were Dr. T. Pachamuthu, Chancellor, Sri C.V. Shankar, IAS, MoEF, Tamil Nadu, Sri P. Bala Krishna, National Biodiversity Authority, Chennai, Dr. M Vairamani, Dr. R. Annadurai, Dr. W. Richard Thilagaraj., Faculty, and students were present in the convention.

Prof. B. Raviprasad Rao addressing the participants

Sri. K. Rosaiah, Hon'ble Governor, Tamil Nadu, addressing the convention

Regional Convention On Eastern Ghats 10 March 2012, Acharya Nagarjuna University, Guntur, AP

The second regional convention on Eastern Ghats by GrACE was organized in association with Dept. of Environmental Science Acharya Nagarjuna University, Guntur, on Andhra Pradesh on 10 March 2012. The program was inaugurated by Sri Dokka ManikyaVara Prasad, Minister of Rural Development., The Chief Guest and other guests emphasized the very responsibility of all citizens in protecting the invaluable natural wealth of the region.

Sri Kakumanu Peda Peri Reddy, Former Chairman, Human Rights Commission, Andhra Pradesh, Dr. R. Hampaiah, Chairman, A.P. State Biodiversity Board, Sri M. Samuel, IAS, Sri V Kamal Vardan Rao, IAS, Chairman Tobacco Board, Guntur, Chelikani Seetha Ramaiah, Environmentalist Guntur, Prof. K. Viyyanna Rao, Prof. G. Prasad Rao, Prof. Z. Vishnu Vardan, Prof. N. Vijaya Ratnam, have graced and supported the convention. Students, researchers, activists, academicians, media, policymakers and several others participated in the convention.

Release of Akshara Vrukshalu book by the dignitaries

Sri. Dokka Manikya Vara Prasad, Minister, AP, addressing the convention

Regional Convention on Eastern Ghats, 19 November 2011, Andhra University, Visakhapatnam, AP

GrACE organized a convention on Eastern Ghats at Andhra University, Visakhapatnam on 19th November 2011. Smt. Purandeshwari, Union Minister inaugurated the programme and emphasized the role of concerted human efforts for safeguarding vital ecological wealth. Sri Shatrucharla Vijayarama Raju, Minister, Andhra Pradesh, Prof. T. Shivaji Rao, Environmentalist, Andhra Pradesh, Dr. Sadashivaiah, Asst. Prof. Dept. of Botany, Palamuru University, Dr. Razia Sultana, EPTRI, Prof. PVGD Prasad Reddy, Prof. Udaya Bhaskar Reddy, Prof. T. Bairagi Reddy, Prof K. Kameshwara Rao, Prof. Rajashekar, Prof. V. Subramaniyam, Prof. D.S. Prakasa Rao, Dr. N. Srinivas, GITAM University, Visakhapatnam and GrACE members were present at the convention. Faculty, researchers and students participated. Mr. P.V.G.D.Prasad Reddy , Rector, Andhra University welcomed the gathering. Smt. Leela Laxma Reddy, Patron-GrACE, President, Council for Green Revolution; Mr.R. Dileep Reddy, Chairman-GrACE, former Right to Information Commissioner addressed the inaugural session and eminent environmentalists Prof. T. Shivaji Rao and Prof. K. Purushotham Reddy, delivered their messages in the inaugural session. Sri. Mohan. V. Srinivas, Convener, Regional convention- Visakhapatnam, gave the vote of thanks.

The Convention and the two parallel technical sessions were held at the Seminar hall-1, Platinum Jubilee Guest House, Andhra university Campus and Sri. EAS Sharma, IAS (Retd), Forum for Better Vishaka chaired the first technical session on Status of Eastern Ghats Today. Eminent Environmentalist Prof.Shivaji Rao, GITAM university; Dr. Thulsi Rao, Dy.Conservator of Forest (Retd), Biodiversity conservation expert; Dr.N.Sai Bhaskar Reddy, CEO- GEO; Mr.B.T.Govind Reddy, Sr.Journalist, Miss. Md.Naziya Thabassum, M.sc Environmental Science student, spoke on the topic Status of Eastern Ghats Today and encouraged the initiative.

Prof. Udayabhaskar Reddy, HoD, Envi. Sciences, AU, chaired the 2nd technical session on Policy Options to Protect Eastern Ghats. Environmentalist Prof. K. Purushotham Reddy; Prof. D. Praksah Rao, College of Law AU; Mr. Prabhat Swain, EPTRI, spoke on Policy Options to Protect Eastern Ghats and encouraged the initiative.

Sri.J.Bapu Reddy, IAS (Retd) chaired the valedictory function and Sri.Lav Agarwal, IAS, Distict Magistrate & Collector - Visakhapatnam delivered the key note address.

Several scholars, academicians, conversationalists and representatives of the line departments of the respective State and Central Governments participated in the Convention. Throughout the day the venue was lively with huge number of academicians, scientists, activists, policy makers and students from Andhra University.

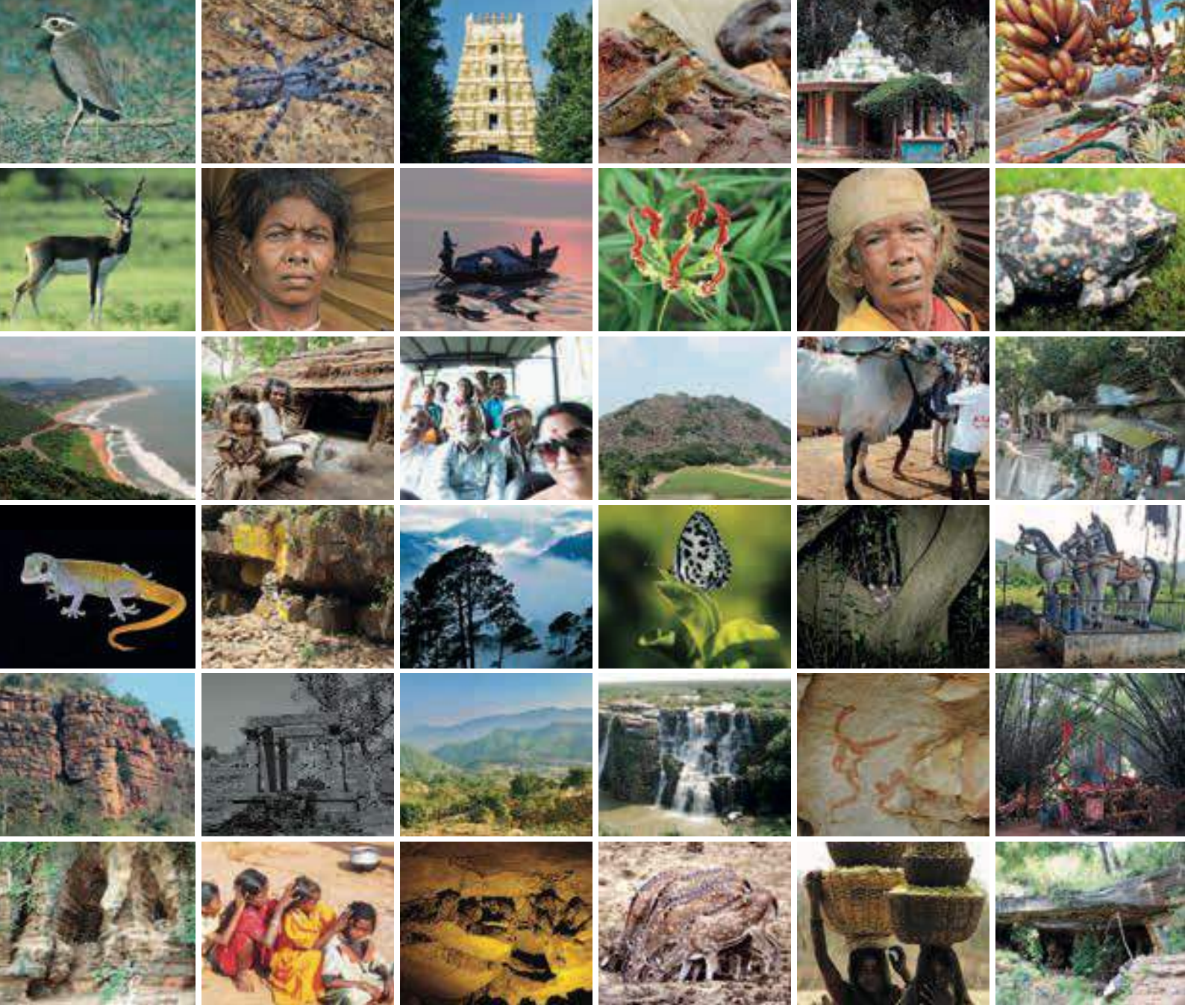
GrACE chairman Sri R. Dileep Reddy spelt out GrACE action plan to carry forward the mission with regional conventions at Tirupati, Khammam, Guntur, one in Odisha and Tamilnadu. The convention has come up with a "Vizag Statement" with a charter determined to conserve the Eastern Ghats.

Lighting the lamp by Prof. T. Shivaji Rao and Smt. Purandeswari at the convention

Launching of GrACE

Launching of GrACE
5th June 2011, Srisailam, Kurnool district, AP

GrACE was launched on 5th June 2011 at Nallamalai in Srisailam, the middle ranges of Eastern Ghats. The program was launched by Justice B. Subashin Reddy, former Chairman, State Human Rights Commission. He said that the preservation of a wholesome environment is a vital part of human rights. The program was organized in association with Srisailam Devastanam, Forest Department. A Green Rally was followed by plantation of saplings in the park. This was attended by Dr. Mishra, PCCF, Dr. Thulsi Rao, Project Director and other forest officials, Sri Immidisetty Koteswar Rao, Chairman and EO Srisailam Devasthanam, and their staff were present on the occasion.



Greens' Alliance for Conservation of Eastern Ghats (GrACE) was founded on 5th June 2011 by Council for Green Revolution, Hyderabad based environmental organization. GrACE was envisaged to provide an ideal platform for the protection of the ecosystems and natural heritage of fragile Eastern Ghats hill ranges which are undergoing an unprecedented degradation. GrACE mission so far include two national conferences, three regional conventions, a conservation expedition and brought out this outlook publication.

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