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THE HEARTBEAT OF SOIL HEALTH



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ISALINE AND MAY



Africa, Europe and South America lead in the Partnerships and Engagement team, the former coordinates Global Rewilding Alliance's work on Rangelands and Animating the Carbon Cycle. The latter is the Deputy Director of Communications, coordinating communications, advocacy and influencing, bridging the pillars of alliance work.

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A faculty member at ATREE, he is a naturalist at heart; his work straddles different ecosystems and domains, including evolutionary biology and conservation practice. Field work gives him great joy and a sense of purpose. He enjoys teaching and writing about nature and its conservation.

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A graduate with a degree in Conservation Practice from ATREE-TDU, Bengaluru, she studies grassland ecosystems in different landscapes in India together with their fascinating life forms. At ATREE, she continues to focus on grassland ecosystems to gain a better understanding of how to better manage them.

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ANIRUDDHA DHAMORIKAR



Based in Tezpur, he is the Lead for Species Conservation at WWF-India's Brahmaputra Landscape, He studies the ecological and social dynamics of human-nature relationships and is currently co-writing a book on Kanha's moth diversity.

Sanctuary Asia April 2026

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With each monsoon, grasses across India's plains return with a flourish to life. On the Deccan Plateau near Ahmednagar, Maharashtra, these flowering grasslands become lifelines for wild herbivores and livestock alike. Beneath them, dense root networks enrich and hold the soil, storing carbon, conserving water, and quietly sustaining the living systems that make life on Earth possible.



Photographer: Kalyan Varma

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The Forgotten Wilderness

Across the vast sweep of the Indian subcontinent lies a landscape long misunderstood, frequently dismissed, and quietly vanishing. India's grasslands and Open Natural Ecosystems (ONEs), which cover an estimated 15 to 20 per cent of the country's land area, sustain some of our most iconic wildlife species and store more carbon in their soils than most people realise. Between the covers, some of the most credible field biologists and conservationists make a strong case for their preservation, a theme you will see carried throughout this issue.

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DEEP RAJWAR/SANCTUARY PHOTOLIBRARY



Wu Wei

This *Sanctuary Asia* issue is pointedly focused on grasses and grasslands, which some foolish humans treat as wastelands. This despite the fact that 75 per cent of all the food and sustenance humans need for their survival today, directly or indirectly, comes from incredibly diverse, once wild grasses!

From the diminutive five centimetre-tall Antarctic hair grass *Deschampsia antarctica*, to Asia's massive, 40 m.-tall giant bamboo *Dendrocalamus giganteus*, all of Earth's 10,000 to 12,000 current recorded grass species emerged from shade-loving ancestors between 100 and 70 million years ago. Biologists still cannot accurately state when land plants first emerged on Earth because without backbones, or shells, plants such as grasses leave few fossil traces behind. Chemical fossils/biomarkers, however, indicate that some of the first ever pre-Cambrian filter-feeding marine animals existed 600 to 700 MYA, and that they gave rise to soft bodied sea sponges around 541 MYA. Interestingly, scientists largely now agree that land plants made their appearance on Earth earlier than we once presumed. They suggest that plants and animals emerged in near tandem some 450 to 500 MYA! Compare that to *Homo sapiens'* appearance on Earth around 300,000 years ago.

If I had a time machine I would love to have watched the process of pioneer algae washing ashore from the sea, somehow surviving desiccation, and then speciating until land was clothed with the magical botanical diversity we see today.

Incidentally, the dramatic image on this page is not a wildfire. It was intentionally lit in selected parcels of the tiger reserve as a controlled conflagration. Time for me to offer a short explanation for the curious title 'Wu Wie'! It's the deepest foundation of Taoist philosophy, suggesting that all humans should live with the natural flow of nature. However, at times, some human interventions might be necessary! With controlled fires, the famous Dhikala grasslands continue to support the herbivores upon which its carnivores are dependent. Such management practices have become necessary because, after *Homo sapiens* discovered agriculture 11,000 years ago, successive generations relentlessly declared war on grasslands to make way for settlements, farms, villages, cities, factories and more. Essentially, outside our Protected Areas, we continue to treat grasslands – and wetlands – as wastelands, effectively tearing asunder the ancient equilibrium between fire, trees and grasslands. The fires are timed and monitored prior to the monsoons to ensure that while the grasses thrive, trees do not colonise the grass larder, without which parks such as Corbett and Kaziranga would never be able to support their magnificent large mammalian populations.

Speaking for myself, I am unapologetically in love with Corbett and Kaziranga, both of which would never need to be thus 'managed' if we humans desisted from declaring war on virtually all unprotected wildernesses.



WORLD SCAN

DARK CLOUDS BLANKET TEHRAN SKY

As US-Israeli air strikes on Iran escalated in March, apocalyptic images emerged from Tehran, the country's capital. Thick black clouds, smoke plumes, and fires could be seen following confirmed strikes on at least four oil facilities. The World Health Organisation (WHO) warned that the smog and pollution resulting from oil infrastructure attacks posed serious health risks to residents. Air pollution has spiked near the damaged oil sites, and residents reported a strong burning smell. Oil fires are extremely harmful to the environment as they release toxic particles into the air, including carbon monoxide, sulphur, nitrogen oxides, and soot particles. Apart from damaging air quality and impacting the lungs, these pollutants can also dissolve in rainwater to form acids, leading to acid rain. The day after the strikes, Tehran residents reported downpours of 'black rain' (pollutant-contaminated rain). As the war continues to claim human lives in real time, the prolonged environmental damage caused as collateral could last for much longer, leading to health problems for years to come.

TWO 'FOSSIL-ONLY' MAMMALS REDISCOVERED

A pygmy long-fingered possum *Dactylonax kambuayai*, previously known to modern science only from 6,000-year-old fossils, has been rediscovered in the remote rainforests of the Vogelkopf or Bird's Head Peninsula in New Guinea. It was documented along with the ring-tailed glider P*etaurus ayamaruensis* in two new studies published in the journal *Records of the Australian Museum*. Both are considered Lazarus taxa, species believed extinct and known only from fossils before being found alive. The findings add to growing knowledge of the roughly 100 marsupial species in New Guinea and nearby islands. Researchers worked closely with Indigenous communities, whose knowledge helped locate the animals, though the exact sites remain undisclosed to protect them.

- **UGANDAN PARK WELCOMES RHINOS AFTER FOUR DECADES:** Two southern white rhinos have been relocated to Kidepo Valley National Park, marking the first step in a repopulation effort after poachers wiped out the species for their prized horns and meat.
- **TRUMP ADMIN TO LOOSEN OCEAN SPEED LIMITS:** The Trump administration is considering rolling back speed restrictions that are meant to protect endangered North Atlantic right whales from vessel collision and entanglement.
- **GLASS EEL POACHING CONTINUES:** Since the 1980s, European eel populations have declined by more than 90 per cent. Each year, thousands of juveniles, known as glass eels, are illegally poached for culinary delicacies and exported outside Europe.
- **PANGOLIN TRADE SHOWS DECLINE:** A recent analysis of Chinese court records from 2010 to 2023 shows pangolin scale seizures have steadily declined since 2018, but experts warn the true volume of trade is likely much higher and underreported.
- **ANTARCTICA RECORDS FIRST DEATHS FROM AVIAN FLU:** A recent study confirms that more than 50 skuas in Antarctica died from H5N1 during the summers of 2023 and 2024.

SOURCE: INTERNET



Young Kenyan environmentalist Truphena Muthoni has set a Guinness World Record for the second time by hugging a tree for 72 hours from December 8-11, 2025.

MODERN AFFORESTATION COUNTERS HISTORY

A new study, *Revisiting Europe's temperate forests,* which examines Europe's vegetation history, concludes that for more than 20 million years, the continent's landscape was a mosaic of grasslands, scrub, open woodlands rich in wildflowers, and tree-covered areas, and not dense forests. The findings suggest that modern afforestation drives counter Europe's natural long-term ecological trajectory. The authors say current reforestation practices are misguided, both in Denmark, where subsidies favour the planting of dense forests, and in other parts of Europe. Such approaches may contradict the kinds of ecosystems in which many of Europe's species have evolved over millions of years. A different study has found that grasslands disturbed by wild boar (pig) rooting supported more plants and greater species diversity than undisturbed areas. Controlled wild boar activity can help slow the natural transition of grassland into woodland, which threatens the survival of grasslands. These findings will be crucial in guiding more ecologically informed land management strategies across Europe.

YOUNG ACTIVIST INSPIRES A MOVEMENT

Young Kenyan environmentalist Truphena Muthoni has set a Guinness World Record for the second time by hugging a tree for 72 hours from December 8-11, 2025. Her marathon embrace aimed to raise awareness of climate change and protest the destruction of Indigenous forests. She seeks to protect Indigenous knowledge and inspire people to reconnect with and care for nature. Muthoni's act inspired a tree-hugging movement in Kenya, highlighting the importance of protecting native trees and valuing Indigenous knowledge for climate solutions. Activists across Kenya have now started hugging trees for various causes, often for even longer durations. She continues to engage youth in tree planting initiatives, and works with the Kenya Forest Service to restore a forest reserve.

INDIA SCAN

TRADE DEAL OPENS INDIAN MARKET TO US

India has agreed to a carefully managed opening of its markets for certain agricultural products as part of an interim trade agreement with the United States announced on February 7, 2026. Union Commerce and Industry Minister Piyush Goyal said India will reduce or remove tariffs on several US food and farm items such as Distillers Dried Grains with Solubles (DDGS), red sorghum used in animal feed, tree nuts, fruits, soybean oil, wine and spirits. Farmer organisations have raised concerns that cheaper imports could affect the prices of crops such as maize, jowar and soybean. They also fear that lower duties on soybean oil may reduce domestic soybean prices. On concerns about genetically modified (GM) content, since DDGS in the US is made from GM corn, Goyal said existing environmental regulations will handle the issue. The government has said sensitive sectors remain protected. However, increased competition from US agricultural imports could pressure Indian farmers to specialise in fewer crops, potentially encouraging monocultures in some regions. The agreement will also allow zero duty access for several Indian farm exports to the US market.

FOREST FIRES IN ARUNACHAL PRADESH AND NAGALAND

Forest fires were raging across parts of Arunachal Pradesh and Nagaland for nearly a week, after breaking out in Walong on February 13, 2026. The flames have swept through remote, mountainous areas, making access extremely difficult for emergency teams. A coordinated response involving the Indian Army, the Indian Air Force, and local civil authorities successfully put out the fire after sustained efforts. Troops from the Army's Spear Corps, supported by ground and aerial teams, are working tirelessly to douse residual fires. The IAF deployed helicopters for sustained aerial firefighting at altitudes above close to 2,900 m. Dry weather and shifting cultivation are cited among possible causes. In the Lohit valley, over 12,000 litres of water have been dropped to contain the blaze.

BIRD NUMBERS FALL EVEN IN UNDISTURBED GRASSLANDS

A research study examined bird populations in Spiti between 2002 and 2023, looking at how different habitats have changed over time under the influence of both human activity and climate pressures. The findings, published in *Ecological Applications*, were reported by researchers from the Nature Conservation Foundation. They found that bird densities declined across several habitats. However, a statistically significant decline over a decade was recorded in the ungrazed steppe, an area with the least direct human disturbance. This questions whether simply restricting direct human use of land is enough to protect biodiversity. Several common insect-eating bird species showed noticeable declines. While the study could not clearly separate the effects of climate change from land use changes in disturbed areas, the researchers suggest that climate change may be playing a role in the decline of birds even in undisturbed habitats.



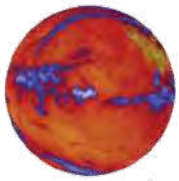
JAINY MARIA/SANCTUARY PHOTOLIBRARY

A research study examining bird populations in Spiti between 2002 and 2023 has shown that bird numbers are declining even in undisturbed areas, raising questions about whether restricting human use alone is enough.

INDIA AND NEPAL SIGN MOU FOR CONSERVATION

India and Nepal have signed a memorandum of understanding on forest management, wildlife protection, biodiversity conservation, and climate action. The agreement, signed in New Delhi on February 25, 2026, aims to strengthen cooperation in conserving cross-border ecosystems and restoring wildlife corridors. As wildlife frequently moves between the two countries, coordinated conservation efforts are essential. The partnership will also focus on protecting key species such as elephants, Gangetic dolphins, rhinoceroses, snow leopards, tigers and vultures while strengthening joint action to tackle wildlife crime and safeguard shared natural habitats.

- INDIA'S CHEETAH POPULATION CROSSES 50: Jwala, a cheetah relocated from Namibia under Project Cheetah, has given birth to five cubs at Kuno National Park, raising India's cheetah population to 53.
- KERALA DECLARES STATE MICROBE: Kerala has become the first state in the country to officially declare a state microbe. *Bacillus subtilis*, a type of probiotic or 'good' bacteria found widely in soil and the human gut, has been given this recognition.
- BANDIPUR AND NAGARAHOLE SAFARIS RESUME: After a 100-day temporary suspension caused by a rise in tiger and leopard attacks across parts of Karnataka, the safaris have reopened with new, stricter restrictions, including reduced safari hours and limits on the number of vehicles allowed.
- SILENT VALLEY BIRD SURVEY RECORDS 192 SPECIES: The survey, jointly organised by the Kerala Forest Department and the Malabar Natural History Society, is the most extensive ever conducted in the Silent Valley National Park, recording 192 bird species, including 20 species endemic to the Western Ghats.
- RARE AND ELUSIVE CARACAL MAKES AN APPEARANCE: A camera trap set up by the Rajasthan Forest Department has recorded the presence of a caracal within Bandh Baretha Wildlife Sanctuary in Bharatpur district, Rajasthan.



CLIMATE WATCH

CLIMATE CHANGE COULD SHRINK GRASSLANDS BY HALF

The Potsdam-Institute for Climate Impact Research has found that by the end of the century, grasslands could shrink by 36 to 50 per cent owing to climate change. Grasslands cover a third of the planet and are the largest production system. The study found that "future climate change will threaten grazing suitability across large portions of Earth, endangering the livelihoods of numerous communities and potentially triggering widespread socioeconomic consequences." This would impact over one billion grazing animals, food security, and more than 100 million pastoralists. African grasslands, which already exist at the extremes of what these ecosystems can bear, are particularly vulnerable. In a business-as-usual scenario, up to 65 per cent of these grasslands could be lost; with reduced emissions, losses could be limited to 16 per cent. Like Africa, the loss of grasslands will hit hardest in countries already grappling with hunger, economic and political instability, and higher levels of gender inequity, explained lead researcher Chaohui Li. This indicates that climate change will further amplify existing inequalities.

WOMEN MOST IMPACTED BY CLIMATE CRISIS

Women's Day passed by in a flurry of messages and programmes, but the reality of women's life in a rapidly changing world remains worrying. A UN Women report of 2025 found that, in a worst-case climate scenario, nearly 158.3 million more women and girls worldwide could fall into extreme poverty by 2050 – 16 million more than men and boys. Yet, only about 10 per cent of the required funds are used to support women affected by climate change, said Vaishali Nigam Sinha, president of the United Nations Global Compact Network India, to PTI.



©YANN FORGET/WIKIMEDIA COMMONS/CC-BY-SA

Women working on road repairs in Umaria district, Madhya Pradesh. In a worst-case climate scenario, nearly 158.3 million more women and girls could fall into extreme poverty by 2050 – 16 million more than men and boys.

The UN report notes that the climate crisis is not "gender neutral". Women working in agriculture, for instance, bear the brunt of rising extreme heat, which affects their physical and mental health, yet their labour often remains unrecognised and unpaid. When food, water and fuel grow scarce, women who already shoulder the greater burden of gathering these resources must travel farther and work harder. All is not bleak, however. Women are also leading climate solutions: the "*conchera* women" (shell women) of Tumaco, Colombia have launched a programme to replant local mangrove forests that sustain their mollusc harvests. With stronger capacity building and better funding, women can be empowered to secure their livelihoods.

MILLIONS MORE IN THE PATH OF RISING SEAS

Climate change and sea level rise are closely enmeshed concerns. Yet, the number of people impacted by sea level rise has been underestimated. The study '*Sea level much higher than assumed in most coastal hazard assessments*', released in March 2026, has shown that between 77 and 132 million more people will be affected by rising sea levels. The researchers calculated a higher coastal sea level than assumed in most hazard assessments. Predominantly in the Global South, which includes Asia, the rise is one metre above previously calculated levels (from 1995-2014). The underestimation is greatest for Southeast Asia and the Indo-Pacific region, says the study. The analysis shows that 31 to 37 per cent more land and 48 to 68 per cent more people would "fall below sea level".

The discrepancy has crept in since many scientists have only considered the Earth's gravity and rotation (geoid models), which has turned out to be an oversimplification. However, the sea level is also influenced by factors such as winds, temperature and salinity of the seawater, ocean currents, and tides. This has direct implications for land use in coastal areas, and would require serious attention from urban planners and policy makers. Sea levels across the world have already risen by 20-23 cm.

- **FASTEST GLACIER RETREAT EVER RECORDED:** Antarctica's Hektoria glacier receded by eight kilometres in two months, with nearly half of it collapsing and disappearing in 2023, new analysis finds. If larger glaciers collapse just as quickly, there could be severe consequences for sea level rise.
- **INTERNATIONAL YEAR OF RANGELANDS AND PASTORALISTS:** The United Nations has dedicated 2026 to spotlight these vital ecosystems. In 2022, a group of international scientists wrote a letter urging the UNFCCC to factor grasslands into climate goals.
- **ARUNACHAL PRADESH GRASSLANDS FACE GREATER CLIMATE CHANGE THREATS:** Along with this, experts and scholars speaking at Siang Dialogue 3.0 said that development pressures and habitat degradation prove to be a risk to biodiversity as well as livelihoods.
- **AMAZON RAINFORESTS NOW PRODUCE MORE PHOTOSYNTHETICALLY EFFICIENT YOUNG LEAVES:** The study of a 22-year-period found that trees are adapting to harsher environments (intense sunlight, less precipitation, etc.) by having more juvenile leaves than mature leaves in the canopy. This shift correlates tightly with climate changes.

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PHOTO CREDIT: DR. MOHAN RAM



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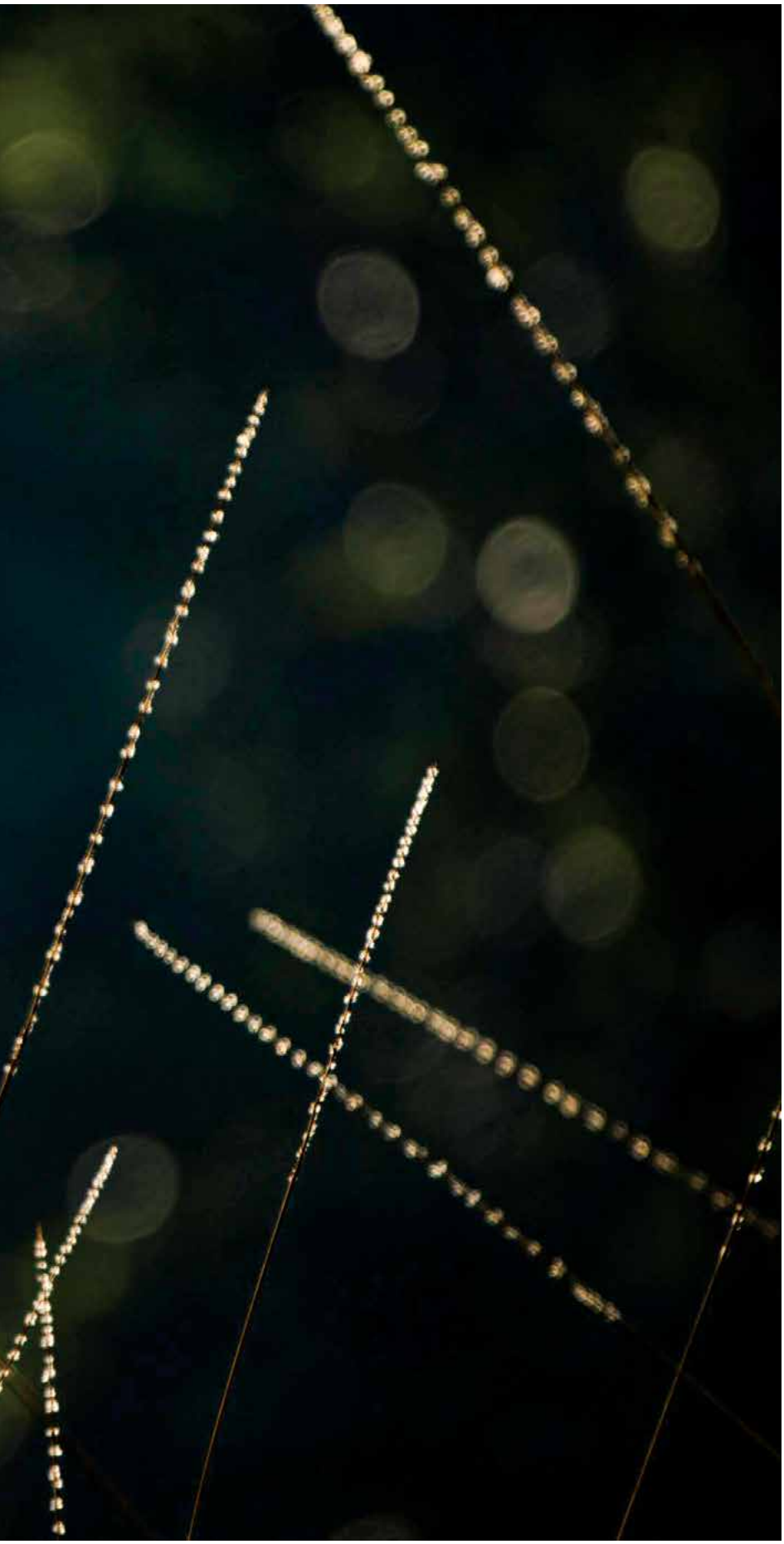
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WAVES OF GRASS

WEB OF LIFE

Often taken for granted or just considered as fallow land or wasteland, or simply stretches of grass, grasslands are powerhouses of life and climate resilience. Covering around 40 per cent of the Earth's land, these ecosystems support over 70 per cent of India's large herbivores, from blackbuck and chinkara to Nilgiri tahr, forming the foundation for predators like wolves and tigers. Beyond wildlife, grasslands quietly fight climate change, storing up to 3.3 gigatonnes of CO_2 each year in their soil and vegetation (IPCC, 2022). They prevent soil erosion, regulate water cycles, and sustain pastoral communities, proving that protecting these seemingly simple landscapes are vital for both nature and people. In the following pages, breathtaking images of grasslands and wildlife that call them home, invite you to witness the hidden beauty and vital importance of these often-overlooked landscapes.

Nature's Fireworks Morning sunlight catches tiny droplets on grass in the Kanha National Park, Madhya Pradesh, making each blade glow like rockets streaking into the night sky. This unassuming grass species, from the park's grasslands, is a vital food source for ungulates, sustaining the very prey base that supports Kanha's predators.

KALYAN VARMA



Close to the Summit A wide swathe of water cuts across a *shola* grassland, reflecting serene skies in the Eravikulam National Park, Kerala. A *shola* is the local name for patches of stunted tropical montane forest found in valleys amid rolling grasslands in the higher regions of South India, largely in Kerala, Karnataka, and Tamil Nadu. These *shola* forests occur mainly in valleys and are typically separated by undulating montane grasslands, together forming the unique *shola*-grassland mosaic.

RAJARSHI BANERJI/SANCTUARY PHOTOLIBRARY



Spot the Tiger With their bold black and orange stripes, tigers *Panthera tigris* melt into the grass, ambushing their prey with relative ease. While working on a book for the Kaziranga National Park authorities, the photographer could capture this unique bird's-eye perspective of a tiger checking out possible threats before crossing a forest road, which is a typical cat instinct. These grasslands are vital habitats essential to predators and prey, and are the foundation for the intricate balance of life on our planet.



DR. MOHAN RAM

Hide and Seek The smallest of the bustard family, the Lesser Florican *Sypheotides indicus*, is disappearing on account of degrading habitats and increasingly intrusive human presence. A recent, robust survey across much of its range estimated just 340 displaying males, underscoring its precarious status. Dependent on native monsoon grasslands for breeding displays and nesting, its survival is intricately linked to the health of these rapidly vanishing ecosystems.



ARPIT PAREKH/SANCTUARY PHOTOLIBRARY

Resplendence The resplendent frog *Raorchestes resplendens* is found exclusively in the high-altitude montane grasslands (*shola*) of the Eravikulam National Park and surrounding Anamalai hills in Kerala, south India. It inhabits moss-covered rocks and grass clumps in areas above 2,000 m., particularly around the Anamudi peak, making it highly endemic to this specific southern Western Ghats landscape.

AMIT DARUNKAR/SANCTUARY PHOTOLIBRARY



Selfie with the Pack The Indian wolf is an iconic species of India's grasslands. The Indian grey wolf *Canis lupus pallipes*, with an estimated wild population of 2,000-3,100, is classified as Vulnerable and listed under Schedule I of the *Wildlife Protection Act*. Found across the semi-arid grasslands of Rajasthan, Gujarat, Maharashtra, Madhya Pradesh, and Karnataka, this elusive predator is a keystone species, playing a crucial role in maintaining the balance of grassland ecosystems by regulating prey populations and keeping these landscapes ecologically healthy.



KALYAN VARMA



Gouged Earth A JCB converts a grassland into 'green' in Bengaluru. Among India's most exploited ecosystems, grasslands are often mislabelled as wastelands and fall under revenue departments, despite supporting local communities with grazing and fuel. In a push to make them look 'green', these habitats are frequently planted with trees, overlooking their natural ecology. When JCBs move into a grassland, it often marks the beginning of the end.



SATYANATHAN VIKRAM/SANCTUARY PHOTOLIBRARY



Peering into the Future A Black-breasted Parrotbill *Paradoxornis flavirostris* clings to tall elephant grass at the Jia Grasslands in Roing, Arunachal Pradesh, a habitat increasingly threatened by rapid commercial development. Listed as Vulnerable on the IUCN Red List, this endemic species is now confined to fragmented 'island' grasslands in Northeast India, facing habitat loss from roads, dams, and other infrastructures, highlighting the urgent need for a comprehensive conservation plan.

PUSKAR BASU/SANCTUARY PHOTOLIBRARY

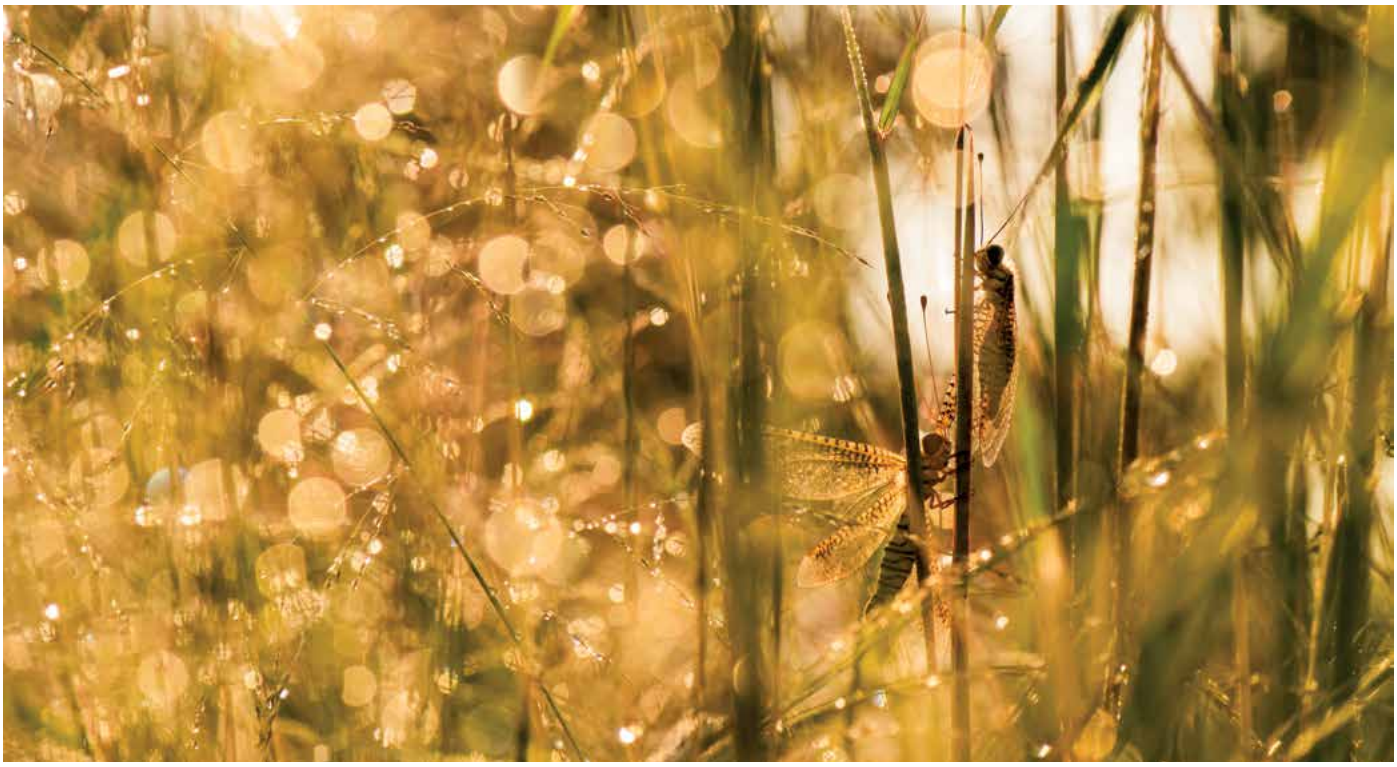


The Black and White of It The marshes of Hanle in Ladakh were once a key breeding ground for the near-threatened Black-necked Crane *Grus nigricollis*. Today, this wetland–grassland mosaic is steadily shrinking under expanding settlements, grazing, tourism, free-ranging dogs, and climate change, threatening the crane's survival. Conserving this high-altitude ecosystem is vital to protect the unique wildlife it supports.



VIKAS YADAV/SANCTUARY PHOTOLIBRARY

Elegant But Not Cute The Tibetan gazelle *Procapra picticaudata*, or *gowa*, is one of India's rarest mammals and teeters on the brink of local extinction. During the 1960s and '70s, Tibetan gazelles were heavily persecuted and now are mostly confined to just 100–150 sq. km. on the Kalak Tartar plateau of Hanle Valley. They are typically found in forb dominated pastures, particularly areas with *Krascheninnikovia ceratoides* (locally known as *gyab-shen*).



DIPAK MANDLIK/SANCTUARY PHOTOLIBRARY

Microworlds in the Grass A pair of antlions (family Myrmeleontidae) peer intently through a dewy grass curtain in Badlapur, Maharashtra. Grassland ecosystems host complex, highly specialised associations between insects and grass, with an estimated average of 41.4 insect species linked to a single grass species. These relationships span a wide range of roles, from herbivores that defoliate grasslands to specialised insects that live within stems.



VIKRAM BATRA/SANCTUARY PHOTOLIBRARY

THE FORGOTTEN WILDERNESS

INDIAN GRASSLANDS

By Asad Rahmani



Across the vast sweep of the Indian subcontinent lies a landscape long misunderstood, frequently dismissed, and quietly vanishing – grasslands. To the untrained eye they may appear empty, even barren, especially when compared with forests clothed in towering trees or wetlands alive with shimmering waters and aquatic and semi-aquatic life. Indian grasslands are not wastelands awaiting improvement; they are living archives of evolution, climate, and coexistence between wildlife and pastoral cultures.

From 'Wasteland' to Lost Ecosystem

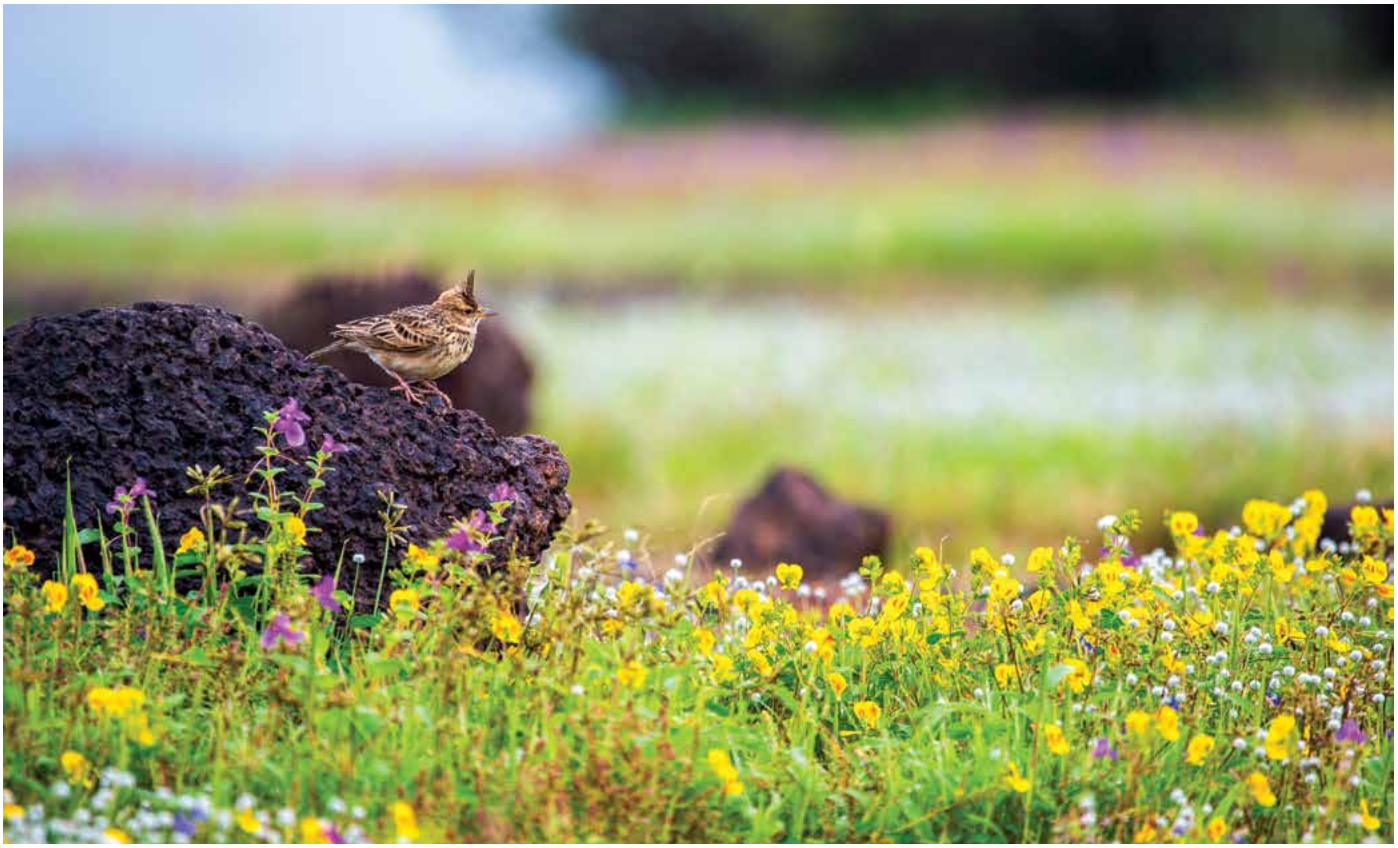
For centuries, ecological imagination in India has been dominated by forests. Colonial administrators equated tree cover with productivity and conservation, and this perception still survives even after India's Independence. Land without trees was labelled 'waste', a term that has perhaps done more ecological harm than any invasive species. Under this misconception, millions of hectares of natural grasslands were converted into plantations, croplands, industrial sites, and urban expansions. In attempting to 'improve' the land, we erased ecosystems that had taken millennia to evolve.

Globally, rangelands – encompassing grasslands, savannas, and shrub-steppes – cover more than 40 per cent of the Earth's terrestrial surface and sustain the livelihoods of a growing proportion of the world's rural poor through agro-pastoralism. These landscapes simultaneously provide critical habitat for wildlife, creating complex ecological relationships between domestic and wild herbivores.

In India, savannas and grasslands together occupy nearly 10 per cent of the national landscape. Yet, in policy frameworks and popular imagination alike, these ecosystems have long been viewed as degraded remnants of forests. Consequently, they are frequently targeted for large-scale tree-planting programmes

Indian grasslands are not wastelands awaiting improvement; they are living archives of evolution, climate, and coexistence between wildlife and pastoral cultures. The grasslands of Tal Chhapar in Rajasthan (facing page) are famous for their large blackbuck herds.

PUSHKAR ACHYUTE/SANCTUARY PHOTOLIBRARY



Grasslands in India are remarkably diverse. They range from the semi-arid savannas of western India and the rolling plateaus of the Deccan to the tall alluvial grasslands along Himalayan rivers, shola *grasslands of the Western Ghats, and the alpine meadows that bloom briefly under melting snow. Each type is shaped by rainfall, soil, fire, grazing, and seasonal extremes. A Malabar Lark* Galerida malabarica *sits pretty in the seasonally flowering plateau of Kaas, Maharashtra.*

intended to restore presumed forests and enhance carbon sequestration. Such well-intentioned interventions often overlook the ecological identity of savannas, risking the replacement of biodiverse open ecosystems with ecologically inappropriate plantations. For example, in the Dudhwa National Park (see page 64), where we worked on the Bengal Florican and other species, most of the grasslands were planted by teak, leaving very little habitat for the florican, Swamp Francolin, munias, prinias, swamp deer and hispid hare.

Hidden Grassland Biodiversity

Grasslands in India are remarkably diverse. They range from the semi-arid savannas of western India and the rolling plateaus of the Deccan to the tall alluvial grasslands along Himalayan rivers, *shola* grasslands of the Western Ghats, and the alpine meadows that bloom briefly under melting snow. Each type is shaped by rainfall, soil, fire, grazing, and seasonal extremes. Unlike forests, grasslands thrive on disturbance. Grazing ungulates, periodic fires, and climatic variability maintain their structure and species composition. Remove these forces, and the grassland slowly transforms – first into scrub, then woodland – losing the species uniquely adapted to open habitats. Or, they degrade into a barren landscape.

Despite their importance, grasslands have undergone a far higher rate of conversion than forests, even as forest conservation has advanced more rapidly in advocacy, funding, and policy attention. Grassland biodiversity has consequently become among the most threatened on Earth. Avian communities have suffered severe declines; in North American grasslands alone, more than 60 per cent of endemic bird populations have disappeared since the 1970s. India is no different. The case of the Great Indian Bustard (see page 93), a bird of the short grass plains, is well-known. Its dependence on large undisturbed landscapes, and vulnerability to infrastructure such as power lines have pushed it to the brink. Their survival strategies reflect adaptation to visibility, camouflage, and mobility rather than concealment within forests. Ground-nesting behaviour, elaborate courtship displays, and seasonal movements evolved in response to open horizons and fluctuating resources. The bustard's plight mirrors that of the ecosystem itself – gradual decline unnoticed until crisis becomes unavoidable. The same fate is faced by the Lesser Florican, whose dramatic breeding displays once animated monsoon grasslands. Males leap vertically above tall grasses, their sudden appearance and disappearance resembling fleeting sparks in a green sea. Such behaviours evolved in landscapes where uninterrupted visibility allowed communication across distances. As grasslands shrink and become fragmented, these displays lose both stage and audience. The exhaustive study by Dr. Sujit Narwade of the Bombay Natural History Society has highlighted the considerable decline of grassland birds such as the Indian Courser, Common Sandgrouse, larks, and munias in the Deccan area.

GODFATHERLESS GRASSLANDS

By M.K. Ranjitsinh

Grasslands and the grassland-forest mosaics are the most productive terrestrial ecosystems on earth. A majority of mammalian species evolved upon them (see page 29), many becoming very prolific with the year-round nutrition available. Some became grassland-specific and non-adaptive to other biomes.

When I drafted the *Wildlife (Protection) Act* in 1972, and even more so now, the most critically endangered species in India – the barasingha, Manipur brow-antlered deer, hog deer, pygmy hogs, caracals, the bustards, floricans and others – were grassland and grassland-forest mosaic specific animals. But grasslands were not only their abode. Others such as the nilgai and blackbuck thrived here, venturing to raid neighbouring croplands under the cover of night. Blackbuck nibble wheat crop only in the first three weeks of its growth. Howwever, now with the disappearance of grasslands, the nilgai, blackbuck and even livestock, which have no other land to stand upon, live permanently on croplands, trampling at times more than they consume. Many ground-laying bird species – partridges, quails and the sandgrouse in particular – have lost their primary breeding sites with the loss of grasslands.

Back to the Future

Lands in rural areas are under the control of two authorities. The Forest Department exercised control over the Reserve and Protected Forests established under the *Forest Act* of 1927. The Revenue Department dealt with private lands, communal, and government-owned lands. The last two categories include grasslands for public livestock grazing – the *charokhars, beeds, videes* and others. And there were vast tracts in the western Himalaya, the arid western India and elsewhere including the lush northeast, which were classified as 'Wastelands' and hence became dispensable, irrespective of the fact that they supported animal husbandry and livestock.

After the Mutiny of 1847, the British government took over India from the East India Company and Queen Victoria became the Empress of India. Her daughter was the Kaiserina of Germany and the Germans were then recognised as the greatest foresters of the world, having replanted their Black Forest. Germans – Brandis, Ribbentrop and others – drafted the forestry and forest management policies of India and incredibly, these continue today without much change. Forests were plentiful then and the human population low. Revenue from forests was primary, their ecological importance was unimportant and indeed, almost ignored. The growing and harvesting of timber – teak and *sal*, oak and pine – were the main, often the only, concern. The other tree species were titled 'Miscellaneous' and ignored. Grass – except the lucrative bamboo – was also deemed 'Miscellaneous' and extraneous. Grasslands were either planted over with timber species or allotted for human settlements in forests, to provide '*begar*' (bonded) labour for forestry operations.

Even the invaluable frost hallows in monogamous *sal* forests became forest



KEDAR GORE

Three grassland sanctuaries that the author established as the Forest Secretary of Madhya Pradesh for the critically endangered Great Indian Bustard, Lesser Florican and others – Sorsan, Sailana and Sardarpur – have been totally denotified.

Grasslands also harbour wolves, foxes, blackbuck, chinkara, and a remarkable diversity of reptiles and insects. Pollinators flourish in seasonal blooms, while rodents and invertebrates sustain complex food webs. Raptors, such as the Red-headed Falcon, depend on open terrain for hunting, and migratory birds such as larks, pipits, sandgrouse, use these landscapes as winter refuges. Remove grasslands, and entire ecological networks collapse.

Ecologically, grasslands are engines of productivity. Their dense root systems bind soil, prevent erosion, and store vast quantities of carbon underground. During the monsoons, they absorb water like sponges, reducing floods and replenishing groundwater. In dry months, they sustain pastoral livelihoods and wildlife alike. What appears sparse above ground is matched by extraordinary biological activity below, where networks of roots, fungi, termites, ants, beetles, and microorganisms sustain nutrient cycles essential to ecosystem health.

For decades, this neglect was reinforced by deeply rooted assumptions about origin and authenticity. Most ecology books say that Indian grasslands have arisen through human-driven forest destruction. If such habitats were merely secondary formations, one would expect them to harbour few, if any, endemic species, despite the fact that most grassland types do host endemic species such as the Nilgiri tahr and Nilgiri Pipit in the Western Ghats.

Emerging ecological research tells a markedly different story. Evidence increasingly points to the antiquity of Indian savannas and to a biodiversity far richer than previously imagined. A principal argument historically used to dismiss these ecosystems – that they lack endemic species –has proven untenable. A comprehensive review of plant species restricted to the peninsular savannas by a team of scientists has identified at least 206 endemic plants. Their distribution reveals striking regional concentrations: undivided Andhra Pradesh supports 88 endemic species, Tamil Nadu 78, Karnataka 61, and Maharashtra 54, while other states harbour smaller yet significant assemblages. Seventeen of these plants are already recognised as threatened on the IUCN Red List, and numerous recently described taxa await formal conservation assessment. Some researchers suggest that the true number of endemic grassland plants in India may approach as many as 500 species.

Endemism itself serves as powerful ecological testimony. Secondary habitats rarely generate high levels of restricted-range species; such evolutionary distinctiveness typically reflects long-term ecological stability. The presence of endemic flora in Indian savannas thus strengthens the argument that these landscapes are ancient ecosystems shaped by climate, fire, herbivory, and evolutionary time rather than recent human disturbance alone.

RAM SURENDAR/SANCTUARY PHOTOLIBRARY



Indian grasslands, including montane shola *grasslands, are ancient ecosystems, not merely secondary landscapes shaped by human activity. They support rich biodiversity, including endemic species such as the Nilgiri tahr and Nilgiri Pipit, which are uniquely adapted to these habitats.*

Pastoralism and Other Challenges

Yet conservation challenges in grasslands differ fundamentally from those in forests. Forest protection often involves restricting human presence, but grasslands have historically coexisted with pastoral communities. Nomadic and semi-nomadic herders shaped these ecosystems through controlled grazing patterns, seasonal movement, and intimate ecological knowledge. Livestock grazing, when moderate and rotational, maintains habitat heterogeneity beneficial to wildlife. The challenge lies not in excluding people, but in sustaining traditional practices while preventing overgrazing, land conversion, and industrial pressures.

Many pastoral societies, such as the *Masai* of Africa, *Bakerwals*, *Gujjars* and *Changpas* of the Himalayas, *Maldharis* and *Rabaris* of Gujarat, *Dhangar* and *Banjara* of the Deccan, and *Todas* of the Nilgiris, have evolved their own cultures, taboos, and mobile land use systems. They also conserve indigenous varieties of livestock. Modern conservation increasingly recognises pastoralism as a co-evolved ecological system, rather than a driver of degradation – especially relevant for India's neglected grassland biomes.

Modern development has introduced new threats. Renewable energy infrastructure, though essential for climate mitigation, often overlaps with prime grassland habitats. Wind turbines, solar installations, transmission lines, and roads fragment landscapes and create mortality risks for large birds. They also disrupt the movement of pastoralists, besides taking away their grazing lands. Conservation planning must therefore reconcile climate goals with biodiversity protection, ensuring that green energy does not inadvertently eliminate already endangered ecosystems and pastoral communities.

villages, depriving the grassland – specific mammalian and avian species, of their only abode in these biomes.

The other nefarious practice that became a part of forestry operations was regular, rampant burning of grasslands and open forests without any knowledge of its impact on the soil and forest ecology. In teak biomes, fire helps teak regeneration and preponderance, as this tree and its seed are fire-resistant, unlike the other 'miscellaneous' species. In *sal* forests, burning of wet grassland patches hardens the soil and helps their conversion into treelands. Unfortunately, the same ignorance of fire ecology and of the long-term consequences of persistent burning still continue, albeit somewhat less.

When I went to Mandla district as Collector in 1967, the world population of the Central Indian subspecies of barasingha *R. duvaucelii branderi* was confined to two central meadows of the Kanha National Park, which were also being subjected to repeated burning to show the deer and tiger to visitors, depriving the deer of high grass cover to breed and raise their fawns. The remaining grassland meadows had been converted into forest villages. The relocation of 23 such villages and a better grass burning regime have been the main reasons for the current revival of this barasingha.

The fate of grasslands under the control of the Revenue Department in rural areas was much worse. The landless were the poorest people, reduced to menial labour and seasonal migrations to obtain wages to survive. Large portions of grasslands were diverted to croplands under the Grow More Food Campaign started after the Indian Independence in 1947 and giving away grassland title deeds or '*pattas*' to the landless, became the most popular pastime of politicians and district collectors.

When I was appointed Collector of Dhar district in Madhya Pradesh in 1965, the then Agriculture Secretary of the state specially directed me to distribute to the landless the ample grasslands that then existed in Dhar and which, to a limited extent, I did.

When the Narmada dams were constructed in Madhya Pradesh and Gujarat, the compensatory afforestation that was carried out by the Gujarat government was by planting the pestilent and persistent '*pardesi babul*' *Neltuma juliflora* on the Banni grassland of Kutchh, arguably the most productive grassland of India and which, therefore, devastated the grasslands and the livelihoods of the local pastoral communities. Just recently, the Government of Gujarat has sanctioned some Rs. 85 crore to clear the *Neltuma* of Banni, which was planted by the government itself. Between the years 1880 and 2020, India lost 26 million ha. of forests (from 89 million reduced to 63 million) and 20 million ha. of grasslands/shrublands (from 45 million reduced to 25 million). In contrast, croplands have increased by 48 million ha. (from 92 million to 140 million) during the same period. (Hanguin Tan, Kamaljit Banger, Tan Bo, V.K. Dadhwal, 2014 '*History of land use in India during 1880-2010: Large–scale land transformations reconstructed from satellite data and historical archives*,' ELSEVIER Global and Planetary Change. 2014.)

"India has the largest livestock population in the world, almost entirely dependent upon free rangeland grazing and the livelihoods of millions depend upon them. A grassland policy would imply regulation of the extent and timing of grazing, of rational use of grasslands." – M.K. Ranjitsinh

India has promulgated a slew of forest policies. In piloting the prevalent Forest Policy as a functionary of the Union Ministry of Environment and Forests in 1988, I tried to incorporate in it aspects of grassland management. Subsequently, both while in service and in retirement, I tried to persuade various governments of different political parties to adopt a National Grassland Policy. I failed. India has the largest livestock population in the world, almost entirely dependent upon free rangeland grazing and the livelihoods of millions depend upon them. A grassland policy would imply regulation of the extent and timing of grazing, of rational use of grasslands, which is not politically acceptable. Even the three grassland sanctuaries I established as the Forest Secretary of Madhya Pradesh for the critically endangered Great Indian Bustard, Lesser Florican and others – Sorsan, Sailana and Sardarpur – have been totally denotified. Other grassland sanctuaries in Gujarat, Rajasthan, Maharashtra, Karnataka and elsewhere have been reduced.

Grasslands across the country continue to be reduced, abused and over-used. The nation is paying for this profligacy, for there is no 'free lunch' in nature and ecology.



M.K. Ranjitsinh is an author and an authority on wildlife and nature conservation from India, and one of the prime architects of India's *Wildlife (Protection) Act* of 1972. He helped save the Central Indian barasingha from extinction as part of the Indian Administrative Services. He served as the country's first Director of Wildlife Preservation under the Environment Ministry from 1973 to 1975.

Agricultural intensification has also reshaped grasslands. Expansion of irrigated farming alters soil structure and vegetation, replacing native grasses with monocultures. Chemical inputs affect insect populations, reducing food availability for birds. Meanwhile, abandonment of traditional grazing in some regions leads to shrub encroachment, demonstrating that both excessive use and total exclusion can harm grassland ecology. Invasive species such as *Neltuma juliflora* (earlier *Prosopis juliflora*) thrive in disturbed grasslands. One of the greatest obstacles to grassland conservation remains perception. Forests inspire emotional attachment; grasslands demand ecological understanding. Their beauty is subtle – found in shifting light across waving grasses, the sudden flush of a coursing bird, or the quiet persistence of life adapted to extremes. Conservation therefore requires not only scientific research but cultural reawakening. Society must learn to see value where it once saw emptiness.

Encouragingly, awareness is slowly growing. Protected Areas established for species such as blackbuck and bustards have demonstrated that grassland restoration is possible. Removal of invasive shrubs, regulation of grazing intensity, and protection of breeding sites have yielded measurable improvements in some regions. Community-based conservation initiatives show particular promise, as local people often possess the strongest incentive to maintain ecological stability. Sumer Singh of Jaisalmer is a fine example: he is fighting to protect his community's grazing lands in Degrai-mata oran. Orans, like *rakhals* or *beeds* of Gujarat and Madhya Pradesh, are grasslands traditionally protected by villagers for their own use.

Scientific research has begun to illuminate the complexity of these ecosystems. Long-term monitoring reveals that grasslands respond rapidly to management interventions, offering hope for recovery if action is timely. Some good examples are Velavadar National Park and Naliya grasslands in Gujarat and Tal Chappar in Rajasthan, where grasslands have been restored and maintained by the Forest Department. Velavadar grasslands have one of the largest roosts of harriers, as does Tal Chappar – though both are more famous for their vast blackbuck herds.

Satellite imagery now allows mapping of grassland extent and seasonal productivity, correcting earlier classifications that misidentified them as degraded forests. Such advances underscore the importance of interdisciplinary collaboration between ecologists, policymakers, and local communities.

Climate change adds another layer of urgency. Grasslands are inherently resilient to climatic variability, yet extreme weather events may alter species distributions and phenology. Some regions may experience intensified drought, while others face invasive species expansion. Protecting large, connected landscapes will allow wildlife to adapt through movement – a strategy difficult in fragmented habitats.

The Future of Grassland Conservation

Education plays a crucial role. When students visit grasslands, many initially perceive monotony, yet guided observation reveals astonishing diversity – tiny orchids blooming after rain, larks singing invisibly from the sky, and intricate insect communities thriving at ground level. Such experiences transform perception, fostering appreciation that statistics alone cannot achieve. A visit to Kaas plateau in the monsoon will change your perspective of a grassland. Incidentally, the Kaas plateau is maintained by regulated grazing after monsoon flowering is over.

Policy reform remains essential. Official recognition of grasslands as distinct ecosystems rather than degraded forests would fundamentally change conservation priorities. Land-use planning must integrate biodiversity assessments before approving infrastructure projects. Incentives for sustainable pastoralism, compensation for wildlife-related losses, and participatory management frameworks can align conservation with livelihoods.

The story of Indian grasslands ultimately reflects a broader philosophical question: how do societies define nature? If conservation values only dense forests and charismatic megafauna, vast ecological worlds will continue to disappear unnoticed.

Grasslands remind us that biodiversity often resides in subtlety, adaptation, openness, and seasonal transformation.

Standing in a grassland at dawn offers a lesson in ecological humility. The horizon stretches unbroken, grasses shimmer with dew, and life reveals itself gradually – a call from a distant lark, the silhouette of an antelope, the silent glide of a harrier searching for prey. Nothing appears dramatic, yet everything is precisely balanced. These landscapes teach patience, resilience, and coexistence.

India's conservation future depends partly on restoring this balance. Protecting grasslands is not merely about saving individual species; it is about safeguarding ecological processes that sustain biodiversity, livelihoods, and climate stability. The disappearance of grasslands would represent not only biological loss but cultural amnesia – the forgetting of landscapes that shaped human history across the subcontinent.



Asad Rahmani, Director of BNHS (1997-2015), has authored 26 books, and several scientific papers and articles. His main interest is in grassland and wetland birds. He was also the Executive Editor of the *Journal of BNHS*, and other BNHS publications.

WHICH CAME FIRST: THE GRASS OR THE GRAZER?

By Dr. Seshadri K.S.

When one thinks of a grassland, it likely conjures up images of the African savanna, with herbivores grazing in the foreground and a lone tree in the background. It would logically follow that the great diversity of mammals that occur in grasslands evolved with the grasslands. Recent studies provide evidence that grassland-mammal evolution is more complex than previously thought. Grass belongs to the family Poaceae, and there are over 11,700 species, varying in size from a few centimetres to tall bamboo, occupying areas from the arid regions of the world to lush green mountaintops. Grasses play a crucial role in shaping the Earth's climate as they are reservoirs of biomass that they produce by sequestering carbon dioxide. Grassland ecosystems are also increasingly recognised as a crucial reservoir of biodiversity globally.

Photosynthesis

"When and where did grasslands evolve?" has been a recurring theme in evolutionary biology. Answering these questions requires a wealth of information drawn from various fields such as field biology, taxonomy, genetics, and palaeontology. A bit of high school biology also becomes relevant here.

Photosynthesis is essential for plants to grow, producing biomass. Although nested in one family, grasses have two distinct ways in which they photosynthesise. Most grasses are classified as C_3 and are found in cool, temperate environments. The other group, C_4, are found in warm tropical environments. The two pathways differ in the mechanism of absorbing atmospheric CO_2 to produce glucose. C_4 is the more efficient of the two.

Record Keepers

Fossil records offer a window into the past. Plant fossils include macroscopic material such as leaves, stems, and seeds, as well as microscopic material such as pollen and silica bodies found in grasses called phytoliths. The phytoliths differ across plant groups, and a close examination can indicate which forms existed in the past.

Contrary to popular belief, fossil records are incredibly poor, especially in the warm tropics, where degradation of organic material is much easier compared to the cold, stable environments in the temperate regions. While fossils can tell us about ancestral lineages of grasses, genetics helps us understand the relationships between species. While extracting genetic material from fresh specimens can be easy, doing so from fossils can be a challenge.



RASHMI TRIBHUWAN/SANCTUARY PHOTOLIBRARY

The tooth structure of living and extinct mammals reveals clues about their diets. Because plants contain high levels of silica, eating them is comparable to chewing sandpaper. As a result, mammals that graze on grasses were believed to have evolved high-crowned teeth with a greater proportion of enamel that wears down gradually – a condition known as hypsodonty. Therefore, the presence of hypsodont mammals was once thought to coincide with the evolutionary rise of grasses.

THE GOLD BENEATH OUR FEET

By Anuja Malhotra and Abi T. Vanak

On World Environment Day (June 5), something wonderfully predictable happens across India every year – politicians, school children, techies, and people from all walks of life line up to get some dirt under their fingernails, to plant saplings. The headlines proudly announce records of lakhs if not crores of 'trees' being successfully planted across the nation, and the mood is genuinely hopeful. The intention is real, and the urgency driving it is righteous. India faces severe land degradation, a biodiversity crisis, and the accelerating pressures of climate change. We need to act now, and we need to act at scale.

However, given that most of these plantation drives fail, it is worth pausing over a question that rarely gets asked in all the planting enthusiasm: where, exactly, are those trees going?

Across India, a significant number of them are going into grasslands. And that is a problem – not because the impulse to restore and green our landscapes is wrong, but because planting trees on grasslands does not restore them. It destroys them.

India's grasslands and Open Natural Ecosystems (ONEs) – landscapes that cover an estimated 15 to 20 per cent of the country's land area, sustain some of our most iconic wildlife, and hold more climate value in their soils than most people realise. However, understanding them is not a niche scientific concern. Given their contribution to the economy (Rs. 1.3 lakh crore per year through the pastoralist economy) – it is one of the most important things India can do to get its restoration ambitions right.

Ancient Architectures

The Terai grasslands along the Himalayan foothills once hosted some of the greatest densities of large mammals on Earth, comparable only to the African savannas. The Banni grasslands of Kutchh (see page 60) were woven into the pastoral economies of communities whose knowledge of the land stretches back hundreds of years. The Deccan savannas sustained wolves, blackbuck, Great Indian Bustards, and the intricate seasonal rhythms of *Dhangar* shepherds who moved across them for generations.

These are not degraded forests, patiently waiting to return to their 'true' form. Phylogenetic and paleoecological evidence is unambiguous: grasslands and savannas are ancient, self-sustaining biomes – evolutionarily distinct from forests, shaped over millions of years by rainfall, fire, soil, and grazing. The grasses themselves – *sewan, dhaman, anjan, marvel* – are not pioneer species marking a transition. They are the destination.

How We Got Here

The idea that India's open landscapes were degraded or unproductive is largely a colonial inheritance, and understanding that history helps explain why correcting course is harder than it sounds.

THE CORBETT FOUNDATION



The Corbett Foundation has restored ~400 acres of grassland in Abdasa taluka *of Kutchh, Gujarat, transforming Neltuma-infested and overgrazed land (above right side) into a thriving grassland habitat (above left side) supporting 300+ species and benefiting local communities.*

Organisms that depend on grasslands give us an opportunity to examine the past. The tooth structure of both present-day and extinct mammals can tell us about what they eat. Because plants have high concentrations of silica, eating them is like chewing sandpaper. Mammals that feed on grass were thought to have evolved teeth with a high crown, having a greater proportion of enamel that gradually wears down, a condition called hypsodonty. Thus, the presence of hypsodont mammals was thought to correspond to the time when grasses evolved. In recent years, studies of carbon isotopes have provided critical evidence to establish the chronology of grassland evolution.

An Evolutionary Trail

Grasses start showing up in the fossil record from the late Cretaceous period, 66 to 70 million years ago (MYA). However, these plants were likely rare and sparsely distributed. The origin likely happened in the supercontinent called the Gondwana, which derives its name from the *Gond* tribes of Central India. Researchers were able to determine this by examining coprolites (fossilised dung of dinosaurs).

However, the trajectory of grasses dominating and forming grassland ecosystems was a multi-step process. The earliest evidence of open grassland habitats is thought to be from southern South America, around 40 MYA. Here, there was evidence of phytoliths and scratches on the hypsodont fossils. Mammals also start showing up in fossils in just about two million years (~38 MYA). The hypsodont fossils with scratch marks are likely telling a tale of the mammals feeding on plant matter, covered with volcanic dust and not necessarily entirely dependent on grassland ecosystems.

In North America, grasses show up about 34 MYA and grassland habitats form around 22 MYA. A couple of million years passed until mammals that graze came to dominate these habitats, around 18 MYA. A similar pattern is seen in Africa as well. Grassland habitats formed around 20 MYA, but the mammals came to dominate only a few million years later, around 18 MYA. In contrast, parts of Eurasia tell a different story. While grass evolved ~30 MYA, open grassland habitats emerged around 15 MYA, coinciding with the prevalence of grazing mammals. In South Asia, primitive forms of grass appear as early as 66 MYA, but grassland-dominated habitats form around eight MYA, after a massive lag, and this coincides with the mammals dependent on grasslands dominating them.

"Grasslands are ancient, distinct biomes that established themselves over eight million years ago, long before the first axe was ever swung. By afforesting these landscapes today, we are effectively erasing an evolutionary heritage that took nature millions of years to assemble." – Dr. Seshadri K.S.

Climate Change

When grass started evolving, there were much higher levels of atmospheric carbon dioxide compared to today. Therefore, the less efficient C_3 method was still working fine for grass to build biomass. The rise of the Himalaya and the subsequent weathering reduced the atmospheric CO_2, and the plants likely evolved the C_4 pathway to effectively produce biomass.

Across all the continents, C_4 plants evolved much more recently, between 10 and five MYA, with the exception of Australia. The environment also underwent a dramatic shift from moist to being seasonal, with distinct dry periods. The C_4 mechanism allowed plants to utilise water effectively, and these plants could dominate the grassland ecosystems. In addition, with increased aridity, the cycles of fire increased and C_4 plants were at an advantage compared to trees, which have a C_3 pathway and are less capable of recovery from fire. Grasslands dominated by C_4 plants help in retaining grassland systems as they are prone to fires and woody saplings die out.

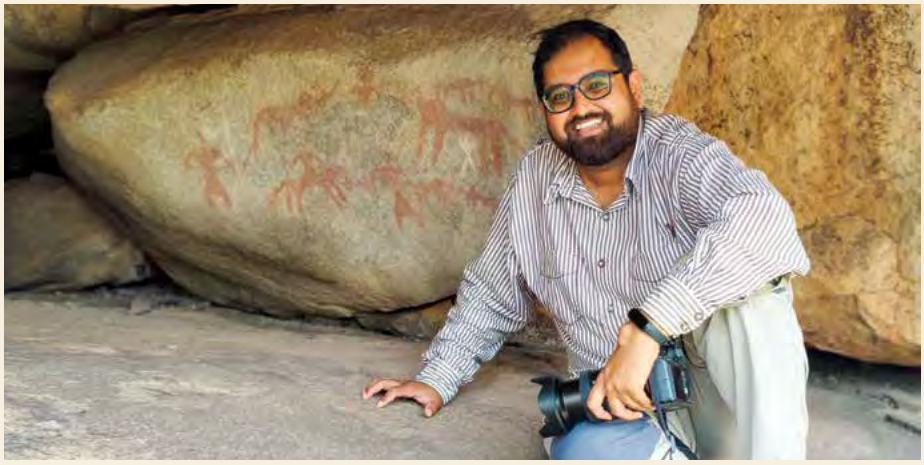
Nature's Answer to a Healthy Planet

India is home to some of the most primitive forms of grass. They are nature's answer to a harsh environment. Yet today, these resilient systems face their greatest threat not from the climate, but from land-use change and the misconception that a landscape without trees is empty.

A grassland is not a landscape waiting to become a forest; it is a climax ecosystem. Yet, we continue to describe them as wastelands and subject them to large-scale land-use conversion. They are ancient, distinct biomes that established themselves over eight million years ago, long before the first axe was ever swung. By afforesting these landscapes today, we are effectively erasing an evolutionary heritage that took nature millions of years to assemble.

To conserve the myriad forms that call grasslands home, we must first respect the antiquity of the grass. After all, a humble blade of grass managed to defy a forest, outlast the dinosaurs, and feed the rise of civilisations.

Further reading: Strömberg, C. A. E. (2011).* Evolution of Grasses and Grassland Ecosystems. Annual Review of Earth and Planetary Sciences, 39*(1), 517-544. doi:10.1146/annurev-earth-040809-152402



Dr. Seshadri K.S. is a faculty member at ATREE. He is a naturalist at heart; his work straddles different ecosystems and domains, including evolutionary biology and conservation practice. Fieldwork gives him great joy and a sense of purpose. He enjoys teaching and writing about nature and its conservation.

"The Indian wolf, one of the most genetically distinct wolf populations in the world, depends on the open Deccan landscape and the pastoral communities who have long coexisted with it."
– Anuja Malhotra and Abi T. Vanak

British foresters, trained in European traditions that associated ecological value almost exclusively with closed-canopy forests, arrived in India with no conceptual framework for its savannas and grasslands. The *Forest Acts* of the 19th century formalised this blind spot: forests were to be protected and managed, while open lands were categorised as revenue land, commons, or tellingly 'wastelands'. The word implied that these landscapes were not doing anything useful. Hence, the fix seemed obvious: make these lands productive by either converting them to agricultural land through intensive irrigation or carry out high intensity plantation drives.

For what remained, afforestation campaigns followed, often using fast-growing non-native species such as eucalyptus, gliricidia, and African acacia. The intention was understandable but the outcomes have not been ideal. Native grass communities were displaced. Grassland soils, which act like vast slow-release sponges for water, were disrupted by tree roots engineered for rapid, water-intensive growth. The pastoral communities that depended on these commons – the *Dhangar* shepherds of the Deccan, the *Rabari* herders of Kutchh, the *Bishno*i of Rajasthan – found their grazing lands shrinking without any formal recognition of what was being lost.

This history matters because its classifications are still with us. The *Wasteland Atlas of India* continues to map millions of hectares of ecologically intact grassland as unproductive land, and the revenue records classify large swaths of lands as 'culturable or non-culturable wastelands'. That classification, inherited from colonial revenue surveys, now shapes which lands are earmarked for development, afforestation drives, and other infrastructure projects. Updating this classification is one of the most consequential and tractable things India's land management institutions could do, and it is increasingly within reach.

What a Grassland Actually Does

The case for grasslands is not sentimental. For example, Rajasthan's open ecosystems cover roughly a third of the state. Karnataka's grasslands account for at least 10 per cent of its land area. These are not marginal zones. They are the ecological backbone of vast regions, providing fodder security for millions of livestock, groundwater recharge for agriculture, habitat for some of India's most endangered species, and climate buffering that is only now being appreciated.

On climate, the numbers are striking. Grassland soils are among the most significant

KALYAN VARMA



A Dhangar *shepherd stands tall with his herd of sheep in Maharashtra. The pastoral communities that depend on these commons – the* Dhangar *shepherds of the Deccan, the* Rabari *herders of Kutchh, the* Bishnoi *of Rajasthan – find their grazing lands shrinking without any formal recognition of what is being lost.*

INDIA'S GRASSLAND POLICY: MISSING IN ACTION

By Aparna Watve

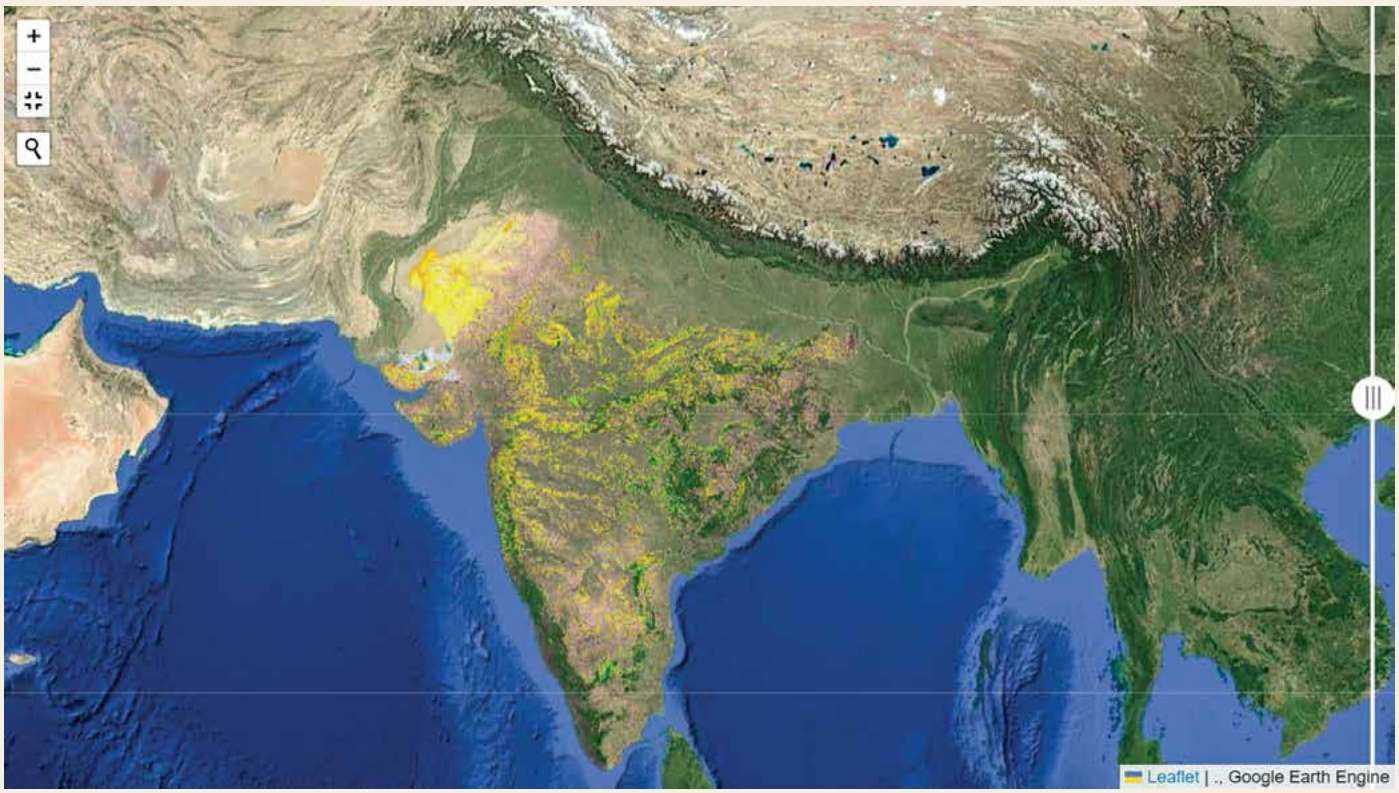
Recognising the Indian Grassland crisis, the Wildlife Conservation Society–India hosted a consultation in February 2018 which was attended by grassland ecologists, conservation organisations and policy experts. A background document for the consultation gave an overview of grassland management since historic periods and progress of grassland policy efforts to date. All previous efforts to create a policy that protects grasslands, grazing lands and commons have been abandoned or have failed.

Hence the experts decided to try a new approach. Based on previous research, policy documents, stakeholder meetings and expert consultations, a 'Grassland Conservation Action Plan' was designed, which suggests strategic directions to be followed and action to be taken for India's grasslands. It calls for formal recognition of grasslands as distinct ecosystems and recommends identifying and safeguarding them across both forest and revenue lands. Assessment of the current status of biodiversity and ecosystem services, improving management within forests and revenue lands, integration with social development plans, and futuristic conservation planning followed by training and awareness for the stakeholder groups are the main strategic directions suggested. It emphasises management approaches that maintain native biodiversity, ecological processes and the livelihoods of local communities. A list of activities to be undertaken by different agencies on a short- and long-term basis are added to help achieve conservation outcomes in a time-bound manner.

The Conservation Action Plan (https://www.researchgate.net/publication/334947614_Grasslands_of_India_Suggested_Action_Plan_for_Govt_agencies), along with supporting documents (https://www.researchgate.net/publication/401757210_Background_Document_for_the_Management_of_Grasslands_in_India), was sent to the Honourable Minister of the MoEFCC in April 2019 with a request that the issue be formally discussed by the Standing Committee of the National Board for Wildlife, and that all states adopt and implement grassland management guidelines within a defined time frame. There is no further information on this effort.



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MADHUSUDAN, KOULGI AND VANAK 2023

By using refined categorisations, researchers have created a map of Open Natural Ecosystems in India that reveals the larger extent of these ecosystems than can be found in most datasets. The lemon yellow represents savanna-grasslands.

carbon stores on earth. Soil in a mature grassland sequesters carbon as effectively as a forest, often more so, and in a form far less susceptible to sudden release. World Soil Day 2025 brought renewed attention to this fact: India's grassland soils are not a climate liability; they are a climate asset, one whose value only grows as temperatures rise. The most important point to consider is that across most of India's semi-arid regions, forcing trees into a landscape that cannot support them would demand enormous quantities of water, a resource already under severe stress. In a warming world, that is not a climate solution. It is a climate cost.

Grasslands are also the last refuge for some of India's most imperilled species. The Great Indian Bustard (see page 93) survives in only a handful of sites, its range reduced to fragments by habitat loss and collisions with power infrastructure. The Indian wolf, one of the most genetically distinct wolf populations in the world, depends on the open Deccan landscape and the pastoral communities who have long coexisted with it. With populations of blackbuck, chinkara, Lesser Florican and Indian fox, the grassland biome constitutes a parallel ark to India's better-publicised tiger reserves. Yet, these ecosystems receive a fraction of the legal protection afforded to forests. India's wildlife protection framework is overwhelmingly forest-centric, with most Protected Areas conceived as forest blocks. The grassland biome, which sits largely outside forest boundaries on revenue lands and commons, has historically fallen through the gaps. The encouraging news is that this is beginning to be recognised.

Knowing What We Have – And What We're Building

One of the most striking gaps in India's land governance is the absence of a comprehensive, scientifically validated national map of its grasslands. Data exists, but it is fragmented across agencies, in inconsistent formats, and often reflecting the same historical biases that obscured the value of grasslands. This is beginning to change in significant ways and many agencies are now mapping these ecosystems. It is thus high time to create a national database of grasslands, commons and other important ONEs.

This is imperative, since a major push for conversion of our last remaining ONEs is from large-scale renewable energy plants. Land classified as 'wasteland' carries minimal environmental clearance requirements, making it administratively straightforward for project developers. The result is that ecologically intact grasslands have become attractive candidates for solar and wind development not because they are the best sites ecologically or socially, but because they appear unoccupied on paper. The good news is that renewable energy and grassland conservation are not inherently opposed. Genuinely degraded lands (of which India has plenty) can and should host clean energy infrastructure. The challenge is having accurate ecological data to reliably distinguish between land that is truly degraded and land that only looks empty to an untrained eye. That is precisely the kind of information that a robust *National Grasslands Atlas* would provide, and it is why the knowledge work and the policy work are so deeply connected.

At the state level, momentum is tangible. The *oran* of Rajasthan – sacred community commons managed by pastoral communities for centuries – are perhaps the most vivid example of what lasting stewardship looks like. These are not wilderness areas from which humans are excluded. They are living landscapes shaped by human presence and care, where seasonal grazing and biodiversity have coexisted in a dynamic equilibrium refined across generations. The *Bishnoi, Rabari* and *Jat* communities, who have tended these landscapes, carry ecological knowledge that no remote sensing platform can replicate. There is now a strong grass-roots movement to map and protect these *oran* from destruction. Any serious policy framework for India's grasslands must treat this knowledge as an asset, not an obstacle.

Restoration as Possibility

Across India, there is now a growing recognition that just planting trees is not restoration, and definitely not in grasslands. In Rajasthan's Deshnoke Oran, a 100-ha. site within a 2,100-ha. sacred landscape near Bikaner, native grass seeds were dispersed by hand during the monsoon, root slips of sewan grass planted in shallow pits to avoid disturbing the soil, invasive Senna uprooted from 10 ha., and demilune water-harvesting structures built to slow runoff and support natural regeneration. Camera traps track returning wildlife. Soil cores measure the recovery of organic matter. Women from the local community are employed in every stage, building both livelihood and ecological ownership into the work from the start. Similar grassland restoration stories are playing out across Maharashtra (see page 48), Karnataka, Tamil Nadu and elsewhere.

This is what restoration looks like when it is done with communities, not for them. It is patient, season-sensitive, ecologically specific work, the kind that earns trust slowly and holds it across years. It is also, the data is beginning to suggest, the kind that works.

Perhaps this year, we will also see politicians, corporates and school children lining up to work with local communities to plant grasses on World Environment Day.

It is after all the green and gold beneath our feet.





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Abi T. Vanak is the Director of ATREE's Centre for Policy Design, studying ecology, human-wildlife coexistence, Open Natural Ecosystems, disease ecology, and conservation policy.



KALYAN VARMA



KALYAN VARMA

In many parts of India, including Hessarghatta near Bengaluru, the government has been using JCBs to dig pits for planting alien species like Eucalyptus (above) and Acacia. From above, these plantations may appear as dense forests, but on the ground they do not support wildlife and disrupt soil, natural regeneration, and groundwater, especially in arid regions. Dry thorn-scrub and grassland habitats without trees are natural and vital ecosystems. Open Natural Ecosystems like these are critical for wildlife and should not be treated as wastelands. The scraped earth (top) destroys topsoil containing seed banks and nutrients, and planting alien species, often under social forestry or compensatory afforestation programmes, cannot replace the ecological value of natural habitats.

SANCTUARY PHOTOLIBRARY



The *Sanctuary* Interview

MEET PROFESSOR G.D. MURATKAR

*"The smallest blade of grass is as important as the tallest tree," says **G.D. Muratkar**, widely known as the 'Grass Man of India' and recipient of the Sanctuary Green Teacher Award 2013. At a time when grasslands were poorly understood and often dismissed as wastelands, he was developing scientific techniques for their restoration. His interventions have helped revive thousands of hectares of grasslands, supporting ungulates, tigers, and broader wildlife ecosystems. Today, he is mentoring the younger generation to become better ecologists through his lectures and hands-on field-based methods. Senior Editor **Shatakshi Gawade** sits down with him to understand his journey and to explore how far India has come, even as its grasslands continue to rapidly disappear.*

Tell us about your journey to becoming a grasslands specialist!

My journey began in the Vidarbha region of Maharashtra, in Daryapur *tehsil* of Amravati district, where I was associated with the cropland ecosystem and developed a deep-rooted connection to the local landscape. My upbringing in an area surrounded by rich biodiversity laid the groundwork for my future vocation. I eventually earned the title 'Grass Man of India' for my work in creating grassland habitats across the country.

What first sparked your interest in botany and environmental science, and how did your Ph.D. shape your life path?

My interest in botany was sparked by a desire to understand the floristic diversity of Sant Gadge Baba Amrawati University campus during my days as an undergraduate and postgraduate student. The curiosity deepened during my Ph.D., where I focused on the ecological and environmental study of grasses and floral diversity of the Melghat Tiger Reserve, a phase that turned to be a turning point. This is when I realised that everyone was focused on charismatic species such as tigers, but very few were looking at the grass that sustained the entire food chain.

Often referred to as the 'Grass Man of India', Professor G.D. Muratkar was honoured with the Sanctuary Green Teacher Award in 2013. He continues to share his love of grasses with his students.

What is it like guiding students in a college that is so close to a Protected Area, and especially teaching about grasses and grasslands?

The Arts, Science and Commerce College Chikhaldara – run by Sipna Shikshan Prasarak Mandal, Amravati – is located near the Melghat Tiger Reserve. Having a Protected Area as a neighbour allows me to use the landscape as a living laboratory! The ecological study of grasses of the Melghat Tiger Reserve, collection of baseline data, Ecological Impact Assessment of rehabilitated villages… encourages students to see beyond the trees, focusing on the taxonomy, use of grasses for wildlife habitat, role of grasslands to increase prey density, and importance of grasses. This proximity helps bridge the gap between academic theory and practical field conservation, inspiring the next generation of ecologists.

Since we had the honour of naming you a Sanctuary Green Teacher in 2013, what would you say has been the impact of grassland restoration projects that you have been involved in?

My restoration techniques have been scaled up significantly. I have provided my expertise and services to 44 tiger reserves and 37 wildlife sanctuaries across 12 states in India, supporting the development and management of grasslands in Protected Areas. I am grateful that my work has led to the successful revival of thousands of hectares of degraded grasslands, and I have been able to train frontline staff for grassland development and management. These projects have directly increased the carrying capacity for herbivores in several tiger reserves. I have been able to influence national conservation strategies, moving the focus toward habitat-specific restoration.

Please tell us about your meadow development technique (see box on page 39), and how it can be applied in different regions. Why are grasslands important for biodiversity in India?

Grasslands are the foundation of India's wilderness. I'd say grasses are the engineers of forest ecosystems. They provide the primary energy source for ungulates such as chital, sambar, and barasingha. Without healthy grasslands, prey populations dwindle, leading to a collapse of the predator (tiger/leopard) population. They are essential for specialised species such as the Great Indian Bustard and the recently reintroduced cheetah. Grasslands are also important for wildlife, especially grazing, browsing, resting, breeding, hiding and prey-predator relationships.

My signature 'seed mother bed' technique is a scientific, low-cost method that can be adapted to various climates. I'm glad you asked! The grassland management plan (see box on page 39) involves assessing soil characteristics such as colour, texture, and water-holding capacity to determine suitable grass species, followed by seasonal identification of grasses, weeds, legumes, and browse plants. It includes timely seed collection and processing, weed control, and restoration through seed broadcasting and habitat management. The plan is implemented over three to five years with regular monitoring, site-specific treatment strategies, and maintenance of seed banks to track progress and ensure effective restoration.



Prof. Muratkar pioneered scientific methods for restoring grasslands at a time when these ecosystems were largely overlooked and commonly mischaracterised as barren wastelands. Prof. Muratkar was inspired by the grassland restoration and management initiatives of Ex. Chief Secretary of Maharashtra, Dr. Praveensingh Pardeshi IAS (above) and geologist and environmentalist Dr. Rajesh Jaipurkar.

You have worked in several tiger reserves across India. What have been some of your notable experiences working in these reserves?

I have worked in several iconic landscapes, including Melghat, Tadoba, Satpura, and Corbett. A key highlight of my career was being called upon to help prepare the habitat for herbivores and carnivores in the Melghat Tiger Reserve (Vairat-Gugamal Wildlife Division), and the Tadoba-Andhari Tiger Reserve. Then there is the wildlife habitat development and grassland restoration work at the Debrigarh Wildlife Sanctuary in Odisha, which has ensured that the landscape supports a healthy prey base.

What are the most serious threats to grasslands in India, and what are our solutions?

One of the biggest threats is the invasion of exotic weeds such as *Lantana camara*, *Parthenium*, and *Eupatorium*, along with the unintentional introduction of invasive


COURTESY G. D. MURATKAR


COURTESY G. D. MURATKAR

Prof. Muratkar works closely with Forest Department officials (top) on grassland management and restoration. Based on the grassland restoration approaches that he has developed, he encourages them to adopt scientifically planned management interventions to enhance grassland productivity and biodiversity conservation. He also enjoys spending time with children (above) and is seen here appreciating their artwork. His message to young adults is simple: "Understand the soil before you plant the seed, and remember that the smallest blade of grass is as important as the tallest tree."

grasses in Protected Areas by frontline staff, and the lack of proper grassland management techniques. The problem is compounded by the absence of grassland management guidebooks. The best solution is systematic weed eradication, followed by active 'mother bed' grass plantations, and a change in the legal status of grasslands, to prevent their diversion. *Lantana* should be removed and affected areas restored using suitable palatable grasses and browsing species. It is equally important to train frontline forest staff in grassland management and develop guidebooks with standard operating protocols.

Some suggest that grasslands are in-between ecosystems – a stage towards a forest climax?

I challenge that outdated 'climax forest' theory, which suggests grasslands are just a temporary stage before becoming a forest. I argue that many Indian grasslands are stable, ancient ecosystems that are complete in themselves and provide unique ecological services that a dense forest cannot!

Why are grasslands often overlooked when forest conservation policies are framed?

Historically, the Indian Forest Policy has undoubtedly been 'tree-centric' because trees are easier to identify and count, and have a perceived higher economic value. But the *Forest Conservation Act* actually specifies that grasslands, wild fruit trees and browsing species be conserved and protected as tree species. Grasslands were all too often officially classified as 'wastelands' in revenue records, making them soft targets for development projects, rather than for conservation.

Have Forest Departments, elected officials and the general public changed their attitudes towards wild grasses and grasslands, since you began your work?

Yes, there has been a drastic change in perspective. Forest Department officials now view grass management as critical to wildlife habitat management. There is a discernable rise in the percentage of open grasslands and along roadsides in rehabilitated areas. This has helped develop good wildlife habitats and soil moisture conservation. And among the general public, there

is a growing realisation that 'greenery' isn't just about planting trees, but about restoring native ground cover.

Can grassland restoration help reduce human-wildlife conflict?

Restoration is key to conflict reduction. When grasslands inside Protected Areas are natural and healthy, herbivores tend to stay within park boundaries thanks to plentiful food access. Consequently, this keeps predators (such as leopards and tigers) inside the park reducing straying incidents into villages, thus reducing negative encounters with humans. Grasslands and grass nurseries help create livelihood opportunities based on fodder production for domestic cattle.

What is the latest research that you are excited about?

I am particularly excited about the use of GIS mapping and soil-moisture analysis to identify which grass species will thrive in specific microclimates, and the study of phenology of grasses of Protected Areas. I am keen on developing eco-restoration techniques after uprooting invasive species, and developing a digital herbarium of grasses. I am also interested in developing a grass nursery, and studying seed germination of grasses with reference to edaphic and climatic factors.

Who inspires you, and what would your message be to the next generation of researchers, conservationists and officials?

I am inspired by Dr. Praveensingh Pardeshi IAS (Ex. Chief Secretary of Forest, Maharashtra), Dr. Rajesh Jaipurkar (geologist and environmentalist) for doing grassland restoration and management work in Protected Areas of India in 2010-11, and Dr. Kishor Rithe (Director, Bombay Natural History Society), who encouraged and promoted me to do advanced research, and write quality research papers in the field of grassland management.

My message to the next generation is simple: Understand the soil before you plant the seed, and remember that the smallest blade of grass is as important as the tallest tree. Grasses are architects of the forest ecosystem.

For Forest Department officials I would like to emphasise that the need of the hour is grassland management and restoration. Grasslands are ecologically significant habitats that support rich biodiversity, including herbivores, pollinators, ground-nesting birds, and numerous medicinal and forage species. Effective grassland restoration and management is therefore essential for sustaining ecosystem health within Protected Areas. Based on the grassland restoration approaches that I have developed, forest officials are encouraged to adopt scientifically planned management interventions to enhance grassland productivity and biodiversity conservation.

Key factors that grassland management principles should include

1. Habitat restoration: Promote natural regeneration of native grass species through soil and moisture conservation, removal of invasive weeds, and assisted regeneration where required.
2. Control of invasive species: Systematic removal and monitoring of invasive plants such as *Lantana camara* and *Parthenium hysterophorus*, which suppress native grassland diversity.
3. Scientific grazing regulation: Implement rotational and controlled grazing regimes to prevent overgrazing, and maintain sustainable biomass production.
4. Protection of native grass species: Conserve ecologically important grasses such as *Heteropogon contortus*, *Dicanthium annulatum*, *Cynodon dactylon*, *Themeda quadrivalvis*, *Chrysopogon aciculatus,* etc., and maintain the diversity of native palatable grasses, which are valuable as forage and for ecological stability.
5. Community participation: Engage local and tribal communities in grassland conservation through awareness programmes and sustainable resource management practices.
6. Carrying capacity: Know the carrying capacity and utility index of grassland for herbivores in Protected Areas.

The grassland management plan broadly includes

1. Field soil observation – colour, texture, water-holding capacity, which decides the choice of suitable grass. Select grasses for grassland restoration with reference to soil parameters:
   - Black soil: perennial grasses, palatable soft grasses
   - Red soil: annual, taller and coarse grasses
   - Black-red soil: mixed type of grassland
2. Identification of grasses: October
4. Identification of weed species: July to August
5. Identification of browsing plant species used by herbivores
6. Identification of wild leguminous plants: September to October
7. Collection of grass seeds and wild legumes seeds
8. Drying of grass seeds: for 12 days after collection; Drying of wild legumes seeds: for seven to eight days in indirect sunlight
9. Management of brush woods (woody species): June and January
10. Eradication of weeds: July and September, before fruiting
11. Restoration: seeds broadcasting, and weeds uprooting from May to June
12. Preparation of grassland management plan – three to five years
13. Season wise monitoring of grasslands by Deputy RFO and RFO
14. Comparative analysis of grassland before intervention and after intervention
15. Treatment plan of each grassland
16. Prepare grasses seed bank and maintain a record of the seeds



ENONKISHU CONSERVANCY TEAM IN KENYA.



THE ECOLOGICAL UPLIFT

REWILDING THE WORLD'S GRASSLANDS

By Isaline Tihon and May Scott

From the steppes of Kazakhstan to the rangelands of Kenya, a global movement is bringing grasslands back to life – and discovering that wildlife and human prosperity are not in competition, but in partnership.

In the golden steppes of Kazakhstan, a vast grassland dotted with wetlands stretching thousands of kilometres in every direction, a remarkable species is making a comeback. With its distinctive bulbous nose that filters dust from dry air and ice from winter winds, the saiga antelope has roamed Central Asian grasslands since the Pleistocene. By 2003, only 40,000 individuals remained, a species on the edge of extinction.

Then, steadily, the tide began to turn. Thanks to the collaborative vision of the Altyn Dala Conservation Initiative, today over four million saiga thunder across their ancient migration routes once again. It is possibly the greatest mammal recovery the world has ever witnessed, a story of what is possible when nature is given the chance to heal. The animals' recovery has become woven into national identity itself. "It's become a species that people are really proud of," says Vera Voronova of the Association for the Conservation Biodiversity of Kazakhstan.

The saiga's return has not occurred in isolation. It is part of a growing, global movement to restore the living processes

In Chile, Rewilding Chile has founded a chain of national parks together with the Chilean government. The Route of Parks of Patagonia looks to restore and protect keystone species such as guanacos (facing page), condors and pumas in complex, healthy ecosystems.

By applying holistic grazing management, such as using bomas *to move livestock in patterns that mimic the natural behaviour of wild herds,* Maasai *communities in Kenya's Enonkishu Conservancy have created a rich mosaic of wild and domesticated life.*

driven by herds of large herbivores, their predators, and the stewardship traditions of local communities that shape the world's rangelands. Grassland landscapes cover 40 per cent of the world's land area. Yet as much as half of them are degraded, their great migratory systems largely gone, and with them the ecosystem services we all depend on, lost primarily to overgrazing, agricultural conversion, and industrial development.

Wild Animals as Ecosystem Infrastructure

To understand what is lost when these animals vanish, consider the scimitar-horned oryx, now making its comeback in the Sahelian grasslands of North Africa under the care of Sahara Conservation. For thousands of years, this elegant antelope has traversed hundreds of kilometres across arid terrain, depositing nutrient-rich dung as it goes, halting desertification and seeding new plant life. A study on the closely related Arabian oryx found that acacia seeds passing through the animal's gut were 250 times more likely to germinate than those that had not. The oryx is the engineer of the ecosystem.

Keystone species in sufficiently large numbers are essential to the functionality of ecosystems. Their presence maintains health and resilience, and with it, the ability to provide what humans need for survival, wellbeing and prosperity: food, fibre, and clean water, as well as carbon sequestration, protection from floods and droughts, and cultural identity. Wild animals can be regarded as 'ecosystem infrastructure', as important to the living world as roads and hospitals are to modern civilisation.

Once on the brink, the saiga antelope has made a remarkable comeback in Kazakhstan's grasslands. Sustained conservation efforts to restore their habitat have allowed their populations to rebound dramatically, offering one of the most hopeful wildlife recovery stories.



ALTYN DALA CONSERVATION INITIATIVE, ALBERT SALEMGAREYEV

Re-Animating the Carbon Cycle

The climate implications of rebuilding wildlife populations hold potential at a global scale. Grasslands alone store roughly 34 per cent of all terrestrial carbon on Earth. When American bison are returned to prairie grasslands not otherwise grazed by cattle, models suggest they could sequester 595 million tonnes of CO_2 annually – equivalent to over 18 per cent of India's total annual fossil fuel and industry emissions in 2024.

Wild herbivores graze, trample, and fertilise in ways that foster the deep-rooted, carbon-rich grasses that lock carbon into the soil. Their presence creates a cascade of effects – healthier soils, better water retention, richer biodiversity – that industrial solutions can only dream of replicating. Known as 'Re-Animating the Carbon Cycle', this mechanism, is reshaping how we think about climate solutions.

Rewilding as a Scalable Solution

In Kenya's Enonkishu Conservancy, *Maasai* communities are pioneering a replicable, scalable model in practice. By applying holistic grazing management, such as using bomas to move livestock in patterns that mimic the natural behaviour of wild herds, they have created a rich mosaic of wild and domesticated life. Through sustainable livestock management and eco-tourism, direct income is generated for local families, the landscape itself becoming the engine of long-term economic prosperity. The results are extraordinary: conservancies of this sort now boast a greater density and diversity of wildlife than many national parks.

The rewilding vision is being put into action across continents. In Chile, Rewilding Chile has founded a chain of national parks together with the Chilean government. The Route of Parks of Patagonia looks to restore and protect keystone species such as guanacos, condors and pumas in complex, healthy ecosystems. In North America, American Prairie is stitching together fragmented temperate grasslands, rebuilding connectivity for bison across millions of hectares. Across southern and eastern Africa, the Peace Parks Foundation is supporting the relationship between rangelands and pastoralist communities. Its 'Herding for Health' programme, launched in 2017, has created over 2,000 jobs and generated more than six million US dollars in revenue for 5,533 farmers to date.

The rewilding vision is being put into action across continents. Rewilding offers a clear path towards restoring ecological functionality at scale. Moving forward requires openness, shared learning, and practical collaboration across sectors.



The smiling faces of the Enonkishu Conservancy team who work with ecosystems on the edge of the Mara Serengeti Ecosystem, a vast grassland and savanna landscape. The climate implications of rebuilding wildlife populations hold potential at a global scale. Grasslands alone store roughly 34 per cent of all terrestrial carbon on Earth.

Rewilding offers a clear path towards restoring ecological functionality at scale. Moving forward requires openness, shared learning, and practical collaboration across sectors and traditions.

Wildlife and Human Prosperity are Intertwined

As our Partners and other global organisations demonstrate, transforming rangelands globally requires a diversity of approaches. Grassland landscapes have long been shaped by grazing animals, both wild and domesticated, and the stewardship traditions of local human communities. The question rewilding practitioners are asking is subtle: are the ecological roles being filled? Are the limits of the land being respected?

The Rewilding Rangeland Initiative, convened by the Global Rewilding Alliance, is working to translate these replicable approaches into coordinated, global change; advancing shared vision, credible science, institutional alignment, and a connected global community so that recovery can happen across entire continents.

Wildlife rebounding within the living grassland systems of our Alliance Partners is making recovery visible and tangible – these are just a few examples from our growing movement. Imagine scaling these efforts to span our world's critical ecosystems where wildlife, livelihoods, and climate resilience coexist.

In the golden steppes of Kazakhstan, four million saiga are proof of that. Their return across ancient routes is a signal that recovery is possible. That the world's grasslands can vibrate with life again.



MRUNAL KULKARNI/SANCTUARY PHOTOLIBRARY

GETTING MORE BANG FOR THE BUCK

ARE CONSERVATION RESERVES PROTECTING THE BLACKBUCK?

By Dr. Seshadri K.S.

The overnight rain had washed everything clean. At daybreak, eight of us, in two cars, drove out of Bengaluru, in search of a mammal that none of us had seen. It was July 2007. We had a hand-drawn map of how to reach the site. All was well until we missed a turn and ended up driving into the neighbouring state of Andhra Pradesh. Asking passersby was of no help. Eventually, we tracked back and the sight of a faded board pointing at the village of Mydnahalli – our intended destination – revived our hope. Little did we know that we would end up running into the animal we were in search of, before we even entered the reserve meant to protect it. One of us had spotted the outline of three blackbuck along the distant horizon.

The landscape was an undulating savanna grassland with a backdrop of rocky hillocks as far as the eye could see. Of the three individuals we had spotted, two were females and it appeared that the third, a male, was trying to woo them. We were outside the Jayamangali Blackbuck Conservation Reserve, which was established in 2007 and is spread over 3.1 sq. km. The reserve gets its name from the Jayamangali river that flows nearby. Having finally

The blackbuck Antilope cervicapra *is the only member of the genus* Antilope *and is largely restricted to savanna-grassland habitats in the Indian sub-continent. Though listed as Least Concern by the IUCN, they face threats from habitat loss, poaching, and agriculture.*

seen the animal we had come in search of; we entered the gates of the conservation reserve and went up a large watchtower covered with a pergola. From this vantage point, we could see the savanna-grasslands intermixed with fallow agriculture fields and plantations of *Eucalyptus sp.* and *Acacia auriculiformes*. We shared snacks as we settled down, hoping to spot some wildlife.

The Open Habitat Specialist

The blackbuck *Antilope cervicapra* is the only member of the genus Antilope and is largely restricted to savanna-grassland habitats in the Indian sub-continent. In India, they are found in 13 states and have a fragmented distribution, with varying population sizes, from 10 to over a hundred at some sites. The current distribution range is likely a fraction of the historical distribution. The latest assessment, made a decade ago, pegs the number at around 35,000 individuals. Although listed as Least Concerned in the IUCN Red List, they are protected in India under the *Wildlife (Protection) Act* of 1972. People often associate the infamous incident of film actors indulging in sport-hunting them, not too long ago.

We did not have to wait too long before spotting a blackbuck herd approaching a waterhole nearby. With eight pairs of binoculars trained on them, we estimated 83 individuals, comprising both adults and juveniles. Blackbuck form social groups of varying sizes including solitary males, females, and offspring, and groups of females and males. The structure of grouping is known to vary between and within populations and this structuring is linked to habitat heterogeneity and availability of food and water resources. The fact that we saw a rather healthy population size despite the overall shrinking distributions and fragmented populations, was a good sign. Today, evidence from multiple locations points to the fact that blackbuck can persist in and around agricultural landscapes interspersed with savanna grasslands. They are also known to damage crops and can be seen competing for resources with livestock as well.

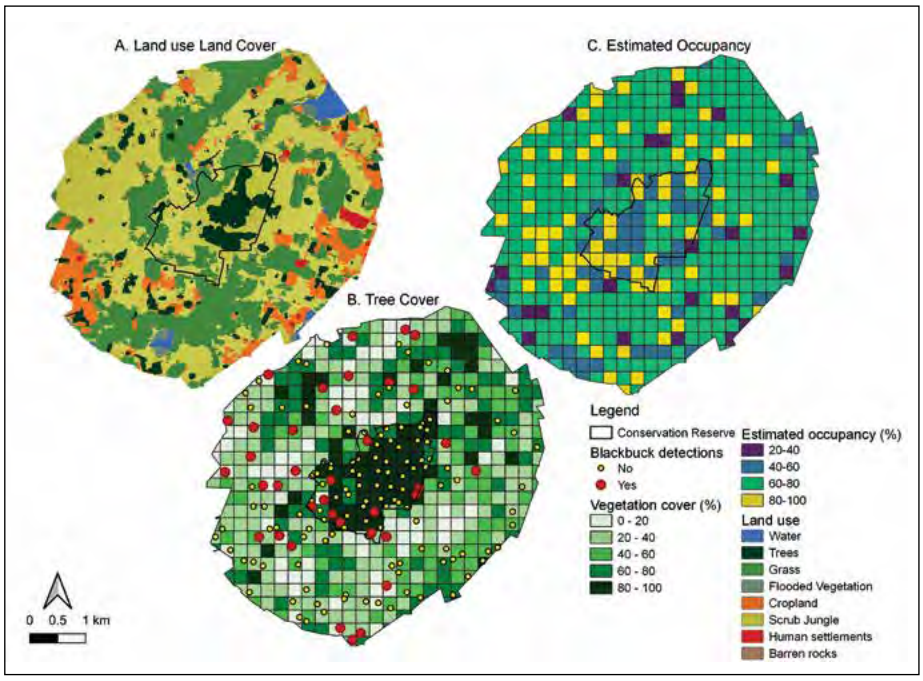
We spent the entire afternoon walking around on the trails in the grasslands. We stopped often to observe pipits and larks. An occasional Bay-backed Shrike would fly off a shrub, and an odd raptor would soar by in the scorching sun. We saw the hoof marks of blackbuck along the trails along with middens. A midden is a pile of droppings; as like other antelopes, blackbuck too defecate in a pile in the same place. While bending down to observe hoofmarks, we were startled by the sudden flutter of a sandgrouse that took to the air. Having heard about how they come to water in the afternoons, we sat down on the *bund* of the waterbody nearby, but the bird was a no show. We encountered evidence indicating the presence of a sloth bear, black-naped hare, and pugmarks of what we thought was either a wolf or a feral dog. Apart from wildlife, we encountered several herds of grazing livestock from nearby villages. Before long, the evening sun painted the landscape a golden shade of yellow and as the sun disappeared behind the rolling hillocks, we began to make our way back home.

Today, evidence from multiple locations points to the fact that blackbuck can persist in and around agricultural landscapes interspersed with savanna grasslands.

A Consistent Pattern

Over the next decade, I have made it a point to visit the reserve at least once annually. Each time, I have encountered blackbuck outside the reserve and progressively, fewer are seen inside the reserve. These grasslands were historically a common village land, and people would bring their cattle to graze. The conservation reserve makes room for such traditional grazing practices to continue. But, shrinking habitats from the intensification of agriculture and land-use change, and raising livestock numbers, can push blackbuck to the brink. Protected Areas are the most common tool used for conservation globally. So much so that nearly 18 per cent of the terrestrial ecosystems are protected in some form. Recently, several countries, including India have agreed to increase the area protected to 30 per cent of the landmass, by 2030. India currently stands at 28 per cent. Yet, in all this urge to declare Protected Areas, an important

Occupancy modelling revealed that blackbuck presence was similar inside and outside the Jayamangali Blackbuck Conservation Reserve in Tumkur district, Karnataka. Detection probability was influenced by habitat and livestock: it decreased as shrub density increased, increased alongside livestock presence, and remained unaffected by tree cover.



COURTESY DR. SESHADRI K. S.

The blackbuck, however, has no notions of constructs such as a conservation reserve and moves freely to where the resources are, often into the human-dominated landscape.

question is neglected. Is the Protected Area effective? Is it helping to conserve the species it is intended to conserve?

Fast forward to January 2023, as I was settling into my new role as a faculty member at ATREE, Manoj Kumar approached me with the intention of studying the blackbuck. My colleague, Dr. Ganesh T., who has been studying grassland ecosystems for over two decades, happily agreed to come on board and co-supervise the student. We had visited Jayamangali in the past and had always wanted to study and contribute to conserving the landscape. Manoj was pursuing his master's degree in conservation practice and shifted base to a rented house in Madhugiri. He visited the conservation reserve to get a sense of the area and decide on the questions he would be addressing. He came back to report the same pattern that we had been observing since our first visit to the site. Blackbuck appeared to be more frequently encountered outside the reserve than inside! A few rounds of brainstorming were all it took for him to decide on his questions: How are the blackbuck using the space in and around the conservation reserve and, what are the habitat variables that would explain the patterns observed?

The Blackbuck Attendance Sheet

We began by mapping the land-use and land cover using satellite images to determine how fragmented the landscape was. We then divided the conservation reserve and an area of two kilometres from the boundary into grids of 250 x 250 m. This decision was based on how much the blackbuck would move in the day. Manoj then spent the next two months surveying the grids for the presence or absence of blackbuck. Since the animals move away, we had to rely on detecting droppings or hoofmarks within the grids. In the end, we had sampled a total of 177 grids: 65 inside and 112 outside the reserve. Along with data on presence and absence, we noted habitat variables such as the number of trees, and the presence of shrubs and livestock while sampling. This pattern, however, could be an artefact of the season and we decided to revisit the sampled grids just after the monsoon. When Manoj went to repeat the surveys, many of the grids we had sampled were inaccessible as farmers had fenced off the areas and began to cultivate crops. Despite the limitations, we were able to resample most of the grids to yet again find a similar pattern: blackbuck appeared to be more common outside the reserve than inside it.

When we analysed the data using a robust statistical approach called 'occupancy modelling', we found that the likelihood of finding blackbuck was similar inside and outside the reserve. The probability of detecting blackbuck was dependent on the

From an elevated perspective from a watchtower in Mydnahalli, the landscape revealed itself to be a mosaic of savanna-grasslands, interspersed with fallow agricultural plots and timber plantations of Eucalyptus sps. *and* Acacia auriculiformis *trees.*



COURTESY DR. SESHADRI K. S.

combination of the number of shrubs, trees, and presence of livestock. The probability of detection decreased with increasing shrubs, increased with presence of livestock, and did not vary with the number of trees. These were insightful findings as they showed how blackbuck use the landscape. Being open habitat species, shrubs such as Lantana and trees such as *Neltuma juliflora* create impenetrable habitats. The positive association with livestock is likely because both livestock and blackbuck are looking for grasses and other feeding resources. Although trees are not ideal in grassland habitats, we have observed blackbuck resting under the shade of trees, especially in the hot afternoons.

Conserving Blackbuck

Protected Areas are created by drawing a line and creating a divide, where something is perceived to be safe on one side and unsafe outside. The preservationist mindset of conservation has also led to what is called the nature-culture divide. In this dichotomy, everything wild belongs to nature and everything human would be culture. One crossing over to the other is not tolerated. In the case of Jayamangali, a conservation reserve had been declared, and plantations of exotic trees were raised. The blackbuck, however, has no notions of constructs such as a conservation reserve, and moves freely to where the resources are, often into human-dominated landscapes.



A long-term plan to conserve blackbuck would be to conserve the habitat. This includes removal of plantation trees inside the reserve and removing shrubs such as Lantana.



SAPTARSHI MUKHERJEE/SANCTUARY PHOTOLIBRARY

The positive association of blackbuck with livestock is likely because both are looking for grasses and other feeding resources. Shrinking habitats from the intensification of agriculture and land-use change, and rising livestock numbers, can push blackbuck to the brink.

Nearly all conservation efforts fail when they ignore the fact that ecosystems are complex, and that there is also a societal dimension. In the case of Jayamangali, simple solutions such as expanding the conservation reserve are not going to work because the land around the reserve is privately owned and people are dependent on it for livelihood. A long-term plan to conserve blackbuck would be to conserve the habitat. This includes removal of plantation trees inside the reserve and removing shrubs such as Lantana and trees such as *Neltuma juliflora* and Eucalyptus. The Karnataka Forest Department has already been cultivating pulses inside the reserve to prevent blackbuck from going outside to forage. Alongside, there is a clear need to understand the grassland plant community and work on rejuvenating some of the fallow lands to promote grasses and forbs.

The land around the reserve is a matrix of grasslands and agricultural fields and this heterogeneity is essential for maintaining a viable population of blackbuck. We must not hesitate to explore innovative pathways to conserve the species. A community-governed model where blackbuck are tolerated, and revenue generated from wildlife tourists viewing them is shared among the farmers may be a viable option to offset the loss from crop damage. At a much broader level, there must be a systemic shift in our thinking too. Grasslands are not wastelands and we should refrain from planting trees and where necessary, actively work towards removing them.

For the blackbuck and other myriad denizens of the grasslands to survive for posterity, it is important that we miss the forest and its trees!



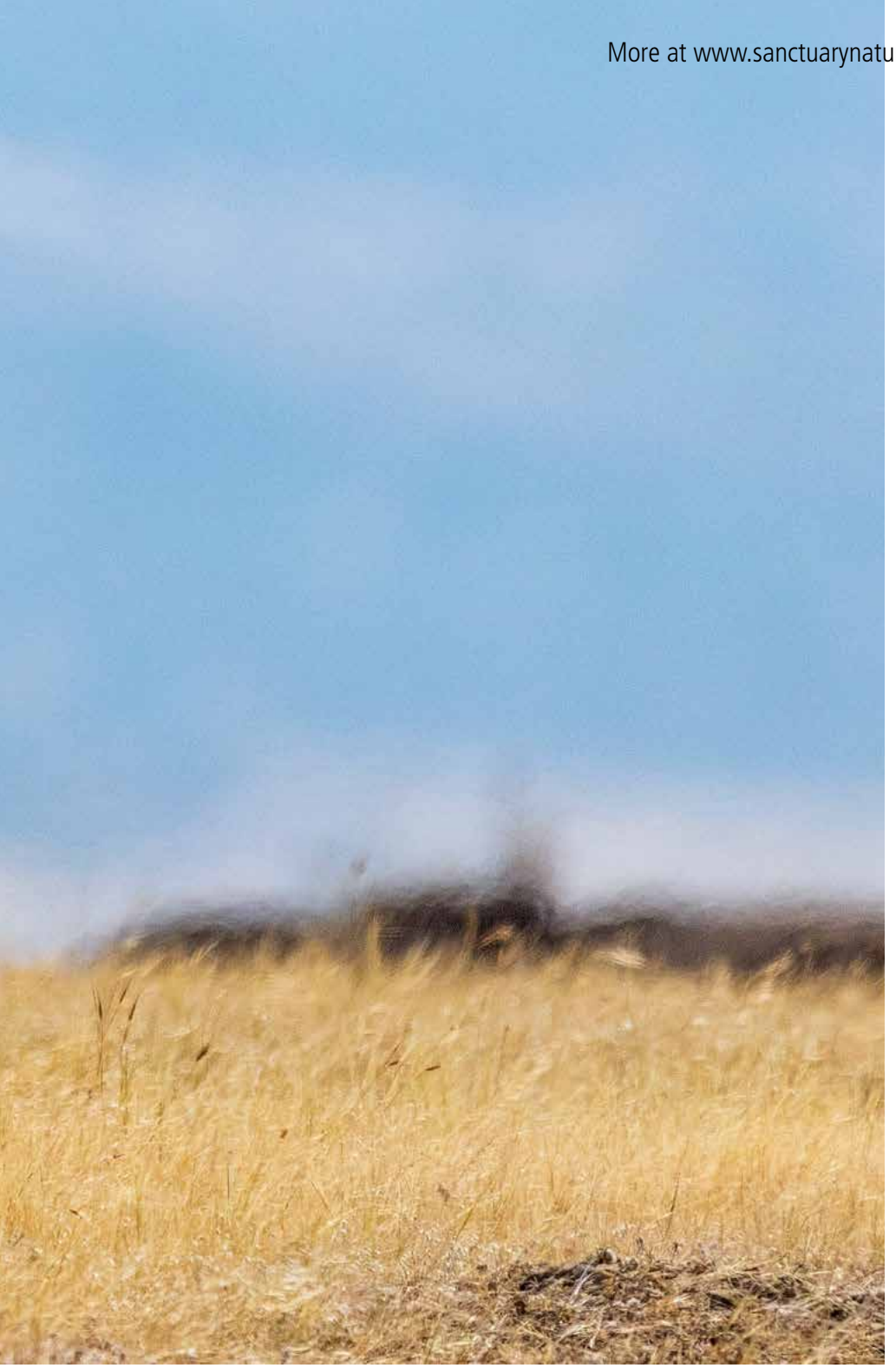
SUSHANT JADHAV/SANCTUARY PHOTOLIBRARY

THE SENTINELS OF THE DECCAN PLAINS

THE WOLVES OF KIRAKSAL

By Chinmay P. Sawant

As I stand on a rocky outcrop in Kiraksal, looking across the vast landscape of Maan *taluka*, I see something entirely different from the colonial lens of degraded forests or wastelands: I see a vibrant, high-functioning Open Natural Ecosystem (ONE) that covers approximately 25.6 per cent of Satara district. In 2023, we launched the Kiraksal Conservation Project to document the pulsating life of the Maandesh region.



Supported by WWF-India's flagship Conservation Catalyst Programme (CCP) and local stakeholders, our team set out to prove that these semi-arid scrublands are critical biodiversity hotspots.

The climate here is harsh, with summer temperatures soaring to 43°C and average annual rainfall of only 300-500 mm. Yet, this environment has fostered a resilient assemblage of flora and fauna. During our systematic biodiversity assessments, we documented 606 species, including 212 birds, 34 herpetofauna, 160 vascular plants, and 18 mammals. Trekking through the Kukudwad forest with team member Ajit Katkar, we found the landscape hosts 295 distinct floral species with a remarkable 15 per cent endemism. We spent hours photographing the rare 'lantern' flowers (Ceropegia), which are highly sensitive to habitat disturbance and emerge only during monsoons.

Changing the Narrative

The true sentinel of this landscape is the Indian grey wolf. For years, Kiraksal was dismissed as a mere transit route for these predators, but our research transformed that narrative. By deploying camera traps with our field assistants in a 1 km. x 1 km. grid and conducting intensive sign surveys, we confirmed that Kiraksal is a breeding stronghold for the striped hyena, golden jackal, Bengal fox and the Indian grey wolf. We are currently monitoring two wolf packs, mapping active breeding dens and essential rendezvous sites for species persistence, in the rocky crevices of the Dambi Hills and Madladara of Kiraksal forest.

Our fieldwork blended high-tech monitoring with traditional tracking. Conducting night surveys using spotlight counts to detect nocturnal eye-shine, we recorded 211 independent camera detections, documenting species such as striped hyenas and jungle cats. We identified seven distinct hyenas by examining unique flank-stripe patterns, potentially the first village-level study of its kind in Maharashtra.

There has been tremendous progress since we received the WWF-India CCP grant. As this area lies in the drought-prone region of Satara, past schemes have focused primarily on watershed management. However, biodiversity monitoring is just critical in this unexplored landscape. 'Kir' (किरकsss) means dense in Marathi, for its dense scrub-covered hills and grasslands. The region's geography is complex; droughts occur every three to four years, and vegetation is sparse. Yet, the wildlife is well-adapted, and we found strong signs of wild canids and other biodiversity.

Overcoming Challenges

Mass hunting was once common during the annual Nagapanchami festival. Villagers hunted wild animals with their dogs, paid obeisance to the deity at the Shrinath temple, and then distributed their winnings among the community. Besides hares, animals such as hyenas, jackals, foxes, and even wolves were

The true sentinel of the Kiraksal landscape is the Indian grey wolf. The survival of this keystone predator will be crucial to saving what remains of the Deccan's grasslands.

The villagers have pioneered a unique 'Tri System' of social prohibitions. This includes kurhad-bandi *(logging ban),* shikar-bandi *(hunting ban), and* vanva-bandi *(fire ban).*

hunted. Most heartbreaking was the killing of wolf pups, sometimes taken from their dens. This history of destruction strengthened my resolve to begin this project and work toward ending such ambush hunting practices.

Habitat destruction from firewood collection and tree felling is another severe issue here. We held meetings with local hunters, many of whom also use snares to hunt hares, porcupines, and wild pigs, to explain the study and its importance. Because these hunters know every mammal den in the area, we engaged and trained local youth as project assistants to support conservation efforts. Field assistants Prathamesh Katkar, Vishal Katkar, and Abhijit Mane were also trained to support shepherds and farmers navigate the tedious compensation process, helping bridge the gap between the community and the Forest Department. This has encouraged the department to engage more actively with the community.



PRATHAMESH KATKAR


CHINMAY SAWANT

Since then, hunting has declined significantly, and several young people have been trained for sustainable livelihoods. We also worked with the village panchayat and biodiversity committees to celebrate International Wolf Day, making Kiraksal the first village to do so.

While this work lays an important foundation, practices such as hunting and tree felling must be addressed by actively involving communities in biodiversity conservation. Gram panchayats, shepherds, and the Forest Department must all act as stakeholders, working together to foster coexistence and better manage human-wildlife interactions and conflicts in Kiraksal.

In the Driver's Seat

The soul of this project are the villagers of Kiraksal, and our field ornithologist Dr. Praveen Chavan. Conservation in human-dominated landscapes must be cultivated from within. The villagers pioneered a unique 'Tri-System' of self-imposed social prohibitions. This includes *kurhad-bandi* (logging ban), *shikar-bandi* (hunting ban), and *vanva-bandi* (fire ban).

This transformation has empowered our 'Green Guardians' and para-taxonomists, many of whom come from traditional hunting families. By learning to use GPS, install camera traps, and identify species, they became primary custodians of the land. I still recall the excitement of local youth as they learned to distinguish between a Bengal fox and a golden jackal using field guides. Despite these successes, the landscape remains under siege. Our land-use and land-cover analysis shows that between 2020 and 2025, thorny

International Wolf Day (top left) was celebrated in a local school – a small step that could go a long way in changing the negative perception around this enigmatic canid. Kiraksal's scrub forests (bottom left) labour quietly, sustaining life through unseen ecosystem services – their silence is wisdom.

scrub forests and open savannahs in Kiraksal declined by about 1.6 sq. km., owing to expanding agriculture, irrigation canals, and built-up areas.

We also face the threat of hard barriers. Proposed linear infrastructure, large-scale solar installations, windmills, stone crushers, and sand mining could sever the vital corridor connecting Kiraksal to the newly formed Atpadi Wolf Conservation Reserve. If these links break, our thriving wolf population risks genetic isolation, hybridisation with feral dogs, and eventual collapse.

Invasive species such as *Lantana camara* pose another silent crisis, showing up to 90 per cent relative dominance in some patches. This plant forms dense thickets that suppress native grasses, obstruct hunting visibility for wolves, and reduce livestock fodder for the *Dhangar* community. As grazing commons shrink, the potential for human-carnivore interactions/conflict increases. Furthermore, free-ranging dogs pose a dual threat of resource competition and the transmission of lethal diseases such as canine distemper virus (CDV) to wildlife.

Now, our strategy must shift. Informal community protection is no longer sufficient against external developmental pressures. Our primary recommendation is the formal legal notification of the Kiraksal continuous forest cluster as a Conservation Reserve (CR) to prevent detrimental land-use changes. Otherwise, we are likely to lose these fragile Maandeshi grasslands, their culture, and wildlife. Alternatively, designating it a Biodiversity Heritage Site (BHS) would legally recognise the community's role in preserving traditional ecological knowledge while safeguarding grazing rights.

The Kiraksal Conservation Project demonstrates that the semi-arid Deccan is not a barren stretch of land, but a vibrant ecosystem linking human culture and wild nature.

We must also implement critical policy changes. First, we must reclassify these areas as 'Old-growth Savannas' rather than wastelands. Second, we must halt misguided afforestation; planting exotic trees such as gliricidia or eucalyptus destroys wolf and fox habitat. Most importantly, we must stop the tillage of virgin savannah lands, as ploughing destroys the underground bud banks of native perennial grasses.

The Sentinel

Running this project while doing my Master's in wildlife science from WII gave me hands-on training in field techniques, task implementation, and financial record-keeping. This opportunity reinforced that grassroots conservation needs strong support; as rural and semi-rural areas rapidly urbanise, we are losing crucial grasslands. We successfully tackled numerous challenges such as manpower and community support, including initial political arrogance when placing camera traps. Trust-building was essential, as rural sociology is uniquely shaped by local political, social, economic, cultural and ecological needs.

The Kiraksal Conservation Project demonstrates that the semi-arid Deccan Plateau is not a barren stretch of land, but a vibrant ecosystem linking human culture and wild nature. The Indian wolf acts as the sentinel; its survival indicates the health of our water tables, pollinators, and pastoral economy. By formally protecting this strategic ecological tri-junction, India can fulfil a global conservation priority and set a gold standard for community-led stewardship.

I remember a quiet evening near Waghjai Lake, watching a Bengal fox trot through the Gavalkhora forest. In that moment, the complexity of the landscape felt tangible; the perennial springs provide hydration for over 160 bird species, and *Dhangar* shepherds unconsciously maintain the habitat heterogeneity the wolves need. We present this work hoping it inspires a future where the howl of the wolf continues to resonate across the Deccan. The king of the grassl[illegible]ust have a place to stay, and that place is here, in the heart of the Maandesh.



Chinmay Prakash Sawant is the Project Lead, Kiraksal Conservation Project in Satara district, Maharashtra.

Kiraksal's camera traps reveal a quiet nursery of the wild – a thriving breeding stronghold for the less-celebrated yet vital ones: the striped hyena, golden jackal, Bengal fox, and other overlooked denizens that keep the ecosystem in balance.



COURTESY CHINMAY SAWANT



PUSHKAR ACHYUTE/SANCTUARY PHOTOLIBRARY

The Living Plateaus of the SAHYADRIS

By Kedar Gore

In the early 1980s, I had my first glimpse of Konkan, a land of extraordinary natural beauty, biodiversity and culture. Forested hills rose behind Dorle, my maternal native village, while streams trickled down to meet creeks edged with dense mangroves. Scattered across the landscape were rocky, flat-topped plateaus locally known as *sadas*, ancient lateritic formations formed millions of years ago through volcanic activity and tropical weathering. These stark yet beautiful plateaus supported a unique ecosystem, one that harboured a remarkable variety of life, especially birds. During the dry months, the grasses covering the plateau turned a soft ochre-yellow, and across this open expanse, the Paddyfield Pipit *Anthus rufulus*, Malabar Lark *Galerida malabarica*, Rufous-tailed Lark *Ammomanes phoenicura*, Ashy-crowned Sparrow-lark *Eremopterix griseus*, Indian Robin *Copsychus fulicatus*, and Pied Bushchat *Saxicola caprata* were a common sight. Armed with a bamboo stick and guided by my uncle, a keen naturalist par excellence – the late Manohar Harchekar, I spent hours wandering across the plateau turning over stones and peering into crevices. Beneath the rocks, we often found geckos, skinks,



spiders, and the occasional scorpion, each discovery revealing a hidden layer of life thriving in the lateritic world. In the cool of early mornings, fan-throated lizards basked on the warm rocks and occasionally, we stumbled upon saw-scaled vipers *Echis carinatus*, which quickly curled into their typical s-shaped defensive posture.

More than four decades have passed since, yet those memories, experiencing nature at Dorle, remain vivid. It was my uncle who nudged me onto the path of exploring the wilderness, opening my eyes to the natural world around us.

A Dramatic Transformation

For much of the year, *sada* ecosystems scattered across the Konkan landscape appear dry and desolate. But as the southwest monsoon arrives in June, the entire landscape undergoes an overnight transformation from an almost lifeless plateau into a biodiversity treasure house with lush green grasslands, vibrant mosaics of seasonal wildflower meadows, carnivorous herbs and ephemeral wetlands. The entire landscape comes alive with lifeforms adapted to this challenging environment. What appeared in summer as a dry fallow land to my then untrained eyes was one of the most fascinating and least understood and overlooked biodiversity treasures: the lateritic plateaus of the Northern Western Ghats.

As the rainwater fills the shallow rock depressions to become temporary wetlands, it gives rise to multiple food webs – bees hovering around flowers, carnivorous plants trapping unsuspecting insects, amphibians breeding in temporary pools, and snakes lurking around to catch unsuspecting frogs, insects and lizards. In the next few weeks, hundreds of plants bloom in a spectacular riot of colours – yellow, pink, purple, blue and white, putting up a display that is characteristic of the lateritic plateaus of the northern Western Ghats.

This show of dazzling colours is best seen at Kaas Plateau (see Vol. XXXIII No. 2, April 2013), a UNESCO-recognised biodiversity hotspot, popularly described as the 'Valley of Flowers of Maharashtra'. But similar seasonal blooms occur across several dozens of plateaus throughout the Konkan and Sahyadri hills – as the northern Western Ghats are more popularly known. These monsoon meadows typically flower between July and October, depending on the local rainfall patterns, attracting nature lovers for whom these plateaus represent a living laboratory of adaptation and evolution.

A Botanical Paradise

There is an astonishing diversity of plants on laterite plateaus. A report published by the Bombay Environmental Action Group and The Habitats Trust in May 2025 documented up to 450 plant species, 169 bird species, 31 reptile species, 20 amphibian species and 37 mammal species from such rocky plateaus. Many species are endemic to the Western Ghats, and some occur only on specific plateaus. Renowned botanist Dr. Aparna Watve (see page 33 and Vol. XXV No. 3, June 2005) has extensively studied the rocky plateaus and recorded rich biodiversity and high endemicity, including more than 100 endemic to the Western Ghats and 24 endangered species of plants and animals. Unlike forest ecosystems where plants grow tall and compete for sunlight, plateau vegetation remains low and compact. The shallow soil cannot support large plants, so most species complete their life cycle during the monsoon. Within weeks of flowering, seeds disperse and plants wither, waiting for the next rains.

These plateaus sport an amazing variety of plants, including varied grasses (*Glyphochloa forficulata*, *Indopoa paupercula*, *Dimeria* spp., *Tripogon bromoides*, *Ischaemum* spp., *Arundinella* spp., *Coelachne minuta*) and other associated plants – sedges, orchids, aquatic herbs and carnivorous species. Endemic plants from the lateritic plateaus of northern Western Ghats include species of Ceropegia, Eriocaulon, Impatiens, Smithia, and a few others. Important examples are *Ceropegia mahabalei*, *Ceropegia santapaui*, *Trithuria konkanensis*, *Eriocaulon ratnagiricus, Pogostemon deccanensis*, *Hubbardia diandra*, *Silentvalleya chandwadensis*, *Begonia concanensis*, *Aponogeton satarensis*, *Dipcadi concanense*, *Corynandra elegans, Curculigo konkanensis, Lepidagathis ushae* and *Utricularia albocaerulea*. There are several other common herbs such as *Smithia hirsute, Impatiens lawii*, and *Pleocaulus ritchiei*, sporting beautiful flowers that bloom once in seven years, practically transforming the entire area purple. Terrestrial (ground) orchids are in abundance too with species of Habenaria, Pecteilis, Eulopia, Geodorum and Nervilia – all playing a critical role in this ecosystem.

Among the most fascinating inhabitants of these plateaus are carnivorous plants. In the nutrient-poor soils of the laterite crust, nitrogen is often scarce. To compensate, some plants have evolved the ability to trap insects and digest them. Species such as *Drosera indica* and *Drosera burmannii*, commonly called sundews, possess sticky glandular hair on their leaves that trap small insects. Another group, the bladderworts (*Utricularia*) (See Phytofocus, Vol. 45 No. 12, December 2025), uses tiny underwater

The Kaas Plateau in Maharashtra bursts into riotous colours each monsoon. Similar seasonal blooms occur across several plateaus throughout the Konkan and Sahyadri hills with up to 450 plant species recorded here.

As the southwest monsoon arrives in June, the entire landscape undergoes an overnight transformation from an almost lifeless plateau into a biodiversity treasure house with lush green grasslands, vibrant mosaics of seasonal wildflower meadows, carnivorous herbs and ephemeral wetlands.

suction traps to capture microscopic prey. These plants are tiny – often only a few centimetres tall – but they represent some of the most remarkable evolutionary adaptations among plateau flora. For four months, rocky plateaus exhibit a striking display of vibrant colours before these features fade as subtly as they emerged.

Critters Galore

The ephemeral pools that form during the monsoon serve as critical breeding habitats for frogs and toads that have evolved incredible strategies to cope with the short lifespan of the pools. Their eggs hatch quickly and tadpoles develop rapidly before the water evaporates. Within the amphibian community, the cricket frog *Minervarya* spp., Indian bullfrog *Hoplobatrachus tigerinus*, and skittering frog *Euphlyctis* spp. use these areas as breeding sites during the rainy season. The genus *Beduka* serves as a pertinent example; it comprises only two species. The Koyna toad *Beduka koynayensis* is endemic to the plateaus of the Sahyadri Tiger Reserve in Sangli and Satara districts, while the Amboli toad *B. tigerinus* is confined to the plateaus near Amboli and Chowkul in Sindhudurg district. Both species depend only on the ephemeral waterbodies of these plateaus, underscoring the importance of protecting these areas. *Gegeneophis valmiki*, *Indotyphlus maharashtraensis*, *Gegeneophis seshachari*, and *Ichthyophis bombayensis* are unique amphibians called caecilians. These specialised and the least-studied animals lack limbs, making them well-suited to a fossorial life buried in the soil or beneath the rocks.

These rocky plateaus also abound in reptiles. Among the most charismatic are the fan-throated lizards of the genus Sitana and Sarada, whose males display colourful throat fans during the breeding season. The white-striped viper gecko *Hemidactylus albofasciatus*, first discovered in Dorle village, and *Hemidactylus sataraensis*, discovered from Chalkewadi plateau in Satara, are highly threatened owing to their restricted occurrence and sole dependence on the rocky plateaus. Dr. Varad Giri, a distinguished herpetologist, has extensively studied and guided several researchers to document the amphibians and reptiles of the rocky plateaus.

The invertebrate diversity of laterite plateaus remains poorly studied, yet available research indicates remarkable species richness. During the monsoon, flowering plants attract numerous pollinators such as butterflies, bees and beetles, while spiders and ants thrive in the grassland vegetation. Dragonflies and damselflies indicate healthy freshwater ecosystems, signifying clean, oxygenated water and minimal pollution. Akshay Dalavi, a researcher with an interest in studying these fascinating insects, has systematically documented multiple odonate species in the ephemeral pools of Chipi, Vimaleshwar, Tembavli, and Dhamapur within Sindhudurg district.

Insects emerging during the monsoon attract insectivorous birds that forage across the grasslands. In May 2025, a lone Lesser Florican *Sypheotides indicus* was seen at a lateritic plateau near Ratnagiri town, highlighting the immense ecological importance of these plateaus as a stopover site during the in-country nomadic movement of this critically endangered and endemic bird.

Several new colourful freshwater crab species, such as *Ghatiana splendida*, *Ghatiana atropurpurea*, and *Gubernatoriana thackerayi*, have been found in the rocky plateaus of the Western Ghats in Maharashtra near Amboli and Ratnagiri. A species of spider *Tylorida*

These lateritic plateaus teem with reptiles, including the fan-throated lizards of the genera Sitana and Sarada, whose males flaunt colourful throat fans during the breeding season. Yet the Wastelands Atlas of India *(2010) labels them as 'barren rocky', which has paved the way for wind farms and other infrastructure.*



ANINDITA DATTA MUHURI/SANCTUARY PHOTOLIBRARY

sataraensis was discovered from Chalkewadi plateau in Satara. The work done by many researchers has proved beyond doubt the ecological significance of the lateritic plateaus.

Misunderstood Landscapes

As we see throughout this issue, official terminology often oddly labels any ecosystem without trees as a 'wasteland', a misclassification that originated during the British era. This anomaly, unfortunately, remains uncorrected till today. The *Wastelands Atlas of India* (2019) classifies large areas that are high biodiversity lateritic plateaus in Kolhapur, Pune, Satara, Ratnagiri and Sindhudurg districts as 'barren rocky'. This classification has facilitated land use changes for mining, wind farms, mango, coconut and cashew plantations, townships and other urban infrastructure, leaving only a small portion of undisturbed plateaus, which are mainly in Protected Areas or remote regions. Several areas have already been compromised for setting up industrial belts. Laterite blocks are widely used as building material in Konkan architecture, leading to extensive quarrying of plateau surfaces. The proposed oil refinery project to be established in the Barsu-Solgav area of Sindhudurg district will create largescale destruction of these ecosystems. Over the years, the wasteland tag has been responsible for severe habitat and biodiversity loss of the *sada* ecosystems across Maharashtra and also parts of Goa and north Karnataka.

Although nature-based tourism can support livelihoods and conservation, unregulated tourism can contribute to habitat destruction and significant loss of biodiversity, as was seen at Kaas Plateau. Chalkewadi plateau has been threatened because of hundreds of wind mills. Roads passing through these plateaus fragment the habitat, posing a huge threat to biodiversity owing to road kills. In addition to these anthropogenic pressures, fluctuating rainfall patterns on account of climate change could affect the delicate seasonal cycles of plateau ecosystems. Recognising these ecosystems as specialised grasslands and ephemeral wetlands is vital for their conservation. While Kaas Plateau and a few others have some protection, most laterite plateaus lack safeguards and are vulnerable to land-use changes. Road infrastructure is essential, but it is crucial to include active mitigation strategies during the planning stage. This will only be possible if these plateaus are no longer labelled as wastelands. Effective conservation requires landscape-level approaches, thorough ecological surveys and legal protection – ideally as Conservation Reserves. Declaring these as Biodiversity Heritage Sites and including them in the Eco-Sensitive Area of the Western Ghats and various town planning acts would enhance their protection. Promoting community-led conservation through Biodiversity Management Committees and implementation of responsible tourism guidelines are crucial initiatives for the long-term preservation of these sites.

The ephemeral pools that form during the monsoon serve as critical breeding habitats for frogs and toads that have evolved remarkable strategies to cope with the short lifespan of the pools. Their eggs hatch quickly and tadpoles develop rapidly before the water evaporates.



A GEOLOGICAL LEGACY MILLIONS OF YEARS OLD

Laterite plateaus found between 700 to 1,200 m. above mean sea level in the northern Western Ghats were formed through prolonged geological processes. The Western Ghats originated from volcanic eruptions that created the Deccan Traps around 65 million years ago. Over time, tropical rainfall and weathering altered the basalt rock, leaching away minerals and forming laterite that is rich in iron and aluminum. The surface hardens under intense sunlight and most vegetation retreats underground as dormant tubers, seeds or bulbs.

Ephemeral Beauty, Enduring Value

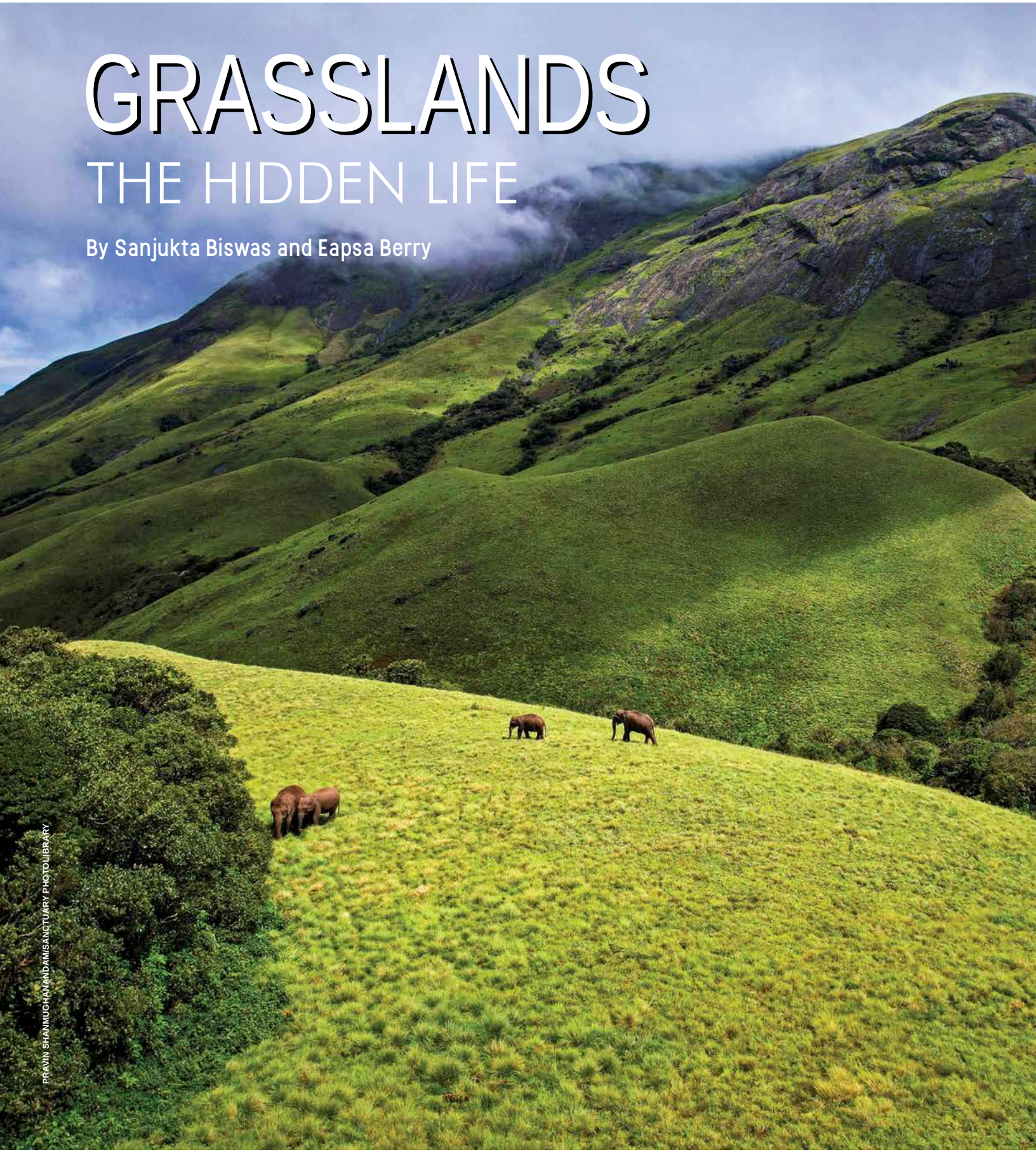
The Konkan laterite plateaus remind us that nature's most fascinating ecosystems are not always the most obvious and even the most unassuming landscapes can harbour extraordinary life. For much of the year these landscapes appear empty and desolate. But with the monsoon rains, they transform into vibrant mosaics of life, supporting species found nowhere else. Their beauty is fleeting – lasting only a few weeks each year – yet their ecological significance is profound. Safeguarding these hidden grasslands of the northern Western Ghats is not only about protecting rare plants or animals. It is about recognising and preserving one of India's most remarkable seasonal ecological phenomena.



Kedar Gore is a naturalist, writer, and advocate for nature with three decades of experience in wildlife conservation. Currently, he works as the Director of The Corbett Foundation.

GRASSLANDS
THE HIDDEN LIFE

By Sanjukta Biswas and Eapsa Berry



PRAVIN SHANMUGHANANDAM/SANCTUARY PHOTO LIBRARY

Lush grasslands have always felt to me like the very embodiment of freedom – of spring's quiet joy and inspiration carried on wandering breezes. Whether in the alpine meadows of Sikkim or the sweeping plains of northern Madhya Pradesh, my admiration once lingered mostly on their floristic details, viewed through the careful lens of a botany student.

Now, just after the rains, a vast grassland stretched before us in a Protected Area of Central India, set to become our field site for the next few days. I found myself wondering how often a layperson considers a grassland as a distinct social or scientific entity. I was reminded of the unnamed child in an early poem by Christina Rossetti, who moves from a pink rose and the blue sky to an orange, simply an orange, where colour and object merge seamlessly in name.

But is a grassland only as green as the grass it grows? What if we told people that its golds and browns speak of long, arid, sun-drenched months that define deciduous grassland ecosystems? What if we explained that many of the world's most common grasslands are 'semi-natural', shaped as much by human activity as by ecological processes? And what if we revealed that, in a profound sense, the true grassland lies underground?

I glanced sideways at my colleague, a keen student of microbiology, who, oblivious to my presence, seemed already to have descended beneath the surface.

Later that night as we exchanged our reflections, we realised that we must explore grasslands in India with greater depth. Beneath the waving grasses lies a dynamic and intricately balanced world, where below-ground communities shift with the environment (temperature and rainfall) and elevation, quietly shaping grassland structure and driving essential ecosystem functions. It was at that moment that we, individually and together, succumbed to the quiet pull of the grassland underground. Drawn by its unseen force, our journey drifted inward, uncovering the whispered wonders resting beneath its green expanse. And so, that is where our story truly begins.

A Whole New World

What began as a quiet discovery soon emerged as a fascinating entry point into a vast and globally significant ecosystem. Grasslands cover approximately 40 per cent of the Earth's land surface, and are dominated by herbaceous plants; they constitute one of the most ecologically vital and biogeochemically significant biomes. Grasslands occur across tropical, temperate, and alpine regions depending on rainfall patterns, soil type, and fire or grazing regimes. While grasses dominate the landscape aboveground, a vast and unseen world exists beneath the soil surface, one that determines how grasslands function, evolve, and respond to changes in climate. This hidden world is composed of trillions of microbes, mainly including bacteria and fungi, along with archaea, and other microorganisms that form intricate relationships with grasses, influencing the integrity and vitality of the ecosystem.

Soil microbiota (organisms particular to soil) act as a foundational community essential for maintaining soil structure, functionality, and fertility. Microbes regulate key nutrient processes, such as nitrogen fixation and the solubilisation of phosphorus and potassium (which means microbes help dissolve phosphorus and potassium into the soil water that roots of plants can easily uptake), and synthesise phytohormones (or plant hormones) that promote plant growth across all terrestrial ecosystems, including grasslands. These microbes also play a crucial role in soil aggregation (i.e., the binding together of smaller soil particles, crucial for soil health) and the sequestration of carbon (the capturing and storing of atmospheric carbon dioxide in suitable carbon forms to control its concentration and combat climate change).

As climate change intensifies drought, temperature fluctuations, and pressures from invasive species, microbial communities become critical determinants of grassland resilience. These microbes enrich the soil and boost soil fertility through leaf-litter decomposition and the production of microbial necromass, the non-living remains of microbes that become a part of the soil organic matter.

So who, or whose presence, shapes the soil structure at various layers, and influences, even regulates, aboveground vegetation dynamics? Our story of the microbial world proceeds.

India's Unique Saline Grassland

The Banni grasslands (see page 60), constitute an arid landscape that gradually gives way to the marshy salt flats of the Rann of Kutchh to form one of India's most distinctive saline ecosystems. Shaped by an arid to semi-arid, monsoon-driven climate, the Banni sustains a unique ecosystem. Its fine, silty, and clay-rich soils store remarkable amounts of carbon, making the grassland a natural carbon reservoir. Banni's plant community is dominated by hardy grasses and low-growing forbs (which are short herbaceous flowering plants other than grasses). Most of them are halophytes, plants with an extraordinary ability to live and flourish in saline conditions, where many would perish. The vegetation is a fascinating mix of C3 and C4 plants (two groups of plants that use different methods to capture carbon dioxide for photosynthesis), though the C4 grasses clearly lead the way with their super-efficient photosynthesis and deep, powerful root systems, reaching far into the earth and tapping moisture. These roots not only help the plants survive; they pull carbon deep underground, enriching the soil and transforming this salty plain into a powerful natural carbon bank.

The soil here hosts a diverse microbial community dominated by halophilic (salt-loving) bacteria. A prominent function of these bacteria is to produce powerful enzymes that break down tough organic matter, driving nutrient cycling in these harsh soils. Many survive long dry periods by forming resistant spores, reviving quickly with the onset of rain. As they reactivate and begin to grow, they release distinctive volatile compounds that give the soil its distinctive earthy smell after the first showers.

Microbiota in high-altitude shola *grasslands play a crucial role in sustaining the ecosystem through symbiotic associations with grasses and shrubs, enhancing nutrient availability, and enriching the soil with organic matter and nitrogen.*

As climate change intensifies drought, temperature fluctuations, and pressures from invasive species, microbial communities become critical determinants of grassland resilience.

India's Alpine Grassland: The Bugyal

The high-altitude alpine meadows, or *bugyals*, are found between 3,000 and 4,500 m. above the treeline and just below the snowline, resulting in a uniquely distinct vegetation zone. The alpine meadows are broadly divided into two major categories: the moist meadows and the cold arid meadows. Indeed, most *bugyals* alternate between being snow-covered pastures in winter and vibrant grazing grounds in the summer, acting as important water catchment areas. *Bugyals* are biodiversity-rich, known for their diverse grasses, flowering plants, and medicinal herbs, and are dominated by C3 grasses, whose physiological traits make them well adapted to the cold temperatures and high-altitude conditions typical of this region. The dominant C3 grasses in these meadows include Tenaxia species, especially *Tenaxia cachemyriana* (or the Kashmir wire grass), which forms a major alpine grassland type and serves as nitrogen-rich fodder for livestock. With increasing altitude, grasses such as *Campeiostachys nutans* and *Poa pseudamoena* become more common.

Bugyal soils are typically shallow, rocky, nutrient-poor, and highly prone to erosion, characteristic of mountain meadow, and are called brown forest soils. The soil layer is thin, often underlain by rock or permafrost, with textures ranging from gravelly to stiff clay, reflecting their fragile nature. *Bugyals* face extreme conditions such as cold temperatures, intense UV radiation, soil erosion, and slow continuous decomposition. Yet these grasslands harbour diverse cold-tolerant microbial communities that provide vital functions of fixing nitrogen and cycling phosphorus. Beyond nutrient supply in these ultra-cold grasslands, many of these microbes also function in the breakdown of hydrocarbons, detoxify heavy metals, and protect alpine plants from diseases.

The Distinctive Sub-Himalayan Terai-Duars Grassland

Shaped by a monsoon-driven subtropical climate marked by high temperatures and heavy rainfall, the sub-Himalayan Terai-Duars region forms a mosaic of tall grasslands, savanna, and forest patches. The vegetation is dominated by C4 grasses, which are well-adapted to intense sunlight, high temperatures, and efficient water use. Among them, Tripidium species form the tallest grass stands, while *Saccharum spontaneum* (*kaans* grass in Hindi) rapidly regenerates after the monsoon, playing a key role in seasonal succession.

In this region, soils have developed from the extensive alluvial deposits brought down by the Himalayan rivers. They typically have a coarse to sandy loam texture composed of sand, silt, pebble, and gravel. Thanks to dense forest cover and high biomass turnover, these soils are also rich in organic matter and contain substantial soil-organic carbon. The microbial community that dominates the Terai-Duars region is largely decomposers. The presence of *Mucor* as a prevalent genus indicates the presence of saprotrophs, the microbes that decompose the organic matter and participate in nutrient cycling.



MAYANK JAISWAL/SANCTUARY PHOTOLIBRARY

Shaped by a monsoon-driven, subtropical climate, the sub-Himalayan Terai-Duars region forms a mosaic of tall grasslands, savanna, and forest patches. The microbial community here is dominated by decomposers that break down organic matter, enriching the soil with nutrients that support lush vegetation, which in turn sustains the prey base on which tigers depend.

The Intricate Mosaic of the *Shola* Grassland

As the winding slopes of the Western Ghats rise, the enchanting *shola* grasslands begin to unfold. Found above 1,500 m., these landscapes form a striking mosaic of open grasslands interwoven with pockets of dense evergreen and deciduous forest. Their ability to capture moisture from condensed clouds has earned them the name 'tropical montane cloud forests'. The vegetation comprises both C3 and C4 grasses, though the hardy C4 species dominate the cool, wind-swept slopes. Shaped by altitude, mist, and constant cloud cover, this unique mosaic gives the *shola* grasslands their remarkable character and ecological significance, and is home to various endangered and endemic species of plants and animals.

The grassland is typically loamy and acidic. Forest patches have deeper, nutrient-rich, higher water-holding soils compared to the adjoining grasslands with shallow, drier soils, which together create a mosaic landscape. The resident microbiota in the *shola* grasslands play a crucial role in sustaining the ecosystem by symbiotic association with grasses and shrubs, improving nutrients, and are rich in organic matter and nitrogen. *Shola* soils are dominated by cold-adapted, acid-tolerant, and oligotrophic bacterial groups or communities that grow in extremely low nutrient environments. In particular, these grasslands host high fungal diversity. Functional microbial communities include nitrogen fixers, phosphate solubilisers, decomposers, and plant-growth-promoting rhizobacteria.

Rethinking Soil Health

The diverse grasslands throughout India – the tropical savannas of Kutchh in the west, the alpine *bugyals* in the north, the sub-Himalayan terai-duars in the northeast, and the mist-laden *shola* in the southern regions – show a striking diversity of microbial communities that reflect climatic, elevational, edaphic (soil-related or soil-driven), and vegetational diversity. By driving essential functions such as nutrient cycling (promoting plant growth), decomposition, pollutant breakdown, carbon storage, and disease regulation (enhancing soil resilience), these microbial communities serve as the hidden engines that sustain the unique vegetation patterns and ecological stability of each landscape.

Grasslands cover approximately 40 per cent of the Earth's land surface, and are dominated by herbaceous plants; they constitute one of the most ecologically vital and biogeochemically significant biomes.

Understanding the function of these 'microbial networks' is essential in predicting the response of grasslands to global climate change and ever-increasing anthropogenic pressures. The extremely diverse microbial communities of the soil also harbour potential pathogens. Soil health must be understood as inseparable from the living, dynamic microbiome hub, fundamental to the biosphere's ecological balance, agriculture, environmental sustainability, and One Health (a collaborative approach that recognises the interconnectedness of all organisms and the environment) as a state of life, because these microbes simultaneously influence ecosystem functions, plant health, animal health, and ultimately human health.

When soil microbial diversity declines on account of degradation, pollution, or climate change, it weakens plant productivity, ecosystem resilience, and overall environmental health, ultimately affecting food security and human well-being. By safeguarding the soil microbiome (the entire community of soil organisms), we conserve grasslands, forests, and waterbodies, because the health of soil underpins the health of life above ground.

The story might as well continue. But the beginnings and ends, as we can say, are beyond human capability and comprehension!



Sanjukta Biswas, currently at the Ashoka Trust for Research in Ecology and the Environment (ATREE), is a microbial ecologist focusing on harnessing eco-friendly soil microorganisms. **Eapsa Berry**, an evolutionary ecologist, explores the history of plants and their multiple functions in natural landscapes. She is a Fellow-in-Residence at ATREE.



The soil in the Banni grasslands hosts a diverse microbial community dominated by halophilic (salt-loving) bacteria. A prominent function of these bacteria is to produce powerful enzymes that break down tough organic matter, driving nutrient cycling in these harsh soils.



CHETAN MISHER

THE LIFE AND LIVES OF BANNI

By Dr. Chetan Misher

At first glance, Banni did not demand attention. To a passing traveller, it can feel empty. But it is much more; it just doesn't show itself on demand. It reveals itself only to those willing to stay.

It was February 2014, and winter had begun to fade in Banni. We moved through the rocky tracts of Kutchh, small undulating hills dotted with sparse clumps of euphorbia. The only other green came from patches of the invasive plant *Neltuma juliflora*, interspersed with small farms. The bumpy ride over the bending roads of the rocky expanse suddenly softened as I entered a flat stretch, the vehicle gliding through a landscape that seemed to hold its breath.

At first glance, Banni did not demand attention. To a passing traveller, it can feel empty. Many visitors know it only as the edge of the White Rann, where the famous white desert festival is held. But Banni is much more than that; it just doesn't show itself on demand, much like an introvert. It reveals itself only to those willing to stay. I had arrived for my Master's project. The plan was to stay for a few months. Those months quietly turned into years, and years into nearly a decade.

As February nears its end, waterbodies begin to shrink, and grasses shed their green. As March approaches, the land appears to slip into a deep sleep. Within a few weeks, temperatures rise sharply. What starts as dust veils grow into powerful sandstorms by April and May. When the air finally settles, the land is rearranged. Fine sand, lifted and carried by wind, gathers against small shrubs, forming delicate *bunds* covering the vast land. The saline soil creates the illusion of water in the distance, shimmering under heat, though there may be no water for kilometres. Even as the ground hardens, temperatures soar and visibility blurs, life in Banni grasslands continues – mostly unseen. It thrives beneath the surface, inside burrows, and in the narrow windows of dawn and dusk, invisible to the hurried or unfamiliar eye.

Hurried eyes have long misread such a landscape as 'wasteland', mistaking invisible life for absence. That label justified a series of interventions that slowly eroded these ecosystems – not through sudden destruction, but through death by a thousand cuts. Lack of tree canopies is often associated with degradation, yet what seems barren is often a finely tuned system shaped by water, wind, and seasonal pulse. Banni is one such landscape.

In Search of the Elusive Fox

After months of searching these plains, I finally caught a fox on a camera trap deployed the previous night. A pup, likely a few months old, emerged, pushing loose sand from a den entrance, soon joined by a lactating female, possibly the mother. Though considered common where I grew up in Rajasthan, the Indian desert fox proved unexpectedly elusive in Banni.

Over the next few days, I located several den sites. Spiny hedgehog skins scattered nearby, along with fresh scat, suggested that many of these dens were active, some perhaps even hiding pups. While speaking with a local elder, I heard a fascinating account of how foxes hunt hedgehogs. According to him, when a hedgehog curls itself into a tight defensive ball, the fox flips it onto its back and urinates on it. The pungent smell is said to force the hedgehog to uncurl slightly to breathe, exposing its nose. The fox promptly seizes it and pulls it free of its spines. Whether entirely true or not, this story is widely told not only in Banni but in other parts of Rajasthan as well.

What is certain, however, is that the Indian desert fox is a dietary generalist. Its omnivorous diet ranges widely – from insects such as termites, ants, dragonflies, crickets, and beetles to nutritionally rich rodents and seasonal fruits. In a desert, where resources are scarce, one cannot afford to be selective. Desert foxes prefer to place their dens in isolated areas away from human habitation, another contrast from what is seen in parts of Rajasthan. As a species that has evolved in open deserts and grasslands, the expansion of *Neltuma*

Banni's expansive plains (facing page) may be misunderstood as barren 'wastelands', but in truth these grasslands form finely tuned Open Natural Ecosystems (ONEs) shaped by weather, wind, water, seasons, and geography. The desert jird (below left) and Indian long-eared hedgehog (below right) are among the mammals found in the dry grasslands of Banni, which live a largely fossorial existence in burrows underground.





Some of the largest flocks of Common Cranes can be seen foraging on freshly emerged grasses. Locally revered as Koonj, *they feed on Cyperaceae root tubers, leaving behind clear foraging marks.*

woodlands in Banni is shrinking its suitable habitat.

An Ever-transforming Banni

It was the end of July. After a brief break from the field, I returned to the landscape I had left only months earlier. Crossing the rocky terrain now familiar to me, I emerged onto what I expected to be vast open plains, only to find them gone. The monsoon had arrived, and with it came a transformation so complete it felt as though someone had repainted the landscape with vivid colours. Shallow water shimmered between patches of green sedges, giving way to a vast carpet of short grasses unfolding for miles. Scattered across this green were clusters of low shrubs such as suaeda, their forms repeating until they dissolved into the horizon. As we drove towards my field station at the heart of Banni, I could do little more than stare, absorbing the beauty of a scene that I had not experienced before. Little did I know that, over the weeks to come, these quiet lands would host a noisy yet symphonic festival.

As September arrives, Banni begins to fill with an astonishing diversity of migratory birds. Flocks of ducks, teals, and grebes glide across the water, while pelicans drift heavily in their wake. Egrets and herons occupy the shallows, standing motionless, monk-like, their stillness broken only by sudden strikes. On a winter morning, the rising sun gives warmth to cormorants perched on the bare branches of shrubs along the water's edge, wings spread wide to dry.

Banni becomes one of the great seasonal hosts for both resident and migratory birds. And it is not only the wetlands that hold this abundance. Beyond them, in the open grasslands, some of the largest flocks of Common Cranes can be seen foraging on freshly emerged grasses. Locally revered as *Koonj*, they feed on the root tubers of ephemeral Cyperaceae during the day, leaving behind clear foraging marks spread across large patches of soil. By night, they

Desert foxes prefer to place their dens in isolated areas away from human habitation, another contrast from what is seen in parts of Rajasthan. As a species that has evolved in open deserts and grasslands, the expansion of Neltuma *woodlands in Banni is shrinking its suitable habitat.*



PRITAM PATIL/SANCTUARY PHOTOLIBRARY

retreat to nearby wetlands, roosting in the centre of shallow water, where even the slightest ripple serves as an early warning against approaching predators.

The monsoon brings a pulse of resources and with it a brief window during which most desert inhabitants begin raising their young before conditions turn harsh again. The den where I recorded my first desert fox in Banni, dug into a vegetated dry wetland, did not survive the monsoon. Waterlogging caused its collapse, forcing the foxes to move. Some individuals, wiser in their choices, reuse dens dug on slightly elevated ground. A desert fox den can stretch up to 10 m., with multiple entrances, providing insulation against both predators and heat.

Driving along a narrow trail near a wetland, tall sedges on one side, and vast open plains on the other, I observed something. Not far from the track on the other side, an Indian fox, clearly a mother, sat alert, her gaze fixed on a nearby steppe eagle. Large raptors such as eagles are known to steal prey from smaller predators, and foxes remain especially vigilant in their presence.

For the pups under the comfort of their mother's protection, everything was worth investigating. Dried dung pellets nearby abound with insects – rich and easy protein, the bugs grab their attention. Foxes are not the only ones drawn to such abundance. This is also a season of plenty for spiny-tailed lizards. Fresh grass carpets the ground, insects surge after the monsoon, and the lizards feed intensively, building reserves to carry them through the long winter hibernation ahead. Though largely herbivorous, they opportunistically add insects to their diet during this brief window of abundance.

Even as families are raised and winter preparations begin, a threat looms quietly over the landscape. One winter afternoon, while checking camera traps in the field, two feral dogs on the horizon, leaping repeatedly at a single spot in the middle of nowhere, caught my attention. As I drove closer, the reason became clear: a den opening. It belonged to a fox. Free-ranging dogs are known to harass and hunt wildlife worldwide, and Banni is no exception. That fox may have escaped, but many are not so fortunate. Even when they do not kill directly, dogs pose another threat, diseases such as canine distemper, which have caused severe mortality in wild canids in other grasslands of India.

As winter deepens, Banni grows busier still. A pair of jackals foraging in the brushland have just caught something – a bulky rodent in its jaws. It was a lesser bandicoot rat, a species typically associated with rice fields and moist climates. Data showed that the transformation of open grasslands into invasive woodland may support their expansion into drylands where they were historically absent. Thick canopies of *Neltuma* provide shelter from predation and relief from daytime heat, creating suitable conditions for them. In effect, one invasion facilitates another.

Under the grip of multiple invasions, Banni renegotiates its future each day. Though changing in scale and character, it remains resilient, for now. The story of its people deserves its own telling, for together, human choices and invasive forces continue to shape this singular ecosystem.



Dr. Chetan Misher is an ecologist passionate about India's grasslands and desert ecosystems. His research explores how new species reshape native wildlife communities and the ecological fabric of these arid regions. Currently, he is working on ecosystem restoration with the Wildlife Conservation Trust in Rajasthan.

Fresh grass carpets the ground, insects surge after the monsoon, and spiny-tailed lizards feed intensively, building reserves to carry them through the long winter hibernation ahead.



CHETAN MISHER

DRY GRASSLANDS AS CLIMATE ASSETS: LESSONS FROM BANNI

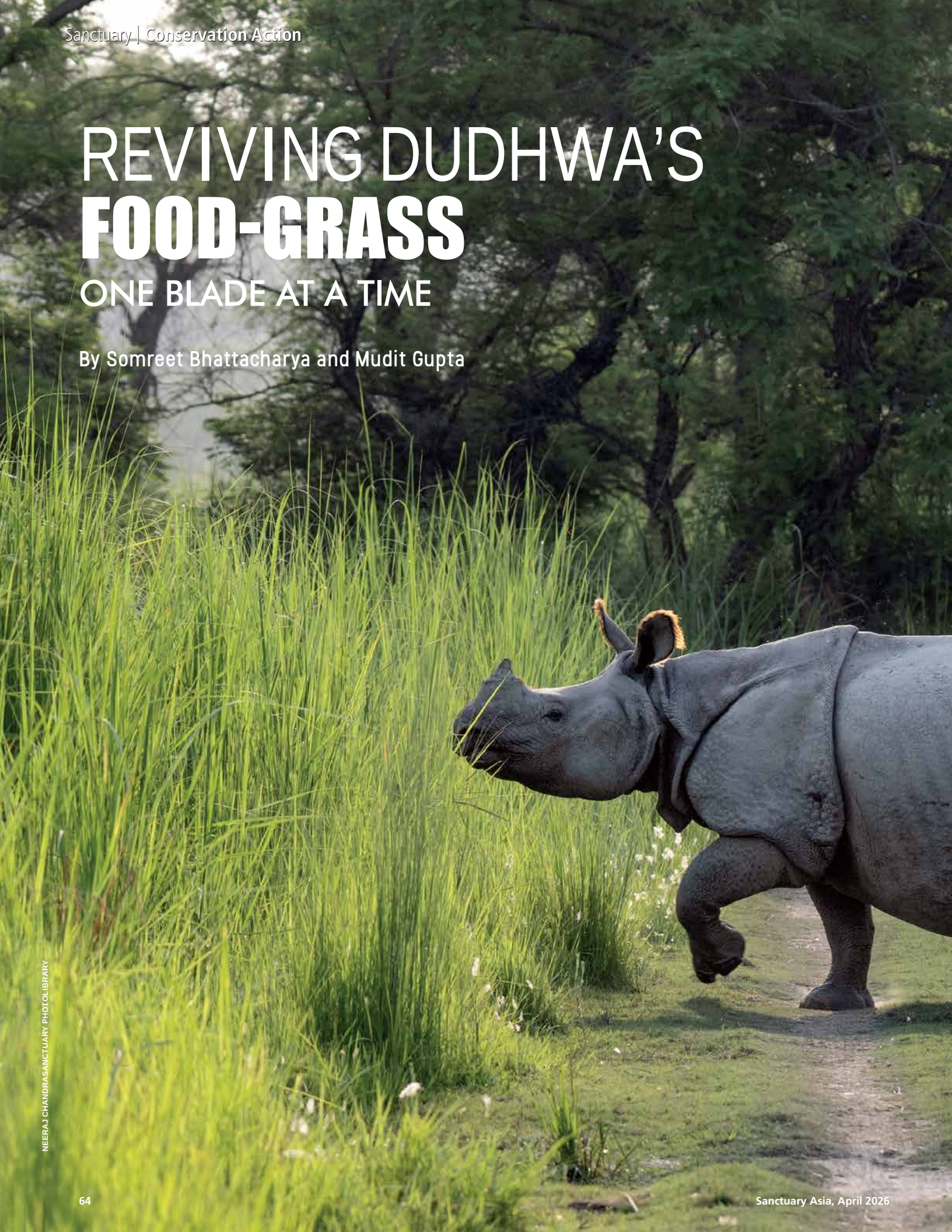
Amid transforming seasons and noisy migrants, there is another story of Banni, one that remained conspicuously untold until recently. Beneath its windswept grasses and seasonal wetlands lies one of the most carbon-rich arid grassland soils in the world. Ecologists Manan Bhan, Ankila Hiremath, Abi T. Vanak, and I, embarked on a scientific study to map the amount of carbon stored in the soils of Banni.

Our study, published in the *Ecological Applications* journal in July 2025, found that this landscape stores nearly 27.7 million tonnes of carbon in just the top 30 cm. of its soil! A carbon stock of 121 tonnes per hectare is comparable to that of some of the world's tropical forests. Remarkably, restored grasslands in Banni store even more carbon than areas invaded by *Neltuma juliflora*, underscoring how grassland restoration can directly contribute to climate change mitigation. At a time when tree planting is often seen as the default climate solution, Banni reminds us that healthy grassland soils are vast, if quiet, carbon reservoirs.

REVIVING DUDHWA'S FOOD-GRASS

ONE BLADE AT A TIME

By Somreet Bhattacharya and Mudit Gupta



NEERAJ CHANDRASANCTUARY PHOTOLIBRARY



Nearly a fifth of Dudhwa Tiger Reserve's landscape is grassland, essential grazing grounds for ungulates and, by extension, prey for tigers and leopards.

As dawn breaks, a soft gold seeps across its vast grasslands. The morning air trembles with the chatter of passerines, and on rare, fortunate days, a tiger pads out of tall grasses in search of prey. The tall Terai grasses, locally known as *phantas*, cradle entire worlds: hog deer carefully picking their way through the undergrowth, swamp deer browsing in small herds, and chital darting in and out of sight. Greater one-horned rhinos graze in these grasslands, leaving wide swathes of flattened vegetation in their wake.

In the Dudhwa Tiger Reserve, almost a fifth of the landscape is grassland, which is essential grazing grounds for ungulates and, by extension, prey for tigers and leopards who move through them like shadows. For the people in the villages surrounding Dudhwa, these grasslands are as much a part of their culture as of the land. They represent the last major expanse of Terai alluvial grasslands in India, and form the beating ecological heart of the reserve. Yet these grasslands, mostly in the buffer areas, are gradually diminishing under the pressures of changing land use, climate impacts and expanding human activity.

The Grasslands that Sustain Dudhwa

Over the past five years, WWF-India has supported an ambitious initiative to protect and restore the grasslands of the Dudhwa Tiger Reserve. The project focuses on the meticulous, plot-based restoration of grassland habitats across the Dudhwa National Park, Kishanpur Wildlife Sanctuary, and the Katerniaghat Wildlife Sanctuary. The approach is simple in theory, but complex in execution: restore edible native grasses and monitor their spread.

Seven sites were chosen to plant seedlings into nursery plots, selected for the extent of tall grassland they harbour. Nursery beds were carved into the earth and seeded with native species collected across the forest, including common species such as *Cynodon dactylon*, *Apluda mutica*, and *Dichanthium annulatum*. When the grassland 'slips' (areas of shallow erosion) were ready, 12 five hectare plots were planted, fenced, then left untouched to measure ecological change with as much scientific rigour as possible.

Restoring the Terai, One Plot at a Time

As the first monsoon washed over the reserve, the fences came down, and the plots were left to their own devices. Throughout the season, forest managers used freely accessible satellite imagery to track the subtle, steady changes spreading across the landscape.

Across all restored plots, 12 species of grass and sedge took hold. *Cynodon dactylon* – the hardy *doob* grass – spread vigorously across the planted plots, forming dense mats rich in early-stage protein and well-liked by grazers. *Dichanthium annulatum*, another nutritious species, performed steadily in multiple ranges, retaining its quality under repeated grazing.

Others offered benefits more selectively. *Imperata cylindrica*, or *kaans*, is valuable when young but grows quickly into a fibrous, less digestible clump. *Saccharum spontaneum*, on the other hand, proved

A controlled slash burning technique is used to remove invasive species. Over the past five years, WWF-India has supported an initiative to protect and restore the grasslands of the Dudhwa Tiger Reserve. The project focuses on plot-based restoration of grassland habitats.



SOMREET BHATTACHARYA

to be a monsoon miracle for large grazers. Rhinos in particular relish these floodplain grasses during the wet months when they flourish in tall, silvery waves.

But some species reveal challenges. Palmarosa *Cymbopogon martini*, while excellent for soil stability and aromatic oils, is almost entirely unpalatable to herbivores. Its rapid spread threatens to overtake space meant for edible grasses. Vetiver *Chrysopogon zizanioides* showed similar limitations – useful for erosion control, but virtually useless as food.

Signs of wildlife returning to the plots emerged through quadrat surveys. Barasingha left clear traces in Belrayan, Kishanpur, and Sathiyana. Chital, hog deer, nilgai, porcupine, and wild boar followed, though the latter two appeared only in Sathiyana.

The effort echoes the Dudhwa Tiger Reserve's Tiger Conservation Plan (2013-2023), which identifies roughly 22 per cent of the reserve's 1,284.3 sq. km. as essential grassland habitat. Globally, the Terai's alluvial grasslands have all but vanished. And where they survive, they require constant tending – cycles of growth, seasonal cutting, and controlled burns to keep nutritious grasses at their prime and to prevent unpalatable species from taking over.

Globally, the Terai's alluvial grasslands have all but vanished. Where they survive, they require constant tending – cycles of growth, seasonal cutting, and controlled burns.

A Fragile Future for a Vanishing Landscape

The long-term challenge for grassland managers is monitoring consistency. It is critical that restoration plots remain viable for at least five years. Joint monitoring teams now include forest staff trained in *Tranam*, a detailed grass-identification manual designed for the project. Understanding how these grasses spread, compete, and respond to grazing will shape future strategies.

Since grassland restoration goes beyond feeding herbivores, the structure of grasslands – short, nutritious patches interspersed with taller, sheltering vegetation – determines the fate of many species. The work ahead remains extensive. Managers continue to fine-tune a mosaic of grass heights and assist the survival of high-nutrition species in strategic ranges, while constraining aggressive varieties that degrade forage quality. Eventually, ongoing monitoring is what will reveal which herbivores prefer restored patches and how the landscape evolves across seasons.

With each new growth cycle, with every hoofprint pressed into fresh earth, these plots whisper a quiet promise: a slow, steady return to health for one of Terai's most iconic and endangered landscapes.



Dr. Mudit Gupta is the landscape lead for WWF-India's Terai Arc Landscape in Uttar Pradesh. An environmentalist and conservationist for over two decades, he has worked extensively in species and habitat restoration across Uttar Pradesh. **Somreet Bhattacharya**, Communications Manager at WWF-India, is a journalist turned conservation communicator with a passion for storytelling and narration.

Across all restored plots, 12 species of grass and sedge took hold. Cynodon dactylon *– the hardy* doob *grass – spread vigorously across the planted plots, forming dense mats rich in early-stage protein and well-liked by grazers.*



SOMREET BHATTACHARYA



SANKAR SUBRAMANIAM

AMONG BROWN GRASSES

By Harshin Meera Ambavarapu

An overnight journey from Bengaluru transported me to Perumalpuram, a small village in the eastern reaches of Tirunelveli district, Tamil Nadu. It was hot, and the dry air brought dust, not relief from the heat. Palmyra palms and scattered shrubs stretched out before me, as livestock grazed on the grass that was a muted shade of brown. I was in remote, arid Perumalpuram to study grasslands for my dissertation. There was nothing dramatic about the vista before me, and I would be lying if I said I had not begun to question my choice.

Grasslands across India have long been ignored, and remain under constant assault. Tirunelveli's grasslands are no exception. What, I wondered, had happened to the plant species composition in these landscapes? Had the composition changed? Did the hyper-abundance of hopbush (flowering plants in the soapberry family, Sapindaceae) alter soil carbon stocks? Had dense shrub influenced grazing patterns? Could these grasslands possibly be restored to their undisturbed state... and if so, how? Such were the questions I began to discuss with my supervisors at the Ashoka Trust for Research in Ecology and the Environment (ATREE), who were leading a broader effort to revive degraded ecosystems.

Mapping Life in the Grasslands

Over the next two months, I sampled the grasslands using one square metre plots to document plant composition and to collect soil samples to assess soil quality and carbon stocks. Grasslands contain two main groups of plants: the dominant grasses and ephemeral herbs known as forbs. Our team would head out early, sampling before the sun began beating down on our backs with daytime temperatures roughly around 40 to 42°C. Often we had to beat a retreat back to our field station, where we would process samples, only to return to the grasslands in the evening.

Our surveys were the first systematic attempt to document plant composition in these grasslands. We recorded 47 species: 15 grasses and 32 forbs. Grasses belonging to the genera *Aristida* and *Chrysopogon* dominated the landscape, along with 11 genera within the family Poaceae. The forbs belonged to 29 genera and 17 families. Interestingly, unlike the grasses, the forbs were distributed more evenly across the 52-ha. site. The grassland itself was not uniform. Microhabitats included a Palmyra plantation, a shallow stream bed, and patches of extremely hard soil that we struggled to dig. Surprisingly, however, the plant composition did not vary significantly across our site.

An iconic grassland species in India, the Indian Courser Cursorius coromandelicus *is typically seen in small flocks among short grasses. It feeds on insects such as beetles, crickets, termites, and grasshoppers.*

My colleagues and I also joined an ongoing experiment aimed at rejuvenating grasslands by working with locals to manage grazing intensity. The experimental plots were sampled as well to examine plant composition and soil quality.

After several weeks of this back-breaking work under the hot sun, I returned to Bengaluru and began the painstaking work of analysing the soil samples, a process that presented its own challenges. Soil carbon analysis requires the use of expensive instruments, and inevitably there is a long queue of researchers awaiting their turn. Some two months later, I had all the data for my master's dissertation. Just when I thought the hard part was over, new challenges appeared – analysing the data, writing code, and producing graphs. But the results made all the efforts worthwhile.

We had completed the first ever estimate of soil carbon from the arid grasslands of Tirunelveli, but found that we had no clear benchmarks for comparison. The low-elevation grasslands of Tirunelveli and Thoothukudi districts remain poorly studied, and face constant pressure from conversion to plantations and housing plots. The nearest available comparison came from the montane grasslands inside Kalakad-Mundanthurai Tiger Reserve, which experienced fundamentally different rainfall, elevations, and plant compositions.

Excluding grazing was beneficial. Plots protected from grazing had higher biomass and marginally higher soil carbon. Could rotational grazing, allowing some areas to recover while others are grazed, offer a natural pathway to grassland restoration?

Searching for Restoration Clues

One pattern was evident: excluding grazing was beneficial. Plots protected from grazing had higher biomass and marginally higher soil carbon. The four treatments involving hopbush removal did not significantly affect soil carbon, though the plant composition improved where the shrub had been cleared. Could rotational grazing, allowing some areas to recover while others are grazed, offer a natural pathway to grassland restoration?

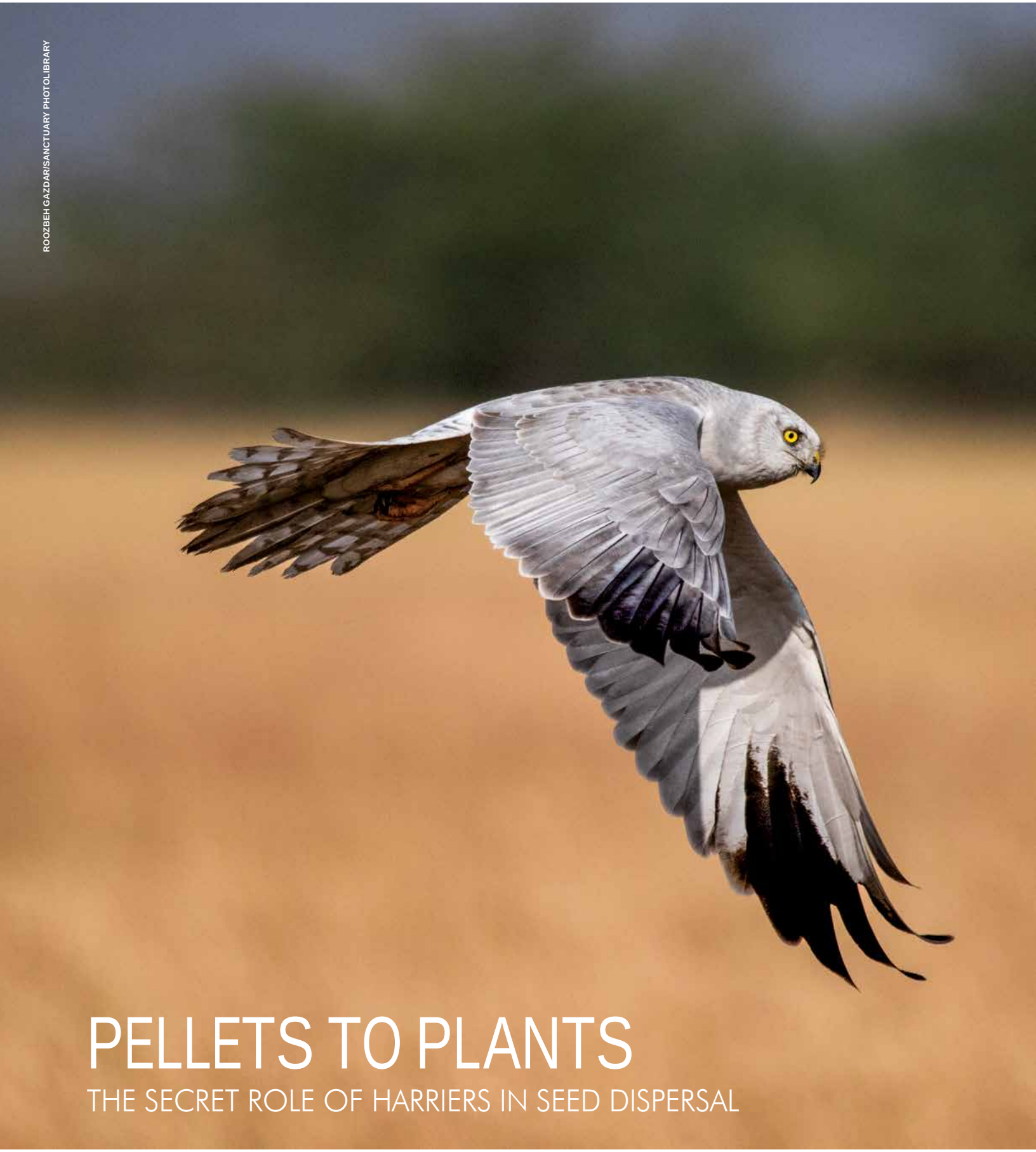
Earlier this year, I returned to the Tirunelveli grasslands to explore that very question. Our team repeated the study to understand how seasonal changes influence the patterns we had observed. This time the sampling felt less daunting. As I now wait in another long queue to process this year's soil samples, my mind drifts back to the field. In the air-conditioned laboratory I find myself missing the swaying grasses and the hot, dusty wind.

Studying the grasslands of Tirunelveli was a lesson in resilience. Fieldwork tested me in many ways. I learned to live in a field station, identify plants, wrestle with statistics, and manage time and resources. In some ways, I may have become like the ecosystem I studied, seemingly unremarkable at first glance, yet deeply heterogeneous and quietly resilient.


SELVA KUMAR

The author sampling the grasslands (above) using one square metre plots to document plant composition and to collect soil samples to assess quality and carbon stocks. A drone picture of the 52-ha. restoration site (below) in the Tirunelveli grasslands. Microhabitats included a Palmyra plantation, a shallow stream bed, and patches of extremely hard soil.


VINOD KUMAR M.



ROOZBEH GAZDAR/SANCTUARY PHOTOLIBRARY

PELLETS TO PLANTS

THE SECRET ROLE OF HARRIERS IN SEED DISPERSAL



Savannah-grasslands play home to six of the world's 16 harrier species each winter in India, which hosts the world's largest roost of the near-threatened Pallid Harrier *Circus macrourus* and Montagu's Harrier *Circus pygargus*, write Arjun Kannan, Prashanth M.B., and Ganesh T.

Every year, thousands of harriers migrate into the Indian subcontinent from their central Asian breeding grounds, as they fly past the circum-Himalayan flyway, avoiding the lofty Himalaya. This is no different from regular travellers avoiding bustling city traffic and taking the bypass to ensure ease of movement. In the case of harriers, circumventing the Himalaya makes migration a less treacherous and more productive route to find food at stopover sites, such as the Thar Desert. Once they cross over, they winter in the savanna and grassland habitats spread across from western India to southern India. Being ground roosters in these habitats, they tend to congregate, often in numbers ranging from a few individuals to a few dozens to hundreds, and even thousands in areas with adequate grass cover. Harriers show high fidelity to such roosting (resting places) and foraging sites, and individuals tend to return to the same sites year after year for wintering. You shouldn't be surprised to find the same ringed harrier returning to and perching on the same fence post in the subsequent years of its life in spite of flying back 5,000-6,000 km. to its breeding home!

The migration of harriers, just like any other migrant bird, is an unbelievable spectacle. At times, we have been able to witness harriers arriving one after the other, like lonely travellers on the Grand Trunk Road, and settling into the grassy plains of western India. Most other times we aren't lucky and the harriers circle high above in the sky and descend as if it was just a simple hop from a place 200 km. away, while riding the winds above. We end up adding their numbers to tediously tabulated counts as part of harrier roost counts. We also account for associated variables, such as the condition of a habitat and prey availability, which we document at their roosting sites to better understand how they move, when they move, and why they move. Most often, the roosts consist of two or three species of harriers: the Montagu's Harrier *Circus pygargus*, Pallid Harrier *Circus macrourus*, and Western Marsh Harrier *Circus aeruginosus*, although their numbers vary each season. The Harrier Watch programme at ATREE has been monitoring roosting sites across India since 2015, helping track wintering populations and trends at a country-wide scale over long periods that extend into a few decades.

Monitoring roosts involves visiting the roosting sites in the evenings, two hours before sunset. As dusk approaches, the harriers start flying into the roost from their feeding grounds, which are spread across grassland and savanna habitats, and occasionally sparse scrub or dryland, or among dryland crops such as cotton, groundnut etc.

Once they arrive at the roosting site, individual harriers first tend to sit on the ground on a bare patch or mud roads, spending their time preening their feathers and looking out for any predators such as foxes, jungle cats, or large raptors. As the sun sets, the harriers take to the air and start circling in a group, a behaviour known as 'milling'. They do this to watch for predators and to choose the best places to roost in the grass. Just before twilight fades, the harriers settle into the roost site for the night until daybreak, when they resume their activities.

Capsules of Information

Within these roosts, harriers regurgitate pellets – masses of undigested prey material. Pellets contain hair, feathers, scales, egg shells, bird gut, bones, and exoskeleton of insects such as grasshoppers. We visit the roost sites in the mornings after the harriers leave for their daily foraging. As we walk in the dew-laden grass, we see pressed grass

The Pallid Harrier Circus macrourus *is a species of harrier, a bird of prey in the family Accipitridae. It breeds in southern parts of eastern Europe and central Asia and Iran and winters mainly in India and Southeast Asia.*

where harriers have roosted. When we look closer, we see droppings, downy feathers of the harriers, and some pellets. Harrier pellets have been collected from multiple roosting sites in Rajasthan, Gujarat, Maharashtra, Karnataka, Andhra Pradesh and Tamil Nadu. These pellets are vital sources of information about the diet of harriers. We collect the pellets delicately, as they can disintegrate, and put them in zip lock bags, later drying them completely in the sun. Then, in the lab, we soak the pellets in water before dissecting them and separating the parts to ascertain the harriers' diet.

Pellet analysis showed that the Montagu's Harrier preys a lot on grasshoppers, followed by insects such as dragonflies, antlions, and occasionally on lizards, rodents and birds. Sometimes we also find bird egg shells, which means the harrier has raided a bird's nest! It was quite fascinating to discern the scales of a fan-throated lizard in some of the pellets, and each subspecies of the lizard seems to have a distinct pattern, suggesting the area where it might have been preyed upon. The Pallid Harrier seems to specialise more on birds and rodents. Since the roosting sites mostly contained only two harrier species, we could not really determine the diet of the Western Marsh Harrier in detail. However, it is known to have a generalist diet, feeding on amphibians, snakes, and waterbirds, and sometimes resorting to scavenging.

Seeds in Harrier Pellets

While analysing pellets, to our surprise, we came across a lot of seeds. Are harriers also eating plants? It was then we realised that the seeds were ingested secondarily from their prey, especially granivorous birds and rodents.

The seeds were present in intact form and when inspected under the microscope, their species and varieties could be identified. We came across 137 different species of plant seeds from the harrier pellets collected between 2016 and 2023. At least some of the seeds (~12 per cent) were viable for germination in spite of long shelf storage in a few cases, suggesting that fresh pellets can disperse seeds originating from prey, thus aiding dispersal. Imagine a munia, a pipit, or a lark feeding on seeds in a distant grassland and a Pallid Harrier preying upon it in the late evening. After all, they are infamously termed the ghost of the grasslands on social media – a result of their white plumage and swift flight late in the evenings to catch prey.

The gut of the small bird goes through the cycle of digestion, and at times the undigested, fully swallowed gizzard ends up in a harrier pellet that may have been carried in the harriers' gut while flying 150-200 km. in a single day during migration. On a subsequent day, it is popped out in a distant roost, where it undergoes degeneration, while the seeds, after passing their dormancy state, may germinate in the following season. We were able to grow back jowar and bajra seeds originating from the pellets collected in Rajasthan in terraced pots in Bengaluru! On the contrary, for wild plants, this represents a fresh lease of life and an opportunity to disperse into depauperate landscapes.



PRAJYOT HANCHANALE/SANCTUARY PHOTOLIBRARY

Restoring Fragmented Grasslands

Harriers could aid in dispersing seeds between grassland patches. Their behaviour of shifting roosting sites throughout the season means that seeds could be dispersed from their foraging grounds in grasslands, scrublands, or croplands to multiple different sites. Birds such as larks are known to be seed predators as they have something called a muscular gizzard, which crushes the seeds they consume for better digestion. However, when a harrier picks up such a bird and consumes it, the seeds can survive in its gut and get expelled with the pellets by means of secondary seed dispersal. Although it is too early to say that harriers are highly efficient seed dispersers that help restore grasslands, there is no doubt they contribute to this ecological function in grassland ecosystems. Thus, the long-term survival of harriers requires the protection and conservation of grassland ecosystems in India. Grasslands, owing to the lack of woody growth and the arid and semi-arid climate in which they occur, become easy targets for land-use transformation. They have been wrongly termed as wastelands, which marks them for urbanisation. This has negative consequences for the biodiversity harboured by these habitats, and also for humans whose livelihoods depend on these ecosystems for agriculture or pastoralism.

We were able to grow back jowar and bajra seeds originating from harrier pellets collected in Rajasthan, in terraced pots in Bengaluru!

As a result of such conversion, grassland habitats have become devoid of endemic grassland fauna such as harriers, wolves, foxes, bustards, floricans, blackbuck and a host of other flora that supports them. Many species of shrubs, herbs, forbs, and stunted trees are also important elements of a grassland-savanna ecosystem.

Forests far outweigh grassland savannas in India both in terms of area and priority, unfortunately leaving little space for the inhabitants of grasslands. During their most productive period, grasslands are full of life. Hundreds of bee-eaters, chats, swallows, and pratincoles feed on swarming insects. A number of raptors, including migratory ones, circle the sky, from small falcons and harriers to large eagles searching for prey. By night, mammals such as foxes and jungle cats become active, trying to prey on the smaller inhabitants such as rodents and roosting birds.

Sadly, fewer than a dozen such thriving grasslands remain across India. Conservation efforts are required to prioritise existing grasslands and also restore them. Given that we are in the UN Decade on Ecosystem Restoration, practitioners and advocates should focus on opportunities to conserve degraded patches of grassland savannas.



Arjun Kannan, a Ph.D. student at ATREE, Bengaluru, works on the migration ecology of harriers in India; **Prashanth M. B.** is an independent researcher working on harriers and grassland birds across India; and **T. Ganesh** is a Senior Fellow at ATREE, Bengaluru, running the HarrierWatch programme since 2015.



A Pallid Harrier (facing page) in the process of regurgitating a pellet. Analysis of such pellets (below) reveals that, unlike some related species, the Pallid Harrier tends to specialise more on birds and rodents, while also somewhat surprisingly consuming a notable amount of seeds. Harrier pellets are regurgitated, undigested remains of prey consumed by them. Recent studies, particularly by ATREE researchers, indicate that these pellets often contain viable seeds, playing a crucial role in seed dispersal across Indian grasslands.



TERESA S. THOMAS

RISING LOSSES, GROWING PRICING, INCREASING UNINSURABILITY

Risky Future?

By Praveen Gupta

Suddenly through the looming dark clouds of climate breakdown and expanding wars, I saw a silver lining in the form of actuarial firepower – surely not the most expected quarter. Risk pricing and all attendant challenges do not always fully sit with an actuary. The pricing of war risk for oil and LNG supertankers, in and around the Strait of Hormuz, turned out to be an actuarial turf. Reinsurers of Protection & Indemnity (P&I) Clubs decided to issue cancellation notices from GMT midnight of March 5, 2026.

It is ironic that on one hand, insurers are in total control of pricing methodology and have a clear 'protocol' when it comes to war risk. On the other hand, in an existential situation like climate breakdown – there is virtual abdication.

Can actuarial might be reined in to energise this and other laggard spaces? Some recent initiatives of the Institute & Faculty of Actuaries (IFoA) are pathbreaking and deserve serious attention. Speaking at a recent Global Conference of Actuaries (GCA) in Mumbai, I flagged the possibility of 'actuaries as healers'.

It is worth pondering if insurers can withdraw war coverage when the risks become too costly, can they also act to address the growing risks of climate breakdown?



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As insurance clubs pulled the plug on war risk coverage, the Persian Gulf turned into a *terra incognita*: Latin for 'unknown land', it is a term used in cartography for regions that have not been mapped or documented. Shanaka Anslem Perera's paper *The Invisible Siege: How Insurance Markets, Not Missiles, Closed the Strait of Hormuz* is an excellent commentary. Here are some insights:

"The structural implication is stark: the Hormuz actuarial blockade will persist not for the duration of Operation Epic Fury's kinetic campaign, but for the duration of the insurance market's reinstatement process. Those are two fundamentally different timelines. The campaign may last four to eight weeks, as the administration projects. The insurance reinstatement, based on the only available reference classes, will require six to 18 months. The mismatch between these two estimates, approximately four to 16 months of unpriced duration, is the single largest temporal arbitrage currently available in global macro. What makes the current timeline particularly intractable is the nuclear overhang," writes Shanaka Anslem Perera. He adds: "The International Atomic Energy Agency confirmed that 440.9 kg. of 60-per cent enriched uranium has been unaccounted for since June 10, 2024, the last date of human verification. Director General Rafael Grossi stated that the loss of continuity of knowledge needs to be addressed with utmost urgency. This quantity is sufficient for multiple nuclear weapons if further enriched.

Regardless of how the kinetic campaign resolves, no reinsurer will restore Gulf's war risk capacity while nearly half a metric tonne of weapons-proximate uranium remains unaccounted for in a country undergoing simultaneous military bombardment and leadership succession. The nuclear tail risk, priced at approximately zero in current

markets, is the factor that could extend the insurance reinstatement timeline from months to years." For a moment let us think of the contrasting approach of insurers to the externalities in the climate context.

The revelation: the critical infrastructure of global commerce does not run on military power, diplomatic agreements, or sovereign guarantees. It runs on a thin layer of private institutional trust that can be withdrawn in seventy-two hours. The P&I clubs that insure 90 per cent of global shipping tonnage are not government agencies. They are private mutual associations, owned by their shipowner members, governed by commercial logic, and regulated by a capital framework that incentivises exit under precisely the conditions when their presence matters most.

In the Strait of Hormuz, the insurance market has not withdrawn because of the risk of attack but because the cost of verifying whether any particular vessel will survive any particular transit now exceeds the premium income from insuring that transit. When risk cannot be modeled, it cannot be priced. When it cannot be priced, cover is withdrawn and then the system freezes regardless of whether the underlying risk has materialised for any specific vessel. Perera connects these dots further: "The reinsurers who backstop those clubs are an oligopoly of perhaps five to 10 firms whose risk appetite is governed by actuarial models, not geopolitical ambition. The entire system of global maritime trade, carrying billions of dollars of cargo across the oceans every day, stands on a foundation that can be dissolved by a small number of private decisions taken in a handful of London boardrooms."

The Other Theatre

If actuarial fire-power can cease a war-cover, because the price isn't right, is there something it can do with climate breakdown? Let's look at the other side of the coin and lay bare the myopia of insurance. In the brilliant paper *Lost in Translation: The Climate Disclosure Paradox and the Missing Price Signal*, Anthony Hobley – Deputy Chair, Climate, Risk and Resilience, Howden Group puts his finger on the pulse: "The commoditised, 12-month renewal model that has defined the non-life insurance market for decades was rational in a world of relative physical and economic equilibrium. In that world, annual repricing worked: if risks shifted, premiums adjusted at the next renewal. Buyers accepted it because it kept them competitive. Insurers accepted it because it limited their long-duration exposure – resting on two interlocking assumptions: that the market would remain broadly stable, and that any disruption would be temporary and quickly corrected. Both assumptions are now invalid. Climate transition stresses on the insurance market will be *'predictable, ubiquitous, growing and sustained over years and decades'*. This is not a shock from which equilibrium will be rapidly restored. It is a structural shift in the physical environment that underlies every risk the insurance sector prices. Whilst it may provide short-term profits, it poses an existential threat to the insurance sector's business model. We have the most comprehensive, institutionally validated body of risk data in human history... And yet the people whose job it is to allocate the world's capital – the finance ministers approving national budgets, the asset managers running pension portfolios, the project finance committees deciding whether to fund a solar farm in Senegal or a port in the Philippines – are, on a day-to-day basis, making decisions as if that data does not exist.

In the Strait of Hormuz, the insurance market has not withdrawn because of the risk of attack but because the cost of verifying whether any particular vessel will survive any particular transit now exceeds the premium income from insuring that transit.



PUBLIC DOMAIN/SGT. ALEXIS FLORES/U.S. NAVY

Insurance dysfunction is neither a monopoly of poor countries nor middle powers. It is a price you end up paying for all the misadventures coming back to sting as a tail risk.

This is not ignorance. The finance minister who attends COP knows the data exists. The pension fund trustee who commissions a TCFD report (Task Force on Climate-Related Financial Disclosures) knows the data exists. The bank credit committee that prices a 20-year infrastructure loan knows the data exists. And then they return to their desks and apply the same financial models, the same discount rates, the same risk premia they would have used before any of this data was produced."

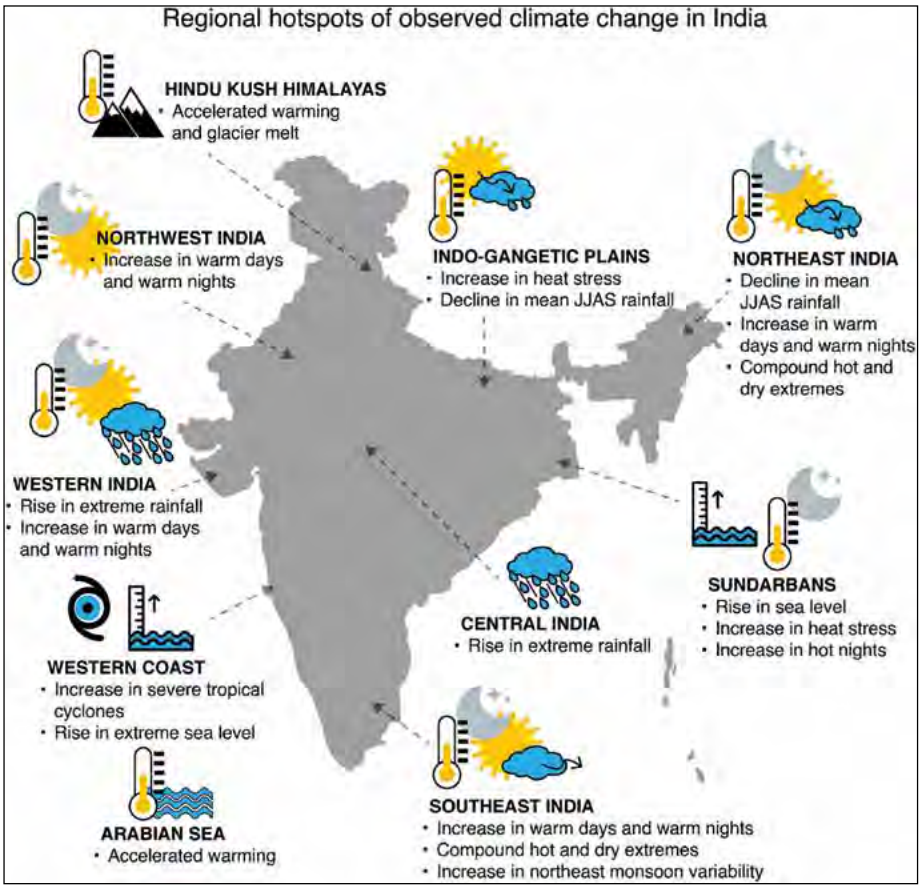
The Wrong Language

Anthony Hobley says, "Climate risk data is not presented in a form that can be easily modelled in financial terms. TCFD reports produce narrative scenario descriptions. Carbon Disclosure Project (CDP) generates disclosure scores. ESG ratings produce relative rankings against sector peers. The IPCC's physical risk projections are expressed in degrees of warming and probability ranges for extreme events. None of these outputs can be plugged directly into the financial models that govern real capital allocation decisions. They inform context. They do not determine price. Even sophisticated climate risk data gets collapsed into crude discount rate adjustments that, as eminent economist Lord Nicholas Stern has argued for two decades, systematically undervalue future lives and create a structural bias against preventive action."

Thereby it fuels, amongst other things, intergenerational risk, which I focused on in my February 2026 piece.

Different regions face distinct combinations of climate hazards, requiring tailored adaptation responses. However, climate change is not fully factored into policies that govern the design and construction of cities.

SOURCE: DR. CHIRAG DHARA AND OTHERS



Repricing Annually at Renewal

"The insurance sector may well hold the missing jigsaw piece, and so is best positioned to complete the forward climate risk price curves puzzle. It has 30 years of catastrophe modelling capability. It does this work internally, every day, as a core business function, using sophisticated models. But here's the problem: for the most part insurers only price 12 months ahead. They reprice annually at renewal and don't, as a matter of course, publish forward curves beyond that horizon. The broader financial system – banks pricing 20-year infrastructure loans, pension funds buying 30-year bonds – can't access multi-decade climate risk pricing because the 12-month insurance model provides no incentive to produce it," explains Hobley.

He adds that he has been asking for a while why there is not a forward price curve for insurance premiums, as there is for almost every other business critical commodity, product and service.

An Assortment of Woes

For a moment look at this map on the left, by climatologist Dr. Chirag Dhara and his team. We stand besieged on all sides. Recently a category VI earthquake classification was pulled back. A concerned friend asked me what insurers would do. Logically, press for the construction codes to ensure the buildings remain standing when the ground moves.

The entire Himalayan region is category VI and almost 60 per cent of our landmass is moderate to high-risk terrain. The Andamans and Nicobar are in the same seismic zone as Banda Aceh. Despite all the rationale as to why the Great Nicobar project could end up a stranded asset, would you still construct there given the category V codes?

The impact of rising heat caused the central Himalaya and Central Asia mountain ranges Tian Shan, 23 out of 24 glaciers, to lose ice mass, leading to an increase in glacial lake outburst floods (GLOF) and landslides. Uttarakhand and Sikkim are live case studies from the immediate past. The Chungthang dam loss still remains a pending claim. Underwriting at the time of a loss is a few steps ahead of uninsurability.

Anna Hurlimann and Sareh Moosavi write in *The Conversation* that climate

change should be a key consideration for designing, building, and managing our cities. However, they rue, policies that govern the design and construction of cities do not achieve this. They also say that, "The emissions generated need to be minimised and eventually eliminated... We must build in locations and in ways that reduce climate risks."

Urbanisation that ignores climate change is further complicated by subsidence, which is caused by the overuse and over-extraction of ground water from land weighed down by urban construction. Subsidence has become a phenomenon in inland areas as well as coastal regions that are already afflicted by rising sea levels owing to climate change. India expects to touch USD 30 trillion GDP by 2047. From now to then, 90 per cent of the infrastructure will be built.

As India urbanises rapidly, it will be increasingly prone to intensive heatwaves. With it will come road building, which will mean subsidence and sinkholes particularly during the monsoon. Sentinel-1 SAR imagery is an excellent tool for tracking the sinking patterns of Indian cities.

In *'Coastal resilience, (mal)adaptation, and justice in Chennai' (Journal of Academics Stand Against Poverty)*, Kashwan, P. and Ramakrishnan, R. and share: "relocation of population with the ostensible goal of climate adaptation has led to adverse impacts on coastal ecology and local livelihoods. It has significantly undermined the goals of improving coastal resilience and climate justice and constitutes a process of maladaptation." Just when the seas are rising, can we afford to mess around with that sacred front? The eagerness to increase penetration of insurance would target resultant asset creation.

Rising levels of the Arabian Sea and Bay of Bengal pose a threat to India's coastal livelihood, according to the World Metrological Organisation (WMO). Mumbai is one of the few megapolises in the world to have nuclear reactors within its boundary – renowned author Amitav Ghosh explained in an interview with nuclear safety expert M.V. Raman that the possibility of a Fukushima-like situation developing cannot be ruled out. Are we prepared?

The fundamental issue is not whether insurance cover is available or not, and its affordability. Equally important is how responsible is it for climate triggers?

Data centres may be fashionable. Not only are they thirsty but have a problem with their waste water. With AI buildup, the fossil fuel driven energy requirements will only skyrocket.

Global Biodiversity

The Global Biodiversity Framework requires $700+ billion in annual investment to meet 30x30 targets and halt biodiversity loss by 2030. Current annual biodiversity investment is approximately $154 billion – leaving a gap of over $546 billion per year. This is not a marginal shortfall. It is a structural mismatch between the scale of the problem and the available capital.

The Parasol Lost report by the Institute and Faculty of Actuaries (IFoA) and University of Exeter warns: "That without action, global warming is now likely to reach 2°C before 2050, a level associated with catastrophic impacts on societies and economies worldwide, with major disruption to water and food systems, migration, and human health. This raises the risk of climate-driven inflation, financial shocks, and the withdrawal of insurance from high-risk areas much sooner than many expect which, in turn, increases the chance of widespread financial instability and 'Planetary Insolvency' – the risk of societal and economic collapse from the loss of nature's critical support systems."

"We don't need an army of actuaries to tell us that the catastrophic impacts of climate change will be felt beyond the traditional horizons," said Mark Carney, the then Bank of England Governor, in his memorable "Climate change is a tragedy of the horizon" speech in 2015.

Sandy Trust, lead author from IFoA cautions: "An actuarial review of key climate change assumptions shows we may have seriously underestimated the rate of warming as well as the related economic impacts." If they have to be healers – actuaries need to also be stewarding away from tragedy on the horizon.

"The insurance dysfunction has spread to California's housing market, the country's (USA's) biggest and most expensive, with nearly one-in-five real-estate agents reporting a canceled sale last year because of clients unable to find affordable insurance, according to a survey by the trade body California Association of Realtors," reveals the *Wall Street Journal*.

The 12-month renewal model; blind sighting externalities; quarterly reporting; basis of valuation; GDP fortified by losses; aiding and abetting triple planetary crisis – all got away in a stable and linear world. We are now in an age of polycrisis.

The actuarial firepower ought to be in the ring. The fundamental issue is not whether insurance cover is available or not, and its affordability. Neither is it solely about the impact of climate breakdown. Equally important is how responsible is it for climate triggers? It does not end with double materiality. There are externalities and irrational penetration, too. Integrity would also see through insurance beyond mitigation, which is increasingly tested in adaptation and resilience zones.

It all boils down to pushing the planetary boundaries too hard, thereby inviting planetary insolvency and exposing Earth systems to tipping points. The scientific evidence is too loud to be muted.

Insurance dysfunction is neither a monopoly of poor countries nor middle powers. It is a price you end up paying for all the misadventures coming back to sting as a tail risk. Engineering to keep them out of your balance sheet is not the best way to manage your books. As Herman Daly articulated so well, "The economy is a wholly owned subsidiary of the environment."



Praveen Gupta is a former insurance CEO. He believes insurers – like other financial services – have a critical role to play not only in nurturing our environment today but also ensuring planetary well-being for the long term.



SANTHOSH PAVAGADA

Grasslands Need Protection – Now!

By Santhosh Pavagada

I watched a lone striped hyena burst onto the wide, roaring Pune-Nashik highway, its gait uncertain, almost bewildered, as it tried to cross back into the other half of its fractured home. Traffic thundered past in relentless waves, tires hissing against asphalt. The animal paused, then lunged forward again, caught between instinct and intrusion. The striped hyena, long burdened with the ominous moniker 'witch's steed', a name born of superstition and its nocturnal, scavenging habits, seemed startlingly out of place in the harsh glare of day. Yet here it was, exposed and vulnerable under the unforgiving sun, daring to navigate a corridor of speeding metal that had cleaved its territory in two.

Its struggle did not end upon reaching the other side. Across the road was a habitat now claimed by a large factory and scattered buildings. How can I, or those who plan such projects, who drive on that highway, or who work faithfully inside that factory, ever truly comprehend the realities of the hyena's world, or indeed that of any wild creature? While this hyena survived its perilous crossing, January 2023 told a harsher story, when 12 blackbuck bolting across the highway, plunged to their deaths from the hill the road was carved through. In more such instances, wolves, foxes, and other animals are crushed beneath speeding vehicles. However, their deaths pass quietly, rarely stirring headlines. However, my purpose is not to highlight the already well-known fragmentation impacts of linear infrastructure, but the negligent treatment meted out towards certain species and, by extension, their habitats. We hardly ever hear of corridors or mitigation measures for species like these that inhabit open ecosystems.

Open Natural Ecosystems

This is ironic, as hyenas, wolves, blackbuck, bustards, and other species that occupy grasslands or scrublands are all listed under Schedule I of the *Wildlife Protection Act* (*WLP*) 2022 and are entitled to the utmost protection, yet their habitats are largely ignored. Grasslands, shrublands, scrublands, deserts, ravines, rocky outcrops, and all other open ecosystems, also known as savannah ecosystems or Open Natural Ecosystems (ONEs), roughly comprise 10-15 per cent of India's geographic area, according to available literature. However, when we were trying to understand the extent of grasslands, there are no credible sources that confirm the actual area. Unlike the routine exercise to estimate the forest cover extent, there are still no nationwide mapping efforts by government authorities for these open ecosystems. While there are several satellite imagery-based land cover products available that can give us some idea of their extent, the disagreement between these products in classifying such lands and the variance in the estimated areas limit our understanding of their actual extent.

Compared to a forest, an open, plain land, albeit flourishing with lush grass and interspersed with shrubs and bushes, is a visual that fails to attract people's attention. Forests have always fascinated us; for decades, we have been taught about the services that forests offer, and the need for their conservation might have created the impression that wild animals exist only there, and hence they alone matter. Add to this their celebration in various media, films and even our curriculum, with chapters on the importance of afforestation, green movements to save forests, and the 30 per cent forest cover theory. All this has made us associate conservation with protecting forests. Coming from a semi-arid place myself, I began my conservation journey by planting eucalyptus saplings with the expectation to vegetate the bare-looking ONEs.

No initiatives have been undertaken to create wildlife corridors or mitigation measures for species like wolves (above), hyenas, and blackbuck that rely on open ecosystems. They traverse landscapes threatened by fragmentation and degradation.

There is no denying that forests and their protection are essential, and that our efforts to safeguard them must only grow stronger. Yet alongside this commitment lies an equally urgent need to conserve and manage other habitats that provide critical ecosystem services and sustain numerous endangered species. Recent research has shown that grasslands can sequester carbon at levels comparable to forests, underscoring the need to accord these open landscapes far greater recognition and protection.

Compared to a forest, an open, plain land, albeit flourishing with lush grass and interspersed with shrubs and bushes, is a visual that fails to attract people's attention.

Grasslands to Wastelands

We appreciate the African savannah and the sightings of the majestic big five and other species. India's Open Natural Ecosystems are also home to bustards, floricans, harriers, partridges, larks, fan-throated lizards, scorpions, and a myriad other birds, reptiles and insects, along with large mammals such as wolves and hyenas. Besides this animal diversity, there is a large variety of grasses, herbs, shrubs, and other woody vegetation. But colonial mistreatment and the sentiment in people's minds that open arid lands are non-productive have led these ecosystems to be considered as wastelands. In fact, the Department of Land Resources commissioned the National Remote Sensing Centre (NRSC) to develop the *Wastelands Atlas of India*, by designating all those unproductive lands as wastelands. Even the Land Use Land Cover (LULC) map developed by the NRSC, which explains the type of cover for a given patch of land, considers wastelands as one of the categories along with forests, agricultural, and other land cover types. Interestingly, this LULC map has grasslands as a category, but covers a tiny fraction of the actual grasslands. But we can easily understand that most of the land that has been classified as wasteland is either grassland or other open ecosystems by checking the extent of grasslands, rangelands, scrublands, or related classifications depicted by publicly available land cover products such as World Cover, Land Cover, and Dynamic World, among others.

It is even more disturbing to know that the extent of the wastelands, which is indirectly the extent of our grasslands and other open ecosystems, is reducing over the years. As per the NRSC data, between 2005 to 2020, the wasteland class has seen a decline of about 30 per cent by primarily being converted to agricultural lands or built-up areas. This is not surprising, since most of the open ecosystems are extensively modified and adapted for human use. While a forest clearing can easily be identified, open ecosystems that have no distinctive physical boundaries are easy to prey upon for land conversions. Though agriculture expansion has been a primary reason for their decline all these years, built-up areas such as industries, residential layouts, irrigation canals, and renewable energy projects are fast evolving as major threats in recent years.

One can witness the pace at which these landscapes are changing either by driving around any grassland patch or by checking historical satellite imagery. It is unimaginable to comprehend the plight of wild animals that depend on these habitats and the way they are forced to swiftly adapt to the fast-changing structure of their homes. A few decades ago agricultural expansion was seen as a moderate threat to grasslands since it was primarily rain-fed cultivation.

Today, expanding irrigation projects have introduced orchards and other cash crops, which drastically change the habitat structure. New entrants to this threat list are renewable energy projects. With an abundance of wind speed and solar irradiance, grasslands form the preferred areas for setting up mega solar parks and wind farms. These energy plants bring along power lines, roads, and other support structures, leaving behind a far greater land footprint. Large tracts of open ecosystems are getting decimated, fragmented, and degraded by one or many of these threats.

Unlike forests, which have the *Forest Conservation Act* and other policies that restrict their clearing, open ecosystems have always been losing ground without any legal protection. Though several Protected Areas are carved out to conserve open ecosystems, some of these have already been denotified to facilitate development. Moreover, there are no specific practices or guidelines to manage these ecosystems, because of which forest management practices are being carried out in these ecosystems. For instance, afforestation targets are a default management practice in any forest division, even when dealing with habitats of blackbuck, wolves, grasslands, or others. At times, authorities have constructed waterholes to facilitate species that have evolved to arid conditions. Similarly, whenever an encroachment is removed, irrespective of whether it is a forest or grassland, it will be planted with saplings. Likewise, the prevailing public sentiment of planting saplings or dispersing seed balls in an attempt to green open ecosystems is another major threat. Either for lack of information or interest, many of the Environmental Impact Assessments of the projects in open ecosystems, do not even mention the presence of its wild denizens. It is high time that we understand and appreciate open ecosystems as natural landscapes and prescribe policies to secure them the way they are.

Now that cheetahs have been reintroduced, striped hyenas and foxes are being protected under Schedule I of the *WLP*, Great Indian Bustards are being successfully reared, and other species recovery programmes are in place, it is extremely important to focus efforts on securing the homes of these species. The first, vital step is to understand their extent, current status, threats, and to map the available open ecosystems. After that, a conservation policy and management practice for these habitats could be established to avoid further damage to these ecosystems. While we have collectively ignored these ecosystems and are responsible for their current state, the government and civil society need to work together to protect or restore them. Unless we begin recognising and conserving such ecosystems with renewed vigour, sprinting blackbuck, scavenging striped hyenas, head-bobbing bustards, or the hauntingly beautiful howls of wolves could disappear from our country forever.



Leading the Technology for Conservation programme at The Habitats Trust, **Santhosh Pavagada** combines engineering and conservation expertise to explore new ways of safeguarding grasslands, coral reefs, and other ecosystems outside Protected Areas.



ANAND PATIL/SANCTUARY PHOTOLIBRARY

GRASSLAND COMMUNITIES

By Aniruddha Dhamorikar

Grasslands are home to some of the most fascinating plant-animal relationships I have ever observed, ones that come as close as anything I know to our own connection with the grasses we cultivate for food. Amidst the stomping elephants, prancing blackbuck, and trotting wolves, I find that much of the grassland's animal diversity is shaped by insects, from ants that gather seeds to bees collecting grass pollen.

When Grass Seeds

The synchronous nature of rain-fed paddy and wild grass maturing at the onset of winter is not a coincidence. Just as farmers prepare to harvest the heavily-set ears of rice, an industrious society dwelling in grasslands prepares for its own. Ants emerge from their underground cities to do exactly as we do: harvest the heavy-set ears of wild grass, and carry them to their colony, a small hole in the ground that, for the most part of the year, remains invisible to the human eye. They toil under the same conditions that threaten our prospects of filling up the granary: unseasonal rains, untamed winds, and wild fires. Worker ants separate the grain from the husk, and store it in large chambers, aptly called granaries. Over days, small piles of husk are seen on foot paths through the grasslands. Called ant middens, they carry repositories of the species of wild grain that ants harvest.

Over 150 species of ants are known as 'harvester ants', many of them specialising on grass seeds. This behaviour, termed 'seed predation', influences grassland dynamics in more ways than the market dynamics of humans. A complex web of life spins around this basic herbivore-plant relationship. In the foot trails through grasses, traps are laid in the fine dust: a slip of foot and an ant tumbles down the pit, where the aptly named antlion – larvae of the slender-winged neuropterans – sit with jaws wide open. If an ant is successful in reaching for the ears dangling from the end of a thin straw, another darts for it: the raptorial 'hand' of the Indian grass mantis captures its prey. Perhaps the ultimate predators of the grassland societies in India are the Indian pangolin and sloth bear, both roaming the meadows in search of ants.

Just as we lose some seeds during harvest, many wild seeds fall along the way or find themselves in niches ideal to sprout. Studies indicate that grass seeds that ants carry are likely to grow nearer the colonies as well as benefit from being dispersed underground and away from above-surface threats such as fires. It is not far-fetched to imagine an ant helping a grain of grass sprout.

When Grass Sprouts

Much of the grass is just leaves. These green, sumptuous blades are credited for the diversification of grazing mammals evolving high-crowned teeth to feed on this abundant resource. Insects, which co-evolved with flowering plants took the first opportunity to associate with grasses as leaf-munchers. Perhaps the most obvious are the grasshoppers that take off as one walks through a bed of grass. Grasshoppers evolved long before grasses, but their specialisation in feeding on grasses has made a grasshopper as much at home in a grassland as a chinkara. Indeed, locusts – grasshoppers that form swarms under ideal climatic conditions – historically migrated from eastern sub-Saharan Africa to western India by feeding on wild grasses, an event of proportions as vast as that of the wildebeest migrating with the seasons to feed on grasses across the African continent.

Over the last century, much of the plains where grasslands once ranged have turned to farmlands. History now remembers locusts as a plague devastating croplands – also grasses. In India, the western and central plains known for grasslands and savannah ecosystems – where rice and wheat grows – fall in the historic range of locust swarms.

Even as scientists race to make crops resistant to insects, the shrinking of grasslands has further pitted grassland specialists against human cultivations. This interface is especially critical in view of the complex food web that revolves around grasses: the global decline in grassland birds is directly linked with pesticide usage in farmlands. Farms are essentially a grassland for most animals, and feeding on insects that accumulate harmful farm chemicals has a magnified effect on insectivorous birds, leading to thinning of eggshells and high mortality in chicks.

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Across the globe, the sprouting of grass is an event that has enabled animals – from mammals to insects – cover enormous distances in a surprisingly short time, for just as monsoon rains stop, the grasses initiate another phenomenon under a blue sky worth marvelling: the mass flowering.

When Grass Blooms

Most grasses flower just once. Called monocarpic annuals, the flowering season is short but synchronised, where grasses flower at the same time. This paints riversides of October in silvery whites and purples as grasses such as *Saccharum* flower en masse. From flowers barely visible to the naked eye to enormous foot-long inflorescences, the monochrome greens get a makeover.

At the right time of the year in a grassland, one can see golden pollen clouds as one brushes past or flicks a grass stalk, but one will never see sunbirds and butterflies rabble around grass inflorescence. Without vivid colours, fragrance, and nectar to attract birds and butterflies, grasses rely on wind to disperse their pollen, shaping their flowers to vibrate with the wind. As munias collect the fluffy awn of grass flowers for nesting, insects home-in to collect the pollen. Solitary, soil-nesting bees and small honeybees (such as *Apis florea*) collect grass pollen for their nests, and beetles such as the monkey beetles (family Scarabidae) and flower flies (family Syrphidae), feed on grass flowers, aiding in pollination.

The relationship between grasses and animals is curious. Unlike most flowering plants, grasses rely heavily on environmental factors. Insects, as a group of animals known to make the best out of every possible available niche, are perhaps a crucial link between grasses and the lords of the grasslands – the bustard, the wolf, and the elephant – forming unique grassland communities.

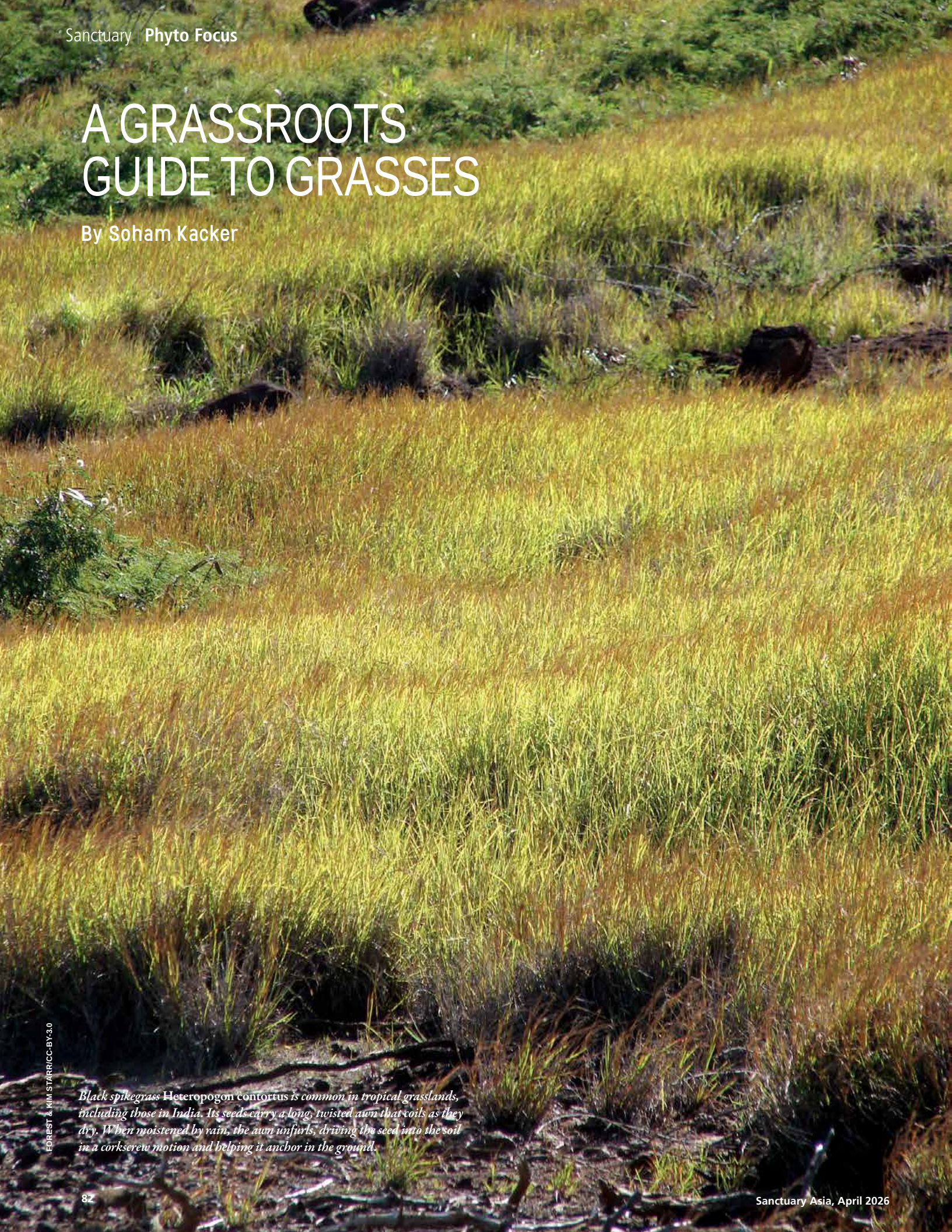
A Common Kestrel (facing page) lunges after a grasshopper in Mhaismal grassland, Aurangabad. A rock bee Apis dorsata *(below) caught pollinating grass flowers.*



MAMTA BHADADE/SANCTUARY PHOTOLIBRARY

A GRASSROOTS GUIDE TO GRASSES

By Soham Kacker



Black spikegrass Heteropogon contortus *is common in tropical grasslands, including those in India. Its seeds carry a long, twisted awn that coils as they dry. When moistened by rain, the awn unfurls, driving the seed into the soil in a corkscrew motion and helping it anchor in the ground.*

FOREST & KIM STARR/CC-BY-3.0

As a plant scientist, grass has always confounded me, and I feel a kind of reverential awe for people who can identify grasses. The global count of recorded grass species, estimated to be over 11,700, outnumbers birds by around a 1,000 species, which is impressive given that grasses are just a single taxonomic family – *Poaceae*. As a family, grasses are also perhaps one of the only groups of plants to have an entire habitat type named after them – *grasslands*. And though grasses have been the source of much personal confusion, grasslands have confused ecologists for decades, and have subsequently been continually mischaracterised, misunderstood, and mismanaged. However, contemporary research is beginning to shed light on how these systems function, and the unique and varied species they support.

The central conundrum ecologists have historically faced while attempting to classify grasslands is the climatic conditions under which grasslands exist globally. Typically, this is in relatively warm areas that are neither too humid (where you would find forests), nor too arid (where you would find deserts or scrub). Termed the 'ecosystem uncertain climate space', these conditions make it difficult to predict what kind of vegetation assemblage should occupy that area. Theoretically, such climatic parameters could support forests, which is what most scientists in the 19th and 20th centuries made the error of assuming that grasslands should be. This was reinforced by the then-emerging theory of ecological succession, which asserted that grasslands and open ecosystems were an inherently unstable state, which, if left undisturbed, would eventually 'mature' into a forest. This failed to take into account complex relationships between plant characteristics, the environment, and disturbance, which have shaped grassy ecosystems since they emerged nearly 55 million years ago!

Pollen records in the soil tell us that grasses were present on all continents by around 50 million years ago (mya). Mostly occurring in cool, dry temperate regions, these ancient grasses are known as C3 grasses, and employ the same photosynthetic pathway as all plants. However, as the climate began to change towards being drier and with a lower concentration of atmospheric carbon dioxide around 30 mya, a new kind of grass emerged. Called the C4 grasses, they evolved to employ a different photosynthetic pathway that was far more efficient under these new environmental conditions. These same conditions caused other C3 plants such as trees to struggle, and led to an overall decline in forest cover. A seasonally drier climate (the beginning of what we now call the monsoon) also led to long periods where biomass could dry out and fire became a more common occurrence in ecosystems. The spread of large herbivores around 15 mya also encouraged the expansion and maintenance of grassy ecosystems through routine disturbance and grazing. Ultimately by around seven mya, a combination of all these factors led to grasslands becoming a dominant ecosystem in warm, seasonal climates across the tropics.

Although the evolutionary longevity and success of natural grasslands would refute early assumptions of grasslands being 'unstable', this erroneous characterisation was cemented by colonial scientists exploring Asia and Africa. Their writings describe grasslands as heavily degraded landscapes, and identify the cause of degradation as continued mismanagement and exploitation by Indigenous peoples. Unsurprisingly, what followed was decades of ill-informed colonial policy to reforest grasslands, make them economically productive, and exclude local people from accessing and managing them. While this prejudiced mischaracterisation of grasslands remains prevalent in many parts of the world, including in India, new research is beginning to shift the way we perceive these ecosystems. Since C4 grasses are a signature of open ecosystems, their presence can help determine which habitats are meant to be grassland, versus those that can be classified as forest.

Ultimately, splitting hair over whether a habitat is a grassland or a forest may appear trivial, it is however vital to understand these complex distinctions to better protect the unique species that have evolved to thrive in specific grassland ecosystems. One such species is the black spikegrass *Heteropogon contortus*, common in grassy ecosystems throughout the tropics including India. Its seeds bear a single long 'awn' (shaft) on one end, which becomes twisted when the seeds dry and mature. During the rains, the moisture causes the awn to unfurl, driving the seeds in a screwdriver motion and helping it to embed itself in the soil. Such adaptations are clearly indicative of evolution in a monsoonal climate.

Other grassland species have evolved to withstand fires, a frequent occurrence in their habitat. Some, like the redfruit vine *Corallocarpus epigaeus*, have evolved a swollen caudex (stem), which rests just below the soil surface, protecting growing tips from fire and herbivory, and also helping to store water and nutrients in an arid climate. In the seasonally dry plateau grasslands of Maharashtra (see page 48), plants such as the purple pincushion *Neuracanthus sphaerostachyus* have instead evolved to protect their growing shoots with an insulating layer of cottony bark-like fibres known as xerocoma, which can prevent surface-level fires from damaging new growth. These structures were scientifically described just this year, which goes to show how much there still is to learn about grasslands and the unique species they host.

Increasingly, a more nuanced understanding of grassland ecology is leading to a drive for their correct recognition, protection and restoration. However, key knowledge gaps remain in areas such as understanding plant-animal interactions in grasslands, monitoring the effect of climate change on grassland processes such as fire regimes, and the cultivation of grassland species at scale for restoration. For the present and future, studying grasslands in a rapidly changing environment must necessarily include the knowledge systems and stewardship of local communities who have lived in and cared for these ecosystems for generations, and better understood their character much before ecological study reached these conclusions. To protect a habitat and its constituent species characterised largely by disturbance, ecology and conservation must also adapt to ensure resilience and constancy in an ever-changing landscape.



Soham Kacker is a plant ecologist and horticulturist from New Delhi. His research looks at plant conservation and ethnobotanical landscapes in the Indian Himalaya and beyond.

WHY EVERY CHILD NEEDS TO EXPERIENCE THE WILD

By Amandeep Kaur Bamrah

In a world of glowing screens and concrete corners, the wild can seem like another planet. But it is our only home. Every child deserves the chance to step outside, feel the ground beneath their feet, and experience the natural world not as an idea, but as something real and alive.

When children walk through a forest for the first time, something shifts. They aren't just looking at nature – they're encountering it. The wind on their face, the scent of damp soil, the sudden call of a bird they can't name yet – these moments do more than teach; they linger in memory. Such sensory experiences nurture empathy in ways that no lecture ever could. They awaken something instinctive and ancient.

Psychologists call it *biophilia* – our innate love for living things. Environmentalists call it *ecological literacy*. I prefer to call it *homecoming*. Every child who climbs a tree, listens to a frog calling at dusk, or watches a butterfly rest on a leaf reconnects with a truth we seem to have forgotten: we are not separate from nature, but part of a vast, living web.

A Childhood Out of Sync

Today's children are growing up surrounded by screens that glow brighter than fireflies and cities that never sleep. Many can identify brand logos more easily than native trees or the birds that chirp outside their windows. Beneath this convenience, however, lies a quiet crisis – a generation slowly losing its bond with the living world.

A Bishnoi *child sits with a rescued blackbuck while a peacock dances in the background. Every child who climbs a tree, listens to a frog calling at dusk, or watches a butterfly rest on a leaf reconnects with a truth we seem to have forgotten: we are not separate from nature, but part of a vast, living web.*

PANKAJ BISHNOI/SANCTUARY PHOTOLIBRARY



The wild, increasingly distant from everyday life, is often treated as a luxury – something to be visited occasionally, like a holiday destination, if at all. But experiencing nature is not an indulgence; it is a necessity. Forests, rivers, and grasslands are not separate from us. The wild is not 'out there'. It is where we come from, where we belong, and where the story of every heartbeat on Earth began – including ours. It shapes the air we breathe and the water we drink, sustaining life in ways we often take for granted.

And that is the reason a key effort of Sanctuary's Kids for Tigers is to conduct guided nature walks for school children. Through these Kids for Tigers Nature Trails, students are taken into urban and rural wildernesses and Protected Areas to experience wildlife and ecosystems first-hand. The walks are designed not as lectures, but as slow explorations that encourage children to observe, listen, and ask questions about the living world around them.

The Forest as Therapist

When children walk through a forest, they don't just learn – they heal. The sound of rustling leaves lowers anxiety. The scent of soil steadies the mind. The simple act of observing wildlife nurtures patience and curiosity.

I've walked many nature trails with students and teachers through the Kids for Tigers programme, and almost every time I notice the same pattern. Children who begin the walk restless and noisy gradually slow down. Children fall silent at the sight of a shimmering cobweb strung between branches. Teachers, often weighed down by routines and responsibilities, pause beside a waterbody, visibly moved

Through these Kids for Tigers Nature Trails, students are taken into urban and rural wildernesses and Protected Areas to experience wildlife and ecosystems first-hand. The walks are designed not as lectures, but as slow explorations that encourage children to observe, listen, and ask questions about the living world around them.



SANCTUARY PHOTOLIBRARY

Every child deserves the chance to step outside, feel the ground beneath their feet, and experience the natural world not as an idea, but as something real and alive. Through the Kids for Tigers Nature Trails, students experience wildlife and ecosystems first-hand. The walks are designed not as lectures, but as slow explorations.

by the calm around them. Chatter gives way to curiosity, and questions replace the constant buzz of conversation. Silence – at first unfamiliar – becomes welcome.

The forest does something gentle yet powerful. It soothes. It steadies. It makes space to breathe. Children don't just learn there – they feel better.

The forest restores balance, not only ecological, but emotional. It offers calm without asking anything in return.

At first, there is hesitation – fear among students and even among teachers visiting a Protected Area for the first time. Questions are whispered in nervous excitement: *Are there insects? Are there snakes? What if we get lost?*

These are exactly the fears the Kids for Tigers Nature Trails aim to gently dissolve. By guiding children through forests with experienced naturalists and educators, the programme helps them replace anxiety with curiosity and discover that the wild is not something to fear, but something to understand and respect.

And slowly, fear gives way to fascination. Curiosity replaces apathy. A child who once recoiled from insects kneels to watch a millipede curl into itself, or peers closely at the web of a tunnel spider. Another listens intently, trying to trace the direction of a bird call echoing through the canopy.

This is when the shift happens. Nature stops being an abstract concept discussed in textbooks; the wild becomes personal. It transforms into a living, breathing presence – one that children begin to feel responsible for. It becomes something they care about, something they do not want to harm.

Call to Rewild Our Classrooms

Environmental education cannot survive on facts alone. We can talk endlessly about climate change, deforestation, or endangered species, but information by itself rarely inspires care. That spark is ignited only when learning becomes emotional, tactile, and immersive.

When children are allowed to touch tree bark, feel moss under their fingers, smell rain-soaked earth, and listen – truly listen – they are not just learning biology. Care grows when a child kneels to observe a beetle or begins to notice the intricate ways everything in the forest is connected.

These quiet, unstructured moments nurture empathy, patience, humility, and respect – qualities no curriculum or syllabus can fully standardise, yet ones our world urgently needs.

Rewilding education doesn't mean abandoning classrooms; it means opening them up. It means bringing the outdoors back into learning – swapping PowerPoint presentations for ponds, whiteboards for wilderness, and passive instruction for lived experience.

It means helping children understand that protecting the planet isn't about saving something distant or abstract, but about protecting home. When a child truly connects with the wild, care follows naturally – not out of obligation, but out of love.

And in times like ours, that kind of learning may be the most essential education of all.



Amandeep Kaur Bamrah is an environmental educationist and the National Coordinator of the Kids for Tigers programme. She works closely with students, teachers, and schools across India to foster meaningful connections with nature through experiential learning, nature trails, and conservation-focused education.

Sanctuary's

MUD ON BOOTS

January-February 2026 Field Updates

RESPONSIBLE TOURISM IN SIKKIM

In Sikkim's Chongri village (Gyalshing district), Project Leader Dawa Sangpo Bhutia and his team of youth volunteers are leading a peaceful and creative resistance through their responsible tourism initiative, against the over exploitation of nature. When talks of possible incidents of hunting in the region reached Dawa and his team, they sprang into action, spending 20 days in freezing conditions on wildlife patrols reinforced by camera traps, in and around the Kanchenjunga National Park (KNP). The carefully positioned cameras have since been documenting several rarely sighted large and small cat species including the elusive Asiatic golden cat. While the images of wildlife from camera traps far within KNP have left the locals in awe of the region's biodiversity, cameras placed closer home near villages have triggered a sense of responsibility among young residents to protect their wild neighbours.

Meanwhile, Dawa is in talks with families from all five villages in the Sindrabung ward to work together to present the region as a living museum. This he feels could incentivise his people to conserve their traditional yak rearing ways. This responsible tourism model has begun creating a positive buzz and young residents are coming around to the view that the region's wildlife is integral to their development.

ICHTHYOLOGICAL RESEARCH

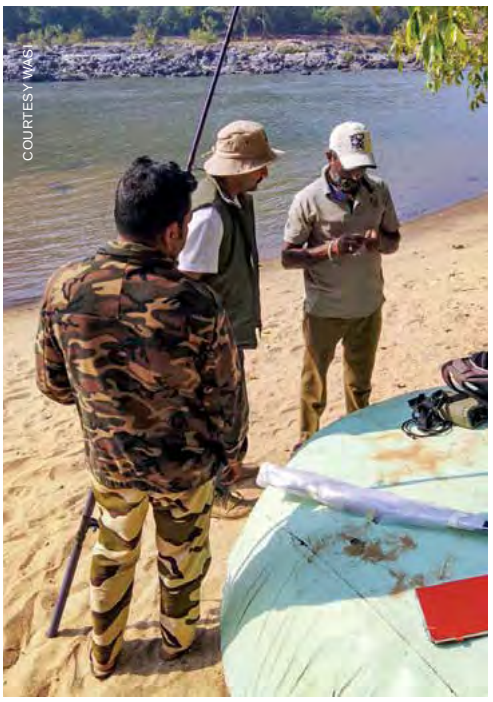
Project Leader Jesu Das of the Wildlife Association of South India (WASI) has blossomed into a fish and river conservation advocate. His knowledge of ichthyology, a branch of zoology focused on the study of fish and their aquatic homes, coupled with traditional knowledge supplements scientific studies. Thanks to his capacity to acquire new skills, he has turned into a much sought-after resource person trusted by scientists and personnel from the Karnataka Forest and Fisheries Departments.

With the publication of short notes on the nesting behaviour of a Leith's softshell turtle (the first-ever report of its kind on the species), 2026 began well for Das and his team. Not one to rest on his laurels, he has already undertaken two field expeditions into the Cauvery Wildlife Sanctuary (CWS) to identify suitable tagging sites for 11 new radio transmitters, for on-going mahseer radiotelemetry studies. The team now plans to focus on locating potential mahseer spawning grounds within the sanctuary.

In the upcoming months, supported by colleagues at WASI, Das will engage with 48 students to familiarise them with the conservation of freshwater fish.



A snow leopard documented on the camera traps set up by Project Leader Dawa Sangpo Bhutia and members of the Yambong Ecotourism Committee.



Project Leader Jesu Das explains a radiotelemetry device to an official of the Forest Department.



Participants shared perspectives on nature through a rangoli making event at the community awareness programme in Mungeli, Chhattisgarh.



Project Leader Kashif Farooq Bhat (centre) at the launch of 'The Nature School of Mulnar'.

PREPARING *BAIGA* CHILDREN FOR TOMORROW'S WORLD

In Chhattisgarh's Mungeli district, Project Leaders Bhumika Yadav and Deepak Yadav, and their team of volunteers, are conducting nature education sessions for marginalised *Baiga* children as part of their 'Hamar Jungle La Hum Padbho' project. Through nature walks, nature craft sessions, local games, art *melas*, and butterfly familiarity sessions, the team is creating a learning environment for children who lack opportunities for formal education.

With growing positive feedback from locals, Bhumika and Deepak seek to enhance opportunities for capacity-building exposure and knowledge sharing experiences for their growing team of local volunteers. In January, two volunteers, Sarita Kujur and Manisha Agaria, travelled to Madhya Pradesh to attend a four-day Friends of Nature Programme organised by the Wild Routes Foundation. Their learnings will be integrated into the 'Hamar Jungle La Hum Padbho' curricula. The duo also led a birdwatching session for students at the Daganiya Government Primary School. Bhumika and Deepak collaborated with the Adivasi Samta Manch in Kabirdham for a community awareness programme on forests, culture and environmental awareness.

MAPPING ALDONA IN NORTH GOA

Project Leader Jerusha D'souza has witnessed largescale, state-driven land-use changes in Goa that have degraded the state's natural and cultural fabric in ways that have left locals out of the decision-making process that impacts their lives. In January 2026 with support from the Mud on Boots Project, Jerusha launched a resource mapping exercise in Aldona village to revive local people's interest in decision-making and land use. Earlier she had worked with local experts to forge a deeper understanding of the issue and to undertake easily understood gap analyses. She then designed and conducted a two-day visioning workshop, in the last week of January 2026, for 29 panchayat members and students, to help them understand common goals for mapping in the context of village development. The workshop also facilitated the larger objective of village development through knowledge sharing. Jerusha and her team have identified several mini projects to feed into the larger resource mapping exercise.

WINNING SUPPORT FOR DACHIGAM, IN J&K

Project Leader Kashif Farooq Bhat, backed by Mud on Boots, is building on-ground community awareness to win support for the protection of Dachigam's unique biodiversity, the only home of the endangered hangul deer *Cervus hanglu hanglu*.

In January 2026, Kashif was invited to deliver a presentation on his work at the National Conference on Lesser-Known Species of the Central Indian Landscape (Bhopal). A third generation wildlife conservationist, Kashif's field experiences have been shaped by community perceptions, traditional knowledge systems and local stewardship, all key to the long-term survival of the hangul and its fragile forest home. The conference enabled Kashif to share learnings and challenges with fellow researchers, practitioners, students, and policymakers working in the conservation sector.

Armed with fresh perspectives, in February 2026 Kashif undertook community outreach in Mulnar village, directly abutting the northwestern boundary of Dachigam. Working to a plan, he has initially reached out to 10 chosen households by way of a door-to-door conservation awareness drive. Apart from art workshops and awareness sessions, the Wildlife Conservation Fund and Voice of the Wild have launched 'The Nature School of Mulnar', where ancestral wisdom and modern education unite to foster environmental awareness in Kashmir. ➔

SOURAVMANDAL/SANCTUARY PHOTOLIBRARY



FOR A FAMILY BEYOND HOTSPOTS

All species of grass, possibly the most important plants in human history, belong to a single family – Poeceae. India has over 1,100 grass species, which amounts to roughly 10 per cent of the global grass richness. There are two hotspots – the east, which coincides with the Indo-Burma biodiversity hotspot, and the second in the west, which includes northern parts of the Western Ghats biodiversity hotspot and parts of the arid northwest. Scientists at the National Centre for Biological Sciences have recently published a study on this distribution for the first time, in October 2025. A majority of conservation efforts are focussed on the hotspots of the Western Ghats, Northeast and Himalaya, but the study's findings underline the need for greater attention to the arid northwest and the Deccan Peninsula, which not only have high grass diversity, but also support several endemic and threatened flora and fauna.

The Sanctuary Papers

By Shatakshi Gawade

GRASSLAND SPIDERS

The *Titanidiops kolhapurensis*, discovered in the grasslands of Kolhapur district in Maharashtra, is the latest addition to the bevy of India's spiders! Researchers from the Shivaji University, Kolhapur and Thackeray Wildlife Foundation have recorded the species from a few areas in Kolhapur, such as the Shivaji University campus, Kolhapur Chitranagari, Puikhadi hill, and Shenda Park. The spider prefers native grasslands and natural forests, rather than areas dominated by exotic tree plantations of *Gliricidia sepium*. As non-native plantations, agriculture, and urbanisation replace natural ecosystems, the spider, which builds slanted or vertical burrows in sloping or flat grass meadows, is at risk of local extinction. Trapdoor spiders are locally known as 'daarkari koli' (*daar* is door in Marathi, *koli* is spider), for their ingenious ability to make hinged doors to their burrows.

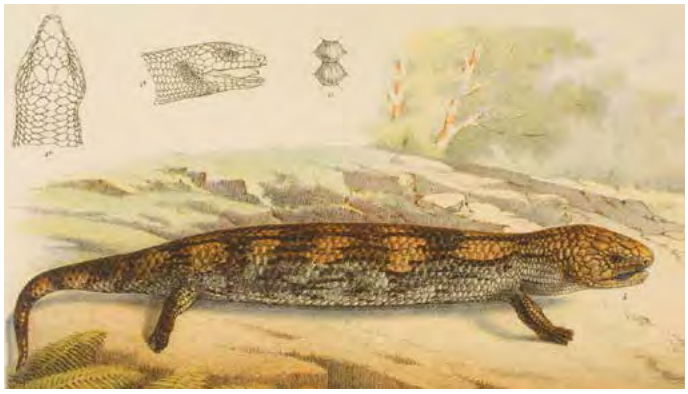
Northeast India has not been widely studied for spider diversity; greater records exist for regions such as the Terai and Western Ghats. In the east, Kaziranga National Park's grasslands are also home to a rich diversity of spiders. A 2022 study found 63 species of these arachnids, with a larger variety in the tall grasslands than the short grasslands. This is possibly because tall grasses are ideal for building webs, creating better microhabitats.



PUBLIC DOMAIN

Meanwhile, the short grasses grow next to wetland habitats, which flood annually in the monsoon. Short grasses are also more preferred by birds and for grazing by mammals.

A NEW HOME



PUBLIC DOMAIN

As temperatures rise with a changing climate, many species, such as fish and sea turtles, are moving to cooler locations in search of suitable habitats. However, the tiny pygmy bluetongue skink *Tiliqua adelaidensis*, an endangered reptile, has shown no such movement, prompting scientists to intervene and relocate it to more suitable habitats. This skink is native to the mid-north of South Australia, and is known only from 19 small natural grassland sites, all on privately owned land. It prefers areas rich in spider burrows, particularly those of trapdoor and wolf spiders. These endemic lizards occupy deeper burrows, in an attempt to avoid predation by snakes and raptors, stay cool, and escape grassfires. Curiously, it has been absent from the only Protected Area in its range, Mokota Conservation Park.

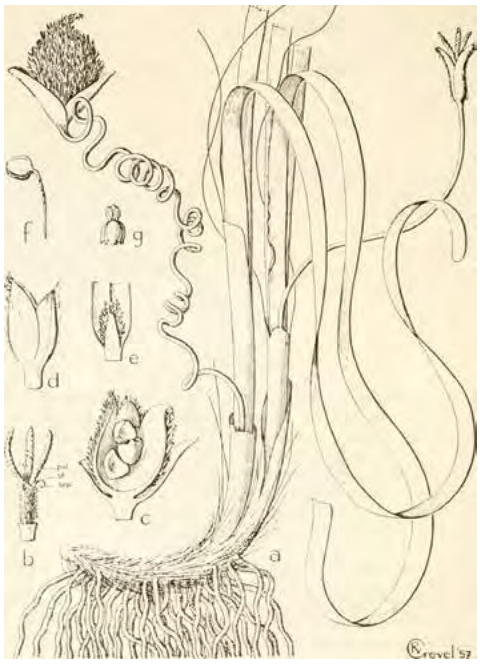
Since the pygmy bluetongue skink is vulnerable to declining rainfall and rising temperatures, populations have been translocated to three cooler, slightly greener locations, where researchers are monitoring their health. Studies suggest that acclimatisation to these new sites, unlike their usual hotter, drier habitats, may take more than two years, and the lizards could ultimately thrive. Some scientists believe that translocation to 'future-suitable' habitats may be the only viable way to conserve several ground-dwelling reptiles.

Did You Know?

Deschampsia antarctica *is the only grass that naturally occurs in Antarctica and is one of just two flowering plants on the continent. Commonly known as Antarctic hairgrass, it grows mainly near the coast. It thrives in areas inhabited by penguins and other animals, as their excreta is a valuable source of nutrients. Birds that feed on it help disperse it through their droppings. Researchers suspect this is how it reached the extreme continent from South America, where it is native. It has become widespread in Antarctica, as higher temperatures decompose more organic matter, thus making more nitrogen available for the grass.*

CONQUERING LAND UNDERWATER

PUBLIC DOMAIN



Seagrasses are the only flowering plants that can survive in saline water. They form meadows in warm, shallow seas, gently swaying with the current. They are also important carbon sinks, processing CO_2 35 per cent faster than tropical rainforests. The health of seagrasses is an indicator of ecosystem health, and they are often called ecological engineers for their role in modifying and stabilising ecosystems. In 2025, marine biologist Sri Chakri Pranav confirmed the existence of a new underwater meadow in Gachakayalapora's lagoon, off the coast of East Godavari district, following a tip from local fisherman Venkat. The 300-ha. patch of seagrasses consisted of two species *Halophila ovalis* (*aaku gaddi* in Telugu) and *Syringodium isoetifolium* (*choppa gaddi* in Telugu). This lagoon was originally a marsh, which transformed recently into a lagoon. This natural change increased catch for local fishermen, from mud crabs to a larger variety of shrimp and fish!

As of 2022, the country's total seagrass area was 516.59 sq. km. There are 16 species of these underwater plants in India. Important seagrass beds are found along the coasts of the Gulf of Mannar (14 species) and Palk Bay in the east, the Gulf of Kutchh in the west, and again in the Gulf of Mannar in the south. The lagoons of the Andaman and Nicobar Islands (12 species) and Lakshadweep (10 species), along with estuaries and backwaters, also support seagrasses. The coasts of Odisha (eight species) and Gujarat (eight species) host seagrass meadows as well. India's seagrasses support about 1,250 species of flora and fauna, including the green sea turtle and the endangered dugong, which graze on the blades for food.

A NATURAL MONUMENT

PUBLIC DOMAIN



With its sturdy trunk and bright green leaves, the African baobab tree *Adansonia digitata* is an essential component of the dry African savanna ecosystem. It keeps the soil humid, slows erosion with its huge root system, and helps nutrient cycling. Where little else can thrive, its bark and fruit have over 300 life-sustaining applications in traditional medicine and rituals, making it the 'Tree of Life' for Indigenous communities. The tree also provides food, water, and shelter to a wide range of grassland life.

Elephants and monkeys eat its bark for moisture if there is no water nearby, while bats feed on the nectar of its flowers and, in the process, pollinate them. Reaching over 30 m., the trunk grows to a diameter of nine metres and can store water. The trunk itself is unique: in older individuals, multiple stems fuse together over time to form a hollow trunk. The oldest angiosperm is an African baobab in Namibia, at about 1,275 years! In fact, the tree first appeared even before humans, over 200 million years ago. However, even the sturdy African baobab is susceptible to climate change. At least five of the largest individuals have died, or the part of their stem that is the largest or oldest has died. This would have been unlikely under normal conditions, and was probably triggered by rising temperatures, or by the trees becoming weaker and more susceptible to disease, wind, and fire, all of which can be triggered by climate change. The African baobab is one of nine species of the baobab genus. Six of the deciduous trees are endemic to Madagascar, one is native to northwestern Australia, and the other two to the Arabian Peninsula and mainland Africa.

Did You Know?

The IUCN Antelope Specialist Group identifies 93 antelope species. Antelopes (family Bovidae) are often mistaken for deer (family Cervidae). They are mainly found in savannas and grasslands and have unbranched, permanent horns. Deer are more versatile, living in woodlands and sometimes in grasslands; males have branched antlers that are shed annually. While Africa is considered the stronghold of antelope diversity, species such as the blackbuck (see page 44), chousingha, and nilgai are endemic or near-endemic to India. Antelope population sizes vary widely: fewer than 100 addax remain in the wild, whereas populations of impala, blue duiker, and saiga (see page 40) exceed one million.

FASTEST OF THEM ALL



PUBLIC DOMAIN

In the case of maximum speed, bigger is not always better; despite their massive muscles, elephants are not the fastest animals on land. In contrast, being average-sized has made the cheetah a winner. Two factors influence speed – how fast and how far an animal's muscles contract. At about 50 kg., the cheetah sits in a physical sweet spot, enabling it to reach speeds of over 100 km. per hour in just over three seconds. Its slender bones also aid its sprinting ability, but it is an internal adaptation that truly makes it the fastest land animal.

If you observe a cheetah in motion, its muscles, back, and legs move in perfect coordination, while its head remains remarkably steady, maintaining a fixed gaze on its prey. This stability is owing to its distinctive inner ear – the organ in vertebrates responsible for balance and head posture during movement. A cheetah's inner ear has a larger vestibular system and longer anterior and posterior semicircular canals than other felids. No other living felids share this structure. In fact, even *Acinonyx pardinensis*, an extinct cheetah species, lacked this unique ear adaptation. This feature likely evolved more recently, giving the cheetah a critical edge over other carnivores in its ecosystem.

A GRASSLAND TOWN



PUBLIC DOMAIN

The American prairie stretches across five states and two provinces in Canada. It is home to bison, white-tailed deer, elk, coyotes, prairie rattlesnakes, and several other species. One species, in particular, has a dramatic influence on the health of this habitat – the black-tailed prairie dog *Cynomys ludovicianus*, a key species in North America's largest grassland ecoregion. A rodent like the squirrel, the prairie dog is 36 to 43 cm. long and can weigh up to a kilo. Research has found that grasslands that are home to prairie dogs have more diversity than those without. With the prairie dog positioned as an umbrella species, protecting it will protect other animals that depend on it for food and habitat.

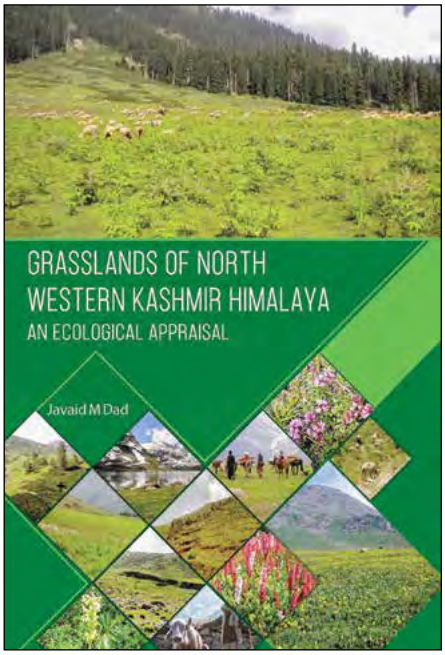
The American prairie is an ecosystem in danger, with substantial loss of native wildlife: the wolf and grizzly have been nearly extirpated, bison and prairie dog populations have declined by 95 per cent, and bird populations are down by 50 per cent. Researchers predict that conserving prairie dogs, even reintroducing them, will bring back species such as eagles, foxes, rabbits, as well as insects and birds. It is a habitat modifier: it digs burrows in close proximity to each other to form colonies known as 'towns', since they support other species. The extensive burrow system is used by reptiles, birds, invertebrates, amphibians, and mammals. For instance, black-footed ferrets use burrows abandoned by prairie dogs. Their colonies also attract Burrowing Owls and Mountain Plovers. As colonies become established, floral cover in the vicinity increases, attracting a multitude of species. Pollinators are also found around prairie dog colonies owing to a greater presence of forbs.

Did You Know?

Grasslands and shrublands are particularly vulnerable to climate change because they experience deficits in precipitation more frequently. When short-term droughts are extreme compared to the less severe droughts, 60 per cent more aboveground plant growth is lost. This translates to a loss of ecosystem functions, such as carbon sequestration, and would affect dependent species including humans. Even with less severe droughts, while losses are moderate, researchers predict large impacts on populations that depend on these ecosystems. The frequency of extreme drought is expected to increase as climate change escalates over the years – one-in-100-year droughts are now projected to occur every two to five years.

BOOK REVIEWS

Grassland ecosystems are complex, diverse, and critically important, yet their contribution to speciation and life on Earth have largely been overlooked. This issue of *Sanctuary Asia* seeks to address that gap. For readers who wish to dive deeper, we requested experts to curate a reading list on grasslands from across genres and regions. These works deserve a place in educational institutions and public libraries, and some in the homes of those who, like us, are mesmerised by the grasslands across our planet.



GRASSLANDS OF NORTH WESTERN KASHMIR HIMALAYA: AN ECOLOGICAL APPRAISAL

By Javaid M. Dad

Price: ₹ 3,250. Pages: 192

Few studies focus exclusively on the grasslands of the Kashmir Himalaya, which have long been overlooked and often unfairly blamed on pastoral and nomadic practices for their decline, says the author. This book offers a focused exploration of the region, covering climate, plant diversity, soil ecology, and ethnobotany, while also addressing conservation issues. It stands out for connecting ecological insights with pastoral livelihoods, providing a rare, region-specific perspective.

GRASSLAND ECOSYSTEMS OF CENTRAL INDIAN HIMALAYA

By Rajendra Dobhal (ed.)

Price: ₹ 9,618, Pages: 296

This scientific work provides an in-depth examination of the alpine and subalpine grasslands of the Himalaya. It also underscores the growing threat of degradation caused by rising numbers of both migratory and settled livestock, coupled with unsustainable grazing practices and the gross underestimation of the value of ecosystem services offered by grasslands.

The book also points out that grasslands have historically been neglected and given low priority in government planning and policy. The book explores key aspects such as vegetation structure, productivity, and nutrient cycling, while also addressing the impact of human pressures. Overall, it offers valuable insight into the functioning of these fragile high-altitude ecosystems.

THE VALLEY OF FLOWERS: MYTH AND REALITY

By Chandra Prakash Kala

Price: ₹ 392, Pages: 223

This work presents a long-term ecological study of the Valley of Flowers National Park, drawing on more than a decade of field research. It examines the region's ecology alongside its conservation concerns and socio-economic context, challenging common misconceptions while offering a clearer picture of its biodiversity and the pressures it faces.

THE PRAIRIE KEEPERS

By Marcy Cottrell Houle

Price: ₹ 2,427, Pages: 274

In the remote northeastern corner of Oregon, the striking Zumwalt Prairie stands as one of the last remaining native prairies in the United States. In this engaging account, Houle journeys across the landscape on foot and horseback, observing its hawks, exploring its intricate ecology, and connecting with the people who call it home. Driven by curiosity, resilience, and a touch of humour, her narrative brings the prairie vividly to life.

MEADOWLAND: THE PRIVATE LIFE OF AN ENGLISH FIELD

By John Lewis-Stempel

Price: ₹ 799, Pages: 304

Meadowland offers a deeply personal portrait of an English meadow across the full cycle of a year. Through elegant and evocative writing, John Lewis-Stempel traces the changing seasons, from the first spring blooms to summer harvests and autumn grazing, while also bringing to life the stories of the creatures that dwell within the grasses and the rich soil below.

RECOMMENDED READING

Balasubramanyan, K., Khanduri, S.K., Nair, K.K.N., Kerala Forest Research Institute, Kerala (India). Forest Department. (2001). *Shola forests of Kerala: environment and biodiversity.* Thiruvananthapuram: Kerala Forest Dept.

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Madhusudan, M.D., & Vanak, A.T. (2022). *Mapping the distribution and extent of India's semi-arid open natural ecosystems. Journal of Biogeography*. https://doi.org/10.1111/jbi.14471

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Reversing Extinction

A Landmark Judgement by the Hon'ble Supreme Court of India

By The Corbett Foundation

The Supreme Court of India issued a landmark judgment to protect the Great Indian Bustard (GIB) and the Lesser Florican, two of the country's most endangered bird species, on December 19, 2025. Led by Dr. M.K. Ranjitsinhji, The Corbett Foundation, and three other petitioners, the case highlighted the urgent need to safeguard these grassland species. Their advocacy was instrumental in achieving this significant conservation ruling.

The Supreme Court adopted a balanced, science-based approach by replacing earlier blanket restrictions, and instead created 'Revised Priority Areas' for focussed conservation. These areas cover approximately 14,013 sq. km. in Rajasthan and 740 sq. km. in Gujarat, representing the most critical habitats for these species. This targeted strategy ensures that conservation measures are both practical and effective.

The judgment addresses the significant threat of overhead power lines, a leading cause of bustard mortality. Owing to their size and limited frontal vision, these birds are prone to collisions. The Court ordered that high-risk power lines be placed underground, with about 250 km. to be buried within a set timeframe. Other lines must be rerouted away from key habitats or aligned within designated powerline corridors. This approach reduces landscape fragmentation and lowers collision risks.

The Court also imposed strict controls on renewable energy infrastructure in these sensitive ecosystems. While recognising the importance of solar and wind energy for India's climate goals, it emphasised that conservation must not be compromised. Within revised priority areas, new wind turbines and large solar projects over 2 MW are prohibited, and existing projects cannot be expanded. Only small-scale, decentralised solar installations for local needs are permitted, balancing development with ecological protection.

The judgment also prioritises habitat restoration and in-situ conservation. Grasslands, often misclassified as wastelands, are recognised as ecologically valuable. The Court directed the removal of invasive species such as *Neltuma juliflora*, restoration of native grasses, predator management, and creation of protected breeding enclosures. Community participation is encouraged, acknowledging the importance of local stewardship for long-term success.

The judgment highlights the importance of long-term monitoring and research, including tracking bird populations, studying habitat changes, and assessing climate change impacts. This approach ensures conservation efforts remain adaptive and science-based.

Recognising ecological protection as essential to community well-being, the Supreme Court clarified that Corporate Social Responsibility (CSR) must include environmental responsibility. Companies have a legal and constitutional duty to support conservation, especially when their activities affect ecosystems. CSR funds should be directed toward in-situ and ex-situ conservation, ensuring corporate involvement in preventing extinction and restoring ecological balance.

The ruling underscores the value of scientific expertise and field-based insights. Dr. Devesh Gadhavi, a member of the Supreme Court-appointed Expert Committee, contributed significantly by applying his extensive experience in western India's grasslands. His inputs helped develop practical, region-specific conservation strategies, particularly for Gujarat, and highlight the need to connect research, field knowledge, and policy in conservation.

The Court has endorsed active recovery strategies in addition to protecting existing populations. Initiatives such as Project Great Indian Bustard are expanding efforts such as conservation breeding and releasing captive-bred birds into the wild. In Gujarat, 'jump-start', an innovative approach that introduces fertile eggs from Rajasthan into wild nests containing infertile eggs, has been recommended to accelerate recovery. This combined in-situ and ex-situ strategy reflects a modern, proactive approach to species conservation.

This ruling is notable for its broad ecological vision. The Great Indian Bustard serves as a flagship species for India's arid grasslands. By protecting it, the Court is also safeguarding entire ecosystems that support many other threatened species. These landscapes in Rajasthan and Gujarat are among the most fragile and least protected in India.

This judgment marks a shift toward an ecocentric approach, viewing development and conservation as complementary goals. If effectively implemented, it will help save the Great Indian Bustard and Lesser Florican from extinction and secure the future of India's grasslands, ensuring these ecosystems thrive for generations.

For over 30 years, **The Corbett Foundation** has been dedicated to wildlife conservation and empowering local communities. TCF works in tiger habitats and semi-arid regions and grasslands, in 850 villages across India.

What You Can Do

- Write to the Environment Minister at MoEFCC, urging prompt action to follow the Hon'ble Court's directives in the 'Revised Priority Areas' in Rajasthan and Gujarat, at mefcc@gov.in.
- If you are a student or researcher, explore long-term monitoring and research options to contribute to GIB conservation.
- You can also raise awareness by sharing credible information on social media, especially the idea that these ecosystems are not wastelands.
- Encourage policymakers to recognise Open Natural Ecosystems (ONEs) in official land-use classifications and conservation plans, ensuring they receive the same protection as forests.
- Connect with The Corbett Foundation and other organisations to contribute CSR for in-situ and ex-situ GIB and Lesser Florican conservation. You can write to TCF at info@corbettfoundation.org.

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NETWORKING

Join *Sanctuary's* online network

The Sanctuary Nature Foundation's print, on-ground and online network has grown to over a million caring individuals, online and offline, across the globe. We would be delighted if you, your family and friends were to 'Seek Sanctuary' and join our mission to celebrate and protect our planet and its utterly miraculous biosphere.

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COURTESY NEHA PANCHAMIYA



On the interview with Neha Panchamiya, RESQ Charitable Trust

Shashi Bhatnagar Great to see such dedication, but the bigger question is, will the current circumstances allow them to do good work peacefully?

Vaijayanti Gadgil Appreciate the great work done by Neha and her team.

On the Kids for Tigers fest in Mumbai

Sahir Doshi When these kids say 'tiger', they mean EVERYTHING that lives in wild India. Kids for Tigers started in the 2000s. On our first camp to Tadoba, we saw no tigers, and no tourists. It was a different time. India hadn't caught onto the big cat yet. Today, India works hard to conserve its tigers. But other species? Landscapes? Seascapes? Communities who depend on nature? Ultimately, all of us? Kids for Tigers has kept its old purpose but massively expanded its message and mission. Tiger = All nature.

On Dr. Sonali Gosh, Sanctuary Wildlife Service Award 2025 winner

Dia Mirza A hero! How I admire and respect you, Kaziranga's first female Field Director. A researcher, a scientist, pursuing environmental law and a Ph.D. In her words, "When the forest speaks, the women have been heard."

On Parveen Shaikh, Sanctuary Wildlife Service Award 2025 winner

Bombay Natural History Society Parveen Shaikh turned a research question into a river-wide movement for an endangered bird. At sites where almost no chicks survived earlier, survival has climbed dramatically once guardians began watching over sandbars round the clock

For this science-driven, community-led conservation model, she has been honoured. She shares this with field teams, Forest Departments and riverine communities who protect Skimmer nests season after season.



COURTESY PARVEEN SHAIKH

On Too Close for Comfort, Honourable Mention, Sanctuary Wildlife Photography Awards 2025, by Abhay Singh

Junglenaama Approaching elephants at such close quarters is not only extremely dangerous but also a direct intrusion into their privacy, natural behaviour, and habitat. Repeated disturbances can lead to heightened stress and aggression. Over time, this behavioural change significantly raises the risk of human-elephant conflict. While tourists may return home after such encounters, the long-term consequences are borne by our green soldiers, forest guards, frontline staff, and local communities. Responsible tourism, grounded in legal compliance, safe distances, and ethical conduct, is essential to ensure the safety of elephants, their habitats, and everyone who shares their landscape.

On Motherhood Deceived, Certificate of Merit, Sanctuary Wildlife Photography Awards 2025, by Lucky Jaiswal

Soumendu Das Astonishing documentation of animal behaviour!

SCAN THE QR CODE TO WATCH THE VIRAL LEOPARD VIDEO.

On the viral video of a leopard climbing a tree in the Corbett National Park

Mike Moore Effortless transition to the higher branch. Amazing and wonderful creatures!

Faby Duran Wow! These beautiful animals should not stop existing.

Sibya R. This is who my cat thinks he is while climbing trees.

READERS' FORUM



Reader's response to the Commentary, *February 2026*

With John Donne's quote, I felt like you were writing about my concerns as huge tracts of open and forested land are replaced by hard concrete. Gone are the days when families travelled by train through forests, children pressing their noses to the glass hoping to glimpse a tiger in the *sal* forests of Ghodajhari, Raigarh, or Jhargram. Rapidly lost too are the days of imagining Rani Rupmati watching the Narmada as one climbed to her fort; now such places are flattened into concrete. There is little thrill in towering statues compared to climbing hills in Ramtek, Amarkantak, Udaygiri, or Pachmarhi, and seeing rock-carved statues and cave paintings made by the rough hands of our ancestors.

The landslides in Uttarakhand and floods in Kerala would not be so devastating if hills were left uncut and landscapes unchanged. Tigers would not stray near cities like Nagpur, and temperatures would not cross 45°C, if forests were not sacrificed for power plants, roads, and flyovers. Some balance, some harmony with nature, is vital as we move toward becoming a developed country in 2047. Thank you for raising this concern through your editorial and commentary.

Kakoli Upadhyay, Nagpur

On Future Imperfect *by Praveen Gupta, February 2026*

Great article although I fear politicians, media and therefore the public are not listening. In the U.K., we are pushing for a National Emergency Briefing. One where leading experts speak directly about the risks we face and the action required. Our children should not be burdened with our legacy. The prioritisation of short-term greed ahead of long-term survival is astonishing. Even our own security services are briefing on the catastrophic risks we face. People such as Johan Rockström and Dr. James Hansen are exactly the sort we must listen to.

Saul Humphrey, United Kingdom

The 'uninsurability loop' is a major concern. When risk becomes too large or too unpredictable, insurers can't price it and without insurance, economies and projects become fragile. Insurance, though undermined and partially ignored, is very crucial for risk pricing, risk transfer and risk management. The article is a warning with respect to intergenerational risk.

Nishtha S., Ahmedabad

What amazes me is how the mad rush to make quick money leads even the most intelligent people into a rationalised mental pit, which encourages them to purposefully poison India's air, land and water. The dramatically-enhanced Floor Space Index (FSI) of

IN OUR APRIL ISSUE...



MIKE PRINCE/CC-BY-2.0

Sisters Who Walk the Himalaya

As fascinating field insights emerge from the remote and demanding terrain of the Himalaya, who are the people on foot making these projects possible? This story of two sisters committed to conservation in the high-altitude landscapes of North Sikkim in the Eastern Himalaya draws on their lived experiences before it becomes data – long days of walking, careful observation, and skills nurtured patiently over time. Through their work with WWF-India, **Phung** and **Song** bring knowledge and care to these fragile landscapes.

Mumbai, Delhi and more is a HUGE contributor to the problem. Equally tragic is the irrational idea of creating highways using melted plastic resin... or of importing toxic waste tyres, at a low financial cost, but at a massive cost to health. And even less said on the callous manner in which industries blithely release death-dealing toxic waste into waterways that poison millions of citizens.

The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal flagged much of this decades ago when the industrial North began exporting PVC and other toxic waste to India. That very Indian talent... described as *jugad*... could be causing debilitating illness among innocent citizens.

Basically human life and rights seem to be looked upon as an acceptable, possibly inevitable collateral damage for economic 'progress'. Future generations will justifiably term this as intergenerational colonisation.

Bittu Sahgal, Mumbai

On Africa to the Aravallis *by Soham Kacker, February 2026*

To come upon those berries! Such joy! And thank you for the caption too.

The Dragonfly Mural , Mumbai

They look absolutely stunning... So gorgeous, beyond imagination.

Dr. Jaisheela, Bengaluru

OBITUARY

In every organisation, there are some people whose names may not appear in print, yet whose presence diligently and quietly holds everything together. Our dear office assistant, Jairaj Naidu, was one such person. Jai came to Sanctuary as a young man more than a quarter century ago, and down the years became a foundation for us all. A key member of the Sanctuary team, he was not the one writing about endangered species and habitats, editing stories, or working in the field on our projects. Yet his contribution to wildlife conservation was woven into almost everything we did. From ensuring the magazine was posted on time, keeping us aware, and helping us overcome any challenges to keeping the office running smoothly each day, he carried out countless tasks that allowed the rest of us to do our work.



SANCTUARY PHOTOLIBRARY

Jairaj Naidu

Behind many of our most labour-intensive initiatives – Kids for Tigers workshops, nature trails, camps, and the annual Sanctuary Wildlife Service Awards, was his steady, dependable presence. He helped manage the many intricacies that make such events possible, working behind the scenes so that there was nothing that prevented the show from going on. He brought sincerity to even the smallest task and we know how much we depended on him to get the job done. His sudden demise leaves us asking "how will we even be able get anything done any more?". Each and every member of the Sanctuary team will remember him with gratitude – as someone who believed in the purpose of what we do, and who supported it in the ways he knew best.

Jai represented loyalty, respect and love for Sanctuary and us all.
May he rest in peace. His work will not be forgotten.

The Sanctuary Team

Tarantulas of the Eastern Ghats

Most people have likely seen tarantulas on American television or in wildlife documentaries, but very few know that these incredible creatures are also found here in India. A wildlife biologist's tireless quest to study and conserve the endangered tarantulas of the Eastern Ghats is unraveling more knowledge about the ecology, behaviour, and habitat of these previously little-known and poorly studied spiders, and the threats that could wipe them out even before we can fully understand them. **Purva Variyar** travels to Tamil Nadu with wildlife biologist Gautam Kadam to sight two fascinating species of tarantulas, and learn more about the research project.



ARVIND AATHIA



VIJAY DHASHMANA

MAKING MOLE HILLS OUT OF MOUNTAINS?

By Bittu Sahgal, Editor, *Sanctuary Asia*

"The Aravalli is a geological range, not a plain brown physiographic hill. Geologically, it's a complete range of diverse hills formed in ancient times and predates the emergence of humans. The undulating terrain, born from the ocean's womb, is a region gradually rising above the land itself. This is how we perceive the entire Aravalli Range as distinct hills, plateaus, and plains."

That's Rajendra Singh, the Water Man of India, expounding on the ranges that he has spent a lifetime protecting. The Aravalli is possibly the oldest geological uprising in the world, studded by hills that were colonised by forests, wetlands, lakes, and plateaus, interspersed by flatlands! This landscape is incredibly biodiverse, which is where the problem begins... for miners, who have always looked covetously at the Aravallis, not as national assets, but as opportunities for private gain, ignoring the fact that the ancient ranges served to prevent the Thar desert, plus a whole lot of polluted air, from creeping into Haryana, Uttar Pradesh and our very own, long-suffering National Capital Region... Delhi!

Not surprisingly, a quarter century ago, Faridabad, south of Delhi, was virtually assaulted by an army of real estate firms. This led India's Ministry of Environment to issue the Aravalli Notification in 1992 banning mining and real estate deals in the districts of Gurgaon and Alwar. But, as often happens, implementation lagged far behind both the intent and the law. A decade later, in November 2002, the Supreme Court finally ordered that the Aravalli ban must be implemented... but omitted mentioning the *definition* of the Aravallis, which stretches from Gujarat to Delhi.

On November 20, 2025 that definition was provided by the Ministry of Environment, Forests and Climate Change and the Supreme Court accepted it *suo moto*, perhaps unaware that it indicated that protected Aravalli land would only include those with rocks over a billion years old that lay at an elevation of 100 m. or more. The miners celebrated. On January 1, 2026 the Supreme Court, possibly realising the full import of how its order would be interpreted, ordered that its instruction be kept in abeyance.

Meanwhile, the rest of us hold our breath, and hope and pray that the high and mighty do not celebrate their good fortune by literally and figuratively turning India's precious, fragile, protective mountains into mole hills!

Don't get angry... get involved. Follow us on www.sanctuarynaturefoundation.org | /Sanctuary Asia



VRRUKSH
eco-stay

By Virya Wildlife Tours

ABOUT

Perched at the edge of the core forest and just 8–10 minutes from five safari gates of Tadoba Andhari Tiger Reserve, Vrruksh Eco Stay is where wilderness meets quiet comfort. Spread across 2.5 acres of lush greenery, the retreat features 11 handcrafted Mud Block Cottages and 6 Luxurious tents, designed to offer guests an earthy yet indulgent stay amidst nature's calm.

A serene 800 sq. ft. pool surrounded by a wooden deck and shaded by forest canopy invites you to unwind after a day of adventure. The soothing ambience is heightened by the surrounding trees — mango, Jamun, Lemon, Betel nut, Bamboo, Mahogany and the vibrant Krishna and Radha sura - making the resort a true sanctuary for both people and nature.

Earth-Crafted Comforts : Stay in beautifully handcrafted mud block cottages and eco-luxury tents that blend rustic charm with modern comforts — designed to offer a mindful retreat amidst Tadoba's wilderness.

Homely Flavours, Heartfelt Hospitality : Relish wholesome, home style cooked meals made with local ingredients and served with warmth — a taste of the region's simplicity and sincerity.

Photographers' Haven : Perfect for wildlife photographers and nature groups, Vrruksh offers peaceful surroundings, natural lighting, and curated safari access — creating the ideal base for your next great capture.

Sustainable Living, Naturally : From eco-friendly architecture to minimal-impact operations, every element of Vrruksh is rooted in sustainability — allowing you to reconnect with nature responsibly.









WALK THE WILD
LIVE THE STORY

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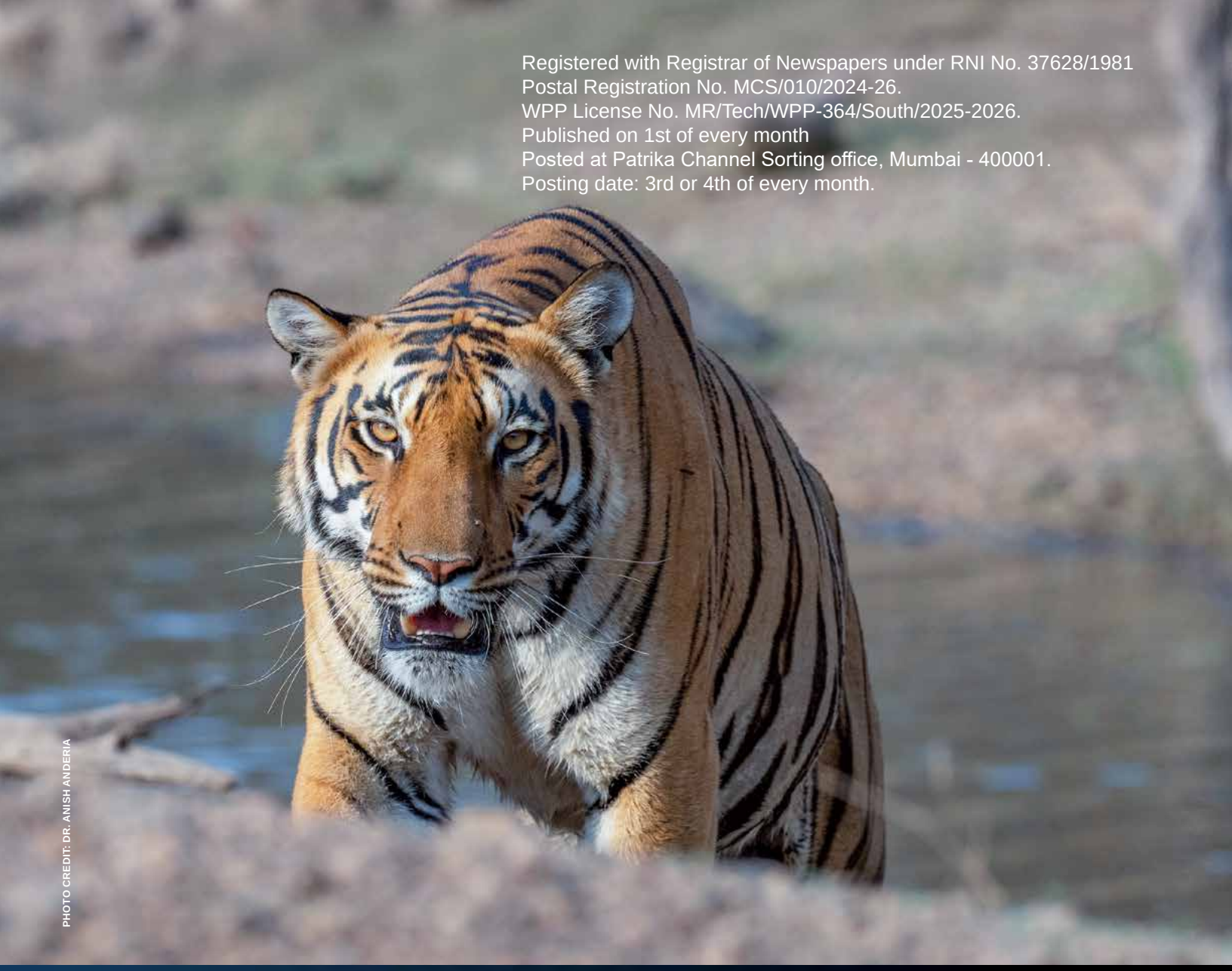


PHOTO CREDIT: DR. ANISH ANDERIA

FOREVER STRIPES

The survival of the tiger and all the creatures that share its habitat, including leopards, wild dogs, elephants, rhinos and uncounted plants, insects, birds and reptiles, depends on whether humans can set aside vast undisturbed wildernesses for nature.

The wildlife conservation movement needs the support of us all. For more information on how you can help, or to pledge your support for those who work round-the-clock to protect our wildlife, write to Dr. Anish Andheria (President, Wildlife Conservation Trust) at anish@wctindia.org or visit www.wildlifeconservationtrust.org

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