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From The Editorial Desk

Madhya Pradesh, often referred to as the "heart of India" due to its vast geographical area and diverse ecosystems it has historically been a leader in forest cover among the Indian states. We know; forests play a critical role in the state's ecology, economy, and cultural fabric, supporting biodiversity, tribal livelihoods, and environmental stability. Most recent data on forest cover are source from the India State of Forest Report (ISFR) 2023, released by the Forest Survey of India (FSI).

India State of Forest Report (ISFR) 2023, the Madhya Pradesh retains its position as the state with the largest forest cover in India in terms of area, with a total forest cover of 77,073 square kilometers. This constitutes approximately 25% of the state's geographical area of 308,252 square kilometers. The state has a tree cover (trees outside recorded forest areas) of 8,650 sq km, bringing the total forest and tree cover to 85,724 sq km, or about 27.6% of the state's area. This state is also home to 9 tiger reserves 12 National parks & 22 wildlife sanctuaries making MP as the Tiger State of India with 785 tigers out of 3682 tigers in the country.

In spite of this the ISFR 2023 highlights a concerning trend; Madhya Pradesh has recorded the largest decrease in forest cover among all Indian states between 2019 and 2023, losing 612.41 sq km of forest area. This alarming decline is caused due to deforestation, mining, infrastructure development, agriculture expansion which has also caused forest fragmentation. Statistical data reveal the state has lost 344.77 sq km of tree cover outside forest areas.

Despite this, the state remains an environment & biodiversity hotspot, along with its diverse flora and fauna, and its Forest Bank Treasure of holding about 608 million tonnes of carbon sink. But, yet ongoing pressures of deforestation illegal felling, shifting cultivation, mining are still pronounced. Man animal conflicts, (human-wildlife conflicts) are continuing challenges amongst the forest & wildlife managers.

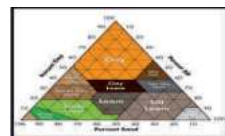
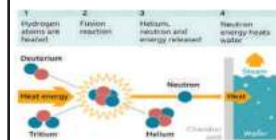
Give a thought: Over few decades; Madhya Pradesh's forests have undergone significant decrease due to detrimental activities of human. While the state maintained its top position in forest cover area; yet, the net loss of 449 sq km since 2013, coupled with notable decline of 612.41 sq km between 2019 and 2023, must worry the forest conservators & the policy makers how to curb such ongoing rising forest loss?

It is noteworthy, in the name of development; sacrificing the forests for mining (especially coal and limestone), highway construction, and agricultural expansion etc.; have intensified the climate change, prolonged dry spells, forest fires and downing of the water table of mother earth. How long we would continue to it?

Editor

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Phone: 0755-2426520 M: 9755936100

Email: menmyearth@gmail.com

Email: jkc153@gmail.com

web: www.meandmyearth.com

Regd. Office:

**H.No. 277, Rohit Nagar, Phase-I,
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STATUS AND DISTRIBUTION OF AQUATIC ANIMALS IN SON GHARIAL SANCTUARY, SIDHI, (M.P.)

- R.K. Sharma¹ A.K. Mishra²

EXECUTIVE SUMMARY

The present study was carried out to find out the status and distribution of Gharial, mugger and turtle present in the Son Gharial Sanctuary. A total of approximately 122 km. stretch in the Sanctuary was studied and data related with population of Gharial, mugger turtles, habitat features, river profile, human activities and threats were collected. A total of 48 Gharial, 36 Mugger, 90 Turtles (47 Hard-shell and 43 Soft-shell turtle). Training was also arranged to train staff of Son Gharial Sanctuary for future conservation and management of aquatic animal.

INTRODUCTION:

The River Son is a major tributary of River Ganga.

It originates from Shosa Kund in Amarkantak Bilaspur District of Chhattisgarh. The river flows through Madhya Pradesh, Uttar Pradesh and meets Ganga in Bihar. The Son Gharial Sanctuary was notified as Sanctuary by Madhya Pradesh Forest Department in 1981 (vide Gazette No. 14-47-80- 10(2) Bhopal. dated 23-09-1981) 161 km stretch of the Son River from the Ban Sagar Dam to Deora up to U.P. Border (Figure 1). The Sanctuary falls within longitude 81°20' and 82°50' E and latitude 24.15' and 25°40' N. The Sanctuary also includes Gopad and Banas River totaling an additional 48 km. At certain points, the river varies widely in depth from 1 feet to 30 ft. The Sanctuary was a safe adobe for Gharial, mugger, turtles and birds for past decades. It was also declared as breeding ground for Indian Skimmer and Chitra indica in recent years.

Studies on riverine ecology and diversity of aquatic animals in Son Gharial Sanctuary from Terideh to Deora last limit of the Sanctuary has been conducted earlier by few workers, Sharma and Sharma (1997), Sharma et al (1999, 2011, 2018), Sharma (2000, 2006, 2013), Tarun et. al. (2013).

METHODOLOGY:

The present survey has been carried out between 3rd to 8th March 2020, covering a total stretch of approximately 122 kms. in Son Gharial Sanctuary, comprising of 101 km. of son river between Sikarganj (Terideh) up to Harna Down and 21 kms. of Banas river (a tributary

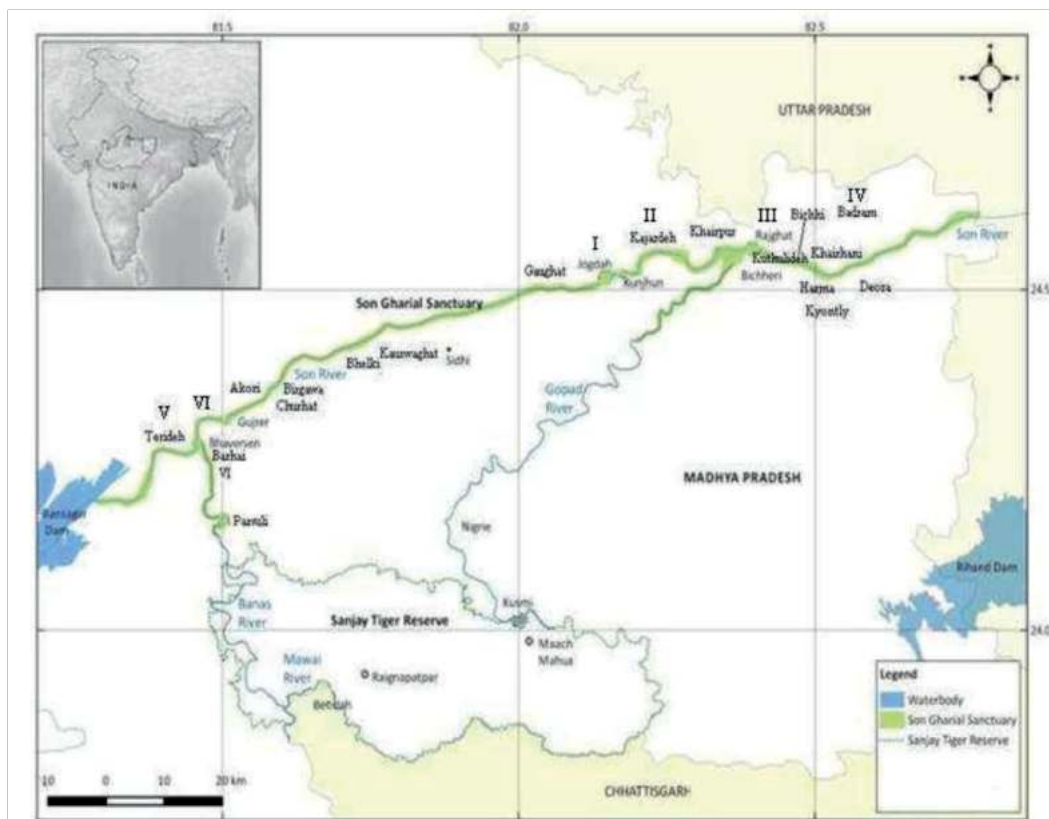
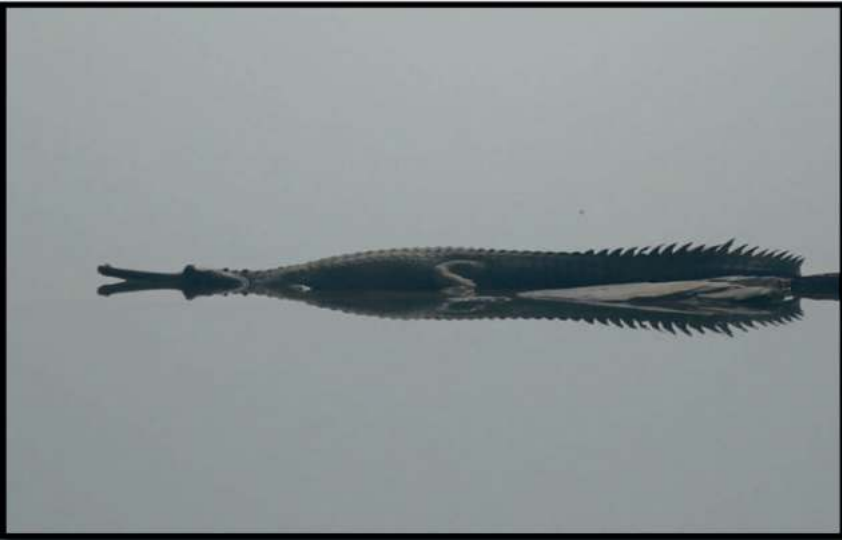


Figure 1: Map of Son Gharial Sanctuary, Sidhi (M.P.)



Gharial Basking Mid-island at Jogdah ghat in Son River

of son river) between Parsuli to Barhai (Figure 1). A survey was carried out for distribution of key aquatic fauna and identification of Gharial and mugger habitats. Elaboration of methods for the field surveys and gharial enumeration in Wild habitats :

The population of Gharial and Mugger was estimated by direct sighting method for different age groups according to IUCN criteria. Many methods for survey and population assessment of crocodilians has been developed each suited to a different crocodilian species or the habitats they occupy. The methods for the assessment of gharial population used in this study were devised and improved upon by previous workers who studied the gharial. The protocol of the field survey was based on the description given in Singh (1985) for Gharial, Mugger and turtles. A one day training programme was also organised by officials of Son Gharial Sanctuary and theoretical training was given on the practical aspects of conservation of the species.

The winter daytime absolute-count for enumeration of gharial populations:

It is well known that gharial, like other crocodilians, are poikilothermic reptiles whose body temperatures vary with that of the their environment. In winter when ambient temperatures in Northern India drop to the range of min 1-5oC to max 20-25oC then gharial are unable to maintain their body temperatures at preferred levels in spite of daylong basking activity. This ensures that during this season

all gharial spend almost all the daylight hours on land.

RESULTS AND DISCUSSION:

Status of Gharial (*Gavialis gangeticus*):

The range of distribution of gharial was much wider in the Indian subcontinent. There are many anecdotal accounts and notes regarding abundance of gharial in the 19th century. Descriptions refer to "hundreds" of gharial in Ganges, Yamuna and Mahanadi. The range got shrunk toward the end of the 19th century and particularly after the middle of the 20th century. Twentieth century description mention presence of gharials in the river systems of Indus, Ganges, Brahmaputra and Irrawady; which covered from west of east the countries of Pakistan, Indian, Nepal, Bhutan, Bangladesh and Myanmar. (Singh 2018)

In present time gharial have become extinct in most of their previous habitats, and wherever they still occur, are highly threatened because of human pressure on habitat and the changing river profile traced to have origin from changing climate and reducing vegetation in river catchments. (Singh & Sharma 2015).

During the present survey, a total of 48 Gharials comprising 09 adult females, 07 sub- adult, 32 Juveniles were recorded. (Table-1). The maximum numbers of Gharials (46) were sighted between Jogdahghat to Rampur and the minimum numbers (2) were sighted between Kuthulideh to Bichhi.

STATUS OF MUGGER (*Crocodylus palustris*):

The mugger or marsh crocodile lives in stagnant water, reservoirs, lakes, and rivers... In most areas of its distribution the mugger makes burrows for habitation. Muggers usually eat fish, frogs, snakes, crustacean, birds



Mugger Basking on the river bank

and large mammals. They also eat dead animal found in or near the water and help keep the environment clean. The crocodile plays a vital ecological role as master predator in the aquatic habitats where it lives. During the present survey, 36 muggers of various size groups , 14 adults, 8 sub-adults, 6 juveniles, and 8 yearling/hatchling were recorded in the sanctuary .(Table-1)

STATUS OF TURTLES:

Enumeration of turtles by individual species, when basking in same size groups, is difficult from a distance. Turtle sightings during the survey were categorized as hard or soft- shell turtles. The number of turtles sighted during such surveys is not indicative of the actual population size of turtles in the river. The data shown below only represents the population which was seen by the survey team. All turtles sighted were counted and noted on the data sheets. A total of 90 turtles (47 hard shell turtles and 43 soft shell turtles) were sighted during the present survey (Table -1).



Soft-Shell Turtle Hard-Shell Turtle

Table-1. Aquatic Animals sighted in Son Gharial Sanctuary 2020

S. No.	Species		Numbers	Total Numbers
1.	Gharial	Male	0	48
		Adult Female	9	
		Sub-Adult	7	
		Juvenile	32	
		Yearling	0	
		Hatchling	0	
2.	Mugger	Adult	14	36
		Sub-Adult	8	
		Juvenile	6	
		Yearling/Hatchling	8	
3.	Turtle	Hard-Shell	47	90
		Soft-Shell	43	

TRAINING PROGRAM :

Training program was carried out on 4th March 2020 at Jogdah in the presence of Shri B.P. Tiwari superintendent of Son Gharial Sanctuary Sidhi. A total of 14 members participated in the training program including forest Range Officer, Foresters and Forest Guards. During training program detailed conservation and management aspects of Gharial, Mugger and Turtles, Census techniques, Nest Searching, Protection , Egg collection methodology, Ex-Situ and In-situ conservation methods, etc in Son Gharial Sanctuary were thoroughly explained.

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Author is :
Retd. Research Range Officer
National Chambal Sanctuary
Morena (M.P.). Notably, he initiated gharial rearing programs and received recognition for wildlife conservation contributions and he continue to play a vital role as a member in IUCN-CSG, TSA, IRDC-GCA amongst others, and have over 100+ publication in various renowned International and national journals and books.



2. Has been a Retd. Chief Conservator of Forest & Field Director of the Sanjay Dubri National, Madhya Pradesh.

Role of Psychology in the Forest and Environmental Management

- Dr. Deleep Kumar (I.F.S)

INTRODUCTION

Humans have an innate ability to understand the behavior of others within a social context. Historically, this ability has played a significant role in safeguarding forests and the environment. The key principle guiding this conservation effort was frugality—using natural resources wisely to ensure their availability for future generations. In early human civilization, greed was not a predominant factor; however, with the advancement of comfort and convenience, insatiable greed emerged, leading to excessive and imbalanced consumption of natural resources.

This situation called for the intervention of professionals who could enhance mental resilience and promote sustainable behavior. This necessity led to the emergence of psychologists as key figures in addressing environmental challenges.

In the early 1960s, the publication of *Silent Spring* (1962) by Rachel Carson acted as a catalyst for the modern environmental movement. Environmental concerns gained traction, eventually leading to the establishment of organizations like the Environmental Protection Agency (EPA) in the United States. Similarly, in India, then-Prime Minister Indira Gandhi attended the Stockholm Conference on the Human Environment in 1972, where she emphasized that poverty was a major cause of environmental degradation. For the first time, the conference crystallized the idea that environmental integrity, peace, and development are interdependent and that civil society's participation is crucial for addressing environmental issues.

Indira Gandhi played a pioneering role in environmental conservation, spearheading legislative and policy initiatives for environmental protection. During her tenure, several environmental acts and regulations were enforced, highlighting the growing significance of environmental governance.

Psychologists gained prominence in mitigating the impact of climate change and environmental degradation, leading to the emergence of environmental psychology. This field focuses on the interrelationship between humans and their environment. Pioneers like Harold Proshansky, William Ittelson, and Robert Bechtel contributed significantly to its development.

During the 1990s and early 2000s, the psychological aspects of environmental conservation gained further recognition. Scholars such as Stephen Kaplan and Rachel Kaplan played a crucial role in advancing conservation psychology, which emphasizes behavioral changes to promote sustainability.

Several theories and concepts in environmental psychology offer valuable insights into fostering a sustainable mind set. These include:

- **Biophilia Hypothesis** – The idea that humans have an inherent connection to nature and that nurturing this connection can enhance environmental stewardship.
- **Restoration Theory** – The notion that exposure to nature can restore cognitive functions and improve mental health, thereby encouraging sustainable behaviors.
- **Environmental Identity** – The concept that integrating environmental concerns into personal identity can lead to more consistent pro-environmental actions.

Climate change has already caused irreversible damage, manifesting in more frequent cyclonic activities, cloud bursts, landslides, avalanches, glacier melting, species extinction, and an increase in respiratory diseases. These changes have disrupted social harmony on a global scale. If immediate action is not taken, the restoration of environmental balance will become nearly impossible.

This is the crucial moment for psychologists to take decisive action. By addressing public attitudes and emotions, psychologists can drive behavioral changes necessary for forest and environmental conservation. Adopting a mission-mode approach, psychologists can help transcend national boundaries to create a collective movement toward sustainable living.



sense of collective responsibility.

- Through education and engagement, they encourage sustainable behaviors and active participation in environmental initiatives.

NATURE BASED INTERVENTION:

Psychologists can promote the benefits of spending time in nature through programs like forest therapy. These programs, such as Japan's forest bathing for school children, help improve mental health and build a stronger connection to the environment.

UNDERSTAND HUMAN BEHAVIOR AND ENVIRONMENT:

1. Psychologist can help to design effective strategies to promote sustainable practices.
2. Psychologist can Address the environmental issues.
3. Psychologist can Encourage the people for positive interaction with natural environment.
4. Psychologist is helpful in identifying barriers to pro-environmental behavior and developing intervention.

KEY ROLE OF A PSYCHOLOGIST:

- Understanding environmental attitudes and perception.
- Understanding how people perceive environmental issues, and their belief about climate change.
- Devise communication strategies to change the belief system of public and their general perception.

DESIGNING EFFECTIVE COMMUNICATION STRATEGIES:

1. Analyze the factors like denial, perceived lack of control, or belief that individual action do not matters, which can hinder the people from liking environmentally responsible action.
2. Identifying psychological barriers to pro-environmental behavior.

PROMOTE ECO-FRIENDLY DECISION MAKING:

Psychologists can guide policymakers in designing policies and incentives that encourage sustainable choices by leveraging insights on cognitive biases and social norms. This includes strategies like framing messages effectively, using default options, and creating social incentives to promote proenvironmental behavior.

COMMUNITY ENGAGEMENT AND OUTREACH:

- Psychologists can facilitate community outreach by organizing workshops that address environmental issues, promote conservation efforts, and foster a

ASSESSING ENVIRONMENTAL-MENTAL HEALTH NEXUS:

Psychologists can study how environmental damage, natural disasters, and climate change affect mental health. They can also develop strategies to help people cope and build resilience.

SPECIFIC AREAS OF INTERVENTION:

- **Risk Perception:** Studying how visual landscapes, like urban forests, influence people's emotions and environmental awareness.
- **Environmental Aesthetics:** Using psychological principles to promote conservation and protect biodiversity through design and engagement.

ROLE OF AN ENVIRONMENTAL PSYCHOLOGIST:

- **Encouraging Behavioral Change:** Helping people adopt eco-friendly habits.
- **Promoting Environmental Solutions:** Raising awareness about sustainable practices.
- **Fostering Pro-Environmental Behavior:** Motivating individuals to act responsibly toward nature.
- **Re-evaluating Human-Nature Relationships:** Understanding and improving our connection with the environment.
- **Encouraging Sustainable Living:** Supporting lifestyles that reduce environmental impact.
- **Creating a Better Planet:** Ensuring a healthier and more sustainable world for future generations.

URBANIZATION & HUMAN-NATURE CONNECTION:

- Large-scale industrialization and urbanization have negatively impacted the relationship between humans and the natural environment (Soga & Gaston, 2015).
- The fast-paced modern lifestyle leaves little time for individuals to enjoy a fulfilling life, making aging a major concern, particularly in China and Korea. This

shift affects people's attitudes, emotions, and behaviors toward nature, creating a cycle of disconnection.

- Kesbir and Kesbir (2017) found a decline in references to nature in cultural products such as fiction, books, films, and song lyrics since the 1950s, suggesting that this trend may contribute to a reduced sense of curiosity, respect, and concern for nature.

ROLE IN ENVIRONMENTAL LAW ENFORCEMENT:

- **Assisting Law Enforcement & Forest Officials** – Providing psychological insights to police and forest officers on investigation strategies, suspect behavior, and effective interrogation techniques.
- **Legal Support & Court Proceedings** – Preparing pre-sentence reports for courts and advising on the best methods for interviewing suspects and cross-examining witnesses.
- **Criminal Profiling** – Utilizing psychological theories and research to develop offender profiles, aiding in tracking and apprehending wildlife criminals.
- **Understanding Wildlife Crime Networks** – Analyzing how organized wildlife crime operates under sophisticated supply chain systems, often rivaling multinational businesses.
- **Global Impact & Interpol's Role** – Addressing the biodiversity, economic, and social threats posed by wildlife crime, with international agencies like Interpol playing a key role in dismantling these networks.

KEY CHALLENGES IN ENVIRONMENTAL ADVOCACY:

- **Interdisciplinary Collaboration** – Bridging the gap between legal, scientific, and policy perspectives

through joint initiatives, workshops, and cross-sector partnerships.

- **Funding Limitations** – Seeking diverse funding sources such as grants, private sector sponsorships, and innovative financial models like carbon credits or green bonds.
- **Public Resistance** – Utilizing behavioral science, social marketing, and community engagement strategies to encourage sustainable habits.
- **Psychological Impacts of Climate Change** – Addressing eco-anxiety through awareness campaigns, mental health support, and resilience-building initiatives.

CONCLUSION:

- **Expanding Opportunities:** Psychology plays a vital role in sustainability and conservation.
- **Interdisciplinary Need:** Collaboration with scientists and policymakers is essential.
- **Behavioral Impact:** How we think and act shapes the future of our planet.
- **Forensic Role:** Psychology aids in addressing wildlife offenses.



About Me

- Renowned Conservationist & Former IFS Officer – Served in the Indian Forest Service (1989 batch) for over 30 years.
- Expert in Forest Governance & Wildlife Protection – Held key leadership roles, including Principal Chief Conservator of Forests (Protection), Madhya Pradesh.
- Acclaimed Author & Researcher – Authored books on biodiversity, endemic species, and indigenous knowledge.
- Continued Impact Post-Retirement – Actively engaged in research, policy development, and global conservation advocacy.
- Visionary Leader in Sustainability – Committed to preserving India's natural heritage through innovation and strategic initiatives.

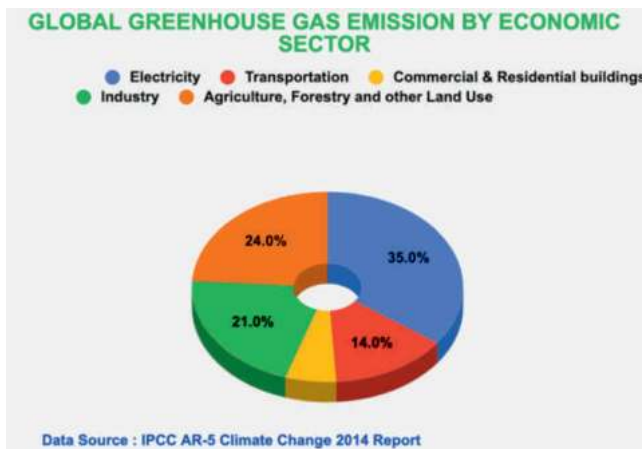


HARNESSING THE POWER OF THE STARS FUSION ENERGY FOR A SUSTAINABLE FUTURE

- Prabhakar A.R Bende

Scientists, environmentalists, and world leaders are continuously focusing their attention on finding a solution to the abatement of anthropogenic climate change, resulting from the rapid rise in greenhouse gas emissions, which are threatening the planet's ecosystems. In the last century, our planet has undergone a drastic rise in temperature, 1.1°C since the pre-industrial period (1850-1900). Global carbon dioxide emissions from fossil fuels and industry totaled 37.01 billion metric tons in 2023. Emissions are projected to have risen 1.08 percent in 2024 to reach a record high of 37.41 billion metric tons. Since 1990, global CO₂ emissions have increased by more than 60 percent. The major threats of climate change include water conflicts, agricultural disruptions, increased natural disasters, risks to critical infrastructure, economic instability, widening inequality, public health threats, resource-related geopolitical conflicts, and risks to the planet's biodiversity.

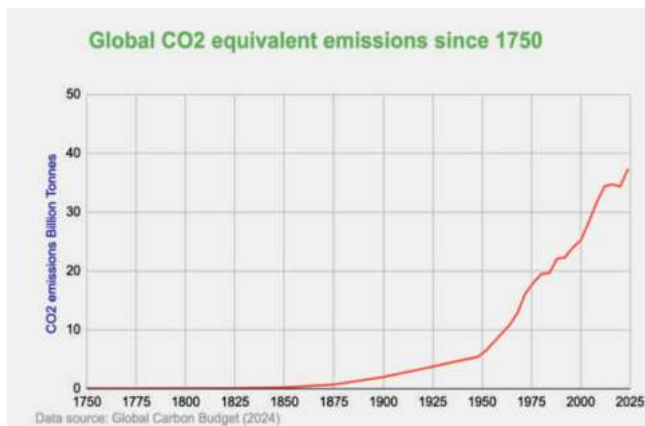
The electricity and transportation sectors together account for about half of the global emissions and that is why the main focus is on transiting these two economic sectors from fossil fuel to renewables to reach net zero. With the corresponding contribution of Coal, Methane, Nitrous oxide and Fluorinated gases in total greenhouse gases emissions as 76%, 16%, 6% and 2%, global warming has started to exhibit its adverse impact across the globe. The detrimental outcomes of climate change on different sectors of society are increasingly visible globally. The threat is expected to grow most likely in a nonlinear way until the world achieves transitions to a net zero economy which is one of humankind's greatest challenges. The historic Paris Agreement (COP21) has set out a global



framework to mitigate climate change by limiting global warming to well below 2°C above pre-industrial levels and pursuing efforts to limit it to 1.5°C. It marked the beginning of a shift towards a net zero emission world.

To deal with these threats, governments and organizations are constantly working to incorporate climate resilience and adaptation strategies into their planning. The transportation sector is quickly shifting to green fuels, while the reliance on fossil fuels for electricity is declining as renewable energy sources gain ground. Though existing renewable energy resources are core elements to mitigate climate change, they are not sufficient on their own. Solar and wind energy have an inherent intermittent quality and cannot substitute for baseload generation. Solar, Wind, hydro and geothermal sources have seen substantial growth over the period but they still account for about one-third of global electricity generation, thereby forcing reliance on fossil fuels for base load power requirements. Nuclear fission power could serve as an alternative to fossil fuels for reliable energy supplies, but it faces significant challenges, including high upfront costs, lengthy development timelines, geopolitical risks, and public concerns about radioactive waste and safety. The inherent limitations of nuclear fission technology make it less attractive, highlighting the need for the development of new technologies that are as efficient as nuclear fission to meet baseload power requirements. This is where nuclear fusion technology comes into play, although it is still in the research and development phase.

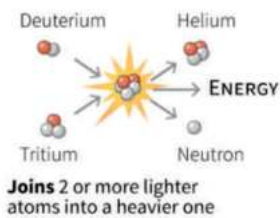
Nuclear fusion technology holds the potential to revolutionize energy production by offering a clean and



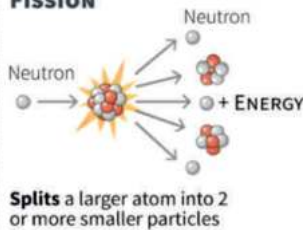
Fusion vs fission

Nuclear reactions that produce massive amounts of energy, but have different processes

FUSION



FISSION



Sources: US Energy Dept, Duke Energy, EIA

virtually limitless source of power with minimal environmental impact. Unlike nuclear fission, which powers current nuclear reactors through the splitting of heavy atomic nuclei like uranium-235 or plutonium-239, nuclear fusion generates energy by combining light atomic nuclei into a heavier one, mimicking the process that powers the sun. While fission produces long-lasting radioactive waste that requires careful disposal, fusion generates minimal waste, most of which has a much shorter half-life. Additionally, the supply of nuclear fission fuel is heavily influenced by geopolitical factors and international sanctions, whereas fusion fuel, primarily isotopes of hydrogen, is abundant and widely available across the globe.

The concept of thermonuclear fusion was first understood in the 1930s. In 1950, American physicist Ira B. Bernstein described the necessity of a magnetic field to create magneto-hydrodynamically stable conditions for the fusion plasma. Since then, scientists and engineers have been relentlessly pursuing the goal of harnessing fusion energy for commercial purposes. While the Sun's massive gravitational force naturally induces fusion, without that force, a temperature at least ten times higher than in the Sun is needed for the reaction to take place. On Earth, temperatures exceeding 100 million degrees Celsius are required to induce fusion between deuterium and tritium. Simultaneously, it is necessary to regulate pressure and magnetic forces to ensure stable plasma confinement. The first successful controlled thermonuclear fusion reactions in a laboratory were achieved in 1958 at Los Alamos National Laboratory (LANL) of the United States Department of Energy. Achieving the dream of commercial fusion power has been the Holy Grail of engineering for the last 80 years. A major breakthrough occurred on 5th December 2022, when scientists performing an inertial confinement fusion (ICF) experiment at the National Ignition Facility (NIF) at Lawrence Livermore, USA, achieved producing more energy from the self-sustaining controlled fusion reaction than was consumed to create it, with an energy gain factor of 1.5. This is one of the most impressive scientific achievements of the 21st century, as fusion could

generate four times more energy from the same amount of fuel than fission, and nearly four million times more energy than burning oil or coal. Recently, France set a new record by sustaining a fusion reaction for over 22 minutes, surpassing the previous record of 18 minutes held by China.

Fusion fuels, such as deuterium and tritium, are derived from water and lithium, respectively. Deuterium is abundant in water, while tritium is produced by irradiating lithium-6 with neutrons. Additionally, tritium is also generated as a by-product in both fission and fusion reactions. This characteristic makes the fuel supply for fusion potentially more sustainable, as tritium can be bred directly within the reactor itself.

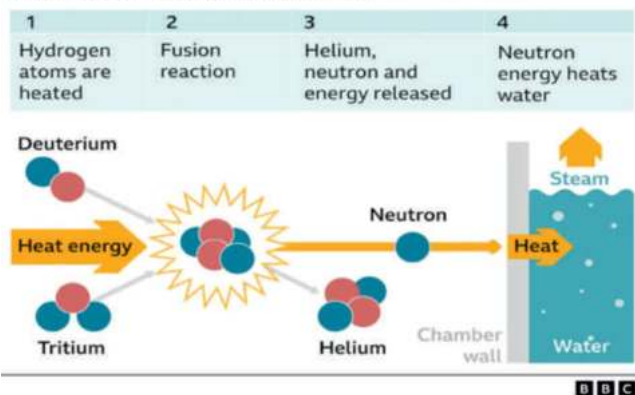
Fusion energy is considered vital for future climate change strategies, as it holds the potential to provide boundless, clean, and sustainable energy. Unlike fossil fuels, fusion generates no carbon dioxide or other greenhouse gases during energy production. This makes fusion energy a promising alternative to fossil fuels, offering the potential to significantly reduce greenhouse gas emissions and play a key role in mitigating climate change. As such, fusion energy could prove to be an invaluable clean energy source.

Fusion processes produce significantly less radioactive waste, with shorter half-lives, thereby reducing the long-term environmental impact and challenges associated with waste management. Fusion energy also eliminates the risk of catastrophic accidents like meltdowns, as the conditions required to sustain a fusion reaction, extremely high temperature, pressure, and confinement, are difficult to maintain, and the reaction would quickly cease if these conditions are not met. However, fusion reactions rely on powerful magnetic fields to confine the hot plasma, and uncontrolled instabilities remain a challenge. Additionally, tritium, a radioactive isotope of hydrogen, presents significant safety and environmental risks when handling and storing it, though these risks are not as severe as those associated with managing fission fuels. Therefore, continued research and development are essential to address the potential risks of fusion technology. It is important to note that despite abundance of fuel, harnessing fusion energy on earth is a complex technological challenge.

The simplified overview of how the fusion process is managed in reactors like the Tokamak or Stellarator covers five main stages: fuel preparation, creating extreme conditions to initiate the fusion reaction, confinement methods, the fusion reaction itself, and energy extraction. These stages are briefly explained below:

Fuel Preparation : The most common fusion reaction uses isotopes of hydrogen, deuterium and tritium. Deuterium can be extracted from water, while tritium is produced from lithium. There are substantial reserves of lithium on

How nuclear fusion works



earth that could last for immeasurable period of time.

Creating Extreme Conditions : Hydrogen isotopes must be heated to extremely high temperatures, exceeding 100 million degrees Celsius to initiate nuclear fusion. At these temperatures, the gas turns into plasma, an electrically charged state of matter where electrons are separated from nuclei.

Confinement Methods: Magnetic confinement uses powerful magnetic fields to contain and control the hot plasma, preventing contact with the reactor walls, whereas Inertial confinement utilises lasers or ion beams to rapidly compress a tiny fuel pellet, creating the extreme temperature and pressure conditions required for fusion.

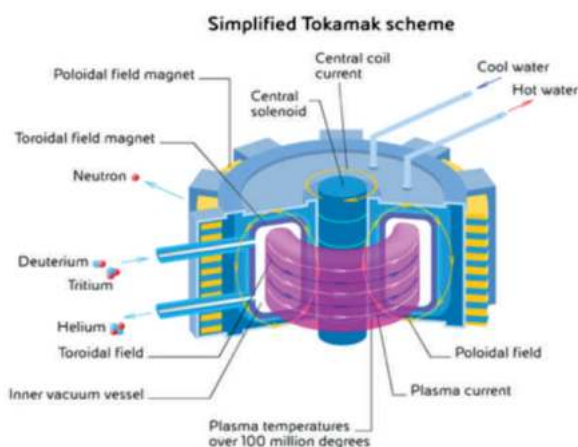
Fusion Reaction : Under these extreme conditions, the nuclei of deuterium and tritium overcome their natural repulsion and fuse together. This reaction produces a helium nucleus, a neutron, and releases a tremendous amount of energy, mostly carried by the neutron.

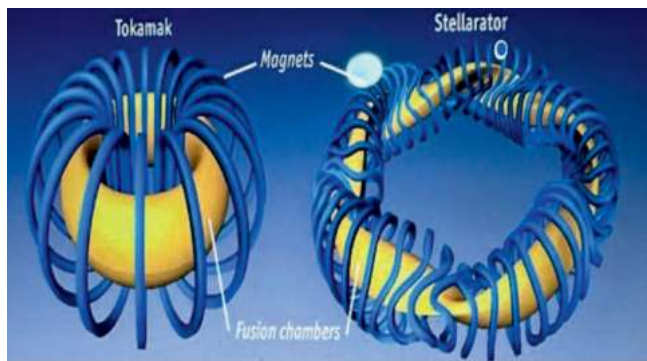
Energy Extraction : The high-energy neutrons, generated during the fusion process, escape the magnetic confinement field and are absorbed by a surrounding lithium blanket. The energy from the neutrons is transferred to the lithium blanket, causing its temperature to rise. This heat is then used to generate steam, which drives turbines to produce electricity, mirroring the process in traditional power plants.

The fusion reaction is achieved in specialized reactors such as Tokamaks and Stellarators. Both utilize powerful magnetic fields to confine plasma in a donut-shaped (torus) configuration, which facilitates the fusion process. In Tokamaks, three sets of large magnetic field coils are used: Toroidal field coils, Poloidal field coils, and the Central Solenoid. These coils work together to create a complex magnetic field that confines and heats the plasma, providing the conditions necessary for controlled nuclear fusion. In contrast, Stellarators rely on an intricate arrangement of multiple magnetic field coils that encircle the

plasma. This design creates a complex, three-dimensional twisted magnetic field that wraps around the toroidal shape, eliminating the need for a central current. Stellarators offer several advantages over Tokamaks, including lower power requirements to sustain the fusion reaction, greater design flexibility, and a reduced likelihood of plasma disruptions. However, a significant challenge for Stellarators is their difficulty in confining the most energetic particles within the plasma, which are essential for sustaining the fusion reaction. Scientists are working diligently to address this issue and improve Stellarator technology to make it a viable alternative. Both Tokamaks and Stellarators are effective at maintaining high temperatures and confining plasma, which are crucial for achieving controlled fusion reactions. Tokamaks are among the most common types of magnetic confinement fusion devices, and much of the current research is focused on them to achieve controlled nuclear fusion. However, research into Stellarators is also gaining momentum. Different designs are being explored worldwide to overcome the technical challenges associated with achieving net energy gain from fusion reactions. Each reactor type has its own advantages and challenges, and it is likely that a combination of various designs will pave the way for successful commercial fusion energy.

The International Thermonuclear Experimental Reactor (ITER), a flagship of intergovernmental collaboration, is conducting a massive international nuclear fusion research and engineering project involving the European Union, United States, Russia, China, India, South Korea, and Japan. The ITER organisation was officially established on October 24, 2007, after all partners signed the agreement. Based in France, ITER is an intergovernmental scientific and engineering organization responsible for designing, constructing, and operating the reactor. This large-scale scientific experiment aims to demonstrate the feasibility of fusion power as a large-scale, carbon-free energy source. ITER will be the world's largest experimental tokamak, with the goal of producing





10 times more fusion power than the heat energy used to initiate and sustain the reaction.

ALCATOR-C-MOD, a compact, high magnetic field tokamak at the Massachusetts Institute of Technology (MIT) Plasma Science and Fusion Center (PSFC), has provided much of the research foundation for SPARC, the world's largest near-commercial experimental fusion reactor currently being developed by the U.S.-based start-up, Commonwealth Fusion Systems (CFS). The SPARC tokamak, a high-field compact fusion reactor, is designed to be the world's first commercially viable fusion device, aiming to produce more power than it consumes. The SPARC reactor uses advanced high-temperature superconducting (HTS) magnets, with 18 magnets, each producing 20 Tesla. The success of SPARC is expected to pave the way for ARC, a full-scale fusion power plant in Virginia, USA, capable of providing significant grid-connected power.

India is contributing to ITER and has been developing its own domestic fusion program, focusing on tokamak technology and fusion materials. Indian research institutions, such as the Institute for Plasma Research (IPR), have been central to advancing fusion science. The IPR operates the ADITYA and SST-1 (Steady-State Superconducting Tokamak) devices to experiment with plasma confinement and heating. These initiatives emphasize India's commitment to harnessing nuclear fusion as a future energy solution. The emergence of the domestic private sector, such as Anubal Fusion, a start-up established in May 2024, also highlights India's growing ambition to participate in fusion technology development. Anubal Fusion has formed partnerships with prominent institutions, including the Tata Institute of Fundamental Research (TIFR) in Hyderabad and IIT Madras.

Two developments in the coming years could mark a significant shift from the public to the private sector in the quest to generate cheap and abundant clean power from fusion. The first is the commissioning of SPARC, the world's first near-commercial 140 MW experimental tokamak, by the private firm Commonwealth Fusion Systems (CFS), which is expected towards the end of 2025 or early 2026. Following the SPARC demonstration, CFS will

proceed with the construction of ARC, the world's first 400 MW grid-connected fusion power plant, marking a major milestone in the commercialisation of fusion energy. The ARC fusion power plant is targeted to be commissioned by the mid-2030s. The second development is the significant delay in the opening of ITER, which was originally scheduled to be ready by 2025. ITER has postponed its timeline due to several reasons, including the pandemic, which led to supply-chain and quality control delays, component faults, and pauses in construction demanded by the French Nuclear Regulator. As a result, the final stage of the ITER project has been delayed from 2035 to 2039, with a €5 billion cost overrun.

Fusion as a primary energy source by mid-century is becoming increasingly possible. With recent advancements in magnetic confinement and high-temperature superconductors, the vision of harnessing the power of the stars no longer feels like distant science fiction. We may see the first commercial fusion power plants emerge, but widespread adoption will depend on sustained scientific and technological breakthroughs, coupled with global investments and policy support. Until then, other clean energy technologies are likely to continue dominating the energy landscape.

As climate change accelerates, threatening ecosystems and human life, the greatest challenge lies in finding transformative solutions. Fusion energy stands as one of the most promising breakthroughs on the horizon. It offers hope for a cleaner, more sustainable future, a potential game-changer in humanity's fight against climate change.



Former Managing Director, MP Power Transmission Company Limited & MP Power Generating Co. Ltd.

SOIL TESTING AND ITS METHODS: AN OVERVIEW

- Sukriti Gupta¹ Vaibhav Singh²

ABSTRACT:

Soil testing plays a pivotal role in modern agriculture and land management, offering crucial insights into soil health and fertility. This article provides a comprehensive overview of soil testing, its significance, various methods employed, and their applications. By understanding soil properties, farmers and scientists can make informed decisions about crop cultivation, land usage, and sustainable practices.

Keywords: Soil, Soil testing. Soil testing methods

INTRODUCTION:

Soil is a fundamental resource for agriculture, forestry, and environmental conservation. The composition and health of soil directly influence crop yield, plant health, and ecosystem balance. Soil testing, a systematic process of analyzing soil's physical, chemical, and biological properties, is essential for optimizing agricultural productivity and maintaining environmental sustainability.

OBJECTIVES OF SOIL TESTING:

1. Determine nutrient availability.
2. Assess soil pH and acidity levels.
3. Identify deficiencies in essential nutrients.
4. Guide fertilizer application and land management practices.

IMPORTANCE OF SOIL TESTING:

1. **Improved Crop Yields:** Soil testing helps identify nutrient deficiencies and recommends specific interventions.
2. **Cost Efficiency:** Reduces unnecessary expenditure on fertilizers and other inputs.
3. **Environmental Protection:** Prevents overuse of chemicals that can lead to soil degradation and water contamination.
4. **Sustainable Farming Practices:** Promotes precision agriculture and conserves natural resources.

METHODS OF SOIL TESTING:

Soil testing methods are broadly classified into physical, chemical, and biological analysis. Below is a detailed description of each category:

1. Physical Analysis:

Physical analysis assesses the texture, structure, moisture content, and other mechanical properties of soil.

I. Soil Texture Analysis:

Hydrometer Method: This method determines the

proportions of sand, silt, and clay in soil by measuring the sedimentation rate of soil particles in a liquid.

Sieve Analysis: Soil is passed through a series of sieves with varying mesh sizes to separate particles based on size.

Laser Diffraction: This advanced method uses laser technology to measure the size distribution of soil particles with high precision.

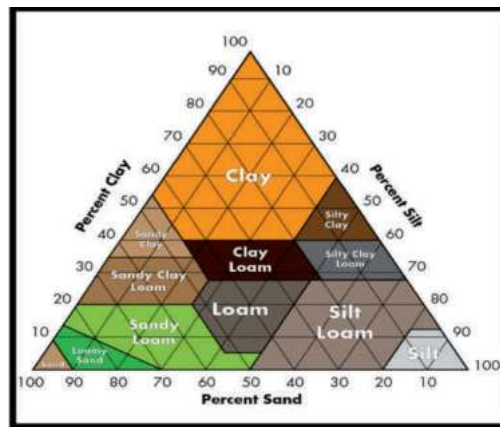


Fig 1: Example of Soil Texture Triangle

II. Bulk Density and Porosity:

Bulk density is measured by collecting a known volume of soil and drying it to obtain the weight per unit volume.

Porosity is calculated from bulk density and particle density to estimate soil aeration and water retention capacity.

III. Soil Moisture Content

Gravimetric Method: Weighing soil before and after drying at 105°C.

Tensiometer: Measures soil water tension in the field.

Time-Domain Reflectometry (TDR): Uses electromagnetic pulses to estimate soil moisture content accurately.

2. Chemical Analysis

Chemical analysis evaluates the nutrient composition, pH, salinity, and presence of contaminants.

I. Soil pH Testing

Colorimetric Methods: Using pH indicators or strips.

Electrode-Based Methods: Using a pH meter with a glass electrode for precise measurements.

Table 1: Soil pH and its impact on crop growth.

S.no.	pH Range	Crop suitability	Examples
1.	4.5-5.5	Acidic, low productivity	Tea, Coffee
2.	5.5-6.5	Slightly acidic, optimal productivity	Wheat, Rice
3.	6.5-8.0	Neutral to slightly alkaline	Maize, Barley

II. Nutrient Analysis:

Macronutrients (NPK):

Nitrogen: Determined using the Kjeldahl method or nitrate-specific electrodes.

Phosphorus: Analyzed using colorimetric methods or spectrophotometry.

Potassium: Measured via flame photometry or atomic absorption spectroscopy.

Micronutrients: Elements like iron, zinc, and manganese are analyzed using atomic absorption spectroscopy (AAS) or inductively coupled plasma (ICP) spectroscopy.

Table 2: Different soil testing methods for macronutrients.

Parameter	Testing method	Impact on crop yield
Nitrogen (N)	Kjeldahl method	Ensures healthy foliage
Phosphorus (P)	Spectrophotometry	Boosts root development
Potassium (K)	Flame photometry	Improves stress tolerance

III. Soil Organic Matter (SOM)

Loss-on-Ignition (LOI): Soil is heated to high temperatures to measure weight loss due to organic matter combustion.

Walkley-Black Method: A chemical oxidation method using potassium dichromate.

IV. Salinity and Electrical Conductivity (EC)

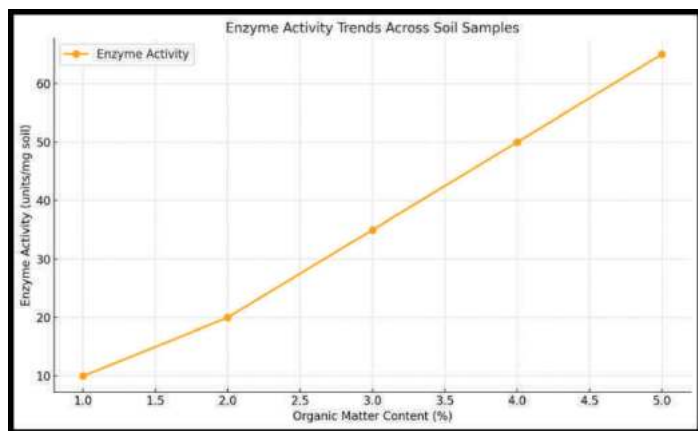


Fig 2: graph showing enzyme activity trends across soil samples with varying organic matter

Electrical conductivity meters are used to measure the salinity of soil extracts, providing insights into soil's salt content.

3. Biological Analysis

Biological methods assess microbial activity and organic components crucial for soil health.

I. Microbial Biomass

Fumigation-Extraction Method: Estimates microbial biomass carbon and nitrogen.

Soil Respiration Tests: Measure CO₂ release as an indicator of microbial activity.

II. Enzyme Activity: Assays for enzymes like dehydrogenase, urease, and phosphatase reveal soil's biochemical potential.

III. Soil Fauna Analysis: Examining earthworms, nematodes, and other organisms gives insights into soil biodiversity and ecosystem health.

4. Field Methods of Soil Testing

While laboratory methods provide detailed results, field tests are quick and cost-effective.

I. Portable Soil Testing Kits: Kits include reagents for pH, nutrient, and salinity testing, offering immediate results.

II. Penetrometer Tests: Measure soil compaction and strength, often used in construction and agriculture.

III. Remote Sensing and GIS: Satellite and drone-based sensors analyze soil properties over large areas using infrared and thermal imaging.

5. Advanced Soil Testing Techniques

With advancements in technology, several modern methods have emerged.

I. Spectroscopy: Near-Infrared (NIR) and Mid-Infrared (MIR) Spectroscopy: Provide rapid, non-destructive analysis of soil organic matter and mineral content.

II. X-Ray Diffraction (XRD): Identifies soil mineral composition and crystalline structures.

III. Soil Metagenomics: Uses DNA sequencing to study soil microbial communities and their functional potential.

IV. Automation and AI: Incorporating machine learning for more accurate predictions.

V. Portable Devices: Development of handheld soil analyzers for real-time testing.

VI. Integration with IoT: Linking soil testing data to smart farming systems.

CHALLENGES IN SOIL TESTING:

Accessibility: Limited testing facilities in rural areas.

Cost: High costs and technical requirements for advanced methods.

Time: Physical and biological tests often take weeks.

Applications of Soil Testing

1. Agriculture: Guides fertilizer application and crop

rotation strategies.

2. Land Reclamation: Assesses the suitability of degraded land for restoration.
3. Environmental Studies: Monitors soil contamination and pollutant levels.
4. Construction: Ensures the suitability of soil for infrastructure projects.

S. Sector no.	Benefits	Key Metrics Assessed
1. Agriculture	Improved crop yield , cost saving	Nutrients (NPK), pH, salinity
2. Construction	Ensures foundation stability	Bearing capacity, compaction
3. Environmental	Reduces pollution, restores health	Organic matter, contaminants

Challenges in Soil Testing

1. Accessibility: Limited availability of testing facilities in rural areas.
2. Cost: Advanced methods may be expensive for small-scale farmers.
3. Variability: Heterogeneous soil properties can lead to inconsistent results.

Case Studies

1. Agricultural Application: Punjab, India

Soil testing revealed nutrient deficiencies and high pH in rice-wheat cropping systems. A shift to balanced fertilization reduced fertilizer use by 20% and increased yield by 15%.

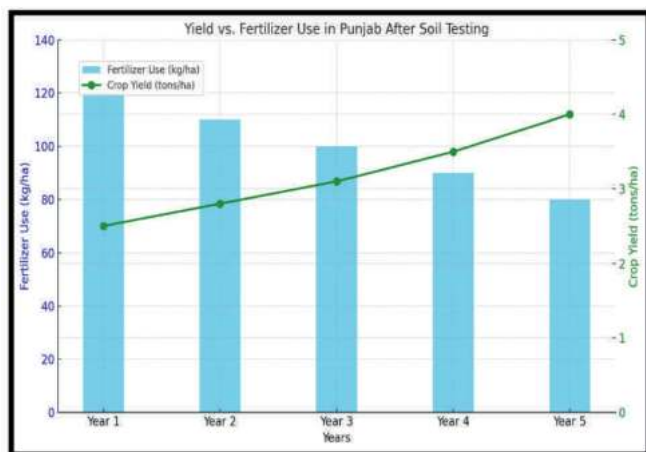


Fig 3: Bar chart showing the decrease in fertilizer use and the corresponding increase in crop yield.

2. Urban Development: Dubai, UAE

Soil bearing capacity and salinity were assessed for the BurjKhalifa foundation. Testing identified high salinity levels, prompting special foundation treatments.

Table 4: Soil Properties in Dubai Construction Sites

S.no.	Parameter	Value	Remarks
1.	Salinity (EC)	8.0 dS/m	Requires remediation
2.	Bearing capacity	250 kN/m ²	Suitable for high- rises
3.	Bulk density	1.6g/cm ³	Moderate compaction

3. Environmental Restoration: Mississippi River Delta, USA

Soil testing in the Delta guided the application of organic amendments to restore wetland ecosystems. Contaminants like heavy metals were reduced, improving biodiversity.

CONCLUSION:

Soil testing is an indispensable tool for sustainable land management and agriculture. By employing a combination of traditional and advanced methods, stakeholders can enhance productivity, reduce environmental impact, and ensure long-term soil health. Expanding accessibility and adopting modern technologies will further empower farmers and researchers.

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Authors :

¹Researcher, Dept. of Soil Science, RMLAU, Faizabad, U.P.

²Researcher, Dept. of Agri. Extension and Communication, SHUATS, Prayagraj, U.P.

MAHUA (MADHUCA LONGIFOLIA) A MULTIPURPOSE TREE SPECIES OF INDIA: A REVIEW

- Nitish Kumar¹ Rahul Kumar² Kumud Dubey³

ABSTRACT

Mahua (*Madhuca longifolia*), a vital multipurpose tree species native to India, holds significant ecological, economic, and cultural importance. Widely distributed across tropical and subtropical regions, it thrives in arid and semi-arid zones. Mahua is renowned for its diverse uses, including edible flowers for food and beverages, oil-rich seeds for culinary and industrial purposes, and timber for construction. The tree also serves as a critical source of fodder, benefits include soil conservation, carbon sequestration, and enhancement of biodiversity. Mahua plays a central role in tribal communities, particularly in India, where its products are integral to local economies and traditions. Despite its potential, overexploitation, habitat loss, and climate challenges threaten its sustainability. This review highlights the multifaceted utility of Mahua, emphasizing the need for conservation strategies and sustainable utilization to balance its ecological and economic significance.

Keywords: Edible Flowers, Climate Resilience, Rural Economy, Oil extraction, Tribe & Medicinal.

INTRODUCTION:

Mahua (*Madhuca longifolia*), a tropical tree species native to India, holds immense cultural, ecological, and economic significance. Belonging to the family Sapotaceae, it is widely distributed across central and northern India, particularly in dry and semi-arid regions. Known as the "Tree of Life" in many tribal and rural communities, Mahua is valued for its diverse uses and resilience to harsh climatic conditions. The Mahua tree grows to a height of 15-20 meters and is characterized by a dense, spreading canopy, making it an effective shade tree. Its adaptability to various soil types, including marginal and degraded lands, contributes to its importance in afforestation and soil conservation efforts. The tree's multipurpose utility is primarily attributed to its flowers, seeds, and wood. The fragrant, fleshy flowers are rich in sugar and are traditionally used to prepare local beverages and sweets. Additionally, they serve as a vital source of nutrition and income for tribal communities. Mahua seeds yield a high-quality oil, which is used for cooking, making soaps, and producing biofuel. The residual seed cake is an excellent organic fertilizer. Mahua wood, though not highly durable, finds application in making furniture, construction materials, and fuel. The tree's bark and leaves are utilized in traditional medicine to treat ailments such as skin diseases,

ulcers, and rheumatism. Moreover, Mahua plays a crucial role in supporting biodiversity, providing food and habitat for a range of wildlife species. In the context of sustainable development, Mahua offers a viable solution for rural livelihoods, energy security, and ecological balance. Its cultural and economic relevance underscores the need for conservation and promotion of this remarkable tree species in agroforestry and reforestation programs across India..

AREA AND PRODUCTION:

Mahua is a frost resistant species that can grow in marginal areas of dry tropical and subtropical forests up to an altitude of 1200-1800 m, in India. It requires mean annual temperature of 2-46°C, mean annual rainfall ranging from 550-1500 mm and mean annual humidity from 40-90 percent. Mahua trees are distributed from India to other Asian countries like The Philippines, Pakistan, Sri Lanka to Australia. It can be found scattered in pasture lands in central India, and on river banks in semi-evergreen forests. In India, large quantities of Mahua trees are found in the states of Uttar Pradesh, Madhya Pradesh, Orissa, Jharkhand, Chhattisgarh, Andhra Pradesh, Maharashtra, Bihar, West Bengal, Karnataka, Gujarat, Rajasthan and the evaluated annual production of Mahua flowers is 45000 Million tonnes. The yield of Mahua flowers varies from 80-320 kg for every tree. Madhya Pradesh is the most astounding Mahua developing state with average trade volume of 5,730 metric tonnes and worth about Indian rupees 8.4 million (Behera et al., 2016).

CLIMATE AND SOIL:

Mahua prefers tropical climate. It can withstand drought admirably. This tree does not survive under waterlogged conditions. Since it is a very hardy tree, it can grow even in pockets of soil between crevices of barren rocks. Trees even grow on degraded rocky areas including salt-affected soils. However, for its better growth and productivity, well drained, deep loam soil is ideal.

CULTIVATION AND COLLECTION:

This is a wild tree so at present it is not cultivated intentionally and naturally found in nature, but nowadays there is a strong need to cultivate this plant and make necessary changes in its genetic structure to make it more useful for commercial purpose. The application of scientific knowledge and agriculture tools is much needed to make this plant more disease resistant and more flowering along

Table-1 Constituent Present different Parts of Mahua.

Plant Part	Phytoconstituents
Bark	Flavonoids, Triterpene, Sterol
Leaf	Moisture, Organic Matter, Minerals, Potash (K_2O) Phosphoric Acid (P_2O_5) Silica, Alkaloids, Flavonoids, Protobasic Acid
Latex	Soluble Resin, Insoluble Resin
Flower	Carotene, Ascorbic Acid, Thiamine, Riboflavine, Niacine, Folic Acid, Biotin, Inositol
Mature seed	Moisture, Protein, Fat, Carbohydrates, Minerals, Calcium, Phosphorus, iron, Carotene, Ascorbic Acid, Tannins

with the enhancement of chemical constituents. The cultivation of Mahua should be done on either wild land for better availability of constituents and its seeds should be spread in the farming areas for the future collection of flower, unripe, and ripe fruits may become easier. Cultivation is generally done in the month of July to September and generally, flowering takes place in March and April. After this time, the flower converts into fruit which is also useful in both unripe and ripe conditions. Although every part of Mahua plant is useful, flower, fruit, seeds oil, and seed cake are more important (Patel et al., 2019).

USE OF MAHUA AS A FOOD:

- **Raw consumption of Mahua:** In spite of being a rich source of nutrition and easy availability in the rural areas these flowers are not very popular as food. Only a small quantity of flowers is consumed raw, cooked or

Table-2 Traditional uses of Mahua in India.

Plant Parts	Medicinal uses	References
Bark	Antidiabetic activity	Kumar and Vidhyasagar, 2011
Flower	Analgesic activity	Chandra, 2001
Leaves & bark	Wound healing activity	Sharma et al., 2010
Leaves	Nephro and hepatoprotective activity, antioxidant and cytotoxic activity	Palani et al., 2010
Leaves and stem	Antimicrobial activity	Khond et al., 2009
Seeds	Effective to alleviate pain	Prashanth and Annampelli, 2010
Seed cake	Anti-inflammatory, anti-ulcer, and hypoglycaemic activity	Seshagiri and Gaikwad, 2007

fried in different parts of India.

- **Utilization of Mahua for processing of different food products**
Sugar syrup: Abhyankar and Narayana, 1942 reports on preparation of sugar syrup from dry Mahua flowers, which can be further use as a sweetening agent in different food products.
Jam, Jelly, marmalade, pickle: Reuther et al., 1967 reported that mature (full grown) but still unripe fruits are made into jam with addition of citric acid. The pulp is also converted into marmalade or syrup, which is used as food material. Jelly is also made from the pulp alone or combined with guava to modify the astringent flavour. The pulp is also pickled. Major quantity of flowers is used in the preparation of distilled liquors. Patel, 2008 prepared the Mahua jam and jelly by using fresh flowers. The developed products were tested for their colour, flavour, taste, texture and overall acceptability, using hedonic test. According to the findings of hedonic test all the developed Mahua products were found to be highly acceptable.

**Fig 1. Observing the Mahua Plantation in Chitrakoot.**



Fig 2. Measuring the Diameter of Mahua Tree.

- **Bakery and confectionary:** Candy, biscuits and cake were prepared using the Mahua concentrate as a liquid sweetener.
- **Puree and sauce:** Patel, 2008 used fresh flowers and crushed it into puree (after manually removing the stamens) and processed it into sauce.

Nutritional and Medicinal Use:

The Mahua tree is having lots of nutritional value in it. It produces fruit which is valued for its seed which yield high quantity of fat commercially known as Mahua butter or morrah butter, many edible and medicinal applications and it is also used as a biodiesel. Its fat has been used as substitute for cocoa butter and ghee. It is one of the single largest sources of natural hard fat. The fat which is thus obtained from Mahua fruit oil is used in cooking, frying and manufacturing chocolates. The seed fat has emulsion property so it is mostly used as an emulsifying agent in few pharmaceutical industries. It is generally applied as massage oil in many part of the country, as it is very good to moisturize skin. Besides edible and medicinal uses, Mahua has industrial application as it can be utilized in the manufacture of laundry soaps and lubricants. Moreover, the seed cake is reported to have insecticidal and pesticide property and used as organic manure in crops like rice, sugarcane etc. The medicinal properties which are seen in this plant are stimulant, demulcent, emollient, heating. Skin disease, rheumatism, headache, laxative, piles, and sometimes as galactagogue, astringent and many more. Review of literature based on chemical composition of mahua flower reveals its high nutritional value. Apart from being a rich source of sugar and protein, the flowers also contain essential minerals like Ca, P, Fe, and K. Calcium is a major component of the bone and assists in teeth development phosphorus is next in importance to calcium as utilization of Ca is closely related to it. Most of the Calcium in the body is deposited as the calcium Phosphate (Bisht *et al.*, 2018).

Table-3 Nutritional properties of Mahua flower.
(Source: Kureel *et al.*, 2009).

Constituents	
Moisture	19.8
Protein	6.37
Fat	0.50
Total sugar	54.06
Calcium	8.00
Phosphorus	2.00
Ash	4.36

Tree-Borne Oil seed Mahua:

Seeds of many tree species contain high levels of oil and their use for bio-energy generation has been a topic of interest for long (Raina, 1986). Mahua oil is also edible and is used by tribal communities. All the TBOS are multipurpose in their utility, making them what is desired for agroforestry systems. However, caution is necessary in assessing whether all the uses will be realized at the same time.

Mahua seed oil:

Mahua seeds contain about 40% pale yellow semi-solid fat. The seed oil is commonly known as "Mahua Butter". The oil content of the seed varied from 33 to 43% weight of the kernel. Fresh Mahua oil from properly stored seeds is yellow in colour with a not unpleasant taste. The oil is used as cooking oil by most of the tribes in Odisha, Chhattisgarh, and Maharashtra etc.



Fig 3.- Mahua: Multipurpose tree species.

Other common uses of Mahua:

- **Fodder:** Leaves, flowers and fruits are lopped for goats and sheep. Seed cake is also fed to cattle.
- **Timber:** The heartwood is reddish brown, strong, hard and durable; very heavy (929 kg/cu. m), takes a fine finish. It is used for house construction, naves and felloes of cartwheels, door and window frames.
- **Shade or shelter:** The wide spreading crown provides shade for animals.
- **Reclamation:** Mahua is planted on wasteland with hard lateritic soils in India.
- **Erosion control:** Mahua has a large spreading superficial roots system that holds soil together.
- **Nitrogen fixing:** Vesicular-arbuscular mycorrhizal associations and root colonization have been observed in Mahua.
- **Soil improver:** These seed cakes have been used as a fertilizer.
- **Ornamental:** Mahua is occasionally planted as a avenue tree.
- **Boundary or barrier support:** It is planted a long



the boundaries of fields.

- **Intercropping:** Mahua can be raised with a gricultural crops.

Conclusion:

Mahua (*Madhuca longifolia*), a vital multipurpose tree species indigenous to India, plays a significant role in rural livelihoods, ecological sustainability, and cultural practices. Revered for its economic and ecological benefits, the tree provides a diverse range of products, including edible flowers, oil-rich seeds, timber, and fodder. Its flowers serve as a crucial source of food and income for tribal and rural communities, especially during lean seasons. The seed oil, widely used in cooking, cosmetics, and medicinal preparations, further underscores its utility. Ecologically, Mahua contributes to biodiversity conservation, soil fertility, and carbon sequestration, making it an essential component of agroforestry and afforestation initiatives. Its drought resistance and adaptability to degraded soils enable it to thrive in semi-arid and arid regions, supporting sustainable land use. Moreover, its cultural significance, particularly in tribal rituals and traditional medicine, reflects its deep-rooted connection to India's heritage. Despite its immense potential, Mahua remains underutilized due to inadequate market infrastructure, policy support, and awareness about its benefits. Challenges such as deforestation, habitat loss, and overexploitation threaten its sustainability. To harness its full potential, concerted efforts are required, including scientific research, value chain development, and community engagement. Promoting Mahua-based enterprises can provide livelihoods and ensure its conservation for future generations. In conclusion, Mahua stands as a testament to nature's abundance, offering a sustainable pathway for economic, ecological, and cultural development. Strengthening its role in rural development and ecological conservation will pave the way for a more resilient and sustainable future.

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- 1st Researcher, Department of Agricultural Extension & Communication, SHUATS, Prayagraj U.P
- 2nd Research Scholar, Forest Ecology and Climate Change Division, Forest Research Institute, Dehradun, U.K
- 3rd Senior Scientist, ICFRE-ECO-Rehabilitation Center, Prayagraj U.P

INTRODUCTION TO AGROFORESTRY: A SUSTAINABLE APPROACH TO PEST MANAGEMENT

- Ashirwad Tripathy¹, Anshu Kumari²

Introduction

Agroforestry is a traditional land-use practice that integrates trees and shrubs into agricultural landscapes. The intensification of agriculture has led to a shift from polycultural systems to spatial and temporal monocultures. This transformation has caused significant biodiversity loss due to the destruction of forests and extensive monoculture practices. High-yielding crop varieties have introduced genetic uniformity, exacerbating pest problems. For example, cotton crops suffered extensive damage from pests like *Heliothis armigera* and *Bemisia tabaci* with the introduction of high-yielding varieties and expanded cotton cultivation (Sundaramurthy, 1992a). Currently, there is a growing emphasis on sustainable pest and herbage management. Over the past decade, agroforestry has gained recognition as an eco-friendly management practice, especially beneficial for smallholder farmers. This approach addresses soil erosion and declining soil fertility issues while providing fodder and fuelwood. Additionally, agroforestry offers multiple outputs, including animal, crop, and tree products, contributing to a more resilient and sustainable agricultural system.

Pest Status in Agroforestry

Diversified ecosystems tend to have lower pest populations compared to monoculture systems. While the insect fauna present on a crop or tree species may be similar regardless of whether they are grown in monoculture or polyculture, the intensity of

pest infestations can differ. Monocultural fields are more easily detected and colonized by pests, whereas plant diversity in polycultures results in fewer potential hosts for any given pest, leading to reduced overall colonization of crops.

In agroforestry systems, plant–insect interactions can be categorized as primary or secondary. Primary interactions occur when tree and crop species share pests or their natural enemies. Secondary interactions happen when one plant species affects the survival and growth of pests and their natural enemies on another plant species. (refer to fig 1) For example, pests such as cutworms, white grubs, termites, grasshoppers, and crickets have been reported to feed on multiple tree and crop species.

Positive Interactions in Agroforestry

- **Physical and Chemical Barriers:** Trees can serve as physical or chemical barriers against pests. For example, maize in a maize/apple agroforestry system saw reduced attacks from *Macrodactylis* sp. (Altieri et al., 1987).
- **Attracting Predators and Parasites:** Intercropping attracts more predators and parasites compared to monoculture. In China, intercropping rice with pond cypress trees increased spider populations in rice fields, reducing brown plant hopper numbers
- **Niche Diversity and Complexity:** Agroforestry systems have greater niche diversity and complexity than monocultures, leading to fewer pest problems (Stamp et al., 1998;)

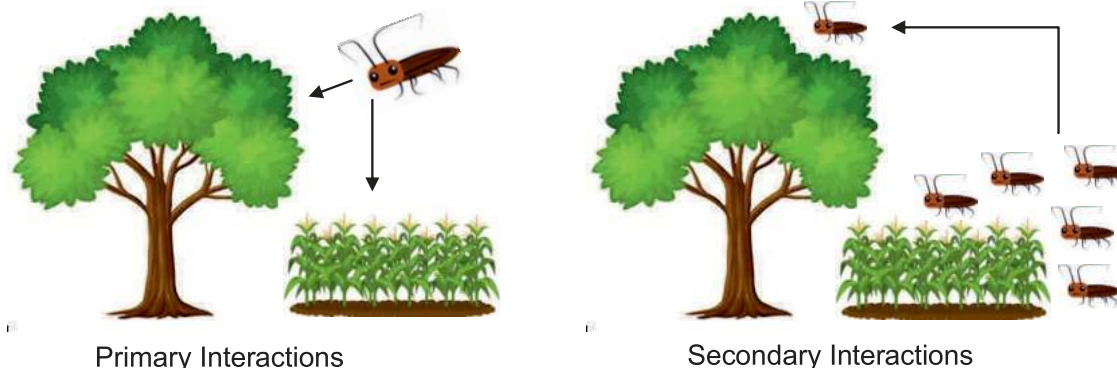


Fig 1: Plant– Insect Interactions

Several mechanisms contribute to this:

- Variable Host Plant Distribution: Pests find it harder to locate host plants.
- Trap Crops: Highly attractive plants act as 'trap-crops,' protecting economically valuable species.
- Repellent Plants: Certain plants repel pests, deterring them from other nearby plants.
- Natural Enemies: Higher plant diversity boosts predator and parasitoid populations, increasing natural pest control.
- Interspecific Competition: Competition between pest and non-pest species limits pest spread.
- Enhanced Pest Regulation: Agroforestry can be managed to enhance pest regulation by providing food sources for parasitoids and sites for mating and resting (Stamp et al., 1998).
- Structural and Microclimatic Diversity: Trees contribute to structural and microclimatic diversity, providing alternate food sources and stable refuges for beneficial organisms. This is particularly valuable after crop harvest when pest populations are naturally reduced (Schmidt and Tschamntke, 2005).

Negative Interactions in Agroforestry

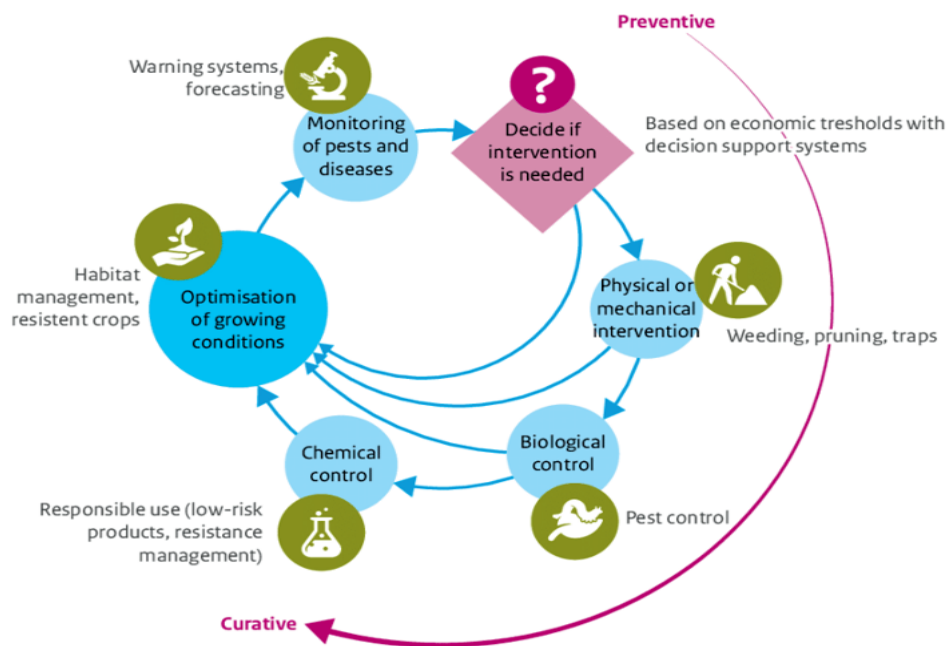
- Microclimate Alteration: The presence of woody components in agroforestry systems changes the microclimate, including temperature, relative humidity, and solar radiation interception. These changes can directly influence pest intensity, particularly sucking pests.
- Year-Round Shelter and Food Sources: Trees provide shelter and alternative food sources throughout the year, which can sometimes

increase pest problems. For example, in Jhansi, India, *Acacia tortilis* trees used as border plantings led to increased blister beetle damage on accompanying pulse crops. This was due to the synchronization of flowering, with beetles feeding on both the trees and crops (Shanker, 1999).

Integrated Pest Management in Agroforestry

A well-designed agroforestry system with carefully selected components can deter pests and promote natural enemies. Here are several strategies for effective pest management in agroforestry (refer to fig 2)

- Cultural Control/Management Practices: Selecting tree and crop components that do not belong to the same botanical taxa helps maintain pest balance and avoid cross-infestation. For instance, *Leucaena* planted as a hedge with maize, cassava, and upland rice exhibited reduced psyllid damage (Parera, 1998).
- Resistant Varieties: Growing pest- and disease-resistant varieties within an agroforestry system can significantly reduce pest loads. However, breeding trees for pest resistance remains an under-researched area.
- Mechanical Control: Trees often serve as shelters for adult pests. Mechanically collecting pests can significantly reduce their numbers and the cost of insecticides. For example, the mechanical collection of white grub adults from *Prosopis specigera* trees was found to be both cheap and effective in a pearl millet cropping system, compared to soil-applied insecticides (Kumawat and Yadava, 1990).



- Physical Control: Various traps are used by entomologists and pest managers to monitor and mass-trap adult pests. Yellow sticky traps effectively catch weak-flying adults of sucking pests, such as aphids and whiteflies. Light traps can mass-trap *Calocephala*, a defoliating beetle of *Gmelina arborea*, which is highly attracted to white light.
- Semiochemicals/Pheromones: These insect behavior-modifying chemicals are identified,

Source: PBL

Fig 2: Steps of Integrated Pest Management

isolated, and commercially produced for many forest and crop pests. Pheromone traps help monitor and trap pests like *Heliothis armigera*, which infest both trees and crops.

Semiochemicals also attract predators and parasitoids of pests (Ananthakrishnan, 1995).

- **Biological Control:** Natural enemies are most successful in stable forest ecosystems, keeping over 90% of arthropod herbivore populations below outbreak levels. Agroforestry, resembling a stable natural ecosystem, can augment and conserve these natural enemies. For example, the parasitization of the gram pod borer, *Heliothis armigera*, by the hymenopteran parasitoid *Campolitis chloridea* was higher when grown with bamboo (*Dendrocalamus strictus*) (Chitra, 1997).

Conclusion and Future Directions

Agroforestry presents a sustainable and eco-friendly approach to pest management by integrating various strategies to control pests and enhance biodiversity. Effective pest management in agroforestry systems involves a combination of cultural, mechanical, physical, and biological controls, as well as the use of semiochemicals and botanical pesticides.

For future practices, further research is needed in breeding pest-resistant tree varieties and understanding the complex interactions within agroforestry systems. Implementing well-designed agroforestry systems can lead to more resilient and sustainable agricultural practices, benefiting both farmers and the environment.

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Forest Research Institute
deemed to be University,
Dehradun



ICFRE-Eco
Rehabilitation Centre,
Prayagraj.

KAZI_TRIP_TRAVELOGUE

-Dr Chandrashekhar Niyogi

Even before we reached the main gates, we caught sight of a lumbering grey mass at 9 o'clock & another about 70 yards behind. We were breathtakingly to catch our first sighting of the Great One Horned Rhino. We were viewing the marshy fields of Kaziranga National Park & Tiger reserve on the eastern wing of Assam, a UNESCO world heritage site. Having toured a number of Tiger reserves our wishful thinking was to see the Great One Horned Rhino. We had an unsuccessful attempt at "Jaldapara National Park" even after gypsy & elephant rides. We were determined & hopeful on this trip & wished to see these gentle giants who are now numbered over 2500 at Kaziranga.

As necessity would have it, my family tried fervently to come to a common program, but slipped up again & again. Elder son Dr Rajaskhekhar is working with an NGO, based at Pune, working on Human Elephant conflict in M.P. He is also touring south India, at Nagarhole & Kali Tiger Reserves, exploring possibilities for the same. Younger son Vijayshekhar, A.P. in Bio-technology at a renowned Institution was the safest bet. He had managed his vacation in the Christmas – New Year period methodically. Wife Dr Krishna principal of a C.B.S.E. school assured us she would be available in the same time. I, a doctor with N.H.M. M.P. squeezed in the few days with grant of superiors.

Our contact in Guwahati was Col Dr Sajal Sen, engaged presently in designing a new-tech hospital with association of IIT Guwahati. Train timings were not exactly convenient & flights touching New Delhi in this season were ruled out. The only option was a road trip, which, though exhausting, held the promise of discovering new places & peoples. It was decided that the three of us, sans Raja, would make the road trip while he would arrive & depart by flight.

On the chilly morning of 24.12.'24, we set out with our Cabbie, Hemant in his spotless white Swift Desire. We commenced our trip after prayers & making the auspicious 'Swastik' on the vehicle. The powerful engine ate up the miles as we caught sight of Ma 'Sharda Devi' hill at Maihar, beyond Katni. Routing now towards Rewa we crossed the division headquarters & broke for lunch at a garden resort. Not much to speak of but provided an excellent cuisine in a green ambience. We pushed further on to cross to U.P. over Mirzapur, the fabled land of carpets, to reach Buxar, known as mini Kashi, on the banks of the Ganges.

Buxar's first cut impression was the distinctive 'Bhojpuri' dialect & the stalls of 'Litti Chokha', a delicious dish said to be savoured by Sri Ram himself. The city has left an indelible print in Indian history, made by the 1764 'Battle of Buxar'. The British, led by Major Munro defeated

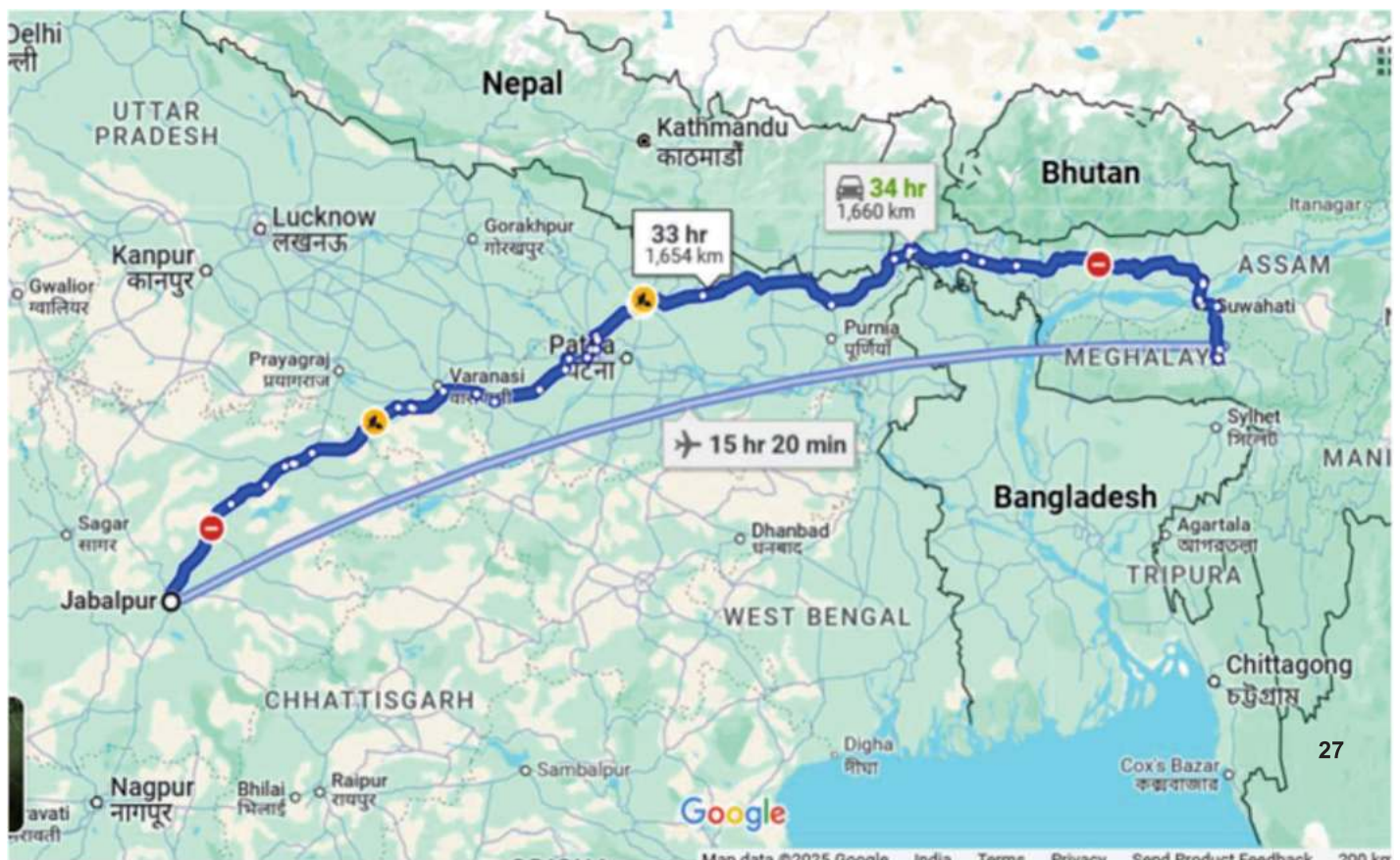
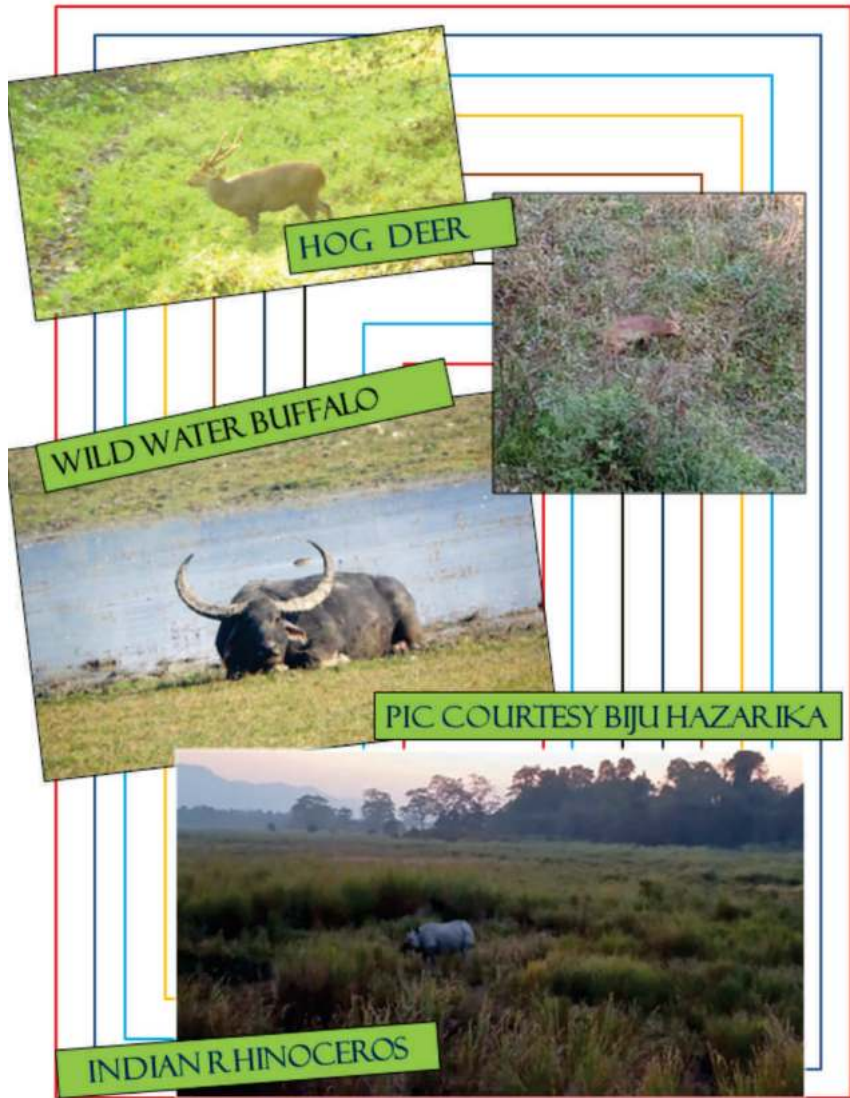


a larger combined opposition of Indian states, to stamp British authority in eastern India. The name Buxar is said to be derived from 'Vyaghrasar', a holy tank which is said to hold many magical powers.

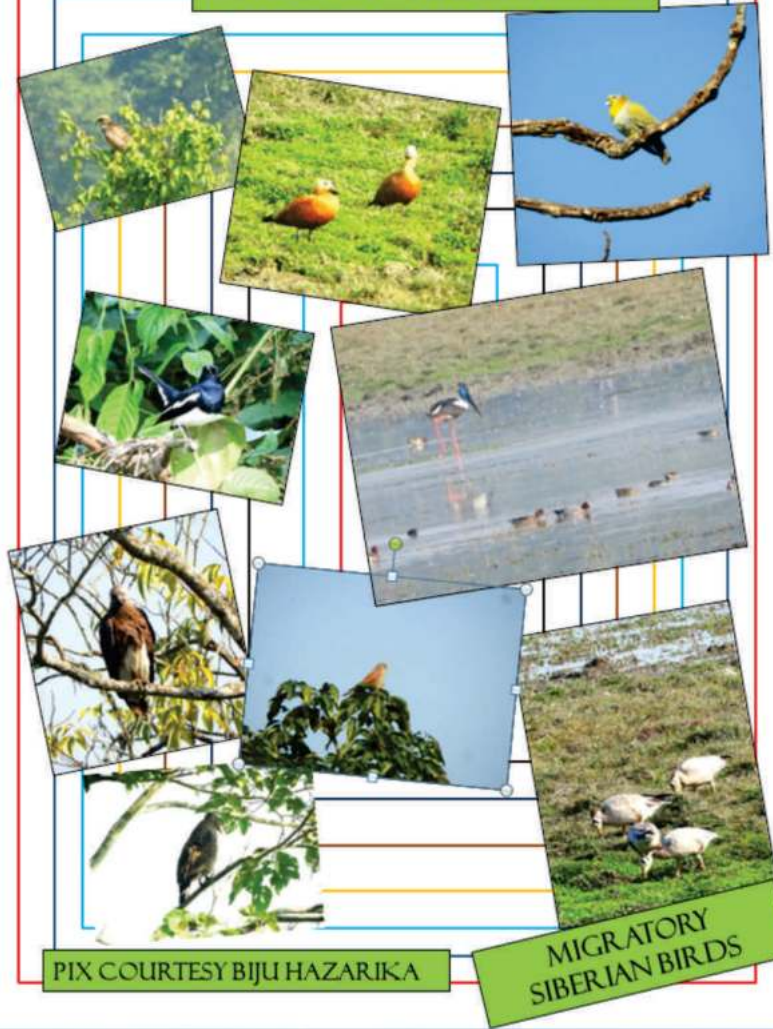
As a largely sleepy town we could bunk easily in a centrally located lodge which excelled itself with courteous behavior & a very palatable dinner. With a few generous pots of steaming tea we managed to hit the road early & made for Siliguri the ancestral home of my maternal in-laws. My wife had spent most vacations there & was really looking forward to meet her uncles & aunts.

Bye-passing Patna, through Chhapra, we arrived at Muzaffarpur, a city of myriad cultures & cuisines: here people spoke Hindi, with touches of Urdu & Maithili. The famed 'Maghai' betel leaf along with 'Litchi' fruit have earned Muzaffarpur the G.I. tag. The real Indian versions of 'Momos' are served here, made from rice flour & lentils served with a curried paste, called 'Dal-peetha'. The famous & delicious 'Champaran Handi Mutton' is originally a product of this region.

We were to reach Siliguri, twin counterpart city of Jailpaiguri, on Christmas. Christmas is celebrated with much pomp & fervor in all major cities of West Bengal. To reach our destination we faced many traffic diversions to accommodate the cheerful multitude. The place was alive with Santa dresses, & houses, chapels'



BIRDS OF KAZIRANGA



PIX COURTESY BIJU HAZARIKA

MIGRATORY
SIBERIAN BIRDS

churches & streets bursting with colour in every direction. Trans-street lightings were a real spectacle to watch.

My maternal in-laws home housed coconut trees the produce of which was commercially managed. Also within the campus were plants of 'Bay' leaves & trees whose bark is separated as 'Cinnamon'. We settled down among greetings & were served traditional food, snacks & Darjeeling tea. The notable change in diet now included the distinctive spices of the region, mainly Mustard whose numerous lemon yellow & ochre fields we had passed on the way.

Inclusion of a variety of fish & lobster prawn dishes were a gourmet's delight. Darjeeling tea & its variants were lovely, served as liquor or with milk & had a grand delectable fragrance. 'Veiled' potato or radish fritters were a treat where the vegetables are so sliced to resemble a 'Net' or 'Veil' & marinated with curds before frying.

Siliguri is a hill station on the banks of the river Mahananda from where we could catch a glimpse of Kanchanjunga from the rooftop of our lodging. Siliguri has been labeled as the 'Gateway to the North East'. On a

previous occasion we had made Siliguri our hub & spoke out to Darjeeling, 'Jaldapara National Park, Sikkim & the Natu-la pass on the Old Silk Route connecting China. From here onwards towards Guwahati we were to experience a vast difference in people, cultures, cuisines & geography. We had left behind the vast Indo-Gangetic plains & were now in the confines of the Himalayan foothills.

After a scratch breakfast with Darjeeling tea & packed stuffed flatbreads we set off for Guwahati. When we broke for tea we discovered that the Assamese preferred to speak Hindi over Bengali, which is actually quite similar. We arrived at Bongaigaon in time for lunch & were introduced to another variation of cuisine. One is supposed to order a 'Rice-plate' with fish or chicken & are treated to a host of complimentary dishes, which included lentils, a gravy vegetable, some fritters, a leafy vegetable preparation & a paste of some herbs; overall a delicious meal.

Guwahati is a pulsating vibrating city on the banks of the Brahmaputra, the flagship of North east India; a bustling business centre & educational hub hosting the A.I.I.M.S. & the I.I.T. The city reflects a fusion of religion, culture & nature. Apart from the Himalayas, the Shivalik range, locally called the 'Cachar' or 'Churia' hills, dominate the north-eastern skyline. Our



OUR HOMESTAY

BAANKAHI
ETHNIC
FOOD HUB

বানকাহী Baankahi
বলুয়া খাদ্যৰ সন্ধ্যা ETHNIC FOOD HUB

'KHASHI' WARRIOR & FLOWER GIRL AT SHILLONG PEAK



order, like the table-shuffling of cards. Efficiently our bags & purses were checked & contraband like cigarettes & lighters removed. Within ten minutes into the park we came upon our first sighting, two hog deer gently grazing. Hog deer form the majority of the ungulates in the region. Many different kinds of birds were gently picking up grubs. We stopped to feed our senses the serenity of the park where the marsh lands rolled on to the tall grass & the hills beyond.

Our tour operator, guide & Gypsy driver Biju was very vocal & spread on us his knowledge & experiences, spanning two decades. We were to know that the park area was approximately 440 sq kms bounded by the rivers Brahmaputra in the north-east & the Mora Diphu in the south. The small park (Kanha tiger reserve, core & buffer, is 2000 sq kms) teemed with a vast array of wildlife. It is an epitome of conservation initiatives & known as a biodiversity hotspot. A UNESCO world heritage site, the status of National Park & Tiger reserve & harsh punishment for poaching of rhinos, enhanced the conservation practices.

We were on the lookout for a better view of the great one-horned rhinoceros, the U.S.P of Kaziranga. The park is home to about two-thirds of the Indian rhino population saved & bred by zealous protection initiatives. The rhino was largely hunted for its horn believed to have virility powers. The horn is just

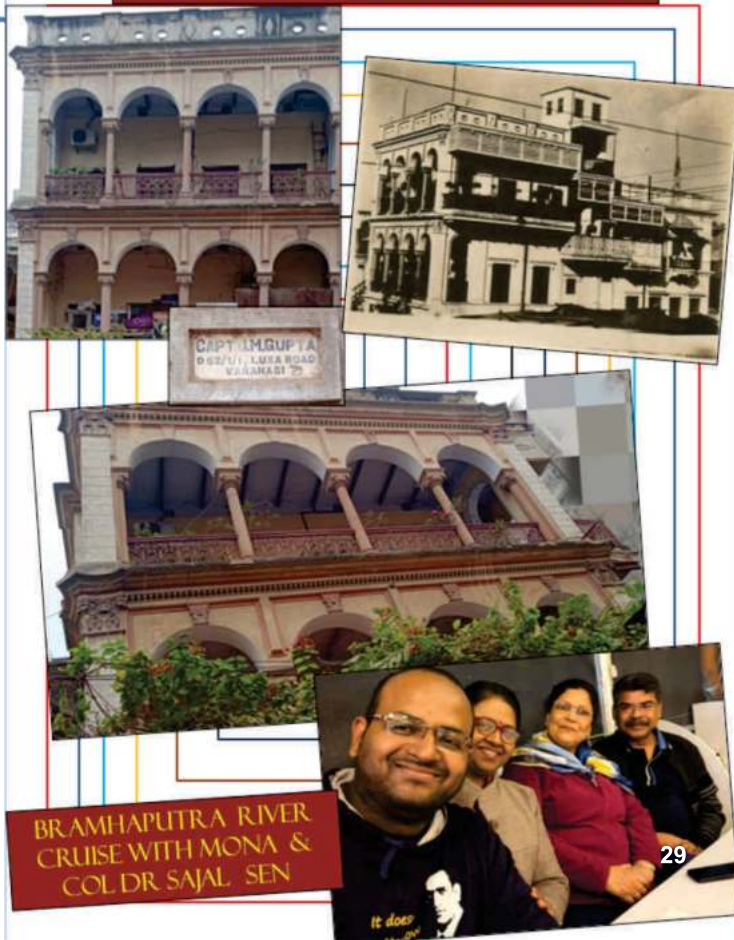
friend Col. Dr Sajal Sen & our hostess Mrs Mona Sen were ready to welcome & accommodate us; elder son Dr Rajashekhar had arrived earlier from Pune & we were set for a grand rendezvous. 4

Pleasantries & notes exchanged we settled down to a relaxing evening with a few top-ups & a fusion of sumptuous ethnic & continental cuisine. Incidentally Boxing Day is my birthday & we all enjoyed the ceremonial cake. We had a late night drive in their 'Thar' in the broad streets & witnessed the local nightlife of fast bikes & colourful Assamese youth.

After boiled eggs, omelettes, buttered toast & cheese, topped with a generous flask-full of Assam granules tea, my family set out for Kaziranga. Col. Sen had arranged an Innova for our Guwahati – Kaziranga circuit & we were to meet our tour operator, Biju Hazarika, at a junction called Nagaon. Biju led us to our nesting, a cozy 'Naturalist's Hideaway' homestay where we refreshed. Next we had lunch at 'Bankahi', a typical Assamese eatery where we enjoyed the 'Rice-plate' with fish & chicken

Soon we were to enter a vast football sized field which led to the check & entry gate to the park. The numerous Gypsies seemed unorganized but soon fell into

"TARUCHHAYA" LUXA ROAD VARANASI



solidified hair made of keratin, which crumbles under the knife & cannot be carved like ivory. We were scanning the marshy meadows when the guide pointed out 'Hathi..!'. Our heads turned to three-o'clock & saw some massive pachyderms as they moved into the high grass. Their backs were towards us & we could estimate roughly six wild elephants bringing up the rear of the herd.

The 'Hard ground Barasingha' is native only to M.P. but here we were to witness the real 'Swamp Deer' Barasingha, adapted to marshy pastures. Their cousins in M.P. have a lighter tawny coat, almost golden during monsoons, but here assumed a darker tan coat. We came upon a small group of six, the males proudly displaying their six-a-side magnificent antlers, grazing lazily in the pleasant winter afternoon. Just beyond we spotted three adult wild boars with half a dozen litter keeping close & almost in single file.

The vast expanse of the park meadows was interspersed with numerous small & large water bodies, possibly flood-formed lakes as per our guide. The land is very fertile aided by the Bramhaputra's deposits. Now deep into the park we finally came across a solitary rhino which was about fifty metres away, at three-o'clock position. The gentle giant was a treat for our eyes as we simply watched in awe. The rhino moved gently forward, grazing, on seemingly ballet-like graceful steps. The lower half of the animal was covered with mud which must have been picked up while wallowing.

The ambience was incredibly serene with the marsh lands flattened out till the distant hills. Almost immediately we spotted another rhino at four-o'clock behind a clump of trees fringed by the tall grass. This one

was closer, at about thirty meters & I believe we disturbed the animal. It stopped grazing & we thought we made eye contact. Presently after ascertaining that all was well, it continued grazing but Biju had managed to capture a well framed picture. Soon after we moved on as the guide insisted that a safe distance should always be maintained. The animals were simply a pleasure to watch, with their plate like armour, pursed lips, flappy ears & of course, their horn.

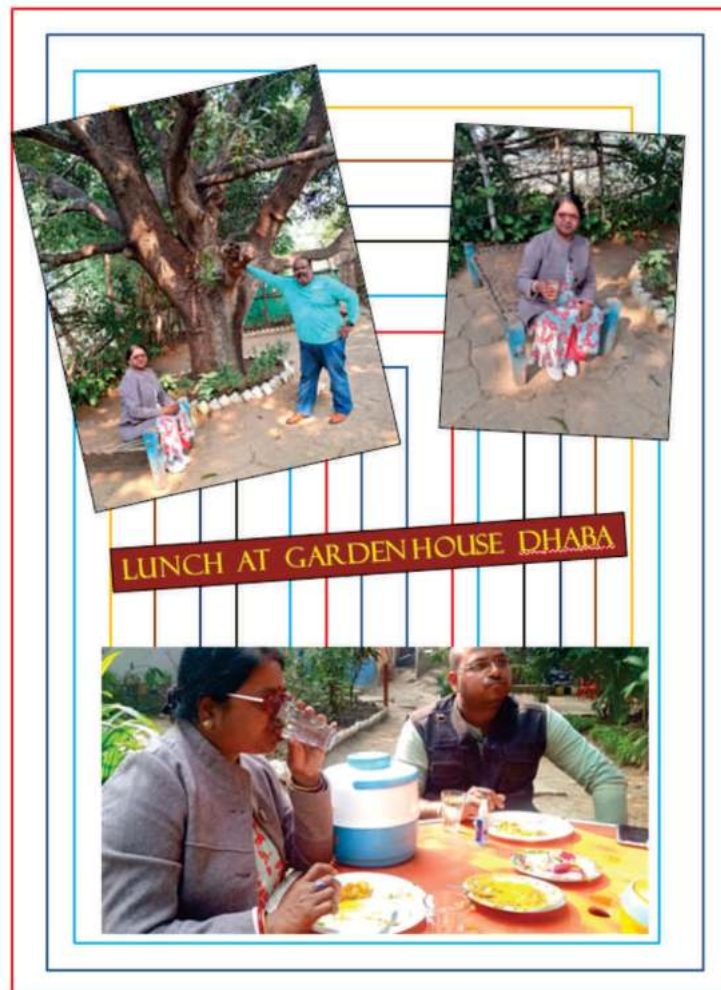
We were also on the lookout for the wild water

buffalo whose horns are among the largest for Indian wild cattle. The afternoon rolled on into evening & temperatures dropped with the setting Sun. A chilly breeze heralded the shadowy evenings & we wrapped up the woollens closer. As we moved to exit the park we were to see many more hog-deer & a small family of Sambhar stag. The male with grand antlers was ahead & a doe with a semi-adult fawn about twenty meters behind.

Our guide assured us that we would see more on tomorrow's morning ride. We came across many birds, some migratory from Siberia. Our guide informed that the birds would next fly to Ladakh on their way back. We missed the elusive tiger & were told by Biju that with

luck one could spot the Indian Muntjac & the great reptiles; the rock python & Hamadryad or king Cobra. To boot golden tigers have also been spotted here.

Our homestay was a very cozy outfit with a green gallery opening sideways into rooms. The gallery led to the dining which was designed in an ethnic rural fashion. The floor & walls was plastered with mud beyond the concrete rooms with a thatched roof, a space about twenty feet square. In one corner was a Indian stove or 'Chulha'. In the





PARK RIDES

stag. Birds, migratory or local, were in plentiful, deftly carrying on their feeding.

Eventually, on the edge of a large water body, we came across a solitary water buffalo. It was at some distance but gave us a clear view of the giant sweeping horns. Our cameras were inadequate but Biju obliged with a close up photo. We are not enthusiastic ornithologists but Biju was busy clicking birds; on the ground, on branches & in their roost.

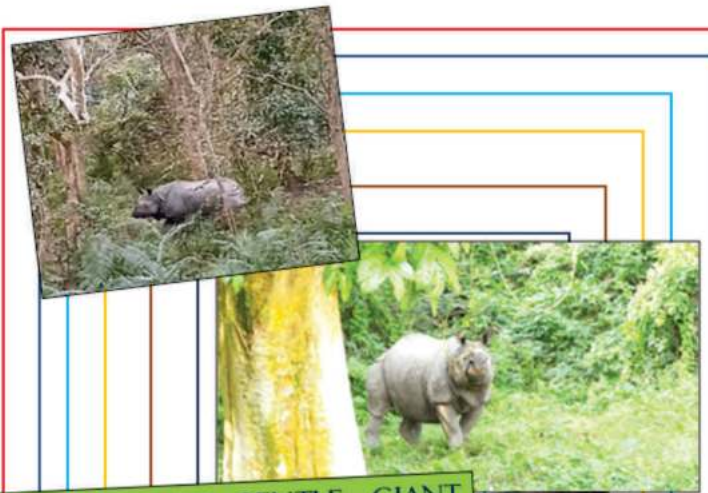
Soon it was time for our exit. We were slightly emotional as we were bidding farewell to one of the best parks in the world. The immense serenity of the marshy terrain with water bodies, bushes, grasslands rolling off into the distant foothills leave an indelible imprint on one's mind & soul. They forever remain the stuff for nostalgia in retrospect.

After our exit we made a beeline for the souvenir shop. We picked up caps, hats, t-shirts, badges, crockery & jackets all marked as 'One Horn Nation' & 'Kaziranga National Park.' We were met by Rajiv & his Innova & we parted ways with Biju with promises to

distinctly chilly evening our hostess had set up a fireplace there, which was very welcome indeed. We ordered some potato & onion fritters to go with the flask-full of hot tea. Dinner was a quiet graceful affair in which two varieties of lentils & a mixed vegetable dish were served with rice. The country chicken curry was delicately spiced & all summed up to a very sumptuous meal.

Over cups of Assam tea we all spruced up in the morning after a well needed sleep & waited for our guide, Biju,. We had packed our bags & asked the Innova driver Rajiv, to meets us at the farther gate. From there we would commence our return journey after exiting from the morning ride.

Five hundred meters in the park we came upon two rhino at a distance of about seventy metres but in perfect broad-side-on position for sighting. Moving ahead we came across more rhino but much closer this time. Their grand profiles were showing the details of their anatomy & it was sheer ecstasy to view them. We spent a good twenty minutes in their company & reluctantly moved on as we were also on the lookout for the wild water buffalo & the elusive tiger. We came across several hog-deer & a sambhar



SPOTTING THE GENTLE GIANT



WILD ELEPHANTS RECEDING

stay in touch & even plan a visit again.

On our return to Guwahati both our families had much to talk about. We were in chance to meet Col. Sen's son, Dr Robin a dental & maxillo-facial expert. He & wife Geetanjali had dropped down from Faridabad to attend Diljeet Dosanjh's concert at Guwahati. Col. Sen & I slipped out for a visit to the Army Golf club. The lush green lawns with well cropped hedges & plants were really beautiful. In the far distance the golf lawns fringed the forest line.

We could make out rolled up barbed wire fences. They were placed because there had been incidents of wild elephants straying onto the lawns. The bar was well stocked & had seating in the verandah hallway. In addition they had a tree-top sit out area & one extending deeper into the course. The snacks were delectable with peppered fish being the specialty of the evening. We returned home where our hostess Mrs Mona had an excellent spread for us.

Nilachal hills, just off Guwahati is a very special place indeed; a must for tourists & those looking for a rare pilgrimage site. The hills are said to house numerous caves where 'Tantra' ascetics practice their rituals. The most renowned & revered site on the Nilachal hills is the 'Kamakhya' temple, steeped in history, architectural wonder, myths & miracles. As legends would have it & described in certain 'Puras', Devi Sati self immolated herself in her father Daksh's ceremonial pyre, after Lord Shiva's insult on being barred from the grand 'Yagna'

The grief stricken Lord Shiva carried the charred remains & began a terrifying dance, the 'Tandava' which threatened the very existence of the Universe. Anticipating devastating consequences Lord Vishnu in consultation with Lord Brahma severed the charred body into fifty one parts using the 'Sudarshan Chakra'. Each part fell to the ground on a different location, to constitute the fifty one 'Shaktipeeths'. Devi Sati's private reproductive parts are supposed to have fallen here, making it one of the most pious & mythical of all 'Shaktipeeths'.

A good roadway led to the temple & we managed to approach to a proximity just a few flights of stairs away from the main sanctum. Col Sen had arranged for V.I.P. passes for us & engaged the services of a senior pandit. On the way we collected mementoes & wore red headbands of 'Jai Ma Kamakhya'. We were led by our pandit onto a wide waiting area after which we were required to assemble in a single file to lead to another seated waiting area. The premises were live with exited people not to miss out a few goats & rhesus monkeys. It was the peak vacation period & the temple was teeming with devotees.

After about spending a good four hours since we entered the temple we progressed through caged corridors to reach the outer wing of the sanctum, which housed gold deities of Kamakhya Devi & Kameshwar Dev. We were guided by the pandit to offer flowers here amidst sacred

chants. Finally we were led into the main sanctum which is a stone cave below the outer sanctum. We were all aware of an unseen energy here as we in the cavern containing the private parts of the Devi etched in stone. The place was partly immersed in water which is said to be perennial, which never dries out nor overflows. There is no idol here & the mythical creation was partly covered with beds of flowers. We were encouraged to touch the magical water amongst more sacred chants.

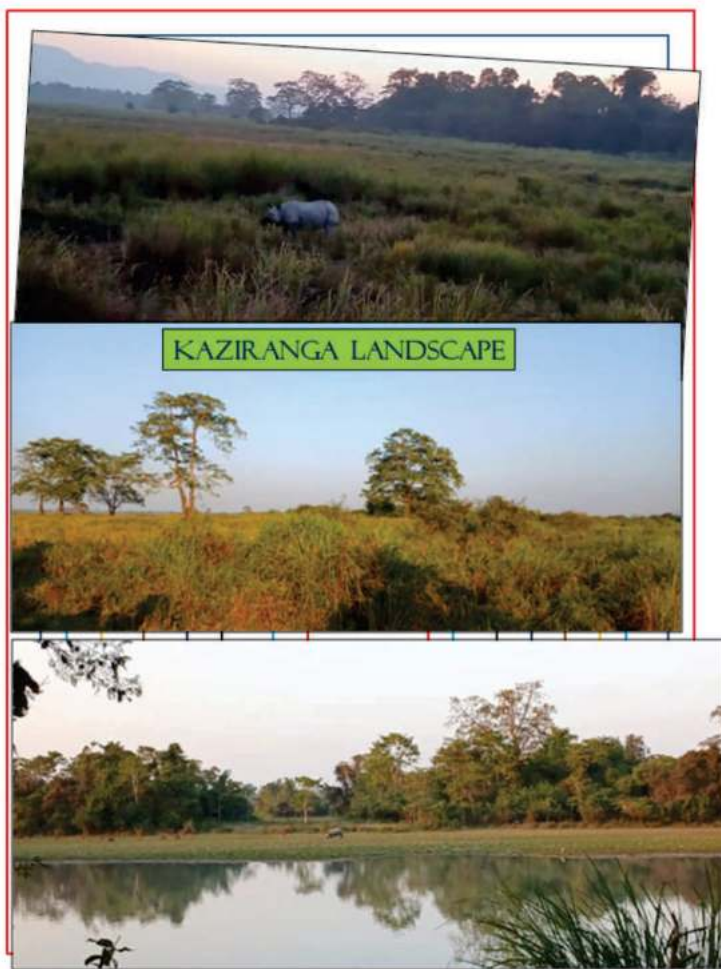
A number of festivals are observed here mainly 'Navratri' and the 'Ambubachi', in the last week of June every year. The temple is closed for three days when during this period the Devi is supposed to menstruate. The water in the main sanctum turns red & even connected parts of the Bramhaputra assume a reddish colour. This is an extremely sensitive affair & I wish to refrain from making any comments whatsoever. It is best left to experts in mythology, ancient beliefs, natural formations & pure sciences

After exiting the temple complex we headed for the top of Nilachal hills. Several watch-points had been made along the way & we stopped frequently to admire the lovely view. On the top of the hill is the 'Bogola' or 'Bhuvaneshwar' temple. The view on both sides of the hill is breath taking & we had a grand panoramic view of the great Brahmaputra River & Guwahati town beyond. After spending a relaxing hour we headed back home in anticipation of a well needed rest & plans of our Meghalaya visit tomorrow.

We were already aware that Meghalaya was created in '72 by separating two districts from Assam, namely the 'Khasi' or 'Jaintia' hills & the 'Garos' hills. Over an early breakfast of buttered toast, scrambled eggs & cheese, Col Sen discussed the British influence & the military significance of the region. The Eastern Command of the Indian Air Force is based here & played a vital role in the Chinese war of '62 & the Bangladesh liberation war of '71. The British regarded the capital Shillong as the 'Scotland of the east' & it still has a distinct cosmopolitan touch. All festivals are celebrated here with zeal & the city also hosts a diverse range of cuisines. We were put into a good mood as we set off to explore the abode of the clouds, Meghalaya.

We were on a time count as we were to board the Brahmaputra river cruise later this evening, so were set our sights on three places; the well maintained 'Hydari' Park, the famed Elephant falls & of course the Shillong peak. Wide winding roads gradually gained altitude as we approached the Shillong peak. High in the roadways were numerous viewpoints from where the scenic beauty was marvelous with clumps of clouds just lazily floating by. The panoramic views were mesmerizing & accorded a sense of serenity, peace & tranquility.

The Shillong peak is situated at a height of about



two thousand metres & under control of the Indian Air Force. For security reasons we had to shift to local certified vehicles. For entry we had our identities verified by Aadhaar cards, as foreign nationals are disallowed from entering the area. The peak itself had a large open area facilitating the car park. We could walk around the area to circumnavigate the peak which accorded a grand circular view of the deep & distant surroundings. Most notable was a glimpse of green veldts of neighbouring Bangladesh. Nearly the full city of Shillong could be seen from here, rolling off into the distant Himalayas.

The height of the peak was an excellent vantage point for the Indian Air Force which served the country both in times of peace & war. Having satiated our senses by the grand view, we were simply thrilled & in awe of the location.

We moved into the campus area where a stall offered traditional costumes on hire. We were excited at the idea & Krishna & I donned the costumes of a Meghalayan flower girl & a 'Khasi' warrior. We spent the next fifteen minutes posing for photographs captured by our smiling amused children. Reluctantly we were to return to the plains where we went onto visit the Hydari park which well maintained

but would fully blossom during the spring.

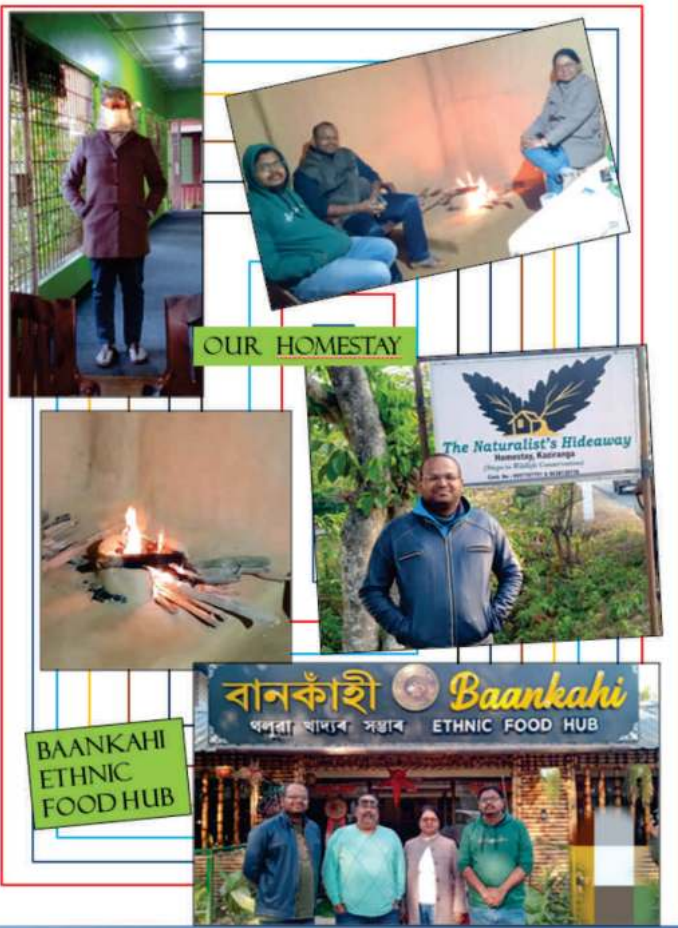
The Elephant falls was next on the itinerary & on reaching were welcomed by the sound of unseen waterfalls. A downward flight of a broad stairway brought the falls into view. The falls was aptly named as the streams of water fell on a giant rock which resembled an elephant's back. I acquired a mini bow & a quiver with arrows as a memento. Pressed for time we had a scratch meal of fried chicken, Singapore rice, steamed momos & rushed back to Guwahati in time for the Brahmaputra cruise. Unfortunately only Krishna & Vijay could join Mrs & Col Sen, as elder son Raja & I had to leave for some urgent shopping.

After a restful sleep we were to undertake the first leg of our return early in the morning. We profusely thanked our hosts with warm embraces & hugs, with promises to catch up in '25 at Jabalpur during the Dussehra festival. As we were going in the same direction we dropped Raja at the airport for his return flight to Pune. We managed a good time on the highway avoiding the under-construction segment & were in time for dinner at Siliguri. This time my maternal in-law aunt & their family had invited us. Dinner was a grand affair with mustard 'Papda' fish, fried lobsters with 'Pulao' & mutton curry, with two varieties of sweets. Later amidst 'pranams' & good wishes, we packed up 'Bay leaves' & 'cinnamon' bark from their garden which had already been picked for us, & reached my in-law uncle & aunt's for the night's bunking.

Due to some communication gap my in-law aunt had prepared fish curry for dinner the previous night. She dried out the curry & packed it for our onward journey. We packed it in our food basket & kept it in the rear seat, lest it jostle on bumpy roads. We broke for lunch at a decent 'dhaba', ordered some chicken & 'tava rotis' & had a fulfilling lunch including our packed fish.

We had planned to stay overnight at Chhapra to commence our last leg to Jabalpur tomorrow. It was New Year's Eve & we reached Chhapra at about five thirty. We had covered a good four hundred & fifty kms but it was still too early to retire. In consultation with our cabbie Hemant it was decided to make a dash to Varanasi, a distance of approx two hundred & fifty kms. Varanasi apart from being a most holy city, was also the residence of my maternal grandparents, uncles & aunts, but now only occupied by my cousin, his wife & some tenants, their sons being away at Mumbai.

My cousins were pleasantly surprised by this chance visit & enthusiastically awaited our arrival. As we entered the fringes of Varanasi it became obvious the New Year's celebrations were in full swing. The major streets were vibrant with lights & colourful motifs. Hotels & restaurants were extravagantly decorated & well dressed waiters wooed the multitude on the streets. The branded showrooms & major stores were prominently on display by



balloons, paper cuttings & ribbons. Flower stalls had sprung up selling bouquets & roses, garlands, headbands, wrist-bands, hats & stuff that festivities comprise of. Blaring music could be heard on all sides & the city was in a full-on gaiety mood.

Traffic was diverted at numerous places & we finally reached our destination on Luxa road situated just two squares away from the Kashi Vishwanath temple. After 'pranams' & pleasantries exchanged we were led to the dining area where my cousins had ordered a special meal for us. At the stroke of midnight heralding the New Year, we delved into a most delicious combination of 'biryani' with 'kababs', amidst the burst of firecrackers outside on the streets.

Varanasi was very special to my wife & me. She a B.H.U. alumnus, having stayed at the 'Rajghat' hostel on the banks of the Ganga, had many treasured memories of the city. I had spent nearly all my winter holidays at my maternal uncle's house, 'Taruchhaya', at Luxa road. During my childhood the household was a buzz of excitement where uncles, aunts, cousins & friendly neighbours talked nineteen to a dozen, amidst much laughter & gaiety. Later a quartet would assemble including my dad, to play 'Bridge'. My birthday was celebrated with much fervor & I used to be overjoyed on receiving a number of gifts, namely toys, books & new clothes.

'Taruchhaya', a palatial bungalow, was built in

1935 by my grandfather Capt Dr J.M. Gupta who had served in the First World War. It was dedicated to my grandmother 'Tarubala' & was designed reflecting the Renaissance period of architecture. The grand old lady still stands iconically on Luxa road, with its impressive galleries & stairways, crimson floors & banisters, cozy bedrooms & dining area, even a small library. Notable are the spacious balconies, exquisite mantle pieces and history reflected in portraits, not to forget the grand arches, & distinctive railings.

We had a traditional breakfast of Varanasi's special 'kachauris' served with potato curry, & a layered sweet with a clove in the centre, best known as 'labang latika'. We departed from 'Taruchhaya' after 'pranams' & getting a tearful farewell from our cousins & the Mukherjis, our neighbours of many a decade. We were disappointed at seeing the swollen crowds at the 'Kashi Vishwanath' & 'Santakmochan' temples, which we hoped to visit but would take the entire day in the process. Regretfully we started the final leg of our journey homewards. There was a trance-like quiet in the car as we all dwelt on our experiences of the last week.

After Mirzapur we crossed Hanumana & entered our home state to reach Maihar following Rewa. We halted at Maihar for lunch at the Indian Coffee House, which is much respected for its quality at all outlets throughout the state. We made a final coffee break just on the outskirts of Jabalpur & reached home at about six-o'clock. The silent stress & strain of the past few days were now taking toll & with leaden feet & stiff bodies we somehow unloaded our luggage. We bid farewell to our cabbie, Hemant, & on entering our house we all thanked the almighty for a safe, comfortable, pleasurable & fruitful journey.



Dr Chandrashekhar Niyogi, 64 years, is an E.N.T. specialist working with N.H. Mission of M.P., based at Jabalpur. He is an avid naturalist having toured all national parks & sanctuaries of M.P. He has also visited the Sunderbans, Corbett T.R. & Sasan Gir with Velavadar (Black Buck National Park) in Gujrat. Also notable were the visits to 'Katarniya Ghat' on the Nepal border famed for the Ganges 'Ghariyal', 'Jaldapara' & 'Rajaji' National Parks. He has also visited numerous hill stations like Gangtok & the Natu-la pass on the Indo-Sino border & river rafted on the turbulent 'Tiesta' on the W.B -Sikkim border. Closely associated with Shri Jagdish Chandra since the early nineties, and also other senior forest officials. Has extended his medical services to Kanha.T.R, Bandhavgarh.T.R & Pench T.R., as and when required. Happily married to Dr Krishna, Ph.D., principal of a C.B.S.E. school. Elder son Dr Rajashekhar Ph.D. is engaged with an N.G.O., managing Human-Elephant conflicts. Younger son Vijayshekhar, M.Sc is an A.P. at a Biotechnology institute. The family is his source of inspiration & are regular companions in tours to wildlife & other exotic destinations.



ROLE OF INTEGRATED FARMING IN LIVELIHOOD GENERATION

- Anubha Srivastav¹ Pritam Kumar Barman²

INTRODUCTION:

The farming system is the scientific integration of different interdependencies and interactions of farm enterprises for the efficient use of land, labour and other resources of a farm family which provides year-round income to the farmers. Integrated farming system (IFS) is an interdependent, interrelated often interlocking production systems based on few crops, animals and related subsidiary enterprises in such a way that maximize the utilization of nutrients of each system and minimize the negative effect of these enterprises on environment. IFS represent multiple crops (cereals, legumes, oilseeds, tree crops, vegetables etc.) and multiple enterprises (livestock, bee-keeping, fish farming etc.) in a single farm in an integrated manner. For the small-and marginal-farmers of India, who constitute more than 85% of the total farming community, IFS plays a vital role for enhancing their economy and livelihood. The main objective of the IFS is to enhance the productivity and profitability of marginal farmers households and to improve the livelihood and nutritional security through diversification approach. Under the gradual shrinking of land-holding, it is necessary to integrate land-based enterprises like dairy, fishery, poultry, duckery, apiary, field and horticultural crops, mushroom, agroforestry etc. within the bio-physical and socio-economic environment of the farmers to make farming more profitable and dependable. The ultimate goal is to maximize production, productivity and income generation from a unit of land area over a stipulated period ([Dashet al., 2015](#)). Furthermore, IFS contributes to nutrient recycling, reduces dependency on external inputs, enhances soil quality indicators, and ensures environmental safety. Hence, adaption of a developed location-specific IFS model plays a vital role in biodiversity conservation, improves soil carbon, and contributes to reduction of greenhouse gas emissions (GHGs) ([Meena et al., 2023](#)). Our country's population is anticipated to reach 1370 million by 2030 and 1600 million by 2050. Developed IFS gave higher net returns and benefit: cost ratio to the tribal farmers as compared to traditional farming in hilly region .

natural mechanism of the system is explored by establishing compatible linkages among the various components, which make it sustainable. Such a system approach is very much needed for developing sustainable model for E-IFS (Energy self-sufficient IFS), organic farming, natural farming, Natural eco farming and conservation farming systems.

An IFS represents multiple crops (cereals, legumes, oilseeds, tree crops, vegetables etc.) and multiple enterprises (livestock, bee-keeping, fish farming etc.) in a single farm in an integrated manner. The level of integration can be easily measured with the level of resources, wastes and by-products recycled within the system. This helps in better utilization of various resources available within a system and enhances the resource use efficiency. More the recycling of the resources/ by-products/wastes, the better is the integration. Such resource flow within the farming system makes the system self-reliant, less dependent on



external inputs and sustainable. In the IFS model developed for small-and marginal farmers with 1.0 ha area involving the enterprises – crop –livestock (dairy, poultry and duckery)- biogas production –fishery-agroforestry composting-medicinal and nutritional garden efforts have been made to recycle the by-product and wastes of one enterprise as the in-put of other enterprise. This has helped in enhancing the resource use efficiency and reducing the production cost. Besides, the farming systems become more self-reliant and less dependent on external inputs.

Componentsof IFS Models:

Crops, livestock, birds and trees are the major components of any IFS. Crop may have subsystem like monocrop, mixed/intercrop, multi-tier crops of cereals, legumes (pulses), oilseeds, forage etc. Livestock components may be cow, goat, sheep, poultryand bees. The farming system takes into account the components of soil, water, crops, livestock, labour, capital, energy and other resources, with the farm family at the centre managing agriculture and related activities. The followings are the



An IFS is a holistic and system approach, in which

integrated components of IFS (Behera *et al.*, 2018).

Fish + poultry+ horticulture-based farming system:

This IFS model was developed using fish, poultry and horticulture components that play a significant role in increasing manifold production, nutrition, profits, and employment generation to marginal farmers of Udham Singh Nagar district of Uttarakhand as reported by (Sharma *et al.*, 2016). Another study conducted reveals that the integration of fish culture with a rice-wheat cropping system can attain the maximum profit in western Uttar Pradesh.

Similarly, a fish-based IFS model was developed on 0.9 ha of land (fish cum horticulture on pond dyke (0.5 ha) + rice-wheat (0.4 ha), where fish as a major component was promoted to maximize the farm income and efficiently utilized farm resources. For this purpose, a farm was selected based on its strategic location, water availability, low land condition, etc. (Sunil *et al.*, 2023). Besides, fish culture pond dykes were chosen for the development of horticulture module (vegetable cultivation). Existing management practices (low input-based aquaculture) like fishes fed with rice polish and intermittent spread of



system effectively utilized the waste materials by recycling them via linking appropriate components, thereby minimizing pollution caused to the environment. Further, the integration of livestock component with crops, the production of eggs, meat and milk leads to nutritional security and stable farmer's income generation. So, there is a need to develop an eco-friendly, ecologically safe and economically profitable IFS model in western Uttar Pradesh (Palsaniya *et al.*, 2021).+

IFS under coastal agro-ecosystem:

The long-term projections prove that by 2030, about 40 % of the dietary demand has to be met from livestock-based commodities other than food grains (Kumar *et al.*, 2018). At present, improvement in the productivity of crops is being examined from their sustainability viewpoint not only by agricultural scientists, planners and environmentalists but also by progressive farmers, who are switching over from modern insensitive farming to ecologically protective farming (Ponnusamy and Gupta, 2009). The coastal ecosystem faces a lot of problems like flash floods, water logging, seawater intrusion, salinity and pollution due to continued expansion of urbanization, industrialization, tourism and other activities. About 10.78 million hectares of land resources of coastal ecosystems support the livelihood security of several million rural poor and also contribute to the national economy in a larger measure (Swarnam *et al.*, 2024). Considering land capability in the coastal ecosystem, the increase in land productivity primarily depends on popularization of alternative land use systems like dairy, fishery, apiary, duckery, mushroom, tree plantation, etc. Therefore, the research focus needs to be reoriented toward developing IFS options, well matched with land and water regimes in coastal areas for sustainable increase in productivity and conserved coastal ecosystem (Sunil *et al.*, 2023).

Agro tourism farming:

Agro tourism is a way of developing the rural



mustard oil cake in pond (Bahera *et al.*, 2004). The existing productivity of fish ponds was less than < 20 q/ha. As a result of adoption of improved management practices, the fish pond production rose up to 35 q/ha (75.0%). Scientists of Krishi Vigyan Kendra have helped farmers in Rajasthan's Barmer district grow fruits and vegetables never grown here before, and earn up to five times more. Lush fields of vegetables or orchards of fruit can hardly be associated with Rajasthan's Barmer district, which lies in the Thar desert on the border with Pakistan (Mishra, 2022)

Crop + livestock-based farming system:

Climate change, nutritional security, land shrinkage and increasing human population are the most concerning factors in agriculture and a further complicated by deteriorating soil health. Among several ways to address these issues, the most important and cost-effective means are to be adopted in IFS. IFSs with livestock enable a way to increase economic yield per unit area per unit of time for farmers under small and marginal categories (Shanmugam *et al.*, 2024). This



location as part of developing these tourism areas sustainably with a concern to increase the living standard of the farm and rural people by providing them the additional avenues of income. Agro tourism has emerged as an unconventional way of increasing farmer's income. Hence, the farmers should adopt agro tourism to diversify agricultural goods and explore new markets to generate more money through agro tourism, rural tourism provides an option for visitors to experience uncover rural life, their farm and other related activities and social and cultural practices which ultimately help the people sustainably living in that locality. The agro tourism development based on local wisdom concerns tourism development and subsequent conditions of sustainable development, as stated by Sriyadil and Eni Istiyanti (2021).

Medicinal garden:



There are several types of gardens such as medicinal, garden which may double farmers income. India has been considered as a major store house of various indigenous plants that are used to cure disease and disorder of various kind. Small and marginal farmers of India usually prefer such plants, since these are safe, economical and easily available to them. A small medicinal garden in 100 to 150 m² area is maintained in IFS unit consisting of medicinal plants such as: sarpagandha (*Rauvolfia serpentina*), ashwagandha (*Withania Somnifera*), aloe vera (*Aloe barbadensis*), tulsi (*Ocimum tenuiflorum*), lemon grass/citronella grass (*Cymbopogon citratus*), ajwain (*Trachyspermum amni*), brahmani (*Bacopa monnieri*), mint (*Mentha piperita*), hadajod (*Cissus quadrangularis*), insulin plant (*Costus igneus*), soursop fruit plant (*Annona muricata*), harida (*Terminalia chebula*), kalmegh/Green chiretta (*Andrographis paniculata*), harsingar (*Nyctanthes arbor-tristis*), Giloy (*Tinospora cordifolia*), sadabahar (*Catharanthus roseus*), pathharchata (*Kalanchoe kinnata*), small cardamom (*Elettaria cardamomum*), curry leaf (*Murraya koenigii*) and shatavari plant (*Asparagus racemosus*).

Nutritional garden:

A small nutritional garden in 150 to 200 m² area was maintained in the IFS unit consisting of papaya (*Carica papaya*), pomegranate (*Punica granatum*), custard apple (*Annona reticulata*), sapota (*Manilkara zapota*), kaintha (*Limonia acidissima*), bael (*Aegle marmelos*), guava (*Psidium guajava*), coconut (*Cocos nucifera*), jackfruit (*Artocarpus heterophyllus*), banana (*Musa paradisiaca*), star fruit (*Averrhoa carambola*), elephant apple (*Dillenia*

indica) and aonla (*Phyllanthus emblica*). There are certain unique fruit plants very useful for health point of view such plants are kaintha, star fruits, elephant apple and custard apple. By maintaining a nutritional garden, the care has been taken how a farm family can get fruits round the year for better nutrition to the family members. Besides this, other fruit plants such as kinnow, lemon, guava, sweet orange and mango are grown in dykes of pond and boundary of the farming system, which also contribute to income and family requirement of fruits.

Agroforestry/ Trees Outside Forests (TOFs) for state of Uttar Pradesh:

Agroforestry system is one of the best known traditional practices and has an important role in reducing vulnerability, increasing resilience of farming systems and buffering households against climate related risks. As the population of India is increasing at a very fast rate; the land-holding size of farmers shrink at a very fast rate and agroforestry is the only way to optimize the farm productivity. The tree species outside forests viz. *Mangifera indica*, *Eucalyptus* spp., *Populus* spp., *Azadirachta indica*, *Dalbergia sissoo*, *Tectona grandis* etc. (FSI, 2023) are cultivable in agroforestry in rural as well urban regions of Uttar Pradesh. The careful selection of these species in plantations will lead to sustainable strengthening rural livelihood.

In the state, TOFs are in the form of small woodlots and block plantations, trees along linear features, such as roads, canals bunds, etc. and scattered trees on farmlands, homesteads, community lands and urban areas. Teak is the dominant species of these forests. Other important species are sal, palash, ber, mahua, dhak, amla, jamun, semal etc. among TOF green cover. The main regions of these forests are the plains of Ganga, Yamuna and their tributaries receiving the rainfall 50 to 100 cm. These trees are widely used in industries for various applications, for instance, Bamboo is used predominantly in Paper Industries, Babul is used to prepare the tanning material, gutel and semal are employed in the matchwood industry. Farmers are coming forward in the region of Eastern UP for adopting TOFs of commercial value as eucalyptus, poplar, melia, mango, aonla, sagwan, mahogany etc. in different agroforestry systems. Table 1 and 2 reflect top species in rural and urban region of Uttar Pradesh (FSI, 2021).

Table 1. Top 5 species in ToFs in rural region of Uttar Pradesh

S.No.	Species	Relative abundance (%)
1.	<i>Mangifera indica</i>	30.25
2.	<i>Eucalyptus</i> spp.	18.52
3.	<i>Populus</i> spp.	7.74
4.	<i>Azadirachta indica</i>	4.90
5.	<i>Dalbergia sissoo</i>	4.88

Table 2. Top 5 species in ToF in urban region of Uttar Pradesh

S.No.	Species	Relative abundance (%)
1.	<i>Azadirachta indica</i>	15.62
2.	<i>Mangifera indica.</i>	12.03
3.	<i>Eucalyptus spp</i>	10.64
4.	<i>Tectona grandis</i>	4.95
5.	<i>Prosopis juliflora</i>	4.12

The state has set a target of 175 Crore plantations in the next five years and also working towards developing agroforestry policies that link to wood-based industries. The state government is also working on the relaxation and simplification of transit rules. Further initiatives would be undertaken to establish one hi-tech nursery in each of the Commissionerates and village-level nurseries in every Nyaya Panchayat. Agroforestry practices would not only be beneficial for mitigating climate change, but also doubling the farmers' income (USAID,2023). Planting ToFs is like a boon for rural livelihood as in one way, they play a vital role in fulfilment of their day-to-day needs and in other way they get a handsome return by sale of commercial species for their timber as well as NTFPs. Besides, they contribute in increasing green cover of the state and can efficiently fix atmospheric CO₂ in its woody biomass and fulfil the

Advantages of IFS

- Residue recycling on far
- Regular income generation around the year from different enterprises/components.
- Maintaining soil fertility and soil and water conservation
- Fulfilment of social and cultural obligations.
- Favourable income generation prospects in rural areas can slow down rural to urban areas.
- Energy production and consumption.
- Production of saleable products and byproducts.
- Fully utilization of surplus family labour on the farm.
- Increased populations of beneficial insects and fishes and migrant birds.
- Risk reduction from diseases, crop failures and climatic failures or hazards.
- Availability and consumption of a variety of products at a farm that reduces problem of malnutrition of family members.
- Utilization of marginal land and nonmarketable produce greatly offsets economic risk.

The IFS has created more working hours in the system owing to more enterprises than the cropping system alone. The model generated 525 man-days/ha/year. The IFS model has provided employment opportunities throughout the year due to the involvement of more manpower than used in one module of the system. Diversification of farming including multifarious activities of different enterprises included in the IFS model paved the way to set of employment opportunities and intact households with farming and their family members were always engaged throughout the year in this business. Rathore et al., (2019) also reported that IFSs under arid and semi-arid regions increased employment opportunities than adopted single farming system. Thus, IFS model helped in solving the problem of unemployment of farm families. The total man-days required for the crop component was 251 man-days/ha/year followed by dairy (155 man-days/year) and horticulture (153 man-days/year) on the mean data of three years.



An example layout of IFS model (Source:Kharche et al., 2022)

timber/NTFP demands.

Strategies to Enable Adoption of IFS:

The following strategies are to be implemented to enable farmers to adopt IFSs.

- The large number of training and demonstrations on site-specific IFS models need to be conducted by involving research institutions, extension agencies, NGOs, and farmers.
- The agencies should be identified and linked with IFS farmers to procure their farm produce.
- Popularizing success through a variety of media mixes may be done by government extension machinery to enhance awareness and knowledge levels.
- Panchayat Raj Institutions need to be empowered to take up infrastructure work like reclamation of village water bodies (ponds), promotion of village common lands for livestock grazing and setting up of common facilities.

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Authors:

Scientist and Research scholar
ICFRE- Eco-Rehabilitation Centre, Prayagraj

Biodiversity on the Brink:

Corporate Culpability and the Threat of Mass Extinction



Humans exist within a wildly complicated, nuanced, and interdependent network of life on planet Earth. We understand that network as biodiversity. Our existence is intricately connected with that of millions of plant and animal species and the collective, cumulative knowledge resulting from millions of years of adaptation to varying physical realities. Today, we are aware of about 1.7 million species — but there are likely millions more that we do not even know about.

Tropical rainforests are epicenters of biodiversity. For example, in only a few dozen acres of Borneo's forests, there may be more species of trees than in North America as a whole. Oxford professor David MacDonald has said, "Without biodiversity, there is no future for humanity."

Sixth Mass Extinction

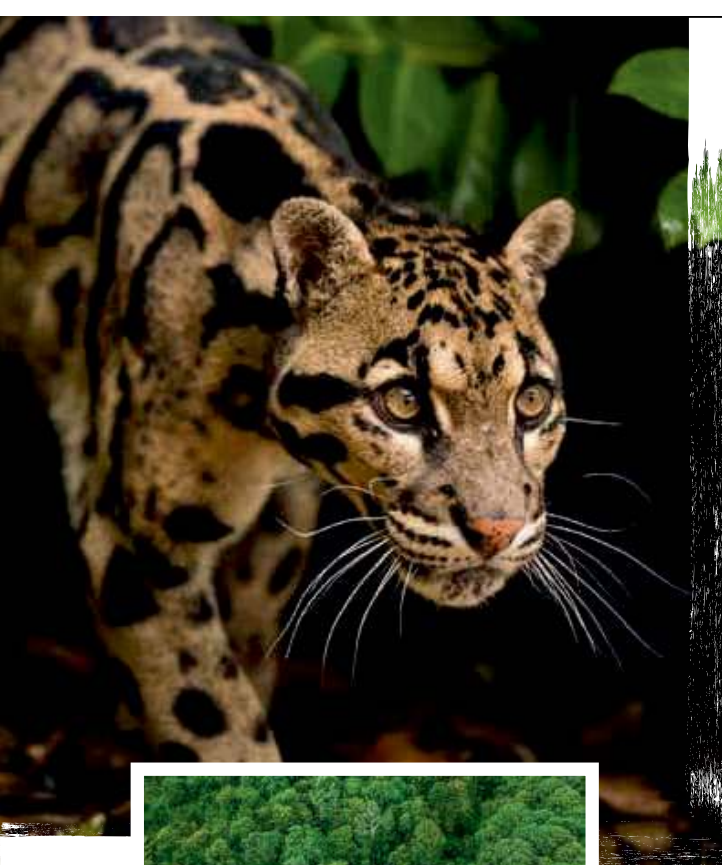
Yet, biodiversity is at extreme risk. Earth is facing what scientists call the Sixth Mass Extinction. While there have been mass extinctions before (the last occurring more than 65 million years ago) caused by volcanic eruptions, meteors, ice ages, and other cataclysmic natural events, the Sixth Mass Extinction will be caused by humans — just as human activity has caused climate

change. Not only are species going extinct, but entire genera are disappearing in an "annihilation" of life. The current extinction is predicted to be more than 35 times as extreme as the previous.

Human-driven land use for agriculture, mining, water, and energy use are the main culprits. Agricultural production alone is the cause of 90% of global deforestation and 20% of global greenhouse gas emissions.

Exposing the Culprits


But just as unchecked human activity can wreak havoc, strategic human activism can make a difference. RAN and the Forests & Finance Coalition published a major report in late 2023, *Banking on Biodiversity Collapse*. The report reveals an in-depth analysis of the financial flows supporting operations of 300 companies directly engaged in forest-risk commodities — products like beef, soy, palm oil, pulp & paper, timber, and rubber. These sectors are primarily responsible for massive deforestation in the world's three critical tropical rainforests — the Amazon, Indonesia, and the Congo Basin. These supply chains are also often associated with gross human rights violations and exploitation. The report indicated that from 2016 to



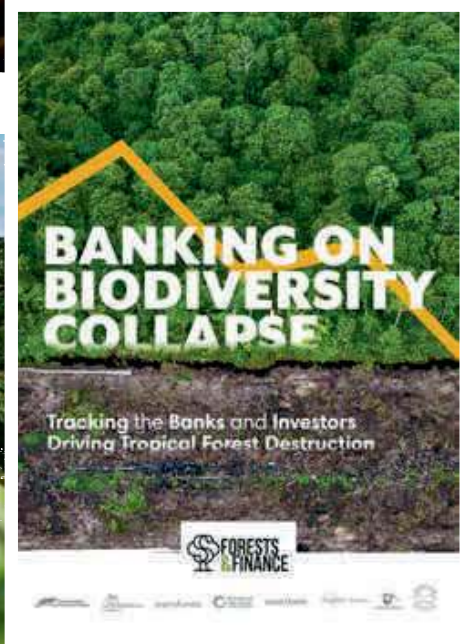
2023, banks provided at least \$307 billion in credit to the agro-commodity sector. Not only are enormous financial flows supporting this sector, but there is a dearth of policies to protect biodiversity and Indigenous and local communities.

Building Global Awareness — and Action

Built on this research and bolstered by our campaigns, RAN is working to influence the global finance and agro-commodity sectors to adopt and enforce stringent laws, policies, and regulations to protect nature and communities. Our new reports, showing systemic failure in stopping the money driving deforestation, engaged nations at the CBD COP16 in Colombia in October 2024, the G20 meeting in Brazil in November, and will continue to do so during events leading to COP30 in Brazil in November 2025.

These pivotal global movement moments are critical opportunities to bring the full force of RAN's research, insideoutside campaign approach, and high level media engagement to call companies and countries to account for their extractive and devastating practices. 

By Courtesy :



PHOTOS: Paul Hilton / RAN; Jj 7317835 / shutterstock; Gunter Nuyts / shutterstock

Impact in Indonesia:

Pressure and Policies Help Forests Stay Intact



Although they can seem far away for many of us, our fight to keep rainforests intact is a fight for all of us. Our biodiversity, our climate, our very future, depends on keeping forests standing.

For more than a decade, much of RAN's focus on protecting Intact Forest Landscapes (IFLs) has centered on the worldrenowned Leuser Ecosystem in Indonesia. These forests and peatlands provide livelihoods and water for millions of people — and they keep massive amounts of carbon in the ground and out of the atmosphere. When peatlands are drained and set on fire for palm oil expansion, thousands of years of stored carbon is suddenly released. Destruction of these precious forests is also often accompanied by land grabs, exploitation of communities, and human rights violations.

In response, RAN has targeted major international brands that source Conflict Palm Oil from the Leuser region. Our Snack Food 20 campaign, launched in 2013, was a prime example of our innovative market sector approach. We have brought significant pressure — and positive changes — to the sector by monitoring deforestation in palm oil supply chains and using field investigations to connect the

dots between unscrupulous producers, traders, and the household brands that source palm oil grown at the expense of forests in the Leuser Ecosystem. And we spread the word — through reports, traditional and social media, and by “naming and shaming” complicit brands on platforms like LeuserWatch.org.

“No Deforestation, No Peat, No Exploitation”

One major result from these efforts has been the widespread adoption of new global standards for implementing No Deforestation, No Peat, No Exploitation (NDPE) policies — a critical tool in efforts to protect tropical forests. The NDPE standard we helped establish is now being used by hundreds of companies across the palm oil sector. For example, after years of pressure from RAN, PepsiCo announced a policy in 2020 to address these supply chain concerns. By leveraging these policies, and the groundbreaking European Union Deforestation Regulation (EUDR) which requires transparency in brand supply chains, we are in a position to push toward significant gains in protecting critical forests — from Indonesia to the Congo Basin and the Amazon.

The impact is clear — deforestation rates have dropped across


The impact is clear **deforestation rates have dropped across the Leuser Ecosystem.** Programs have emerged, engaging local and national government agencies, smallholder farmers, Indigenous communities, as well as brands, producers, and traders, in the **protection and restoration of the Leuser.**



the Leuser Ecosystem. Programs have emerged, engaging local and national government agencies, smallholder farmers, Indigenous communities, as well as brands, producers, and traders, in the protection and restoration of the Leuser. Thanks to years of pressure, corporate giants like Unilever and PepsiCo are now investing millions to establish these innovative new programs with local governments. In 2024, Unilever finalized investments in landscape programs to advance protection of forests at risk of deforestation within existing palm oil concessions. It will potentially secure legal protection for more than 600,000 acres of forests zoned for future development.

Investing in the Future

We now must convince their peers to follow suit. In 2024, we aim to secure new commitments from brands like Mars, Mondeléz, and Nestlé to invest in the protection of the Leuser Ecosystem.

If implemented by traders and brands that use palm oil, these innovative landscape level approaches could end deforestation for palm oil in the Leuser Ecosystem. Major threats remain, but this moment offers hope during a rapidly escalating global climate and biodiversity crisis. 



By Courtesy :



Year:9 Issue-33, Bhopal, January to March - 2025

ME & MY EARTH

Save Forest, Wildlife & Save Earth

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नवरात्रि और नौ औषधीय पौधों के बीच पवित्र संबंध: एक पारंपरिक और चिकित्सीय परिप्रेक्ष्य

- भाष्कर जोशी, राजेश कुमार मिश्रा, अनुपम श्रीवास्तव, स्वामी नरसिंह देव, अमित चौहान

गुड़ी पड़वा अर्थात् चैत्र नवरात्रका प्रारम्भ चैत्र शुक्ल प्रतिपदा तिथि को होने के साथ ही विक्रम संवत् जो पंचांग राजा विक्रमादित्य के शासनकाल से ही जारी, का भी प्रारंभ होता है एवं दक्षिण भारत में इसे उगादी कहा जाता है। नवरात्रि, एक महत्वपूर्ण हिंदू पर्व है, जिसे हिन्दू नववर्ष उत्सव के रूप में भी पूरे भारत में बड़ी श्रद्धा के साथ मनाया जाता है, जिसमें देवी दुर्गा के नौ रूपों के लिए उपवास, अनुष्ठान और प्रार्थनाएँ की जाती हैं। जिन्हें सामूहिक रूप से नवदुर्गा के रूप में जाना जाता है। इस दिन लोग नवीन वस्त्र पहनते हैं, घरों की साफ सफाई कर उसे सुसज्जित करते हैं, आम्रपत्र लरी से निर्मित बंदनवार से द्वार सजा कर रंगोली बनाते हैं। यद्यपि वर्ष भर मेशारदीय नवरात्रि और चैत्र नवरात्रि दोनों ही देवी दुर्गा के नौ रूपों की पूजा के लिए समर्पित हैं, लेकिन वे समय और महत्व के मामले में भिन्न हैं। चैत्र नवरात्रि वसंत ऋतु में आती है और हिंदू नववर्ष की शुरुआत का प्रतीक है, जबकि शारदीय नवरात्रि शरद ऋतु में आती है और आगामी फसल के मौसम का प्रतीक है। भाव भक्ति के साथ साथ इस त्यौहार का सम्बन्ध प्रकृति के साथ गहराई से जुड़ा हुआ है। तभी तो फाल्गुन मास के वासंती बहार के इस माह में प्रकृति में चारों ओर उत्साह और सौंदर्य व्याप्त है तथ बसंत ऋतु के आगमन के लिए संपूर्ण प्रकृति नव वर्ष के स्वागत करने को आतुर प्रतीत होती है। जिसमें खेतों में पुष्पित सरसों के पीले-पीले पुष्प और गेहूं की झुमती हुई बालियाँ, निर्जर सघन वनों में खिले रक्तवर्णी पलाश और सेमल के फूलों का अनुपम सिन्दूरी सौंदर्य मिलकर प्रकृति के सुंदरता का वास्तव में उत्सव मना रहे होते हैं। मंजरियों से लदे आम्र के वृक्ष, नयी कोपलें, कोयल की मधुर कूक, भौरों को आकर्षित करने लगती है। चारों ओर प्रकृति का ही उत्सव चल रहा होता है और इस मधुमासीय रंगोत्सव के साथ नव संवत्सर का आगमन होता है चैत्र नवरात्र के रूप में। जिसका प्रत्येक दिवस देवी के अलग-अलग रूप को समर्पित होता है-

**प्रथम शैलपुत्री च द्वितीय ब्रह्मचारिणी।
तृतीय चन्द्रघण्टेति कूष्माण्डेति चतुर्थकम्।।
पञ्चम स्कन्दमातेति षष्ठं कात्यायनीति च।
सप्तमं कालरात्रीति महागौरीति चाष्टमम्।।
नवमं सिद्धिदात्री च नवदुर्गाः प्रकीर्तिताः।
उक्तान्येतानि नामानि ब्रह्मणैव महात्मना।
(दुर्गासप्तशती-श्रीचण्डीकवच 3-5)**

अर्थात् देवी की नौ मूर्तियाँ हैं जिन्हें नवदुर्गा कहते हैं। प्रथम नाम शैलपुत्री, द्वितीय ब्रह्मचारिणी तथा तृतीय स्वरूप चन्द्रघण्टा के नाम से प्रसिद्ध है। चतुर्थ स्वरूप को कूष्मांडा, पञ्चम स्वरूप स्कन्दमाता, षष्ठम स्वरूप को कात्यायनी कहते हैं। सप्तम स्वरूप कालरात्री और अष्टम स्वरूप महागौरी के नाम से प्रसिद्ध है। नवम स्वरूप को सिद्धिदात्री कहते हैं। ये स नाम सर्वज्ञ महात्मा वेद भगवान् के द्वारा ही प्रितपादित हुए हैं।

प्रत्येक दिवस एक विशिष्ट पौधे से जुड़ा होता है जो दिव्य ऊर्जा, पवित्रता और स्वास्थ्य लाभ का प्रतीक होता है। इस लेख के माध्यम से नवरात्रि के प्रत्येक नवदुर्गा स्वरूप के साथ इन पौधों के संबंध की व्याख्या करने का प्रयास किया गया है, जो आध्यात्मिकता और प्रकृति के बीच सहजीवी संबंध को उजागर करता है। इन पादपों अथवा वनस्पतियों को पारंपरिक चिकित्सकीय ज्ञान के आधार पर उनके औषधीय गुणों के लिए जाना जाता है। अतः इन पवित्र पौधों को दैनिक

जीवन में प्रयोग करने से समग्र कल्याण में योगदान मिल सकता है।
1. प्रथम नवदुर्गारूपः शैलपुत्री - शैलपुत्री (शैलपुत्री), पर्वत राजा हिमवत की पुत्री हैं, और हिंदू देवी माँ दुर्गा का एक रूप है। शैलपुत्री दो शब्दों शैल तथा पुत्री से मिलकर बना है। शैल का अर्थ पर्वत और पुत्री का अर्थ पुत्री है। इसलिए पर्वत की पुत्री का सार एक आवश्यक जड़ी बूटी में समाहित है जिसे हरीतकी या (टर्मिनलिया चेबुला) के नाम से जाना जाता है।

- ☞ सम्बंधित पादपः हरड़ / हरीतकी
- ☞ वैदिक नामः वीरकः हरीतकः
- ☞ वानस्पतिक नामः Terminalia chebula.
- ☞ संस्कृत नामः हरीतकी को संस्कृत में भया, अव्यथा, पथ्या, कायस्था, पूतना, हरीतकी, हैमवती, चेतकी, श्रेयसी, शिवा आदि नामों से जाना जाता है।

चिकित्सीय उपयोगः हरीतकीमधुर, तिक्त, कषाय होने से पित्त; कटु, तिक्त, कषाय होने से कफ तथा अम्ल, मधुर होने से वात का शमन करती है। इस प्रकार यह त्रिदोष हर है। प्रभाव से यह वात प्रकोप नहीं करती, इसलिए त्रिदोष हर है। यह रूखी, गर्म, जठराग्नि वर्धक, बुद्धि को बढ़ाने वाली, नेत्रों के लिए लाभकारी, आयुर्वर्धक, शरीर को बल देने वाली तथा वात का शमन करने वाली है। यह श्वास, कास, प्रमेह, बवासीर (अर्श), कुष्ठ, सूजन, उदर-रोग, कृमि रोग, स्वर भंग, ग्रहणी, विबंध, गुल्म, आध्मान, व्रण, थकान, हिचकी, कंठ और हृदय के रोग, कामला, शूल, अनाह, प्लीहा व यकृत के रोग, पथरी, मूत्र कृच्छ्र और मूत्र घातादि रोगों को दूर करती है। हरड़ का फल व्रण के लिए हितकारी, उष्ण, सर, मेध्य, दोषनाशक, शोथ, कुष्ठनाशक, कषाय, अग्निदीपन, अम्ल तथा आंखों के लिए हितकारी है। हरड़ में पांचों रस साथ रहकर भी प्रकोप नहीं करते। इसलिए एक ही हरीतकी अनेक रोगों में प्रयोग की जाती है। हरीतकी की मज्जा में मधुररस, नाड़ियों में अम्लरस, वृन्त में कड़वा रस, छाल में कटु रस और गुठली में कसैला रस रहता है।

विशिष्टगुणवर्कः- चबाकर खाई हुई हरड़ अग्निवर्धक, पीसकर खाई हुई दस्तावर, उबालकर खाई हुई दस्त बन्द

Terminalia chebula Retz.



करती है। भूनकर खाई हुई त्रिदोष हर, भोजन के साथ खाई हुई हरड़ बुद्धिबल तथा इद्रियों को प्रसन्न करती है, भोजन के उपरांत खाई हुई हरीतकी मिथ्या अन्न-पान से होने वाले सब विकारों को दूर करती है। राजवल्लभ निघण्टु में हरीतकी के लिये कहा है कि- यस्य माता गृहे नास्ति, तस्य माता हरीतकी। कदाचित् कुप्यते माता, नदोरस्था हरीतकी।।

अर्थात् जिसके घरमें माता नहीं है, उसकी माता हरीतकी है। माता तो कभी- कभी कुपित भी हो जाती है, परन्तु सेवन की हुई हरड़ कभी भी कुपित नहीं होती। वसन्त ऋतु में शहद के साथ इसके सेवन का विधान किया गया है। यह शरीर के कोष्ठों में व्याप्त विषों को बाहर निकालने में सक्षम होती है।

2. द्वितीय नवदुर्गारूपः ब्रह्मचारिणी - ब्रह्मचारिणी भक्ति और दृढ़ता का प्रतीक है। यह देवी दुर्गा के दूसरे स्वरूप का नाम है। इस स्वरूप की पूजा नवरात्रि के दूसरे दिन की जाती है।

- ☞ सम्बंधितपादप- ब्राह्मी
- ☞ वैदिक नाम: ब्राह्मिका मेध्या
- ☞ वानस्पतिक नाम: Bacopa monnieri (L.) Wettst.
- ☞ संस्कृत नाम: ब्राह्मी को संस्कृत में कपोत वङ्गा, सोमवल्ली, सरस्वती, ब्राह्मी, ऐद्री; आदि नामों से जाना जाता है।



चिकित्सीय उपयोग: ब्राह्मी कषाय, मधुर, तिक्त, शीत, लघु, कफ वात शामक, आयुर्वर्धक, बुद्धिवर्धक, रसायन, स्वरवर्धक, वयःस्थापक, दीपन, सर, स्मृतिवर्धक, प्रजास्थापन, कंठ शोधक तथा हृद्य होती है। यह कुष्ठ, पाण्डु, प्रमेह, शोथ, विष, ज्वर, कण्डू, प्लीहारोग, अरुचि, श्वास, कास, मोह, उन्माद, हृदय रोग तथा अग्निमांद्य, विबन्ध, दौर्बल्य एवं वात रक्त नाशक होती है। इसका पञ्चाङ्ग प्रशामक, पेशी शैथिल्य कारक, उद्वेष्टरोधी, कर्कटार्बुद रोधी, वेदना शामक, स्तम्भक, हृदय बल कारक, मूत्रल, मस्तिष्क बल कारक, विरेचक, वातानुलोमक, पाचक, शोथरोधी, आक्षेपरोधी, शोधक, श्वसनी विस्फारक, स्वेदकारक, आर्तव वर्धक तथा ज्वरघ्न होता है। इसके लिये आयुर्वेद में कहा है- बुद्धि प्रज्ञं च मेधा च कूर्यादायुष्यवर्द्धनी (राजनिघण्टु पर्पटादिवर्ग- 66) ब्राह्मी क प्रयोग विभिन्न प्रकार के मानसिक विकारों की चिकित्सा में किया जाता है।

3. तृतीय नवदुर्गारूपः चंद्रघंटा - देवी के तृतीय स्वरूप को चंद्र-घंटा के नाम से जाना जाता है। उन्हें चंद्रखंडा, चंडिका या रणचंडी के नाम से भी जाना जाता है। चंद्रघंटा के साथ औषधीय पौधे चंद्रसूर / लेपिडियम सैटिवम को दर्शाया गया है। सम्बंधितपादप- चंद्रसूर

वैदिक नाम: चन्द्रशूरकः
प्रायतकोशः
वानस्पतिक नाम: (Lepidium sativum L.)

संस्कृत नाम: इसे संस्कृत में चन्द्रिका, चर्महत्री, पशु मेहन कारिका, नदनी, कारवी, भद्रा, वासपुष्पा, सुवासरा, चंद्रसूरम्, चंद्रसूरा आदि नामों से जाना जाता है।

चिकित्सीय उपयोग: चंद्रशूरकटु, उष्ण, लघु, रूक्ष, तीक्ष्ण, वात कफ शामक, बल पुष्टि वर्धक, स्तन्य वर्धक, वृष्य तथा वाजी कर होता है। यह हिवका, अतिसार, शूल, गुल्म, त्वचारोग, वातरोग, नेत्ररोग, कृमिरोग, अभिघात-जन्य वेदना तथा वेदना-नाशक होता है। इसका पत्र तथा प्ररोह यकृत-विकार, शीतपित्त, हिवका, उरःशूल, भम तथा शोथ शामक होता है। इसकी मूल कटु, तिक्त, वेदना स्थापन, जंतुघ्न, त्वग दोषहर, दीपन, वातानुलोमन, रक्तशोधक, कफनिःसारक, मूत्रल, वृष्य, आर्तवजनन, वाजीकर तथा उत्तेजक होती है। इसके बीज तिक्त, शोधक, रक्तिमाकर, आर्तववर्धक, गर्भसावक, स्मृति वर्धक तथा मूत्रल होते हैं। इसका फल नेत्र रोग तथा त्वग्-रोग-शामक होता है। इसके बीज से निर्मित उपनाहकुष्ठ, त्वगरोग, अतिसार, प्लीहावृद्धि, अजीर्ण, कटिशूल, नेत्ररोग, श्वेत प्रदर, शीताद, श्वासकष्ट, शुक्र-दौर्बल्य, कास, हिवका, अर्श, आमवात तथा सूति का ज्वर-शामक होता है।



4. चतुर्थनवदुर्गारूपः कूष्मांडा- ब्रह्मांड का निर्माण करने वाली देवी कूष्मांडा, को कलिकुला परंपरा के अनुयायी उन्हें देवी दुर्गा का चौथा स्वरूप मानते हैं। नाम के अनुसार कूष्मांड का सम्बंध कूष्मांडा देवी के स्वरूप से है।

- ☞ सम्बंधित पादप- पेठा
- ☞ वैदिक नाम: कूष्माण्डकः कुम्भफलः
- ☞ वानस्पतिक नाम: Benincasa hispida (Thunb.) Cogn.
- ☞ संस्कृत नाम: इसे संस्कृत में चन्द्रिका कूष्माण्डम्, पुष्पफलम्, बृहत्फलम्, वल्लीफलम्, पीतपुष्पाम्; आदि नामों से जाना जाता है।



चिकित्सीय उपयोग: इसके फलों से निर्मित पेठा मिठाई को किसी परिचय की आवश्यकता नहीं है। कूष्माण्ड मधुर, शीत, लघु, गुरु, स्निग्ध, वात पित्त शामक, कफ कारक, बृंहण, वृष्य, दीपन, धातुवर्धक, पुष्टिकारक, वस्तिशोधक, हृद्य, मूत्रल, बलकारक, केश्य, अभिष्यंदि तथा विष्टंभ कारक होता है। कूष्माण्ड मूत्रा घात, अश्मरी, प्रमेह, मूत्रकृच्छ्र, तृष्णा, अरोचक, शुक्रविकार तथा रक्त विकार-नाशक होता है। बाल कूष्माण्डशीत, कफ कारक तथा पित्त शामक होता है। कूष्माण्डकाशाक मधुर, गुरु, उष्ण, वात शामक, अग्निदीपक, रोचक, सारक, ज्वर, आमदोष, शोफतथादाह-नाशक होता है। पक्ककूष्माण्ड मधुर, अम्ल, लघु, त्रिदोषशामक, मल-मूत्र को निकालने वाला तथा शुक्र रोग-नाशक होता है। कूष्माण्ड-तैलमधुर, शीत, गुरु, वातपित्त-शामक, कफकारक, अभिष्यन्दि, विबन्धहर, अग्निसादक एवं केश्य होता है। आयुर्वेदीय ग्रन्थों में कूष्मांड की प्रशंसा करते हुए कहा गया है कि -

**मूत्राघातहरं प्रमेहशमनं कृच्छ्राश्मरीच्छेदनं विण्मूत्रगलपनं
तृषार्तिशमनं जीर्णाङ्गपुष्टिप्रदम्।
वृष्यं स्वादुतरं त्वरोचकहरं बल्यं च पित्तापहम् कूष्माण्डं प्रवरं भिषजो
वल्लीफलानां पुनः।
(राजनिघण्टु मूलकादिवर्ग-160)**

गुण- कूष्मांड मूत्राघात को दूर करने वाला, प्रमेह-शामक, मूत्रकृच्छ्र तथा पथरी का छेदन करने वाला, मलमूत्र को शिथिल, तृषा को शान्त, दुर्बल अङ्गों को पुष्ट करने वाला स्वादिष्ट, अरुचिनाशक तथा पित्तनाशक होता है। वैद्यों ने लता पर लगने वाले फलों में कूष्मांड को सर्वश्रेष्ठ कहा है। (राजनिघण्टु मूलकादिवर्ग-160)

5. पंचमनवदुर्गारूपःस्कंदमाता- देवी दुर्गा का पांचवा रूप स्कंदमाता के नाम से इसलिए जाना जाता है क्योंकि वे भगवान कार्तिकेय (स्कंद) की माता हैं, और इनसे संबंधित औषधि के रूप में अलसी का ग्रहण किया जाता है।

सम्बंधितपादप- अलसी

वैदिक नाम: अतसिका नीलपुष्पा

वानस्पतिक नाम: Linum usitatissimumL.

संस्कृत नाम: इसे संस्कृत में अतसी, नीलपुष्पी, नीलपुष्पिका, उमा, क्षुमा, मसरीना, पार्वती, क्षौमी; आदि नामों से जाना जाता है।

चिकित्सीय उपयोग: अलसी के बीज मधुर, मंदगंध-युक्त, स्निग्ध, उष्ण, चरपरे, गुरु, बलकारक, कामोद्दीपक, अल्पमात्रा में मूत्रकारक, शोथहर, अधिक मात्रा में रेचक, वात शामक तथा वात रक्त, कुष्ठ, व्रण, पृष्ठशूल, शुक्र, कफ वपित्त शामक होते हैं। अलसी तेल-मधुर,



Tamarix aphylla (L.) H.Karst.

पिच्छिल, वातशामक, मंदगंधि, कुछ कसैला, बलकारक, भारी, गर्म, मलकारक, स्निग्ध, ग्राही, कफ शामक, कास नाशक तथा त्वक्-दोषहर है। अलसी-पत्रकास, श्वास, कफ तथा वातशा मक, इसके ताजे हरे पत्तों की शाक वातग्रस्त रोगियों के लिए विशेष लाभदायक है। अलसी-पुष्परक्त-पित्त-शामक होता है। भुने हुए अलसी-बीज स्तम्भक तथा वेदना-शामक होते हैं।

6. षष्ठः नवदुर्गारूपः कात्यायनी- देवी कात्यायनी को कई नामों जैसे अम्बा, अम्बालिका व अम्बिका से जाना जाता है। इनसे संबंधित औषधि के रूप में माचिका का जिसे मोइया भी कहते हैं का ग्रहण किया जाता है।

सम्बंधितपादप- मोइया

वैदिक नाम: झाबुक: आच्छदपत्रः

वानस्पतिक नाम: Tamarix aphylla (L.) H.Karst.

संस्कृत नाम: इसे संस्कृत में माचिका, सूचिमुखी, साकण्ठमुखी; आदि नामों से जाना जाता है।

चिकित्सीय उपयोग: यह कषाय, तिक्त, अम्ल, मधुर रस से युक्त वृष्य, बल्य, शूलाघ्न, अग्नि प्रदीपक, रुचि कारक तथा उष्ण होती है। इसका प्रयोग प्लीहा रोग, पक्का तिसार, कण्ठरोग, गुल्म, उदररोग, पाण्डु, आनाह, शीत ज्वर तथा रक्त पित्त नाशक की चिकित्सा में किया जाता है। माचिका को पीसकर लगाने से पामा तथा अन्य त्वचा विकारों का शमन होता है। माचिका चूर्ण से निर्मित क्वाथ का कवल धारण करने से गलशुण्डी शोथ तथा दंत शूल में लाभ होता है।

7. सप्तमः नवदुर्गारूपः कालरात्रि- कालरात्रि देवी दुर्गा का सातवां स्वरूप हैं, जिन्हें नवरात्रि के सातवें दिन पूजा जाता है। वे अंधकार और बुराई का नाश करने वाली देवी हैं। देवी का यह स्वरूप नागदौन औषधि से संबंधित होता है।

सम्बंधितपादप- नागदौन

वैदिक नाम: देवाज्यकः पूतः

वानस्पतिक नाम: Artemisia nilagirica (C.B. Clarke) Pamp.

संस्कृत नाम: इस पादप को संस्कृत में दमनकः, दान्तः, मुनिपुत्रः, तपोधनः, गन्धोत्कट, ब्रह्मजट, विनीत, कलपत्रक, दमन आदि नामों से जाना जाता है।

चिकित्सीय उपयोग: नागदौन एक प्रभावी औषधि है, जो मस्तिष्क शक्ति बढ़ाने और तनाव, डिप्रेशन, ट्यूमर व अल्जाइमर से बचाव में सहायक है। दमन ककटु, तिक्त, कषाय, शीत, लघु, रूक्ष, तीक्ष्ण, त्रिदोष शामक, हृद्य, वृष्य, सुगन्धित, ग्राही, स्तम्भक, बल कारक तथा रसायन होता है। यह विष, कुष्ठ, क्लेद, कण्डू, विस्फोट, आम दोष तथा



Artemisia nilagirica (C.B.Clarke) Pamp.

भूतबाधा शामक होता है। इसके पत्र स्तम्भक, कटु, शोथहर, व्रण विरोहक, मूत्रल, आर्तवजनन, वाजीकारक, क्षुधावर्धक, पाचक, कृमिघ्न, ज्वरघ्न तथा रक्त वर्धक होते हैं। इसकी मूल बलकारक एवं पूयरोधी होती है। इसके पुष्प श्वास, कास, शोथ, कुष्ठ, त्वग्-रोग, मूत्र कृच्छ्र, शूल, आत्रकृमि, ज्वर तथा पाण्डु-शामक होते हैं।

8. अष्टमः नवदुर्गारूपः महागौरी- महागौरी, पवित्रता और ज्ञान का प्रतीक है। अष्टमी के दिन उनकी पूजा की जाती है, क्योंकि वे सौंदर्य, शुद्धि और सकारात्मक ऊर्जा का प्रतीक मानी जाती हैं। देवी का यह स्वरूप तुलसी औषधि से संबंधित होता है।

- ☞ सम्बंधितपादप- तुलसी
- ☞ वैदिक नामः सुमञ्जरिकारामा
- ☞ वानस्पतिक नामः Ocimum tenuiflorum L.
- ☞ संस्कृत नामः इस पादप को संस्कृत में तुलसी, सुरसा, देवदुन्दुभिः, अपेतराक्षसी, सुलभा, बहुमञ्जरी, गौरी, भूतघ्नी; आदि नामों से जाना जाता है।

चिकित्सीय उपयोगः सुखवल्लरी, श्री कृष्ण-बल्लभा, वृन्दा, वैष्णवी आदि पवित्र नामों से विभूषित तुलसी के माहात्म्य का वर्णन करना ऐसा है, जैसे सूरज को दीपक दिखाना, या समुद्र किनारे बैठकर लहरों को गिनना। सर्वरोग निवारक, जीवनीय-शक्तिवर्धक, इस औषधि को प्रत्यक्ष देवी कहा गया है; क्योंकि सर्वत्र सुलभ, सुगन्धित, सुन्दर तथा इससे उपयोगी औषधि मनुष्य जाति के लिए अन्य कोई और नहीं है। तुलसी के धार्मिक महत्व के कारण हर घर आंगन में इसके पौधे लगाए जाते हैं। तुलसी पञ्चाङ्ग कफ वात शामक, जन्तुघ्न, दुर्गन्धनाशक, दीपन, पाचन, अनुलोमन, कृमिघ्न, कफघ्न, हृदयोत्तेजक, रक्तशोधक, स्वेदजनन, ज्वरघ्न शोथहर होता है। तुलसी के बीज मूत्रल एवं बलकारक हैं। तुलसी के पत्र प्रतिश्याय, वातश्लैष्मिक ज्वर एवं विषम ज्वर में लाभप्रद है। तुलसी पञ्चाङ्गश्वास, श्वसनीशोथ, कर्कटार्बुद (बड़ी आंत, यकृत, पित्ताशय), कवकरोग, हृदयविकार, प्रतिश्याय, विसूचिका, उदरशूल, विबन्ध, कास, ऐंठन, मानसिक अवसाद, त्वक्विकार, अतिसार, कष्टार्तव, अग्निमांद्य, श्वासकष्ट, कर्णशूल, मस्तिष्करोग, आंत्ररोग, नासासाव, ई.कोलाईसंक्रमण,



Ocimum tenuiflorum L.

ज्वर, कवक संक्रमण, आमाशयिकरोग, सूजाक, अश्वरी, शिरोवेदना, पक्षाघात, यकृतविकार, हिक्का, उच्च रक्तचाप, अनिद्रा, श्वित्र, कटिशूल, मलेरिया, अक्षिरोग, कर्णरोग, पूतिनासा, आमवात, दद्रु, सर्पदंश, प्लीहा रोग, शोथ, क्षय, व्रण, रतिजरोग, विषाणुसंक्रमण, अधिमांस एवं कृमि रोग में लाभप्रद होता है।

9. नवमः नवदुर्गारूपः सिद्धिदात्री - दुर्गा का नौवां रूप सिद्धिदात्री हैं, जो भक्तों को सभी प्रकार की सिद्धियाँ प्रदान करती हैं। नवरात्रि के अंतिम दिन इनकी पूजा की जाती है। देवी का यह स्वरूप शतावरी औषधि से संबंधित होता है।

- ☞ सम्बंधितपादप- शतावरी
- ☞ वैदिक नामः शतावरकः अधरकण्टः
- ☞ वानस्पतिक नामः Asparagus racemosus Willd.
- ☞ संस्कृत नामः इस पादप को संस्कृत में शतावरी, शतपदी, शतमूली, महाशीता, नारायणी, काञ्चनकारिणी, पीवरी, सूक्ष्मपत्रिका, अतिरसा, भीरु, नारायणी, बहुसुता, आदि नामों से जाना जाता है।

चिकित्सीय उपयोगः भावप्रकाश निघण्टुकार के अनुसार यह गुरु, शीत, तिक्त, रसायन, बुद्धिवर्धक, अग्निवर्धक, वात, पित्त, शोक-



Asparagus racemosus Willd.

निवारक, शुक्र दुर्बलता को दूर करने वाली तथा स्तन्य-क्षय को दूर करने वाली है। आचार्य सुश्रुत के मतानुसार शतावरी बुद्धिवर्धक एवं अग्नि वर्धक, बलकारक तथा दूषित-शुक्र का शोधन करती है। धन्वन्तरिनिघंटुकार के अनुसार शतावर जीर्ण से जीर्ण रोगी को पुनः बल तथा रोग से लड़ने की सामर्थ्य प्रदान करती है- अर्थात् शरीर इसके सेवन से रोग-निवारक क्षमता को पुनः प्राप्त करता है। यह वात पित्तशामक, शुक्रजनन, शीतल, मधुर तथा दिव्य रसायन है। आचार्य चरक ने शतावर को बलकारक, वयः स्थापक तथा मधुर बताया है। इसकी मूल शीतल, मूत्रल, पोषक, बलकारक, स्तन्यजनन, वाजीकर, विरेचक, कफनिःसारक, मृदुकारी, वयःस्थापक, वातानुलोमक, क्षुधावर्धक, आमाशय-रसवर्धक, आमातिसार तथा मधुमेह शामक होते हैं। इसके पत्र केश्य, स्तन्य जनन तथा हिक्का नाशक होते हैं।



भाष्कर जोशी राजेश कुमार मिश्रा, अनुपम श्रीवास्तव, स्वामी नरसिंह देव, अमित चौहान
लेखकः पतंजलि अनुसंधान संस्थान, हरिद्वार के वैज्ञानिक एवं चिकित्सक हैं

जैव विविधता संरक्षण में समाज की भूमिका एवं जवाब देही

—स्व. कृष्ण गोपाल व्यास

समाज को वनों और उनकी जैवविविधता की चिन्ता करनी चाहिए। उसके बिना समाज का प्रकृति एजेन्डा अधूरा है। भारतीय संस्कृति में मानव, पशु-पक्षी, कीट-पतंग, जल जीव, पेड़-पौधे लताएँ, नदी तालाब झरने, मिट्टी-पहाड़ इन सबका परस्पर निर्भर संबंध खोजा गया था। उसपर शोध किया गया और प्रामाणिकता के साथ अच्छी अच्छी बातों को आचरण में ढाला गया है जिसे निम्न उदाहरण से समझा जा सकता है-

**दश कूप समावापी, दशवापी समोहदः।
दश हृद समः पुत्रो, दश पुत्र समो द्रुमः।**

मत्स्यपुराण में ऋषि मनीषा कहती है- एक बावड़ी दस कुओं के बराबर होती है। एक तालाब दस बावड़ियों के बराबर होता है। एक पुत्र दस तालाबों के बराबर होता है। एक वृक्ष दस पुत्रों के बराबर होता है। यह उल्लेख वृक्षों की उपयोगिता को सिद्ध करता है।

अथर्ववेद के पृथ्वी सूक्त में कहा गया है- हे धरती माँ! जो कुछ मैं तुझसे लूँगा वह उतना ही होगा जिसे तू पुत्रः पैदा कर सके। तेरी जीवनी शक्ति पर कभी आघात नहीं करूँगा। हे माता! एक पार्थिव गंध हम सबको एक सूत्र में बाँधे हुए है। यह सूत्र, यह नाता मनुष्य के साथ ही नहीं है, वरन पशु-पक्षी नदी-पर्वत, जड़-वेतन, संपूर्ण जगत के साथ है। यह स्नेह बंधन इसी प्रकार बना रहे।

एक बात और, जब कभी हम लोग पानी और प्रकृति की चिन्ता तथा चर्चा करेंगे तो उसके साथ-साथ अनिवार्य रूप से पेड़, पहाड़, जीव-जन्तुओं, हवा, जैवविविधता की चिन्ता और चर्चा भी करनी पड़ेगी। प्राकृतिक घटकों को खंड-खंड में नहीं अपितु एक दूसरे के पूरक के रूप मान्यता देकर समाज के एजेन्डे पर लाना होगा। वही समाज का एजेन्डा है। वही समाज की अपेक्षाओं का आईना है। वही हमारा भविष्य है। वही असली सरोकार है। यह चिन्ता, पर्यावरण चेतना है। उसी चेतना के कारण, अनेक बार, समाज मुख्य धारा में आया है।

पर्यावरण चेतना इतिहास के पत्रों में:

भारतवर्ष में पर्यावरण चेतना और तवानुकूल विकास के प्रमाण वैदिककाल से मिलने लगते हैं। इसी कारण, हमारे प्राचीन ग्रन्थों में प्रकृति एवं उसके घटकों (वन, जल, वृक्ष, पर्वत, जीव-जन्तुओं इत्यादि) के प्रति विशेष सम्मान भाव तथा पूजा का उल्लेख मिलता है। कृष्ण द्वारा गोवर्धन पर्वत की पूजा को प्रकृति की पूजा माना जाता है। इस पूजा के बारे में कृष्ण ने कहा था कि उनके ग्राम के समाज की आजीविका का आधार, गोवर्धन पर्वत की जैव-विविधता है।

भारतीय समाज ने स्थानीय पर्यावरण और मौसम तंत्र के सम्बन्ध को अच्छी तरह समझकर नगर बसाए थे। खेती तथा पशुपालन को आजीविका का निरापद आधार बनाया था। उनके परस्पर सम्बन्धों के विश्लेषण से पता चलता है कि अलग अलग कृषि जलवायु क्षेत्रों में बसे भारतीय ग्रामों ने खेत, खलिहान, चारागाह, जंगल और बाग-बगीचों की एक-दूसरे पर निर्भर तथा मददगार प्रणाली विकसित की थी। यह प्रणाली स्थानीय जलवायु के अनुकूल थी। यह प्रणाली बाह्य मदद से पूरी तरह मुक्त थी। निरापद थी। साईड-इफेक्ट से मुक्त थी।

भारत के अलावा, अरब देशों के चिकित्सा शास्त्रों में वायु, जल,

मृदा प्रदूषण तथा ठोस अपशिष्टों की व्यवस्था करने का उल्लेख है। इसी प्रकार, जब लन्दन में कोयले के धुँएँ के कारण प्रदूषण बढ़ गया तो सन 1272 में, ब्रिटेन के शासक किंग एडवर्ड प्रथम ने कोयला जलाना प्रतिबंधित किया। औद्योगिक इकाईयों द्वारा छोड़े धुँएँ के कारण जब वायु प्रदूषण का खतरा बढ़ा तो ब्रिटेन ने सन 1863 में ब्रिटिश एल्कली एक्ट (पर्यावरण कानून) पारित किया। महारानी विक्टोरिया के शासन काल में चलो प्रकृति की ओर लौटें (Back to Nature) आंदोलन हुआ, जनचेतना बढ़ी तथा प्राकृतिक संरक्षण के लिए अनेक सोसायटियों का गठन हुआ। सन 1739 में बेंजामिन फेंकलिन तथा अन्य बुद्धिजीवियों ने चमड़ा उद्योग को हटाने तथा कचरे के विरुद्ध, अमेरिका की पेन्सिलवानिया एसेम्बली में, पिटीशन दायर की। 20 वीं शताब्दी में, पर्यावरण आंदोलन का विस्तार हुआ तथा वन्य जीवों के संरक्षण की दिशा में प्रयास हुये।

सन 1962 में, अमरीकी जीवशास्त्री रथेल कार्सन की पुस्तक (साइलेंट स्प्रिंग) प्रकाशित हुई। इस पुस्तक में डी.डी.टी. तथा अनेक जहरीले रसायनों के कुप्रभावों के बारे में जानकारी दी गई थी। जिससे पता चला कि डी.डी.टी. तथा अन्य कीटना नाशकों के उपयोग से लोगों में कैंसर पनप रहा है। पक्षियों की संख्या में कमी आ रही है। इस पुस्तक के प्रकाशन के बाद, अमेरिका में पर्यावरण के प्रति जनचेतना बढ़ी। सन् 1970 में एन्वायरनमेंटल प्रोटेक्शन एजेन्सी का गठन हुआ। सन् 1972 में डी.डी.टी. के उपयोग पर रोक लगी। इसी दौरान, अनेक नये पर्यावरण समूह जैसे ग्रीनपीस तथा पृथ्वी मित्र (Friends of the Earth) अस्तित्व में आये।

भारत के प्रमुख वृक्ष बचाओ आंदोलन: पर्यावरणीय हास का सबसे अधिक प्रभाव गरीब लोगों पर पड़ता है इसलिये जब असहायता की स्थिति निर्मित होती है तो प्राकृतिक संसाधनों पर नियंत्रण खोता समाज मुखर होने लगता है। उम्मीद की टूटती डोर की कोख से पर्यावरणीय आंदोलन प्रारम्भ होते हैं। भारत के प्रमुख वृक्ष बचाओ आंदोलन निम्नानुसार है-

विश्वोई समाज का वृक्ष बचाओ आन्दोलन: सन 1737 में जोधपुर रियासत में वृक्षों की रक्षा के लिये आन्दोलन हुआ था। जोधपुर के महाराजा अभय सिंह ने अपने सैनिकों को चूना बनाने के लिए बड़ी मात्रा में खेजड़ी (प्रोसोपिस) के वृक्षों को काटने के आदेश दिये। विश्वोई समाज की अमृतादेवी तथा उनकी तीन पुत्रियों ने राजाज्ञा का विरोध किया और वृक्षों को बचाने के प्रयास में अपने प्राणों की आहुति दी। उनके बलिदान की सूचना पाकर 83 गांवों के विश्वोईयों ने आंदोलन किया। इस आन्दोलन में 363 व्यक्तियों की जान गई। इसके बाद, जोधपुर नरेश ने विश्वोई ग्रामों के समीप के वनों तथा वन्य जीवों के संरक्षण के लिए आदेश जारी किया। इस आन्दोलन का मुख्य उद्देश्य वृक्षों की रक्षा था। उल्लेखनीय है कि विश्वोई समाज में शवदाह की प्रथा नहीं है।

चमोली का चिपको आन्दोलन:

यह आन्दोलन उत्तरांचल के हिमालय क्षेत्र में सन 1973 में प्रारंभ हुआ था। चमोली जिले की स्वयं सेवी संस्था (दशौली ग्राम स्वराज मंडल) ने ग्रामीण समाज के सहयोग से वन सम्बर्धन का उल्लेखनीय कार्य किया है। चंडीप्रसाद भट्ट ने इसे जन आन्दोलन बनाया तथा ख्याति दिलाई।

चमोली जिले के रेनी, गोपेश्वर तथा डूंगरी पायटोली गांवों की

ग्रामीण महिलायें अपनी आजीविका तथा चारा, ईंधन इत्यादि की आवश्यकता के लिये स्थानीय वनों पर आश्रित थीं। जंगल कटने से उनकी आजीविका पर संकट संभव था इसलिए जंगल काटने आये ठेकेदारों के लोगों को रोकने के लिये वे अपने बाल-बच्चों सहित आगे आईं। उन्होंने वृक्षों से चिपक कर वृक्षों को बचाने का प्रयास किया था। धीरे धीरे यह जन आन्दोलन आसपास के क्षेत्रों में फैला, सर्वत्र उसकी चर्चा हुई, सबने आन्दोलन की आवश्यकता से सहमति जताई। पूरे देश तथा विदेशों में उसका सन्देश गया। चिपको आन्दोलन, वन संरक्षण का पर्याय बना। कुछ लोग, इसे वन संरक्षण और पुनर्जीवन का सत्याग्रह मानते हैं। आंदोलन बताता है कि वन तथा सार्वजनिक भूमि भले ही सरकार की हों पर नैतिक रूप से वे उस समाज की हैं जो अपनी आजीविका के लिये उससे जुड़ा है।

केरल राज्य की शान्त घाटी का आन्दोलन:

केरल राज्य के पालघाट जिले में शान्त घाटी (Silent Valley) स्थित है। इस घाटी में शोर मचाने वाले कीड़ों (साइक्रेड) के नहीं मिलते इसकारण उसे शान्त घाटी के नाम से जाना जाता है। इस घाटी में उष्णकटिबन्धीय वर्षा-वन पाये जाते हैं। ये जंगल विलुप्ति की कगार पर हैं। इस घाटी के जंगलों में मनुष्यों का बहुत कम हस्तक्षेप हुआ है। इस घाटी को पाँच लाख साल पुराने जैविक पालने (Biological Cradle) की भी संज्ञा दी जाती है। इन वनों में दुर्लभ जीवजन्तु तथा पश्चिमी घाट में मिलने वाली कुछ दुर्लभ वनस्पतियाँ पाई जाती हैं।

कुछ साल पहले केरल सरकार ने इस क्षेत्र में जलविद्युत परियोजना के निर्माण का निर्णय लिया था। इस योजना से 60 मेगावाट बिजली और मलावार क्षेत्र की 10,000 हेक्टर जमीन पर सिंचाई प्रस्तावित थी। इस योजना से शान्त घाटी के पर्यावरण तथा जैव विविधता को गंभीर खतरा संभावित

था इसलिये कुछ पर्यावरणविदों तथा अनेक स्वयं सेवी संस्थानों ने उससे असहमति जाहिर की। इसके बाद 30 अगस्त, 1979 को फ्रेन्ड्स आफ दी ट्रीज सोसाइटी द्वारा दायर की याचिका पर केरल उच्च न्यायालय ने स्थगन आदेश दिया। भारत सरकार ने बढ़ते आन्दोलनों तथा बौद्धिक दबाव के कारण शान्त घाटी में जलविद्युत योजना को रोक दिया।

जैवविविधता कर्नाटक चिपको आंदोलन:

उत्तरी कर्नाटक के समुद्र तट के समीप पश्चिमी घाट पर्वत श्रृंखला है। यहाँ की जैवविविधता बहुत सम्पन्न है। इस क्षेत्र से बहुमूल्य औषधियों, चारा, फल तथा ईंधन प्राप्त होता है। इस क्षेत्र में सदाबहार वन पाए जाते हैं। चिपको आंदोलन से प्रेरणा लेते हुए यहाँ के स्थानीय निवासियों ने वृक्षों की कटाई का विरोध किया था। सन 1983 में कालासेकुडरगोड के जंगलों में 150 महिलाओं तथा 30 पुरुषों ने वृक्षों से चिपक कर 38 दिन तक वृक्षों की रक्षा की थी। इसके बाद, वृक्षों की कटाई पर रोक लगी। बेनगांव, हर्स तथा निडिगोड के जंगल बचे। इस आंदोलन से सारे दक्षिण भारत में जंगलों तथा पर्यावरण के प्रति जागरूकता बढ़ी। इस आन्दोलन का उद्देश्य सदाबहार वनों के वृक्षों के साथ साथ जैवविविधता की रक्षा था।

वनों की आवश्यकता:

वनों की आवश्यकता निर्विवादित है क्योंकि वे अपनी प्राकृतिक शुद्धिकरण व्यवस्था को सक्रिय रख आक्सीजन का सन्तुलन बनाने में योगदान देते हैं। वनों के कम होने का मतलब है आक्सीजन की कमी। आक्सीजन की कमी का मतलब है जीवन पर संकट। इस कारण वे अपरिहार्य हैं। इसके अलावा, नदियों को पानी उपलब्ध कराने में उनकी महत्वपूर्ण भूमिका है। मनुष्यों के लिये औषधियों, भोजन, उद्योगों के लिये कच्चा माल प्रदान करते हैं। तापमान नियंत्रण में योगदान देते हैं, साथ ही खतरनाक मांसाहारी वन्य प्राणियों से समाज को सुरक्षित रखते हैं। पर्यावरण सन्तुलन एवं संरक्षण में उनका योगदान बहुआयामी और विविध है। वन पृथ्वी के पारिस्थितिक तंत्र को सन्तुलन कायम रखने वाले प्रमुख एवं अनिवार्य घटक हैं इसलिए उनकी आवश्यकता निर्विवादित है।

जैवविविधता की आवश्यकता:

इकोसिस्टम सेवाओं के लिए जैवविविधता अनिवार्य है। उसके घटने से गरीबी बढ़ती है। यह आश्चर्यजनक है कि आदिवासियों ने अपनी परम्परात व्यवस्थाओं और रीति-रिवाजों द्वारा जंगलों के पर्यावरण को काफी हद तक ठीक स्थिति में रखा है।

इसके उलट, जैव विविधता का विकृत रूप, सामान्यतः उन इलाकों में देखा गया है जहाँ वन और जीवन के रिश्तों की अनदेखी करने वाला समाज निवास करता है।

संरक्षण वन विभाग की भूमिका:

वन कई लोग मानते हैं कि वन संरक्षण की जिम्मेदारी केवल वन विभाग की है। यह सही नहीं है। यह सामाजिक जिम्मेदारी और नागरिक दायित्व भी है। वन संरक्षण में उद्योगों और कानून बनाने वालों की भी

भूमिका है।

भविष्य में जलवायु परिवर्तन के कारण मौसम में बदलाव आवेगा। तापमान में वृद्धि होगी तथा वाष्पीकरण बढ़ेगा। वनों और वन्य प्राणियों पर पानी का संकट बढ़ेगा। उन्हें जलाभाव से बचाने के लिए पानी की माकूल व्यवस्था करना आवश्यक होगा। उस व्यवस्था का लक्ष्य जल-स्वावलम्बन होना चाहिए। जल स्वावलम्बन से जीव-जन्तुओं के लिये जंगल में भोजन और पानी का इन्तजाम सुनिश्चित होगा फूड-चैन पर पड़ने वाले असर की कमियों को दूर करने के लिए प्रयास करना होगा।

वन संरक्षण आम आदमी की भूमिका:

नागरिक जिम्मेदारी के अन्तर्गत समाज द्वारा वन विभाग को कुछ सुझाव दिए जा सकते हैं। पहला सुझाव मौजूदा प्रयासों की समीक्षा हो सकता है। दूसरा सुझाव हो सकता है जलवायु परिवर्तन के प्रतिकूल प्रभाव को कम कर वनों की सेहत तथा दायित्वों को बरकरार रखना। अर्थात् वन और जैवविविधता को सुरक्षित रखने के लिए प्रत्येक वन समूह (Forest Grid) को जलवायु की प्रतिकूलता से निपटने योग्य बनाना। इसके लिए वन विभाग को अपनी कार्ययोजना में दो प्रमुख सुधार करने की आवश्यकता होगी। पहले सुधार के अन्तर्गत वनों में पानी के भंडार,



नदियों में अविरल प्रवाह के लिए योगदान, नमी की उपलब्धता, जैवविविधता और फूड-चेन जैसे अनेक बिन्दुओं को यथेष्ट रूप से समाहित करना होगा। दूसरे सुधार के अन्तर्गत भूमि कटाव और जल संरक्षण के कामों की तकनीकी दक्षता को और बेहतर बनाना होगा।

समाज द्वारा कार्य योजना में दोहन और उत्पादन के सन्तुलन एवं जैवविविधता को आदर्श बनाने तथा मिश्रित यनों को विकसित करने हेतु अनुरोध किया जा सकता है। अपेक्षा होगी कि सामुदायिक वनों के विकास में ग्रामीण समाज की जिम्मेदारी बढ़े। विभाग इस हेतु पहल करें। समाज चाहेगा कि वन सम्पदा का दोहन प्रकृति से तालमेल और वनों की कुदरती भूमिका को ध्यान में रखकर हो। आक्सीजन की कमी के कारण जीवन पर संकट नहीं पनपे। समाज की यह भी अपेक्षा है कि सरकार की सहयोगी और उत्प्रेरक की हो। इंडियन फारेस्ट एक्ट 1927 में उल्लेखित ग्राम वन (Village Forest) की अवधारणा को लागू करना चाहिए। मौजूदा कायदे-कानूनों के बन्धनों के कारण आम आदमी जंगल में जाकर वृक्षारोपण नहीं कर सकता पर अपने घर के आसपास तो वृक्ष लगाने का काम कर ही सकता है। उनकी रक्षा कर सकता है। अपने मित्रों, सगे सम्बन्धियों तथा परिचितों को पेड़ लगाने के लिए प्रेरित कर सकता है। अनेक नगरीय निकाय तथा पंचायतें स्मृति-वनों को प्रोत्साहित करते हैं। हम अपने आसपास प्राणवायु बढ़ाने वाले कार्यक्रमों को सफल बनाने में अपना योगदान दे सकते हैं। सूखते पेड़ों को पानी देकर उन्हें बचा सकते हैं।

हरियाली से जुड़ा हर प्रयास हकीकत में योगदान होता है। उस नागरिक दायित्व को पूरा करने के लिए अपने घर में किचिन गार्डन, फूल वाले वृक्ष तथा सब्जियाँ लगावें। संभव हो तो टैरेस गार्डन विकसित करें।

बड़े नगरों में कई मंजिला बिल्डिंग बनने लगी है। इनमें बहुत से लोग निवास करते हैं। उनकी आक्सीजन आवश्यकता को पूरा करने के लिए कई मंजिला बिल्डिंगों के आसपास सघन वृक्षारोपण होना चाहिए। हर बसाहट के आसपास ढेर सारे पार्क होना चाहिए। ढेर सारी हरियाली होना चाहिए।

लकड़ी के फर्नीचर का कम से कम उपयोग करें। कागज के इस्तेमाल में संयम बरतें। कागज के दोनों ओर लिखें। इससे कागज तो बचेगा ही वन भी बचेंगे। रीसाईकिल्ड कागज का लपयोग बढ़ावें। कम्प्यूटर संदेश का उपयोग करें। रेल टिकिट की हार्ड कॉपी के स्थान पर मोबाइल पर दर्ज टिकिट संदेश को बढ़ावा दें। अधिक से अधिक केशलेस ट्रांजेक्शन करें। और भी अनेक तरीके हैं या हो सकते हैं जिन्हें अपनाने से जंगल बचाये जा सकते हैं। सामाजिक दायित्व पूरा किया जा सकता है।



लेखक: म.प्र. शासन वाटर शोड मिशन
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सर्वोच्च न्यायालय (सुप्रीम कोर्ट) पेड़ों को काटना मानव हत्या से भी बदतर है



(न्यायमूर्ति अभय एस. ओका और न्यायमूर्ति उज्ज्वल भुइयां की पीठ ने कहा)

यह टिप्पणी 25 मार्च 2025 को सुनवाई के दौरान की गई थी, और यह फैसला पर्यावरण संरक्षण के संदर्भ में एक महत्वपूर्ण कदम माना जा रहा है।

भारत के सर्वोच्च न्यायालय ने पेड़ों की अवैध कटाई के बारे में वास्तव में एक चौंकाने वाली घोषणा की है, जिसमें कहा गया है कि बड़ी संख्या में पेड़ों को काटना "मानव हत्या से भी बदतर है।" यह टिप्पणी 25 मार्च 2025 को सुनवाई के दौरान की गई थी।

यह मामला उत्तर प्रदेश के मथुरा-वृंदावन क्षेत्र में 'ताज ट्रेपेज़ियम जोन' (Taj Trapezium Zone) से संबंधित है, जहाँ शिवशंकर अग्रवाल* नामक एक व्यक्ति द्वारा डालमिया फार्म पर 454 पेड़ अवैध रूप से काटे गए थे। इस घटना को सुप्रीम कोर्ट ने गंभीरता से लिया और केंद्रीय अधिकार प्राप्त समिति (Central Empowered Committee - CEC) की रिपोर्ट को स्वीकार किया, जिसमें प्रति पेड़ 1 लाख रुपये जुर्माने की सिफारिश की गई थी। कुल मिलाकर, 4.54 करोड़ रुपये का जुर्माना लगाया गया। न्यायालय ने इस तरह की गंभीर कार्रवाइयों से होने वाले गंभीर और अपरिवर्तनीय पर्यावरणीय नुकसान पर जोर दिया और कहा कि, इन 454 पेड़ों से बने हरित क्षेत्र को पुनर्जनन करने में कम से कम 100 वर्ष लगेंगे। न्यायमूर्ति अभय एस. ओका और उज्ज्वल भुयान की अगुवाई वाली पीठ ने कहा कि पर्यावरणीय नुकसान से जुड़े मामलों में कोई नरमी नहीं बरती जानी चाहिए। उन्होंने यह भी अनिवार्य किया कि व्यक्ति अपने कार्यों से होने वाले नुकसान

को कम करने के लिए वृक्षारोपण गतिविधियों में शामिल हो। "पर्यावरण के मामले में कोई दया नहीं होनी चाहिए। बड़ी संख्या में पेड़ों को काटना किसी इंसान की हत्या से भी जघन्य है।" पर्यावरण संरक्षण के संदर्भ में यह फैसला एक महत्वपूर्ण कदम माना जा रहा है। यह निर्णय पर्यावरण संरक्षण के प्रति व्यापक प्रतिबद्धता को दर्शाता है और भारत में अवैध रूप से पेड़ों की कटाई के खिलाफ सख्त दंड के लिए एक मिसाल कायम करता है। इसके साथ ही, कोर्ट ने अग्रवाल* की ओर से जुर्माना कम करने की अपील को ठुकरा दिया और उन्हें निकटवर्ती क्षेत्र में पौधारोपण करने की अनुमति दी गई। यह फैसला सुप्रीम कोर्ट के पर्यावरण संरक्षण के प्रति सख्त रुख को दर्शाता है और इसे कई समाचार स्रोतों ने रिपोर्ट किया है।

संदर्भ और स्रोत:

[1] सुप्रीम कोर्ट: बड़े पैमाने पर पेड़ों की कटाई अधिक हानिकारक है ...

<https://lawtrend.in/supreme-court-felling-trees-on-a-large-scale-more-detrimental-than-homicide/>

[2] सुप्रीम कोर्ट ने पेड़ों की कटाई को हत्या से भी बदतर बताया: व्यक्ति पर ₹1 लाख प्रति ...



<https://voiceofplant.com/sc-cutting-trees-is-worse-than-murder/>

[3] भारत की असली पुष्पा? सुप्रीम कोर्ट ने अवैध रूप से पेड़ काटने के लिए एक व्यक्ति पर 4.54 करोड़ रुपये का जुर्माना लगाया... <https://economictimes.com/news/india/indias-real-pushpa-sc-slaps-man-with-rs-4-54-crore-fine-for-illegal-cutting-over-400-trees/articleshow/119514634.cms>

[4] सुप्रीम कोर्ट ने प्रति पेड़ ₹1 लाख का जुर्माना लगाया | सुप्रीम कोर्ट का फैसला ... <https://www.youtube.com/watch?v=6q0yZe84YPk>

[5] बड़ी संख्या में पेड़ों को काटना किसी इंसान की हत्या से भी बदतर है ... <https://timesofindia.indiatimes.com/india/cutting-large-number-of-trees-worse-than-killing-a-human-being-says-supreme-court/articleshow/119498838.cms>

[6] सुप्रीम कोर्ट ने कहा कि पेड़ों को काटना हत्या से भी बदतर है। जानिए भारत का ...

<https://www.indiatoday.in/information/story/cutting-trees-worse-than-murder-says-supreme-court-know-indias-tree-protection-laws-2699352-2025-03-26>

[7] सुप्रीम कोर्ट ने बिना अनुमति के पेड़ों की कटाई की अनुमति देने वाले 2019 के आदेश को वापस लिया ... <https://www.livelaw.in/top-stories/supreme-court-recalls-2019-order-allowing-tree-felling-without-courts-permission-in-taj-trapezium-zone-287466>

[8] भारत का असली पुष्पा? यह इंसानों को मारने से भी बदतर है - द हंस इंडिया... <https://www.thehansindia.com/news/national/indias-real-pushpa-its-worse-than-killing-humans-957540>

[9] सुप्रीम कोर्ट ने अवैध रूप से पेड़ों की कटाई के लिए ₹4.54 करोड़ का जुर्माना लगाया ... <https://vrindavantoday.in/supreme-court-imposes-%E2%82%B94-54-crore-fine-for-illegal-tree-felling-in-mathuras-dalmia-bagh/>



दुधवा टाइगर रिजर्व में दो एक सींग वाले गैंडों (राइनो) को खुले वन में छोड़ा

27 मार्च 2025, उत्तर प्रदेश वन विभाग के प्रधान मुख्य वन संरक्षक (HoFF) श्री सुनील चौधरी और प्रधान मुख्य वन संरक्षक (वन्यजीव) श्रीमती अनुराधा वेमुरी के कुशल निर्देशन में दुधवा टाइगर रिजर्व में दो और बड़े एक सींग वाले गैंडों को खुले स्थान पर छोड़ा है। भारत के तराई क्षेत्र में मुक्त रूप से घूमने वाले गैंडों को लाने और उनकी आबादी बढ़ाने के उद्देश्य से गैंडों को स्थानांतरित करने का अभियान 27 मार्च 2025 को सरकारी अधिकारियों, क्षेत्र कार्यकर्ताओं, नेपाल राष्ट्र, असम और उत्तर प्रदेश पशु चिकित्सकों, गैंडा विशेषज्ञों और महावतों के सहयोग से किया गया।

इस अभियान को योजनाबद्ध तरीके से दुधवा टाइगर रिजर्व में 27 वर्ग किलोमीटर के बाड़बंद पुनर्वास क्षेत्र के अंदर चार दशकों से अधिक समय से लगभग 46 गैंडों के बीच से दो गैंडों को स्थानांतरित करना शामिल था, ज्ञात हो कि दो गैंडे विगत वर्ष नवंबर माह में अवमुक्त किए गए थे। उत्तर प्रदेश में गैंडा संरक्षण के तकनीकी साझेदार डब्ल्यू.डब्ल्यू.एफ.-इंडिया ने दुधवा टाइगर रिजर्व में ऐतिहासिक गैंडा स्थानांतरण अभियान में उत्तर प्रदेश वन विभाग का सहयोग किया है।



दुधवा टाइगर रिजर्व के फील्ड डायरेक्टर डॉ. राजा मोहन, डिप्टी डायरेक्टर दुधवा डॉ. रेंगाराजू टी और डब्ल्यू. डब्ल्यू. एफ. के तराई हेड डॉ. मुदित गुप्ता के नेतृत्व में के हाथियों और उनके प्रशिक्षित महावतों की मदद से 15 से 20 वर्ष की आयु के एक नर और एक मादा गैंडे की पहचान की गई और उनका पता लगाया गया। इसके बाद विशेषज्ञों की विशेष टीमों ने गैंडों को निश्चिंत करने में मदद की, उन्हें स्थानांतरित किया और उनके स्वास्थ्य मापदंडों की जाँच करने के बाद रेडियो कॉलर लगाकर उन्हें प्राकृतिक आवास में अवमुक्त दिया।



कॉटन-टॉप टेमरिन (सुगइनस ओडिपस) एक अनोखा बंदर

संकलन : जगदीश चन्द्रा

कॉटन-टॉप टेमरिन, जिन्हें वैज्ञानिक रूप से सुगइनस ओडिपस के नाम से जाना जाता है, उत्तर-पश्चिमी कोलंबिया के उष्णकटिबंधीय जंगलों में पाए जाने वाले छोटे न्यू वर्ल्ड बंदर हैं। उन्हें उनके विशिष्ट सफेद बालों के लिए पहचाना जाता है जो माथे से गर्दन के पिछले हिस्से तक फैले होते हैं, जिससे उन्हें अल्बर्ट आइंस्टीन की याद दिलाने वाला एक अनूठा रूप मिलता है

आकार और वजन : कॉटन-टॉप टेमरिन का वजन 0.5 किलोग्राम (1.1 पाउंड) से कम होता है और शरीर की लंबाई लगभग 20.8 से 25.9 सेमी (8.2 से 10.2 इंच) होती है, जिसकी पूंछ 41 सेमी (16 इंच) तक पहुँच सकती है। वे न्यूनतम यौन द्विरूपता प्रदर्शित करते हैं, जिसका अर्थ है कि नर और मादा आकार में समान होते हैं।

फर और विशेषताएँ : उनका फर मुख्य रूप से पीठ पर भूरे रंग का होता है, नीचे का भाग सफेद-पीला, अंदर की जांघें लाल-नारंगी और चेहरे पर महीन सफेद बाल होते हैं। उनकी उंगलियों पर तीखे पंजे होते हैं, जो चढ़ने में मदद करते हैं, जबकि उनके निचले कैनाइन दांत उनके ऊपरी कृन्तकों से लंबे होते हैं, जो दाँतों जैसे दिखते हैं।

व्यवहार और सामाजिक संरचना : कॉटन-टॉप टेमरिन अत्यधिक सामाजिक जानवर हैं जो सख्त प्रभुत्व पदानुक्रम की विशेषता वाले पारिवारिक समूहों में रहते हैं। आमतौर पर, केवल प्रमुख नर और मादा प्रजनन करते हैं, जबकि अन्य वयस्क बच्चे की देखभाल में मदद करते हैं। वे भोजन साझा करने और संवरने जैसे सहकारी व्यवहार प्रदर्शित



करते हैं, जो समूह सामंजस्य के लिए आवश्यक हैं।

प्रजनन : मादा आमतौर पर जुड़वाँ बच्चों को जन्म देती है, और माता-पिता की देखभाल समूह के सदस्यों के बीच साझा की जाती है। पिता अक्सर शिशुओं को अपनी पीठ पर तब तक ले जाता है जब तक वे ठोस भोजन खाने लायक नहीं रह जाते।

आहार और आवास : ये इमली मुख्य रूप से कीटों और पौधों के स्रावों पर भोजन करती हैं, जो उनके पारिस्थितिकी तंत्र में बीज फैलाने वालों के रूप में महत्वपूर्ण भूमिका निभाते हैं। वे उष्णकटिबंधीय वन किनारों और द्वितीयक वनों में निवास करते हैं,

चारागाह और घोंसले के लिए वनस्पति की कई ऊर्ध्वाधर परतों का उपयोग करते हैं। संरक्षण स्थितिकॉटन-टॉप इमली गंभीर रूप से संकटग्रस्त है, अनुमानित जनसंख्या केवल 6,000 व्यक्ति ही जंगल में बचे हैं, जो कि निवास स्थान के विनाश और जैव चिकित्सा अनुसंधान के लिए ऐतिहासिक अति-दोहन के कारण है। इस अनूठी प्रजाति को विलुप्त होने से बचाने के लिए संरक्षण प्रयास आवश्यक हैं। संक्षेप में, कॉटन-टॉप इमली जटिल सामाजिक संरचनाओं और महत्वपूर्ण पारिस्थितिक भूमिकाओं वाले आकर्षक प्राइमेट हैं, फिर भी वे गंभीर खतरों का सामना करते हैं जो उनके अस्तित्व को खतरे में डालते हैं।



स्रोत : विकिपीडिया

https://en.wikipedia.org/wiki/Cotton-top_tamarin



पर्यावरण बचाएँ

- श्रीमती रीना मिश्रा

धरती का सौंदर्य प्रकृति का सबसे अद्भुत नजारा ।
हवा , पानी और सूरज ने मिलकर
इसका रूप संवारा ॥

सागर की ऊँची लहरें भी हम सबके
मन को भाती।
उठ कर गिरना गिर के उठना हम को
हैं सिखलाती ॥

जब सूरज की स्वर्णिम आभा इस वसुधा पर पड़ती।
फल, फूल ,वृक्षों से लदी ये धरती नई
दुल्हन सी लगती ॥

बारिश की रिमझिम बूंदों से खिलता चमन ये सारा।
सुंदर छटा देखकर सबका मन हर्षित
हो जाता ॥

छोटे छोटे शुभ प्रयासों से ही जीवन
सुंदर बनता।
विपरीत परिस्थितियों से लड़कर ही मानव जीवन खिलता।

नभ में झिलमिल तारामंडल कितना प्यारा।
हम सबके जीवन में फिर से आशा का दीप जलाता ॥



श्री राम नवमीच्या हार्दिक शुभेच्छा



मुद्रक-प्रकाशक एवं संपादक जगदीश चन्दा नवसाक्षर प्रिंटिंग प्रेस एम.पी.नगर.भोपाल (म.प्र.)
से मुद्रित एवं म. नं. 277, रोहित नगर, फेस-1, बावडियाकलौ, भोपाल (म.प्र.) से प्रकाशित। मो. 9755936100