

Indian Regional Association for Landscape Ecology

# PANORAMA

IRALE NEWS # 8 · JANUARY 2022

Photo: Shariq Nawaz, Jell

## In Focus: Western Ghats

AMRITA NEELAKANTAN | NETWORK FOR CONSERVING CENTRAL INDIA

**Introduction:** The Western Ghats are older than the Himalayas and represent a geomorphic unit of immense importance with unique diversity, biophysical characteristics and ecological functioning. The chain of mountains runs parallel to India's western coast and are around 30 to 50 kilometres inland spanning states such as Tamil Nadu, Kerala, Karnataka, Maharashtra, Goa and Gujarat. From high montane forests influencing the Indian monsoon (rain giver to much of the Indian subcontinent's agrarian humanity) to lowland forests, the region is known as one of the world's biodiversity hotspots. These Ghats are home to more than 325 globally threatened biodiversity and are increasingly human dominated, but provide some great examples of how consistent and scientific conservation attention can result in truly well-managed bio-cultural landscapes.

**Biodiversity:** The Western Ghats has an exceptionally high level of the biological diversity and endemism. It has some of the best representation of non-equatorial tropical evergreen forests across the whole planet. Strange and uniquely suited to their microhabitat creatures abound – from burrowing frogs to resplendent avian diversity alongside megafauna like tigers and elephants. This amazing diversity of natural life is through high speciation as a result of the geographic complexity as well as moisture and temperature gradients within the region. Notable among the multitudes of species that call the western Ghats home are the Nilgiri tahr, the lion tailed macaque, etc..

**People:** Feel the names of the peoples of the western Ghats – Badaga, Irula, Kota, Kurumba, Nayaka and Toda. These guardians of ancient knowledge are woven into the well-being of these lands and their forests. They remain woven with each other and live the way nature intended – in webs of interdependence and care for each other and their world. The communities have traditionally relied on one another for different goods and services in complex social-dynamics, from trading cloth for music during funeral rights and thatching or carpentry. These associations are alive and well even today with weavers trading with honey collectors or those in the know of traditional medicine. While living in more modern landscapes than before, traditions of tattoos, polygamy and absence of casteism can still be found within these communities.

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Photo: Ramesh Krishnamurthy

**Nature-People Interface:** People and nature are coexisting in the western Ghats in ancient ways and engage in modern paths forward. With more than 39 areas with some form of wildlife protection, the whole region is a world heritage site. Spice, coffee and tea plantations as well as agriculture matrix surround these mega diverse forests. IRALE members and readers of this newsletter will be thrilled to hear that while facing multiple alarming threats (habitat loss, connectivity barriers due to infrastructure), the western Ghats is also a region of continued coexistence over millennia. Be it the well-known spice plantations that pre-date the industrial revolution (yes! before a single steam engine was built) or the latest in conservation consortiums that are led (in a gratifying change of the usual case) indigenous peoples of the region. Some of India's best known scientific minds work alongside some of the strongest (with high levels of agency) indigenous communities to continue to keep the western Ghats intact. The region was and remains one where humans conduct their lives (agriculture, trade, wars, setting up multiple kingdoms) in and around some of the world's most diverse forests.

Do check out these beautiful tales and efforts (they are just the tip of a western Ghat mountain among all the exciting work that takes place in the region):

1. [Coexistence Consortium](#)
2. [Project Dhvani](#)
3. [Lantana Elephants Art-Awareness Campaign](#)
4. [This immersive audio-visual tale that takes you into the heart of how myths are born and reborn in the western ghats.](#)

We hope you enjoy this curated selection and it gives you a glimpse into the fact that whatever your interests the Western Ghats will not disappoint.

*“IRALE wishes everyone Happy New Year 2022 and hope our journey together will advance the Science and Management of our Landscapes ”*

*- IRALE Executive Committee*

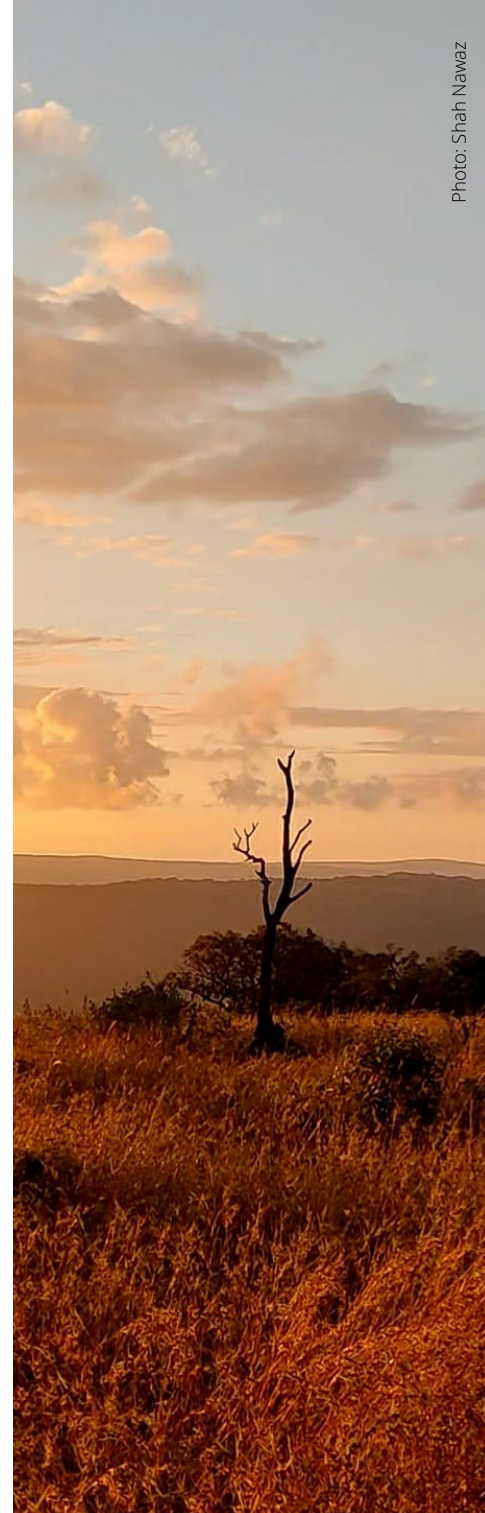


Photo: Shah Nawaz



Photo: Vidyadhar Atkore

## Importance of Scale in Studying Stream Fish Communities

VIDYADHAR ATKORE

SÁLIM ALI CENTRE FOR ORNITHOLOGY AND NATURAL HISTORY (SACON)

I began my academic research by studying stream fish communities in and around Corbett Tiger Reserve in 2005. I was fascinated by shallow and wadable streams of Shivalik Himalayas. Back then I wasn't sure what a small stream and big river is. I was passionate to walk along every possible bend and curve that each stream provided me. I was interested in understanding and mapping the stream fish community structure. With the help of GIS tools, I chose three streams for comparing fish fauna. Khoh, Kolhu and Mandal were three small to medium sized tributaries of river Ramganga. I enjoyed sampling these streams more than anything else during my fieldwork. I slowly understood what each stream habitat actually meant and how to distinguish one stream habitat from another. And it all depends upon the scale at which you investigate and you analyse your data. I learnt that to understand fine scale differences in fish assemblages with respect to stream habitat and water quality parameters, I had to only analyse data at stream segment or habitat level. On the other hand, to understand the large scale differences between fish diversity and their environmental covariates, I had to rely on either stream size (stream order) or sub-basin (river catchment).

For instance, the stream habitats mentioned in the research paper were run, riffle, pool and cascades which first time appeared very abstract. When I started my field sampling, I realized how each of these habitats were different and yielded somewhat similar but different fish assemblages. During my six-month fieldwork, I sampled around 104 stream segments across three stream orders and found total 45 fish species with 12000 individuals! I also observed that these stream habitats were extremely altered due to illegal and harmful activities such as dynamiting, pollution and sand-boulder mining.

While I stumbled upon run habitat (a small stretch of stream ~50-100 m having a gentle to moderate flow and encompass homogenous stream substratum without any turbulence), I observed that many fry and fingerlings of *Barilius*, *Salmostoma*, *Tor* spp were happily playing in the shallow stream substratum. Initial attempts were failed to capture them using castnet – a traditional fishing method originated in India and later got accepted worldwide to capture fishes for subsistence as well as for ecological sampling. It is one of the most non-invasive fishing method. If one operated carefully, there would be minimal fish mortality as against other harmful fishing methods such as gillnet or electrofishing which severely alter not only stream fish population but also stream benthic macroinvertebrates on which many stream fishes survive.



Photo: Vidyadhar Atkore

Cascade



Pool



Photo: Vidyadhar Atkore

At riffle habitat (a stream stretch of ~50-100m, with moderate to high turbulence due to submergence of stream substrate composition) would yield interesting fish species. Often I was able to capture *Salmostoma* spp and *Barilius* spp. Morphologically these species have upward mouth, an adaptation to slow to fast flowing water with higher dissolved oxygen concentration, hence these fishes can be easily classified into Surface dwelling fishes. This shows their high affinity towards the rich dissolved oxygenated water. On the other hand, pool habitat (a stream stretch ~50-100m, either shallow (0.1-1m) or deep (>1m) water) would often yield two kinds of fishes. One with mid-water column dwelling and other one was bottom dwelling fishes. Examples includes - *Tor* spp, *Labeo* spp, *Chagunius* spp (mid-column dwelling-mouth position is in the terminal, specialized on submerged aquatic macrophytes) and *Mystus* spp, *Glyptothorax* spp (bottom dwelling fishes since their mouth position is situated downward side as they specialized feeding on stream benthic insects, detritus).

At stream order scale (regional scale), I was thrilled to find that fish diversity was higher in pool habitats than run and riffle and that was primarily due to its size and volume of water (akin to the species-area relationship) in stream communities. I did not have opportunity to understand how fish communities vary with riverscape (river-sub-basin scale) during my master's dissertation.

Subsequently I pursued this idea for my PhD in the Western Ghats region (Karnataka and Goa) where I sampled four large river sub-basins with 34 streams covering 151 stream segments. In total I captured more than 18,000 individuals of fishes encompassing 92 species! At stream segment scale, I found, water chemistry and stream habitat played important role in shaping stream fish communities, at stream order scale, it was mid-stream order (3rd-5th) that resulted in higher number of species than smaller or larger stream order, whereas at riverscape (sub-basin scale), it was bigger sub-basins (Malaprabha, Mhadei) that were species rich as compared to smaller river sub-basins (Tunga and Bhadra). Again at habitat scale, pools were the fish diversity hotspots.

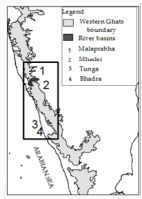
Interestingly, I found free-flowing river stretches (Bhadra-Tunga flowing in the Kudremukh National Park, therefore had adequate protection from anthropogenic disturbances including barriers and fishing) were higher in their endemic fish fauna than rivers which were hydrologically modified (Malaprabha and Mhadei-had many small to large sized barrages and check dams. The headwater regions of Mhadei-Malaprabha witnessed an inter-river basin water transfer affecting fragile headwater habitat thereby affecting few habitat specialist fishes such as *Homaloptera*, *Schistura* and *Glyptothorax* spp) which not only affected stream habitat for endemic species but favored many generalist fish species. This study was one of the systematically designed and followed a hierarchically nested study design (stream habitat was nested under stream segment and stream segment was nested under stream order, and stream order was nested



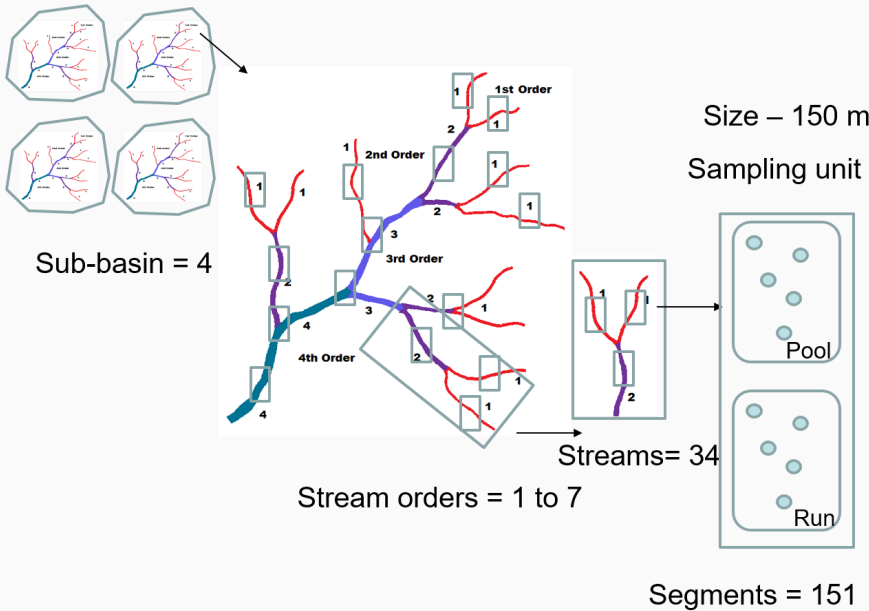
Photo: Vidyadhar Atkore



Photo: Vidyadhar, Aikore



Ecoregion – Central Western Ghats



under river sub-basin) with traditional fishing methods (castnet) across multiple spatial scales. Thus generated useful dataset on the stream fish communities of the Western Ghats filling important knowledge gap on their threatened status and distribution. This study also advocates protecting our last free-flowing rivers, their habitat and associated native stream fauna. Preserving undisturbed and mid-sized stream orders which are free-flowing in nature is important as they harbor migratory stream fishes which completes their life-cycle from downstream to upstream habitats. Similarly, maintaining adequate stream flow and monitoring water chemistry especially during the summer season would benefit native and endemic fishes which has larger conservation implication for river restoration in our country.

In the end, although I followed hierarchical study design to delineate river sub-basin boundaries (to answer ecologist question) but on the ground these boundaries are really porous and native stream faunal communities fall prey to human alterations.



Photo: Vidyadhar, Aikore



Photo: Nandu V S

## THE HIGH RANGE LANDSCAPE – NEED SECTORAL MAINSTREAMING FOR BIODIVERSITY CONSERVATION

P V KARUNAKARAN & NANDU V S

SÁLIM ALI CENTRE FOR ORNITHOLOGY AND NATURAL HISTORY (SACON)

The High Range Landscape epitomizes the Western Ghats in terms of ecological characteristics, socio-economic profile and development course. The key attributes of this landscape are; high levels of endemism and biological diversity, World Heritage Sites and Important Bird Area, presence of globally threatened flora and fauna, part of one of the five viable breeding centres of tiger population in India, harbour the largest viable population of Nilgiri tahr and a significant population of grizzled giant squirrel (both are threatened as per IUCN), catchment of three major river systems of peninsular India, strong eco-cultural affinities, support important economic sectors like commercial plantations and tourism. These attributes and burgeoning development process, depleting resources, expanding various production sectors and climate vulnerability has made this landscape a focal center for planners and managers. Part of the Western Ghats, one of hottest global biodiversity hotspots and running parallel to the west coast, the landmass is so complex resembling a 'fossil landscape'. It is also identified as an important area for fresh water biodiversity by World Conservation Monitoring Centre.

High Range landscape lies (an extend of ~3000 sq. km; 93 deg 8' to 10 deg 21' N & 76 deg 33' to 77 deg 18' E) between the interstate boarder of Kerala and Tamil Nadu on the east and the Periyar River on the west. The northern part consists of Edamala and Pooyamkutty Valleys is connected to Vazhachal Forest Division. On the Tamil Nadu side, the landscape is connected to Anamalai Tiger Reserve and Palni Hills reserve forests. It has high mountain peaks, including the highest peak south of Himalayas, Anaimudi (2695 m) and Misappuli Malai (2637 m). The High Ranges of the Cardamom Hills is one of the widest stretches of Western Ghats. The unique topographical features coupled with climate ranging from extreme wet to dry spells and sub-zero (frost is a common phenomenon during the winter months) to 42 degree celsius makes this area suitable for a wide range of wild biological elements. The landscape has ecological contiguity, though interrupted by settlements, enclosures, plantations, reservoirs and linear infrastructures. The landscape straddles PAs such as Eravikulam, Anamudi Shola, Pampadum Shola national parks and Chinnar, Kuringimala and Thattekkad wildlife sanctuaries. The non-PAs include Munnar, Marayoor, Mankulam, Malayattoor, Vazhachal and Chalakudy forest divisions.

The natural vegetation of the landscape includes high elevation montane shola forests and grasslands, wet evergreen forests of low, medium and high elevation, moist and dry deciduous forests, wet and dry scrub and thorn forests, reed (*Ochalndra* spp.) and bamboo thickets, riparian forests, tree savanna and various plantations and home gardens. The plantations comprise both commercial (tea, cardamom, coffee, rubber, oil



Photo: Ramesh Krishnamurthy



Photo: Ramesh Krishnamurthy

palm, cashew and cocoa) and forestry (teak, eucalyptus, wattle, pine, alnus, mahogany and many miscellaneous species). Among the vegetation types, the shola grassland formations considered as Pleistocene refugia, are unique and one among the most endangered ecosystems of the world. More than 30% of flowering plants found in this region are endemic and the floral elements have phylogenetic affinities with various other biomes of the world. The occurrence of Neelakurinji (*Strobilanthes kunthiana*) a plietesial shrub which blooms gregariously literally carpet the grassland with its mauve blue flowers enhance the grandeur of the landscape.

According to available information, the landscape harbours 265 species of butterflies (22 are endemic to WG), 110 species of Odonata (44 endemic), 72 species of fishes (23 endemic), 50 species of amphibians (43 endemic), 122 species of reptiles (42 endemic), 310 species of birds (15 endemic) and 79 species of mammals (nine endemic). Globally significant species include Nilgiri tahr, Indian elephant, tiger, gaur, Nilgiri langur, lion-tailed macaque, slender loris, leopard, jungle cat, sambar deer, grizzled giant squirrel, Malabar giant squirrel, Nilgiri marten, Travancore flying squirrel, wild dog, great Indian hornbill, Malabar pied hornbill, Kerala laughing thrush, Nilgiri wood pigeon, Nilgiri pipit, etc.

The High Range landscape has diverse cultural and linguistic affinities. People migrated from the central Travancore for centuries, the estate labours who had come from the Tamil Nadu plains and the native ethnic groups, inhabit the area. The migration was focused on plantations and wealth creation and for subsistence. There are thirteen tribal communities such as Muthuvan, Mannan, Hill Pulaya, Oorali, Malavedan, Malayan, Kadar, Paliyar, Ulladar, Malaipandaram, Malayarayar, Irular, and Kattunaikkar inhabit the landscape. Agriculture, forestry and commercial plantations are the mainstay of employment in the High Ranges. The tribal communities are largely engaged in subsistence farming and non-forest produce collection from the forest area. Commercial plantations include large-scale cultivation of cardamom, tea, coffee and rubber in the western slopes and farming in the Anchanad Valley and Vattavada village. The forestry operations include teak plantations and reed extractions in the lower valleys and eucalyptus and wattle in the higher places. The heterogeneous cultivation of crops in the home garden too diversify the land uses. The economic setbacks to the agricultural and production sectors in the recent past and the charisma and magnificence of the landscape promoted tourism as one of the main economic activities.

Hence, at present the High Range landscape is a mosaic of land uses with a blend of conservation, economic and livelihood activities. The dynamics of various land uses from conservation of natural forests to subsistence farming to commercial plantations and to mass tourism at different instances of historical time scale engraved the present complexity of this landscape. A multitude of stakeholders with competing and contradicting interests on the resources of this nearly 3000 km<sup>2</sup> area in the backdrop of climate vulnerability worsened the situation. A prudent strategy to mainstream the management of natural resource and biological richness with the economic / production activities would be the only alternate for the sustainability of the High Ranges for posterity.

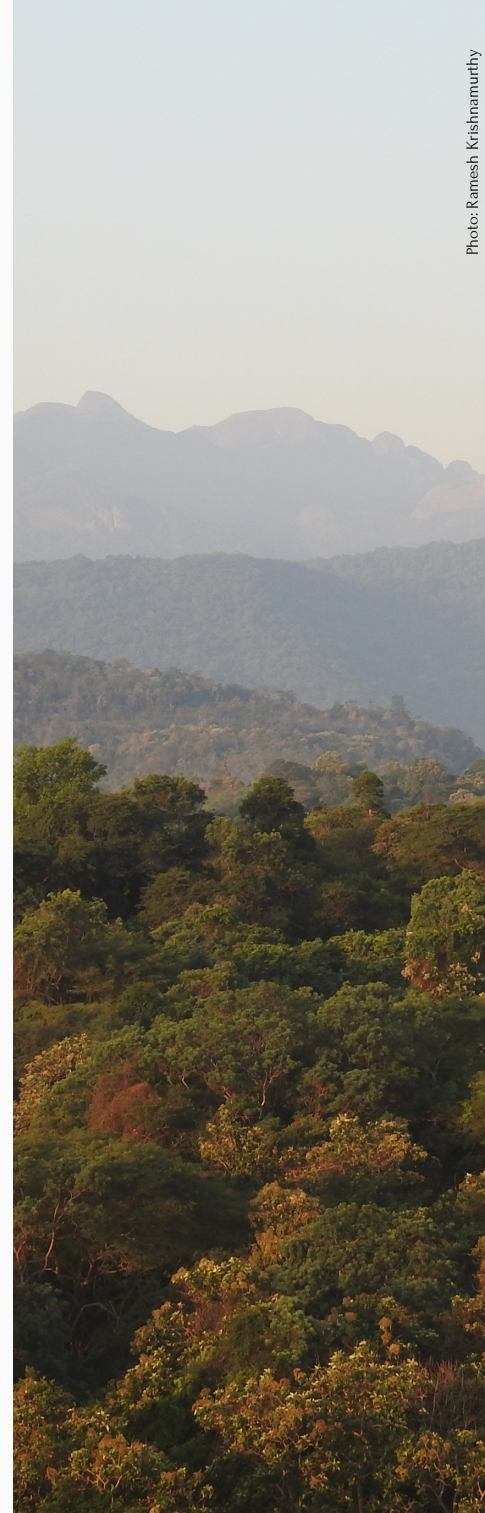


Photo: Ramesh Krishnamurthy



Photo :Ramesh Krishnamurthy

# News

## Western Ghats destruction noted since 1866

Shenoy Karun / TNN / Updated: Nov 11, 2021, 14:12 IST [Read more here](#)

## Western Ghats record a new-to-science semi slug

[Read more here](#)

## Karnataka Against Declaring Western Ghats an Eco-Sensitive Zone, Says it May Impact Livelihood Generation

[Read more here](#)

## Endemic Western Ghats flycatchers could lose third of their range due to climate change: Study

[Read more here](#)

The Black-and-orange Flycatcher could lose up to 31% and Nilgiri Flycatcher 46% of its range by 2050, according to a recent study

## Ecological 'holocaust': Women saving India's Western Ghats forest

[Read more here](#)

All-female rainforest force battling to protect one of the last enclaves of biodiversity along the Western Ghats mountains.

## Two new plant species discovered in Ghats

[Read more here](#)

## Uncertainty over Western Ghats as Kasturirangan Committee draft delayed

[Read more here](#)

Even after a decade of the Gadgil report and Kasturirangan Committee report for the protection of the Western Ghats, implementation of the report is still a far cry from the actual circumstances.

## United on exclusion: States insist on demarcating more area in the Western Ghats from 'ecologically sensitive' category

R. KRISHNAKUMAR [Read more here](#)



Photo :Ramesh Krishnamurthy





Photo :Ramesh Krishnamurthy

# Views

## Decline of Forest Fires in The Nilgiri Biosphere Reserve in Last Three Decades

SATYAM VERMA | UNIVERSITY OF WASHINGTON, SEATTLE

In the 2019 fire season, Nilgiri Biosphere Reserve (NBR) witnessed more than 100,000 acres of forest razed by forest fires killing a forest guard and injuring many others. Such figures might lead people to believe that forest fires are getting more intense in the Western Ghats. However, several studies since last decade show that the amount of burned area declined significantly in NBR. The 2019 fire season in NBR was most damaging last 9 years.

Forest fires have been important part of NBR. Particularly, dry deciduous forests of NBR are most significantly affected by the Fires. NBR was the first Biosphere Reserve designated under Man and Biosphere program in 1986. NBR extends over an area of 5,520 km<sup>2</sup> with an elevation of 80 to 2,600 m. Nilgiri forests host largest population Asian elephants anywhere in the world and NBR plays a significant role in biodiversity conservation of particularly large mammals, by providing diverse and contiguous habitat.

Kodandapani et al. (2004) reported that a fire return interval (FRI) of 3.3 years in Mudumalai in 2004 which was significantly higher than 1920s when FRI was 10 years in the same region. They also reported that approximately 19% (1029 km<sup>2</sup>/Year) of the forest are burning every year in the NBR between 1989 and 2002. Later, Verma et al. (2015) reported that FRI again reached back to 10 between 1999 and 2013 in Mudumalai. They stated that fire is now burning only 10% of the forest compared to 30% between 1989 and 2002. Further study by Reddy et al. (2018) also concluded that burned area has been significantly reduced in NBR in last 3 decades. They reported that only 149 km<sup>2</sup>/Year was burning in NBR which 2.7% of NBR.

These results stand in contradiction to most of the prediction models that project an increase in global burned areas as global temperatures rise. The results of these studies prove that human activity is the most important driver of wildfire frequency and intensity, and this offsets the warming and drying effects of climate change. The reduction in the burned area could be ascribed to the anti-causal factors, particularly stationing of the anti-poaching-cum fire camps in the year 2000 and ban on the operation of private vehicles in some parts as well as resettlement of several hamlets from core zones of Tiger Reserves in NBR.

References:

- 1) Kodandapani, N., Cochrane, M. A., & Sukumar, R. (2004). Conservation threat of increasing fire frequencies in the Western Ghats, India. *Conservation Biology*, 18(6), 1553-1561.
- 2) Verma, S., & Jayakumar, S. (2015). Post-fire regeneration dynamics of tree species in a tropical dry deciduous forest, Western Ghats, India. *Forest Ecology and Management*, 341, 75-82.
- 3) Reddy, C. S., Satish, K. V., & Rao, P. P. (2018). Significant decline of forest fires in Nilgiri Biosphere Reserve, India. *Remote Sensing Applications: Society and Environment*, 11, 172-185.



Photo :Ramesh Krishnamurthy

“The culture of the forest has fuelled the culture of Indian society.”

-Rabindra Nath Tagore

## Members' Page: Members in action

### Research in an Under-explored Haven – Sahyadri

SHAH NAWAZ JELIL | WILDLIFE INSTITUTE OF INDIA

The Sahyadris (northern Western Ghats) boast a splendid milieu of landscapes; an amalgamation of spectacular mountain peaks, thirst quenching rivers, picturesque waterfalls and serene woods. Not only does it house rare and endemic flora and fauna, it provides the much-needed escape to a drab city-dweller. To find an opportunity to spend a substantial amount of time here is an incredibly humbling feeling. I luckily scored an opportunity to study this diverse landscape in 2017 through the Sahyadri Tiger Recovery Project led by Dr. K. Ramesh. The Sahyadri Tiger Reserve is formed by combining Chandoli National Park and Koyna Wildlife Sanctuary.

The western Maharashtra/Sahyadri region area is known for water security as major dams are built here, chief amongst them is the Koyna dam which forms the Shivasagar reservoir and now the Koyna Wildlife Sanctuary. Awestruck with the beauty of Koyna, I decided to focus on Koyna Wildlife Sanctuary for my PhD research. A challenge here was to assess all sites via a boat, which is altogether a unique and refreshing experience. To understand mammal occupancy and factors affecting their occupancy along riparian forests in Koyna Wildlife Sanctuary, camera traps were used nested in an occupancy modelling framework. We adopted a field design wherein riparian forests along perennial and temporary streams were assessed. Using dynamic occupancy models with camera trapping data collected from April 2018 to January 2020, we aimed to understand mammal occupancy and the factors affecting occupancy of mammals along riparian forests. We found three key patterns emerging from this study. Firstly, ungulates dominate riparian forests within Koyna reservoir, in terms of occupancy. Secondly, smaller sized ungulates are more vulnerable to local extinction as compared to large ungulates. Thirdly, stream proximity was a dominant predictor for mammal detection. We observed that as distance from stream increased, mammal detection probabilities dropped.

Within riparian forests in India, such studies have been limited, especially from altered ecosystems such as large reservoirs. The findings from this study have high relevance for management of riparian forests and accordingly how species can be managed within a reservoir. In addition to highlighting species-habitat relationship patterns, the information generated provides a strong empirical basis for developing catchment-wide and multi-species strategies for conservation management. Multi-landscape planning that encompasses streams, rivers and associated riparian habitats which go beyond conventional planning have been recorded to achieve overarching benefits. Finally, the approach and design employed in this study can be scaled up and/or be used in other India riverine landscapes and beyond.

\*The full paper can be accessed at <https://doi.org/10.3389/fevo.2021.643285>



Shah Nawaz presently works as a Project Fellow in the Sahyadri Tiger Recovery Project collaboratively run by the Wildlife Institute of India, Maharashtra Forest Department and National Tiger Conservation Authority. Along with the project objectives, his PhD research focuses on understanding terrestrial mammal assemblages at the interface of terrestrial and freshwater realms.



## IRALE Executive Committee 2022-2024



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## Updates from the Executive Committee

### Highlights from the EC meeting held on January 7, 2022

**Plan 2022-2024:** Discussion on annual plan of operation for 2022 is initiated and includes IRALE delegation participation and chapter contribution in World IALE Congress 2023 in Nairobi, Kenya.

**Roles & Responsibilities** of new EC Members will be communicated. The role of regional coordinators will be substantial in taking the IRALE plan forward, but it will be a team effort with a somewhat flexible structure. The role and participation of advisory board will be reviewed further.

**Membership:** There will be membership renewal in 2022 for each registered member, however, this time there will be addition options for (1) Term Membership (3 Years) and (2) Lifetime membership.

**Working Group Discussions & Webinars:** working group discussion through webinar/panel discussion/etc. will be initiated with first meeting tentatively planned to be first Friday of February 2022. Working groups can brainstorm on different project ideas.

**SOP:** Guideline and Standard Operating Procedure to guide members for association with IRALE will be done.