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From the Editor's

Dear Readers,

In the December issue of our Newsletter, we received several popular articles from diverse fields. All the authors deserve great appreciation for sharing articles in huge numbers. Please continue sending articles to our Publication team and share published newsletter with your friends also.

I would like to thank the Editorial team including Print, Designer and Publication committee for their efforts throughout the edition.

Your suggestions are always welcome for improvement.

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## ELEPHANTS NEED CONSERVATION

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Elephants are magnificent wild animals known for their large size, long trunks, and remarkable intelligence. They inhabit various regions across Africa and Asia and play crucial roles in their ecosystems. These gentle giants are herbivores, consuming vast amounts of vegetation daily. Unfortunately, they face threats like habitat loss and poaching, making conservation efforts vital to protect these iconic creatures. Elephants are remarkable creatures with unique anatomy and morphology adapted for their large size and specific ecological roles. Here are some key aspects of their anatomy and morphology

**Size:** Elephants are the largest land animals on Earth. They can weigh up to several tons and stand up to 13 feet (4 meters) tall at the shoulder.

**Trunk:** The most distinctive feature of an elephant is its trunk. This elongated, muscular appendage is a fusion of the nose and upper lip. It's incredibly versatile and serves various functions, including breathing, drinking, grasping objects, and even making sounds.

**Tusks:** Both African and Asian elephants can have tusks, which are elongated, curved teeth. Tusks are used for various tasks, such as digging, foraging, defence, and in some cases, as weapons. Unfortunately, tusks have also made elephants targets for ivory poaching.

**Ears:** Elephants have large ears that help regulate their body temperature. Blood vessels in their ears radiate heat, acting as natural cooling systems. The shape of their ears can vary between African and Asian elephants.

**Teeth:** Elephants have a unique set of teeth, with six sets of molars throughout their lives. These molars are continuously replaced as they wear down. Grinding of plant material with these teeth is essential for their herbivorous diet.

**Legs and Feet:** Their legs are sturdy and pillar-like to support their massive bodies. Elephants have relatively



short, thick legs with padded feet, which help them move through various terrains, including soft mud.

**Skin:** Elephant skin is thick, rough, and wrinkled, which helps to retain moisture and protect them from the sun. It can also be quite sensitive to touch.

**Tail:** Elephants have a relatively long, coarse tail with a tuft of hair at the end. They use their tails to swat away insects and communicate with other elephants.

**Molting:** Elephants undergo molting, where patches of old skin peel away in sheets. This process helps them get rid of parasites and dead skin.

**Digestive System:** Elephants have a specialized digestive system to process the high-fiber, low-nutrient vegetation they consume. They rely on fermentation in their large, complex stomachs to break down cellulose.

**Brain:** Elephants have large brains, known for their high intelligence and complex social behaviours. They exhibit problem-solving skills, self-awareness, and strong social bonds within their herds.

**Tongue:** The tongue of an elephant is muscular and can be used for various tasks, such as grasping and manipulating food.

Elephants are not only fascinating in terms of their anatomy and morphology but also for their ecological importance and their role in shaping the ecosystems they inhabit. Their unique adaptations have allowed them to thrive in diverse habitats across Africa and Asia. Elephants hold significant importance in the wild for several reasons. Elephants play a crucial role in shaping their habitats as ecosystem engineers. They create water holes by digging in dry riverbeds, which benefit other animals during

droughts. Their feeding habits also influence plant diversity. They consume a wide variety of plants and fruits, and their dung serves as a means of seed dispersal, helping maintain plant diversity in their ecosystems. By feeding on different types of vegetation through browsing and grazing, elephants can influence the composition and structure of vegetation, which can benefit other herbivores and maintain a balanced ecosystem. Elephants are charismatic megafauna, attracting tourists to wildlife reserves and providing income for local communities through ecotourism, which supports conservation efforts. Hence they have significant cultural and ecotourism values.

The health of elephant populations can serve as an indicator of the overall health of an ecosystem. Declining elephant numbers often signal broader ecosystem issues. Maintaining healthy elephant populations helps preserve genetic diversity, which is vital for the long-term survival of the species. Studying elephants in the wild provides valuable insights into animal behaviour, communication, and social structures, contributing to our understanding of wildlife. Conserving elephants is not just about protecting a single species; it's about preserving the intricate web of life in their ecosystems and the cultural and economic benefits they provide to local communities and the world.

Conserving elephants requires a combination of local and international efforts. Here are some key strategies for elephant conservation

**Anti-Poaching Measures:** Implement rigorous anti-poaching initiatives to combat the illegal ivory trade and poaching of elephants. This includes increased law enforcement, technology like drones, and community engagement to report poaching activities.

**Habitat Protection:** Preserve and protect elephant habitats by creating and maintaining wildlife reserves and national

parks. Ensure these areas are well-managed to minimize human encroachment.

**Community Involvement:** Engage local communities in conservation efforts. Providing incentives for communities to protect elephants and their habitats can reduce human-elephant conflicts and promote coexistence.

**Corridor Creation:** Establish and maintain wildlife corridors that allow elephants to migrate and maintain genetic diversity, even in fragmented landscapes.

**Research and Monitoring:** Continuously study elephant populations and behaviours to inform conservation strategies. Monitoring helps identify threats and assess the effectiveness of conservation programs.

**Reducing Demand:** Combat the demand for ivory and other elephant products through public awareness campaigns, stricter regulations on ivory trade, and international cooperation to stop illegal trafficking.

**Human-Elephant Conflict Mitigation:** Develop and implement strategies to reduce conflicts between elephants and local communities, such as using barriers, early warning systems, and non-lethal deterrents.

## NEW DELHI'S AIR POLLUTION CRISIS: A CALL FOR URGENT ACTION

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New Delhi, often hailed as the heart of India, grapples annually with the dubious distinction of being one of the most polluted cities in the world. As winter descends, the capital shrouds itself in a dense blanket of smog, posing severe risks to its residents' health, economy, and overall well-being. The alarming Air Quality Index (AQI) levels have turned air pollution into a public health emergency, necessitating immediate and sustained efforts to combat this crisis. New Delhi, often hailed as the heart of India for its cultural, political, and historical significance, faces an escalating challenge each year as it grapples with the

**Transboundary Cooperation:** Collaborate with neighbouring countries to protect elephant populations that cross borders. Migration routes often extend beyond national boundaries.

**Education and Advocacy:** Raise awareness about the importance of elephant conservation and the ecological roles they play. Advocate for policy changes and support organizations dedicated to elephant protection.

**Tourism Management:** Regulate wildlife tourism to ensure it doesn't disrupt elephant behaviour or habitats. Ecotourism can provide funding for conservation efforts when managed sustainably.

**Climate Change Mitigation:** Address climate change, which can impact elephant habitats and food sources. Reducing greenhouse gas emissions can indirectly benefit elephant conservation.

Conserving elephants is a complex task that requires the cooperation of governments, NGOs, local communities, and the international community. It's essential to address the underlying causes of their decline, including habitat loss and demand for ivory, while also protecting their natural habitats, environments and promoting coexistence with human communities.

unenviable title of being one of the most polluted cities globally. The onset of winter marks a grim turning point, as the city becomes engulfed in a dense, toxic blanket of smog that blurs the skyline and suffocates its residents. This seasonal crisis is driven by a complex interplay of factors, including emissions from vehicles, industrial activities, construction dust, and the burning of agricultural residue in neighboring states.

The Air Quality Index (AQI) frequently reaches hazardous levels during this period, with particulate matter (PM<sub>2.5</sub> and PM<sub>10</sub>) concentrations far exceeding safe limits set by health organizations. Such conditions have transformed air pollution from an environmental concern into a full-blown public health emergency. Residents, particularly children, the elderly, and those with pre-existing respiratory issues, are at heightened risk of developing severe health complications, including asthma, bronchitis, cardiovascular problems, and reduced lung function.

The economic toll is equally severe, as rising healthcare costs and reduced productivity strain both individuals and the broader economy. This crisis not only threatens the well-being of Delhi's 20 million residents but also tarnishes the city's global image as a hub of culture and progress. The urgency to address this issue has never been greater, necessitating immediate, robust, and sustained interventions to mitigate the harmful impacts of air

pollution and secure a healthier future for the capital and its people.

**Causes of Air Pollution in New Delhi**

The causes of air pollution in New Delhi are diverse and complex, stemming from both local and external factors that intensify, particularly during the colder months. The primary contributors to the city's deteriorating air quality includes several factors (Fig. 1):

**Vehicular Emissions:** With over 10 million vehicles on the



**Fig. 1: Deteriorating air quality includes various factors.**

roads, New Delhi's traffic congestion is a major source of air pollution. The large number of diesel-powered vehicles contributes significantly to the emission of particulate matter (PM<sub>2.5</sub>), nitrogen oxides (NO<sub>x</sub>), and carbon monoxide, all of which degrade air quality. The aging vehicle fleet, coupled with inadequate public transportation infrastructure, exacerbates the problem.

**Industrial Emissions:** New Delhi is surrounded by numerous industrial zones and factories, many of which lack adequate emission control systems. These industries release large amounts of pollutants, including sulfur dioxide (SO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>), and volatile organic compounds (VOCs), which contribute to smog formation. Power plants, cement factories, and brick kilns are major culprits.

**Construction Dust:** The rapid pace of urbanization and infrastructure development in New Delhi leads to constant construction activities. Dust from construction sites, including the use of unpaved roads, demolition, and the movement of heavy machinery, adds to the air pollution burden. While measures like dust suppression are in place, they are often inadequately enforced.

**Firecracker Pollution:** During major festivals like Diwali, the use of firecrackers causes a significant spike in pollution levels. The burning of firecrackers releases large quantities of toxic gases, such as carbon dioxide (CO<sub>2</sub>), sulfur dioxide (SO<sub>2</sub>), and particulate matter, into the air. Despite

government bans or restrictions, firecracker usage remains widespread, exacerbating the already poor air quality.

**Geographical Factors:** New Delhi's geography plays a role in trapping pollution. During winter, the city's temperature inversion phenomenon, where a layer of warm air traps cooler air beneath it, prevents the dispersion of pollutants. This leads to pollutants accumulating at ground level, creating a persistent haze and significantly lowering air quality.

**Stubble Burning:** Every year, farmers in neighboring states like Punjab, Haryana, and Uttar Pradesh burn crop residues to clear fields for the next planting season. This practice releases vast quantities of smoke and particulate matter into the atmosphere, which drifts into New Delhi, particularly during the post-harvest period in October and November. Despite regulations aimed at curbing stubble burning, it remains a persistent problem due to a lack of affordable alternatives for farmers.

Satellite-based remote sensing technology plays a critical role in monitoring stubble burning by detecting active hotspots areas where fires are occurring (Fig. 2). These satellites use thermal infrared sensors to identify the heat signatures of fires. MODIS sensors on NASA's Aqua and Terra satellites can capture real-time thermal infrared data, which allows for the identification of fire hotspots. These sensors detect the heat emitted from the fires, even in areas with smoke and clouds, providing crucial data for identifying stubble burning activities in real time.

**Strengthening Policies to Combat Delhi's Air Pollution Crisis**

Air pollution in New Delhi has become one of the most pressing environmental and public health challenges, and despite efforts to address the crisis, significant gaps remain in the city's air quality management policies. To effectively combat this issue, there is an urgent need to fill these gaps with comprehensive and coordinated strategies that tackle the root causes of pollution while ensuring sustainable long-term solutions.

**Ineffective Enforcement of Existing Policies**

While New Delhi has implemented several measures such as the Graded Response Action Plan (GRAP), the odd-even vehicle rationing scheme, and restrictions on construction activities, enforcement remains inconsistent. For example, while there are fines for polluting vehicles and construction sites, these penalties are often not effectively enforced, leading to non-compliance. Similarly, while bans on stubble burning have been in place for years, their implementation has been weak, and farmers often resort to burning crops due to the high costs of alternatives. Strengthening enforcement mechanisms at both the state

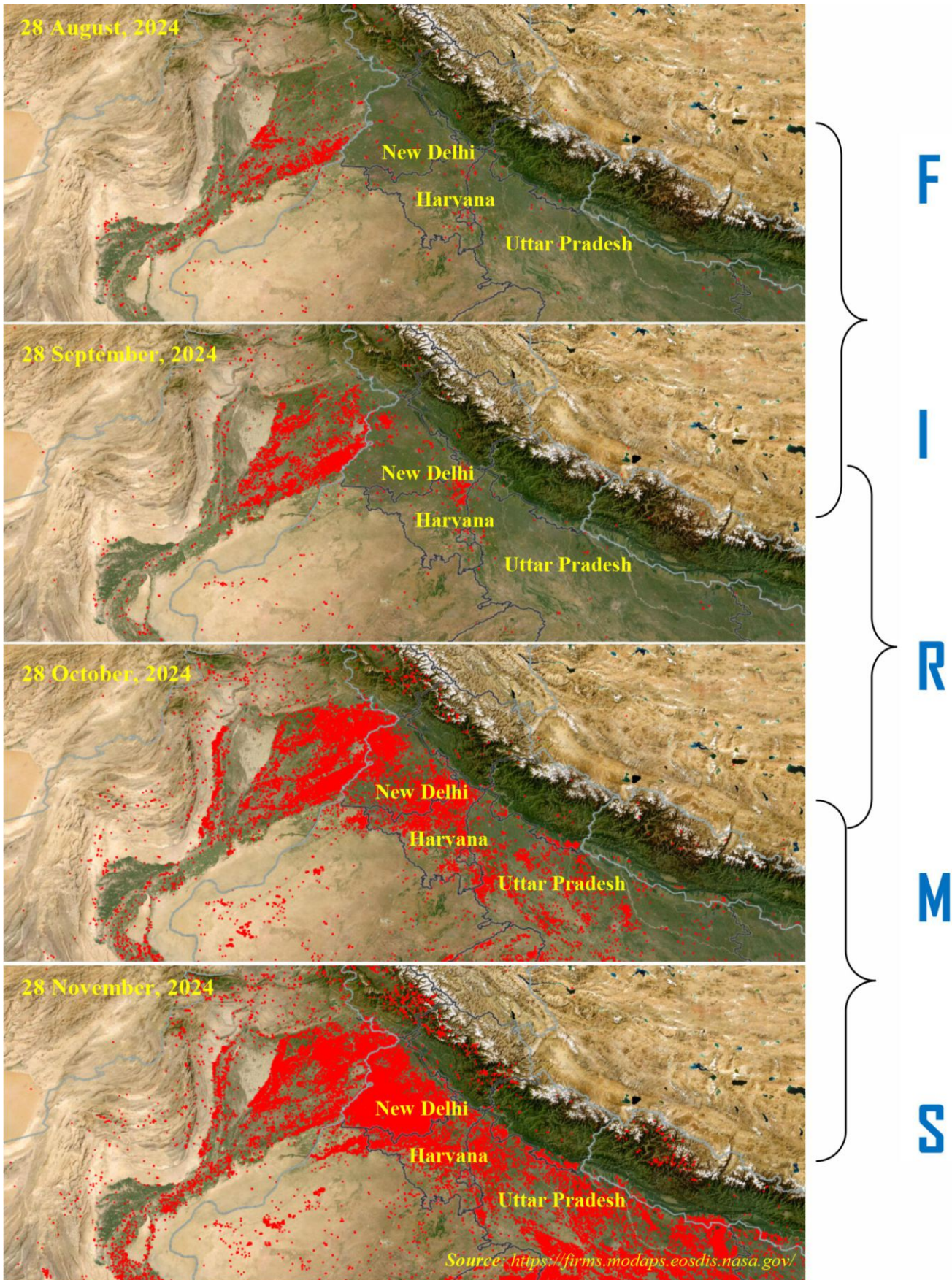


Fig. 2: Active Fires / Hotspots through stubble burning.

and national levels is crucial to ensuring that policies are more than just symbolic measures.

#### ***Lack of Coordination Across Sectors and Stakeholders***

Air pollution in Delhi is caused by a variety of factors, including vehicular emissions, industrial activities, agricultural practices, and waste management issues. The problem is compounded by the lack of coordination between the multiple stakeholders involved in tackling air pollution, such as municipal authorities, state governments, central agencies, and the farming community. A more integrated approach is needed, where all relevant sectors from transportation to agriculture work together under a unified framework. For instance, creating joint task forces between state governments to address the problem of stubble burning could help minimize the transboundary pollution that affects Delhi.

#### ***Need for Cleaner and Greener Technologies***

A significant gap in Delhi's air pollution management policies lies in the promotion and adoption of cleaner technologies. The vehicular sector, for example, remains heavily reliant on diesel and petrol-powered vehicles, contributing significantly to the city's air pollution. While the government has introduced incentives for electric vehicles (EVs), the adoption rate remains slow due to high upfront costs and insufficient infrastructure. Policies should prioritize the swift deployment of EV charging stations and financial incentives for consumers and manufacturers alike. Similarly, industries should be encouraged to adopt cleaner technologies through subsidies and tax breaks for switching to renewable energy sources or upgrading pollution control equipment.

#### ***Addressing Agricultural Pollution at the Source***

Stubble burning remains one of the most intractable sources of air pollution in Delhi. Despite efforts to curb the practice, it persists because of its economic benefits to farmers, who often find it more cost-effective to burn crop residues than to adopt alternative methods. Filling this policy gap requires creating a robust incentive structure that supports farmers in transitioning to sustainable agricultural practices. Subsidies for machinery that helps with crop residue management, such as balers and mulchers, could provide viable alternatives to stubble burning. Additionally, the promotion of agroforestry and the development of biomass-based energy systems could provide farmers with new income streams, reducing their reliance on burning.

#### ***Public Awareness and Participation***

While there has been some progress in educating the public about the dangers of air pollution, much more needs to be done to engage citizens in the fight for cleaner air. Public awareness campaigns must go beyond general information and focus on actionable steps, such as reducing vehicular emissions, minimizing waste burning, and adopting clean energy practices. Furthermore, empowering local communities through air quality monitoring and encouraging public participation in decision-making processes could foster a sense of collective responsibility. Community-driven solutions, such as localized air filtration systems and tree plantation drives, can have a positive impact on improving air quality in specific neighborhoods.

#### ***Integrating Climate Action with Air Quality Management***

Air pollution and climate change are interconnected challenges that need to be addressed simultaneously. The current air quality management policies in Delhi do not adequately integrate climate action into their framework. Policies promoting the reduction of greenhouse gas emissions, such as transitioning to renewable energy sources, enhancing energy efficiency in buildings, and encouraging sustainable transportation, could simultaneously mitigate both air pollution and climate change. Policies that target long-term sustainability, such as improving urban planning to reduce congestion and enhance green spaces, will also be crucial in combating pollution.

#### ***Conclusion***

New Delhi's air pollution crisis cannot be tackled through piecemeal measures or short-term fixes. The current policy gaps ranging from poor enforcement and lack of coordination to insufficient technological advancements and public participation—need to be urgently addressed. A comprehensive, multi-sectoral approach that includes stricter enforcement, adoption of cleaner technologies, incentives for sustainable farming practices, increased public awareness, and better data collection is critical for making meaningful progress. By filling these policy gaps and ensuring coordinated action, New Delhi can begin to address its air pollution crisis and pave the way for a cleaner, healthier future.

**Let's work together to ensure that the air we breathe does not become a barrier to our aspirations for a healthier, greener future.**

## INAUGURAL EVENT OF RELEASE OF SPECIAL COVER WITH MYSTAMP ON DR. U.N. BRAHMACHARI BY THE SCIENCE ASSOCIATION OF BENGAL (SAB) AT THE KOLKATA GPO

**Saikat Kumar Basu**

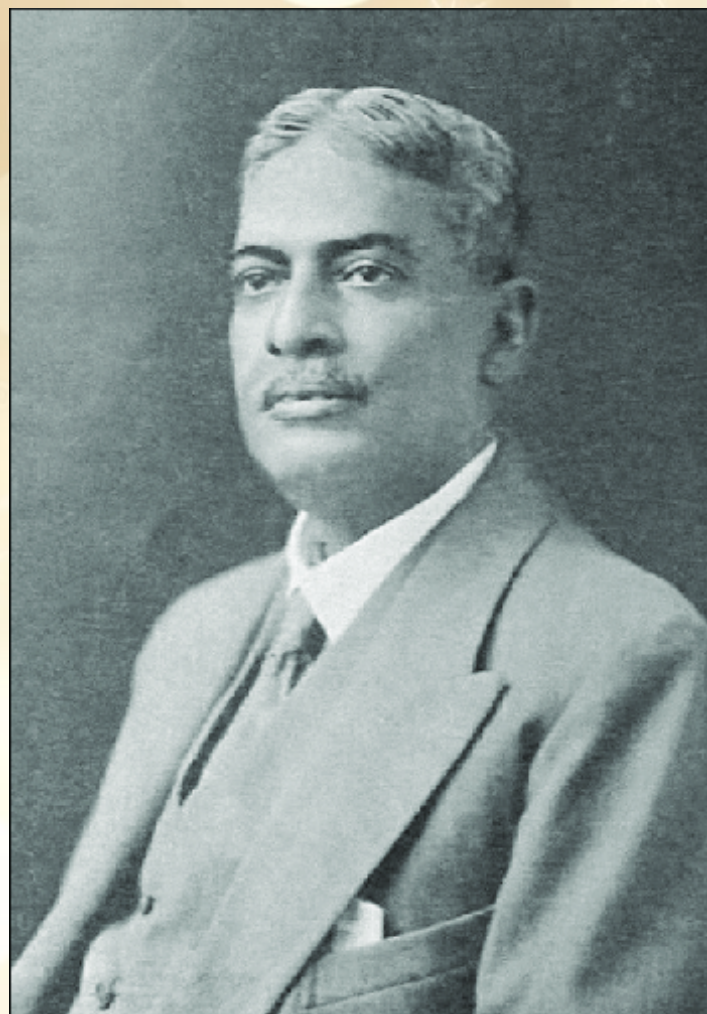
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The Science Association of Bengal (SAB) on the closing ceremony of 150th Birth Anniversary of Dr. U.N. Brahmachari the renowned physician and scientist who discovered the medicine of 'Kalaazar'( Leishmaniasis) and saved lakhs of people from death. In fact from 90% death rate, he brought down to under 10% death rate; and became globally acknowledged as an outstanding researcher. He received Knighthood and was twice refused Nobel Prize. He worked with monumental sincerity and dedication in the prestigious Nil Ratan Sarkar Medical College (Formerly Cambell School of Medicine). To pay respect to this great scientist and physician, SAB along with the active support of Dr. Brahmachari's family organized the Mystamp with cover of Dr. U. N. Brahmachari on 12th December, 2024 at the iconic GPO Auditorium Kolkata with great heritage since the Colonial times.

The program started around 3 pm in the packed GPO auditorium by welcoming the audience, calling dignitaries to the dias; and followed by their individual felicitations by Dr. Kana Chatterjee (grand daughter of Dr. Brahmachari). The garlanding of the photo of Dr. Brahmachari was led by Aloka Nanda Roy (great grand daughter of Dr. Brahmachari); and followed by dignitaries, guests, SAB members and public at large. The opening invocation was made by Dr. Rajib Karchowdhury; followed by the welcome address by Dr. Subhobroto Roy Chowdhury, Secretary, SAB. The members of Governing Body of SAB under the leadership of Secretary, Dr. Chowdhury made a formal appeal to the authorities of the Govt. of India for honoring Dr. Brahmachari with coveted BHARAT RATNA Award posthumously for his monumental contribution towards global humanity. Dr. Roy Chowdhury mentioned that such a great personality needs to be more known to public for his lifelong contributions and selfless, benevolent services for the public.

This was followed by series of lectures by the dignitaries, namely Prof. Dr. Pith Baran Chakraborty, (Principal, NRS Medical College & Hospital), Prof. Dr. Syamal



Chakraborty (Distinguished Professor of Chemistry, Calcutta University, author and eminent science communicator), Dr. Syamal Roy, FNA, CSIR (Retd.), Dr. Sankar Kumar Nath (Renowned Oncologist, author and public speaker). The speakers highlighted in various aspects of the inspirational life and research career and contributions of Dr. Brahmachari.

The release of Special Cover with Mystamp on Dr. U.N. Brahmachari was initiated by Mr. Ashok Kumar, the honourable Post Master General, Kolkata Region and Mr. Hammad Zafar, Director, GPO Kolkata. The dignitaries mentioned above and distinguished members of SAB and family members of Dr. Brahmachari. The Chief Guest of this beautiful program, Mr. Ashok Kumar, (PMG Kolkata Region) made an outstanding inspirational speech on the contributions of Dr. Brahmachari and how it has impacted both India and the world. The vote of thanks was delivered by Dr. N.C. Ghatak G.B. Member, SAB to finally conclude the program.

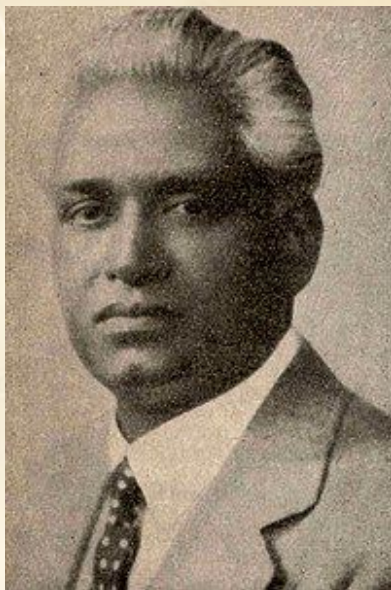
*Photo credit: Saikat Kumar Basu*

## 5TH PROF TARAK MOHAN DAS LECTURE AT DEPARTMENT OF ENVIRONMENTAL STUDUES, CALCUTTA UNIVERSITY

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The 5th Prof Tarak Mohan Das lecture on the occasion of National Energy Conservation Day was held at the auditorium of the Department of Environmental Science at Ballygunge Science College campus, Calcutta University on December 14, 2024. The memorial lecture was delivered by Prof. S. P. Gon Chaudhuri, Professor, IEST, Shivpur, Member of WEBREDA and the



Honorable Chairman of the International Solar Inovation Council. This unique lecture and the celebration of the National Energy Conservation Day was organized by the Society for Audio Visual Study for Life and Environment (SAVSLE), and the Department of Environmental Sciences, University of Calcutta, in collaboration with Vijoygarh Jyotish Roy College, Kolkata, and the National Environmental Science Academy (NESA), West Bengal chapter. This program was attended by members of the participating organizations, faculty members, academics, environmentalists, students, research scholars and members of the press and media representatives.

The program started at 3.00 pm with inaugural speech by Honourable Chairperson, Dr. Mamata Desai; and Co Chairperson Dr. Rita Saha, both Founder Members of SAVSLE. Both the speakers highlighted upon the life and career of Prof Tarak Mohan Das and his monumental contribution towards Agricultural and Life Sciences; and his instrumental role in shaping the establishment of the Department of Environmental Sciences, Calcutta University. The welcome address was delivered by Dr. Punarbasu Chaudhuri, Associate Professor and Head of the Department of Environmental Sciences. Involving public as a stakeholders of conservation initiative was highlighted upon by all the speakers. The broad message from the dias

was an urgent emphasis upon the need for making environmental initiatives, movements and campaigns to be a part of our reality and existence for the betterment of the planet and for protecting our forests, biodiversity and ecosystems.

Dr. Sima Mukhopadhyay, Secretary (SAVSLE) in her elegant speech highlighted the meticulous work on photo documentation, videograophy, electronic storage and dissemination of video based educational materials by Prof. Das in an era when social media was not available. She highlighted how Dr. Das served as mentor for many students and scholars and other inspirational anecdotes of her experience in working with this eminent academic and formidable science communicator. Dr. Krishnedu Das, Vice Chairperson, NESA, West Bengal Chapter explained why Prof. T. M. Das was ahead of his time in his teaching and research and a monumental visionary from multiple perspectives. Dr. Rajyoshri Neogi, Principal Vijoygarh Jaytish Roy College in her speech emphasized upon the need for deeper engagement of the society with nature and the importance of comprehensive sustainable development for a better future for our next generation.

Prof. S. P. Gon Chaudhuri in very simple colloquial terms emphasised upon the importance of the National Energy Conservation Day and how it impacts and shapes our daily life. He presented an erudite lecture stressing upon the history of energy uses and apications, it's challenges and opportunities from both a global and Indian contexts. He was iconic in providing numerous examples from India and overseas highlighting how alternative energy (green energy) has been successful in slowly replacing conventional energy supply systems over a period of six decades. He explained how the future looks like for us as energy consumers in this new millennium and on a global platform of alternative energy sources and their broader long term applications from the perspective of global sustainable development with special emphasis upon developing and under developed nations.

On the occasion of the memorial lecture and as part of the celebration of the National Energy Conservation, Vijoygarh Jyotish Roy College held a statewide essay completion for schools as well as college and university students in two distinct categories. The theme of the essay for the participating school students was 'Application of Solar Energy in Daily Life' and that for the college and university students was 'Beyond Fossil Fuels, Harnessing the Potential of Renewable Energy'. More than sixty students participated, and the best essays judged was awarded on this occasion by Prof. S. P. Gon Chaudhuri. Under the school category the award winners were Modhurima Mitra (1st position, Madarat Popular Academy), Manisha Mal (2nd positon) and Chandrima Bairagi (3rd position), both



from Muchisa Bamangiri Devi Balika Vidyalaya. Under the college and university category, the award recipients included Anisha Chowdhury (1st position) and Anusmita Karmakar (2nd position), both from Asansol Girl's College. Joint third position winners were Jeet Sengupta from Sister Nivedita University and Anwesha Dey from Vijoygarh Jatish Roy College.

The vote of thanks was delivered by Dr. Subhendu Bikas Patra, Convener, NESA, West Bengal Chapter. He extended sincere thanks and gratitude to all the organizers SAVSLE, NESA, Vijoygarh Jyotish Roy College, and Department of Environmental Sciences, Calcutta University for making the 5th Dr. Tarak Mohan Das memorial lecture a memorable event. Dr. Patra extended his heartiest best wishes to all the

awardees, participants, members, faculty members, researchers, academicians, students and research scholars and press delegates for their kind help and support. Special thanks was given to Dr. Amit Krishna De (Chairperson, NESA, West Bengal Chapter), Dr. Sima Mukhopadhyay (Secretary, SAVSLE), Dr. Anirban Banerjee, Dr. Abhijit Das, and Dr. Shilajit Barua (faculty members, Vijoygarh Jatish Roy College), and Prof Anirudha Mukherjee, Dr. Punarbasu Chadhuri, and Dr. Pritha Bhattacharjee (faculty members, Department of Environmental Sciences, Calcutta University) for their painstaking hard work at the bank end for making this event a success. The program ended with close interaction of the audience with Prof S. P. Gon Chaudhuri, multiple photo sessions and high tea.

## TRIBAL CONTEMPLATION CAMP CONNECTING NATURE WITH NURTURE

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A grand tribal contemplation camp was held between December 28 and 29, 2024 at the foothills of the Susunia Hills in a place called Damin-I-Koh of the Bankura district of West Bengal. The camp was attended by close to 200 participants and organized by Rural Development Society (RDS), Jai Bhim India Network (JBIN) and United Religions Initiative (URI). The program started on 28th through a grand celebration of establishing the sacred Jaherthan by tribal elders and priests in the august presence of both tribal and non-tribal participants of the camp. The Jaherthan is a sacred grove which is a residing place of Jaher Ayo and worshiping place of Santal tribe. It is a characteristic feature of a Santal village on the village edge where holy spirits live and where a series of annual festivals take place. This sacred grove is set aside in the founding of the village and left undisturbed except at times of festivals. Inside is set a series of natural (uncut) stones which represent the Bongas, but are not substitutes except during festival. The tribal leaders representing various local communities were recognized and felicitated in the camp to honour their traditional leadership roles and support for the socio-cultural, socio-religious and socio-economic development of their individual communities spread across the state.

A number of contentious issues related to Abua Dism, Abua Raj, Gram Sabha, 5th and 8th Schedules, Forest Act, Tribal Knowledge System and tribal wisdom were discussed in the camp. Contemporary issues such as sustainable development and growth, conservation of forests, wildlife and biodiversity, prospects of organic agriculture and sustainable agricultural systems and practices were



discussed in this forum by various dignitaries including academics, researchers, scientists, teachers, social development workers, agronomists, tribal leaders, various NGO members and camp participants at large. Important notes were taken for following up in the next camp to be held in Kolkata sometimes in February, 2025.

Mr. Saradindu Biswas (JBIN) talked about the political consciousness of tribal communities and they are being exploited by a particular group of people in the country. He mentioned, "Like caste consciousness or regional consciousness, tribal consciousness is fast developing to be a political tool that has become symbolic of privileged treatment, separatist tendencies, and in places a barrier to national integration. It is therefore important to highlight the challenges of tribal socio-economic development and empowerment issues therefore to the forefront to attract government attention".

Reverend Kalyan Kumar Kisku (RDS & URI) stressed upon the fact, "Tribes are very simple and humble and possess a great amount of feelings for their religious leaders and community members in general. They grow in the intimacy of the social atmosphere of the community to which they belong. Their close association with nature inspires them to lead a carefree life. They feel pleasure in roaming about hills, forests, and fields. Nature makes them intimate with the environment. They often meet friends and visit their



own relations on different festive occasions and in periodical new relations along with association with various people. It is therefore important for us to work towards their socio-economic empowerment through various tribal development programs, education and

awareness initiatives, fight against superstitions, better health and nutrition programs and striving towards establishing a vibrant, dynamic and sustainable tribal society for the future."

Prof. (Dr.) Suparna Sanyal Mukherjee from Seacom Skills University, Birbhum and one of the eminent speaker at the camp mentioned, "There have been many attempts made in anthropological consensus to define and characterize on tribes, but there is no definite contemplation on defining characteristics. Territorially race, economy animism, political autonomy, etc have been variously used". She emphasised, "It appears that the dozens of definitions and characteristics of tribes are floating around in an anthropological literature arena as diverse as the field situation encountered by those proposing the definitions. The orthodox denotes that the tribes revealed in the anthropological conception is a social group, usually with a definite geography, distinct dialect, cultural homogeneity, and unifying social organization. It may include several

sugroups, such as sibs or villages. It may and may have a common ancestor as well as presiding deities. The families or small communities making up a tribe are linked through economic, social, religious, or blood ties, i.e., kingship bondage. From an Indian context, too, the term is a British legacy. They classified as tribe such people who were beyond the veil of the Hindu Varna system occupied inaccessible hills and forests and were of dark complexion. Neither Hindu nor any other Indian language has a corresponding term with exact connotation as a tribe. This in itself is proof enough that Indian language has never conceptually set these people apart from the rest."

Photo credit: **Saikat Kumar Basu**

## MUSHROOM CLASSIFICATION: UNDERSTANDING TYPES, MORPHOLOGICAL FEATURES, AND TAXONOMIC CATEGORIES

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### 1. Introduction

Mushroom cultivation is increasingly becoming popular because it not only meets the dietary requirements but also adds to the income, especially of growers with insufficient land (Fig. 1). It is considered to be a very rewarding and fascinating hobby for the retired persons as well as housewives that can grow mushrooms in small boxes or other containers while attending to household chores. Today, mushroom cultivation faces less difficulty provided the grower will follow simple rules of growing. Mushroom cultivation is carried out indoor in any room, shed, basement, garage, etc. which should be well ventilated. However, paddy straw mushroom can be grown outside in shady places also. Of the many mushrooms only three kinds namely button mushroom (*Agaricus bisporus*), straw mushroom (*Volvariella uoluacea*) and oyster mushroom (*Pleurotus sajor-caju*) are suitable for cultivation in India.



Fig. 1: Mushroom cultivation.

Mushrooms may be edible and non-edible. Mushroom is the reproductive structure of edible fungi that belong to Basidiomycota, these may epigeal or hypogaeal. Mushrooms are fungi which lack chlorophyll and can't manufacture their food material, however, mushrooms can produce a wide range of enzyme that degrades the complex substrate on which they grow. Techniques to grow oyster mushrooms from culture to harvest were evaluated using locally available materials. Wheat straw, Paddy straw, and waste grass are used as substrates, Spawn for *Pleurotus sajor-caju* was prepared from wheat and green gram.

### 2. Growth Characteristics of Mushrooms

Mushrooms can flourish in lawns, plant surfaces, compost heaps and many other places. Mushroom colonization requires dark, cool, humid conditions and good air circulation. The growth characteristics of mushrooms are as follows:

Being heterotrophs, they require organic matter for their nutritional source. Whether it's the substrate or the surrounding, there must be moisture. It is a crucial factor for mushroom growth.

- ❖ The moist organic matter provides the moisture, nutrients and energy necessary for the fruiting body.
- ❖ Temperature is also a major factor that decides the duration of mycelium colonization.
- ❖ Cooler temperatures often slow down colonization. High temperatures may speed up the process or increase the chances of contamination. So, there should be an optimal temperature for mushroom colonization. Mushrooms need all these right conditions to form healthy, well-formed fruiting bodies.

### 3. Classification of Mushrooms

**Are all mushrooms edible?** Not all the mushrooms are edible. **Based on edibility**, mushrooms fall into three categories that are as follows:

### 3.1 Edible Mushrooms

These macrofungi are **safe to eat** and offer high nutritional values and delicious taste (Fig. 2). Edible mushrooms can

be harvested wild or cultivated. They include oysters, morel, portobello and button mushrooms, etc.



Fig. 2: Edible Mushrooms

### 3.2 Inedible mushrooms

Inedible mushroom species are unappetizing or have poor taste. These have leathery, rugged textures and a peppery or bland taste. They generally taste like eating wood or a leaf.

They won't cause severe illness but are likely to cause gastric upset. Inedible mushrooms closely resemble poisonous mushrooms and cannot be consumed.



### 3.3 Poisonous Mushrooms

Mushroom poisoning is poisoning resulting from the ingestion of mushrooms that contain toxic substances. Its symptoms can vary from slight gastrointestinal discomfort to death in about 10 days (Fig. 3). Mushroom toxins are secondary metabolites produced by the fungus. Mushroom poisoning is usually the result of ingestion of wild mushrooms after misidentification of a toxic mushroom as an edible species. They contain toxins that protect against hungry wildlife. Ingestion of such mushrooms can cause

gastrointestinal illnesses, lung and kidney damage, or sometimes death. The poisonous types include *Amanita*, *Cortinarius*, *Hypholoma*, etc.

### 4 Types of Mushroom

#### 4.1 Button Mushroom

This is one of the most commonly available varieties of mushrooms. They have a mild flavor, with a creamy-white color. You can eat them in both raw and cooked forms.



Fig. 4: a) Button; b) Straw; c) Oyster; d) Milky; e) Cremini; f) Portobello; g) Shiitake; h) Enoki

Buttons go well with multiple dishes such as pizza, burgers, soups, and salads. They are widely used in India as well, and their cultivation is done seasonally or under a controlled environment. Almost 90% of the mushrooms you eat are of button mushrooms variety, making it one of the most popular types of Mushrooms in India (Fig. 4a).

#### 4.2 Straw Mushroom

Also famous as '[Chinese Mushroom](#),' these are as popular in India as the button mushrooms. They have a good aroma, flavor, and are rich in various nutrients and proteins. Usually, an edible in tropics and subtropics, in India, their cultivation generally takes place in the states of Madhya Pradesh, Uttar Pradesh, Andra Pradesh, Maharashtra, Tamil Nadu, Chhattisgarh, etc (Fig. 4b).

#### 4.3 Oyster Mushroom

One of the popular types of mushroom in India, people call it 'dhingri' in Hindi. This variety can easily grow in tropical and temperate regions. These are common in many cuisines and dishes. Shaped like a fan and dusty color, they look a lot like oysters, just like their names. Their cultivation in India usually takes place in the states of Madhya Pradesh, West Bengal, Orissa, Karnataka, Maharashtra, etc (Fig. 4c).

#### 4.5 Milky Mushrooms

Milky Mushrooms are also known as summer mushrooms. It is a fantastic variety that grows in states like Karnataka, Tamil Nadu, Kerala, Andra Pradesh, and Odisha. They are also less demanding and offer a high yield. These mushrooms look attractive with bright white color and have a good shelf life as well (Fig. 5d).

#### 4.6 Cremini Mushroom

These mushrooms belong to the same species as that of button mushrooms. They just differ slightly due to the

development of a coffee-colored skinny layer on the cap and thus have dark tan patches on top. These Mushrooms are, however, more flavourful in taste and have a firmer texture than button mushrooms (Fig. 4e).

#### 4.7 Shiitake Mushroom

Famous for their medicinal qualities, this variety is gaining popularity among the consumers of mushrooms. Thus the demand for this type is also increasing in the country. Some farmers in Himachal and other northern states of India have successfully begun to cultivate this variety. These mushrooms taste better when cooked, carrying a smokey flavor and low water content (Fig. 4f).

#### 4.8 Portobello Mushrooms

Portobello Mushrooms are similar in texture and flavor to the button mushroom, but much bigger because they are actually the same type of mushroom. Portobellos are just the grown-ups! Portobello mushrooms are great for throwing on the grill as a plant-based burger substitute. Since you generally pay a premium for these larger mushrooms, we prefer recipes that take advantage of that larger size like the Best Portobello Mushroom Burgers Recipe (Fig. 5g).

#### 4.9 Enoki Mushrooms

Enoki mushrooms, sometimes also called golden needle mushrooms, lily mushrooms, or enokitake, are a type of edible fungus, *Flammulina velutipes*, that grows naturally on the stumps of trees from late fall to early spring. The commercially cultivated varieties differ significantly from the ones that grow in the wild. Cultivated enoki mushrooms are deprived of light and grown in a CO<sub>2</sub>-rich environment, which produces a pale white mushroom with long, slender stems, up to five inches in length, and small caps (Fig. 4h).

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## LANDSCAPE RESOURCE ASSESSMENT FOR GROUNDWATER RECHARGE IN TALBEHAT BLOCK, LALITPUR DISTRICT

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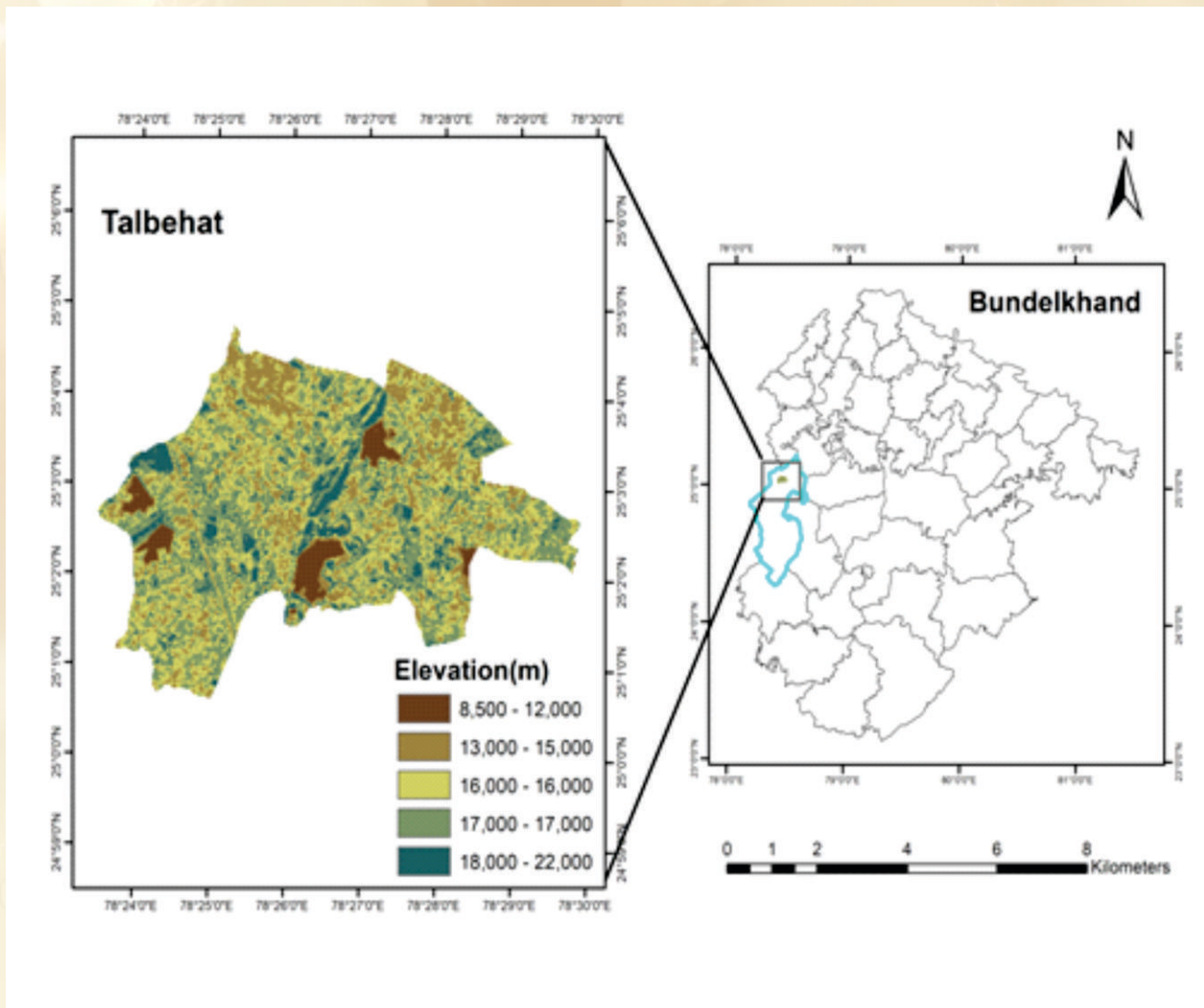
### Introduction

The Talbehat block in the Lalitpur district of Uttar Pradesh is a part of the semi-arid Bundelkhand region, which faces persistent challenges in water resource management. Groundwater serves as the primary source for domestic and agricultural needs in the area. However, over-extraction, coupled with erratic rainfall and limited surface water

storage, has resulted in a steady decline in groundwater levels. Addressing this issue requires a systematic approach to identify potential zones for groundwater recharge and implement strategies to improve water sustainability. Landscape resource assessment offers a scientific methodology to evaluate the natural potential of the area for groundwater recharge by integrating factors such as geomorphology, soil, vegetation, and hydrological features. Talbehat block covers an area of approximately 700 square kilometers and features a diverse topography of hills, plains, and riverbeds. The region experiences an annual average rainfall of 800-1000 mm, which, despite being adequate, often fails to replenish groundwater due to high surface runoff and poor infiltration in certain areas. The geological framework comprises granites, basalts, and quartzites, interspersed with alluvial deposits. These geological variations influence the permeability and porosity of the terrain, directly impacting its groundwater recharge potential. Land use patterns in the area are

dominated by agriculture, barren land, and patches of forest. Seasonal streams and rivers such as Jamni and

Betwa are important hydrological features that contribute to the water cycle.



### Strategy

The methodology for assessing the groundwater recharge potential of Talbehat block involved the use of remote sensing, GIS tools, and field surveys. Satellite imagery from sources like Landsat and Sentinel-2 was utilized for land use and land cover mapping, while Digital Elevation Models (DEMs) provided data on slope and drainage characteristics. Field surveys were conducted to validate remote sensing data and collect soil samples for determining infiltration rates. Secondary data sources, including geological maps and groundwater level records, were also integrated. Using GIS, thematic maps of land use, soil type, slope, drainage density, and geomorphology were created and analyzed using a multi-criteria evaluation approach. The Analytical Hierarchy Process (AHP) was employed to assign weights to these factors based on their influence on groundwater recharge. Overlay analysis of these maps allowed for the identification of zones with varying recharge potential.

The results revealed significant variations in recharge potential across the Talbehat block. Land use and land cover analysis showed that agricultural land accounts for nearly 60% of the area. Recharge potential in agricultural lands varied depending on crop type, soil texture, and irrigation practices. Forested areas demonstrated moderate recharge potential, as they reduce surface runoff and facilitate infiltration. Geomorphological analysis indicated that rocky outcrops with low porosity contribute minimally to recharge, whereas alluvial plains, with higher permeability, emerged as ideal sites for groundwater recharge structures. Undulating hills in the region were identified as runoff zones that supply water to lower-lying areas.

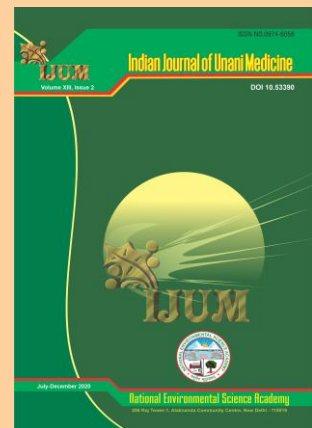
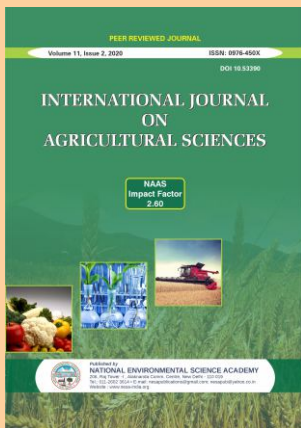
Hydrological features, including seasonal streams and riverbeds, were identified as critical recharge zones. These features, particularly in flat and low-lying areas, provide natural opportunities for water infiltration. However,

anthropogenic activities such as unregulated sand mining pose a threat to these natural recharge sites. The integration of thematic layers allowed the categorization of the block into high, medium, and low recharge potential zones. High-priority zones included flat alluvial plains near riverbeds and areas with sandy soils. Medium-priority zones were largely agricultural lands with moderate slopes and forested areas. Low-priority zones encompassed rocky outcrops and barren lands with steep slopes. The study suggests several interventions to enhance groundwater recharge in the Talbehat block. Structural measures such as the construction of check dams, percolation tanks, and recharge pits can significantly improve infiltration in high-priority zones. Gabion structures along seasonal streams can reduce erosion and promote water retention. Rainwater harvesting systems, both rooftop and surface-based, should be implemented in rural and semi-urban settlements to capture and store rainfall. Farm ponds, designed to collect runoff, can serve as effective recharge structures in agricultural fields. Vegetative measures, including afforestation and agroforestry, can play a complementary role in reducing surface runoff and improving soil structure. Planting native tree species in barren and degraded lands can enhance the region's ecological balance and contribute to groundwater recharge.

Agroforestry systems that integrate trees with crops can provide dual benefits of agricultural productivity and ecological sustainability. Policy interventions and community engagement are critical to the success of groundwater recharge initiatives. Regulations to control groundwater extraction, coupled with incentives for adopting water-saving practices, can encourage sustainable water use. Capacity-building programs aimed at educating local communities on water conservation techniques can foster a sense of ownership and responsibility. Establishing community-led systems for monitoring and maintaining recharge structures can ensure their long-term functionality.

**Conclusion**

The sustainable management of groundwater resources in Talbehat block requires a multi-faceted approach that combines scientific analysis, community participation, and policy support. The delineation of recharge zones provides a roadmap for targeted interventions, while the proposed strategies ensure efficient utilization of available resources. Addressing water scarcity in the region will not only enhance agricultural productivity and livelihoods but also contribute to the broader goal of environmental sustainability.



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