

A UNESCO World Heritage Site: The alluring montane forests and grasslands of the Western Ghats of peninsular India

As a budding wildlife researcher, I often get a chance to visit several locations like the open grasslands of Rajasthan, mixed moist deciduous forests of Maharashtra or the dense mixed-wet forests of northern Bengal. During my internship with Indian Institute of Science Education and Research (IISER), Tirupati, I got an opportunity to visit the Eravikulam National Park as part of a project to examine the spread of woody invasive species across the Sky Island landscape and its relationship with the bird community. Famous for its endemic Nilgiri Tahr, this national park is located along the Western Ghats in the Idukki and Ernakulam districts of Kerala, India. It acts as a distinct biogeographic zone of India and a biodiversity hotspot. During the data collection I got a chance to visit some breathtaking and remote locations in the park.

The landscape that was a mosaic of forest and open grasslands attracted me the most. You could walk miles after miles along the open, windy grasslands only to suddenly experience a complete transformation of your surroundings into a dark, gloomy, moist forest patch. This landscape is often referred to as the shola-grassland ecosystem. The shola landscape contradicts the 'one climate-one biome' view of a single climax community of a given climate (Joshi et al. 2020).

Landscape and biodiversity of the region

The grasslands were mostly open spaces with different varieties of grass species. It

is definitely the only place where one can now witness the grandeur of the mountains covered by the mass flowering 'Neelakurinji' *Strobilanthes kunthiana*, "the great blue flower of Nilgiri". Based on the characteristic spectral radiance value three grassland communities are identified in the region i) *Dichanthium polyptcum-Eulalia phaeothrix-Chrysopogon zeylanicus*; ii) *Arundinella mesophylla-Andropogon lividus-Ischaemum indicum-Chrysopogon zeylanicus*; and iii) *Arundinella purpurea-Chrysopogon zeylanicus-Eulalia phaeothrix*.

The shola forest had different *Strobilanthes* sp. of stunted growth. A plethora of bird calls entertained the journey through the forest. Often distinct rattle and hoots of the Indian Scimitar-Babbler *Pomatorhinus horsfieldii* would be heard and the Palani Laughingthrush *Montecincla fairbanki* would be seen chilling amidst the coffee plantations. Many species like the Nilgiri Pipit *Anthus nilghiriensis*, Black-and-orange Flycatcher *Ficedula nigrorufa*, Nilgiri Flycatcher *Eumyias albicaudatus* or the magnificent Black Eagle *Ictinaetus malaiensis* would pay a visit.

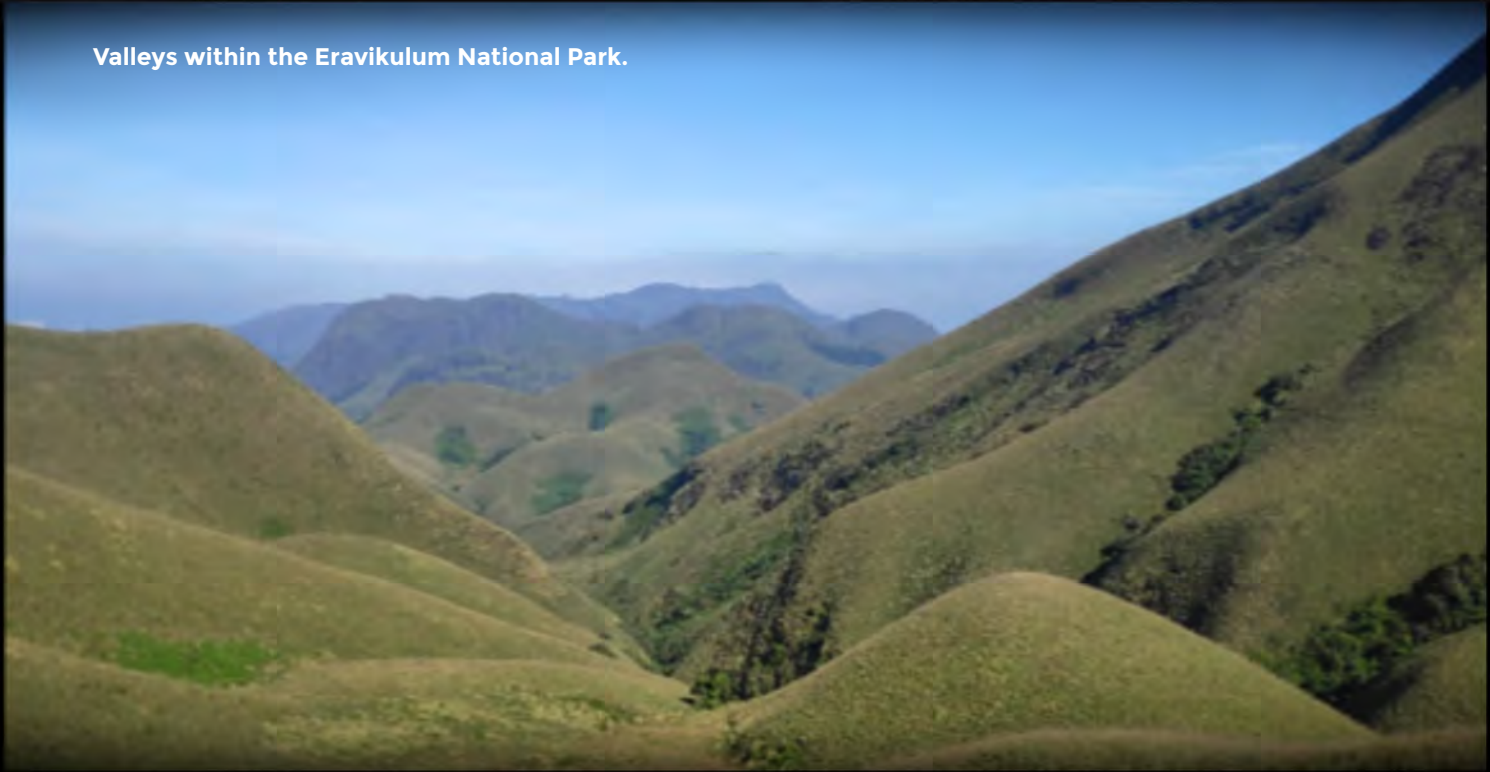
On the last day of work a cacophony of birds caught my attention and after staying on guard at the place, I got a glimpse of three Nilgiri Sholakili *Sholicola major*. I was eager to see this bird and it seemed like it gave me a final adieu before my departure.



A species of fungi *Microporus xanthopus*.



Leopard scat found by a walking track.



Valleys within the Eravikulam National Park.



A *Nyctemera adversata* caterpillar.



Nilgiri Tahr in its natural habitat.

This landscape is mysterious and one of the most diverse in its existence. 29 Species of mammals, 140 species of birds, 100 varieties of butterflies, 20 species of amphibians are found here. The Nilgiri Tahr, Gaur, Sloth Bear, Nilgiri Langur, Tiger, Leopard, Giant Squirrel and Wild Dog are common (Menon 1997). Civet Cats and Jungle Cats live in the Sholas. Atlas Moth, the largest of its kind in the world is seen in this park (Menon 1997).

Cause of existence and maintenance of the shola-grassland ecosystem

The existence of the shola-grassland system has baffled ecologists for decades. Most mosaics occur under climate where most biome distribution models predict the occurrence of forest, not grasslands (Joshi et al. 2020).

Then what caused and maintained this unique landscape? Several theories explain their evolution and adaptation over the long period of time:

- One considers the grasslands and forests to be edaphic climaxes caused by differences in soil moisture (Thomas & Palmer 2007).
- While some say distinct climatic and physiographic factors enable the mosaic's persistence. A dynamic equilibrium maintained by the existence of alternate stable states influenced by environmental parameters including frost, fire, grazing, soil nutrients, soil depth, wind, and illegal harvesting (Bunyan et al. 2012).
- Forest spread over the grasslands during the warmer wetter phases and contract during dry cooler times (Das et al. 2015). A study by Joshi et al. (2020) found that frosts and freezing night-time temperatures that occur during the winter kill native tree seedlings in grasslands,

and thereby maintain this tropical montane forest-grassland mosaic system.

- Topography also influences the vegetation patterns. Higher elevations support large grassland stretches (Ramesh et al. 1997). Other parameters such as the position of the slope, elevation along with the number of winds, and solar radiation faced by a region also determine vegetation types (Das et al. 2015).
- Grasslands are also thought to be formed due to anthropogenic fires caused by humans to clear forests in the past (Das et al. 2015).
- Palaeohistological studies suggest the existence of the grasslands and forest mosaic long before human settlements were established in those regions (Das et al. 2015).

More spatial-temporal data on the disturbance is required to understand the occurrence of the vegetation patterns especially at lower elevations (Das et al. 2015).

Threats and conservation

This ecosystem has been under several threats since the age of time. One such threat is the plantation of exotic species and tea/coffee plantations, these are leading to a loss of the native shola species (Joshi et al. 2018). Non-native species of plants such as Black Wattle *Acacia mearnsii* are better at tolerating frost and cold temperatures, hence surpasses the native species and invades into the savanna (Joshi et al. 2020). Climatic changes can disrupt the shola-grassland equilibrium. The pattern of the mosaics varies greatly across the entire region, hence conservation plans should be crafted with different management guidelines. A better understanding of the interactions between the topographic and bioclimatic conditions will provide insights into



Stream inside the Shola forest.



Neelakurinji seen in the national park.



The Shola forest-grassland mosaic landscape.



A fern of the family Cyatheaceae in the Shola forest.



A flower of the family 'Asteraceae'.

the mechanisms that maintain forest-grassland mosaics and help in their conservation in the face of increasing anthropogenic activities. With the presence of endemic flora and fauna such as the White-bellied Sholakili *Sholakili albiventris*, Nilgiri Tahr and a high rate of species diversity associated with the island-like conditions of mountaintops make these mosaics a priority in conservation. Awareness through workshops should be spread among local communities and biodiversity assessment through citizen science can help conserve this landscape and its diversity. The fate of this bewildering landscape hence depends on further research and appropriate management.

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Ritika Chatterjee

Migratory Bird Monitoring Trust, Kanyakumari,
Tamil Nadu 629702, India.
Email: chatterjeeritika1997@gmail.com



Shola grasslands. ©Ritika Chatterjee.