

COVER STORY

INNOVATION IN ACTION

Harnessing Technology for Wildlife Conservation in India

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World Wildlife Day celebrates wildlife and habitat conservation. World Wildlife Day 2024 theme — “Connecting People and Planet: Exploring Digital Innovation in Wildlife Conservation,” emphasises the role of technology in wildlife conservation. The WWD2024 seeks to raise awareness about digital conservation tools and foster intergenerational exchange and youth empowerment in wildlife conservation.

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**Connecting People and Planet:
Exploring Digital Innovation in
Wildlife Conservation**

#WWD2024

**WORLD
WILDLIFE DAY**
3 MARCH



INDIA possesses remarkable biodiversity, hosting a quarter of the world's carnivore species and ranking as one of the 17 most biodiverse nations globally. With 13% of the planet's bird species, 7% of mammals, 5% of reptiles, and 4% of amphibians residing within its borders, India has successfully preserved its rich biodiversity despite its burgeoning population of 1.4 billion.

Remarkably, endangered species like lions, tigers, elephants, and rhinos, which face declining populations elsewhere, thrive and even experience growth in India. Traditional conservation methods are now augmented with Artificial Intelligence (AI), Augmented Reality (AR) and Virtual Reality (VR) to protect this rich wildlife heritage. As World Wildlife Day 2024 approaches, let's commit to preserving India's wildlife using these innovative technologies while valuing traditional conservation practices and collective action.

Revolutionising Wildlife Conservation with Digital Tools

India is leveraging digital innovations like GIS, remote sensing, camera traps, SMART anti-poaching systems, drones, DNA analysis, and mobile apps for wildlife conservation. These tools offer precise monitoring, efficient data collection, and better protection strategies against poaching and habitat loss. For example, GIS maps assist in tiger conservation, while camera traps in Kaziranga National Park aid in tiger monitoring.

The Indian Government's Initiatives and Beyond

The Ministry of Environment, Forest, and Climate Change is leading initiatives like the Integrated Tiger Habitat Conservation Programme and the National Tiger Conservation Authority's wildlife crime control cell. Additionally, digital databases like the Indian Biodiversity Portal are being developed to support effective conservation strategies. Experts like Chelladurai Raghunathan, Joint Director, Zoological Survey of India (ZSI), MoEFCC, Govt of India, and Afifullah Khan, Professor in the Department of Wildlife Sciences at Aligarh Muslim University, emphasise the impact of climate change on ecosystems and the effectiveness of digital innovations in combating wildlife crimes.

Chelladurai Raghunathan spoke at length about the country's various aspects of wildlife conservation. He has worked extensively on establishing Long-term Permanent Monitoring Plots in the coral reefs of Andaman and Nicobar Islands to study the impact of climate change.

He explains, "Climate change endangers coral reefs in the Andaman and Nicobar Islands. Rising sea temperatures cause coral bleaching and hinder their ability to recover. Ocean

acidification weakens reefs, while sea level rise alters their optimal depth. Severe weather events harm coral colonies and disrupt monitoring. Changes in ocean circulation patterns affect nutrient availability. Digital technologies are used to extract and procure environmental and physicochemical data to establish impact in accordance of the coral reef ecosystem." He even highlights that the "e-Eye" project, implemented with the Wildlife Institute of India and the National Tiger Conservation Authority, uses camera traps with AI to monitor and track wildlife in national parks. The Zoological Survey of India conducts studies on various mammals using camera traps and GIS analysis. These digital tools provide data for analysing animal behaviour, population trends, and habitat health, aiding in conservation strategies. Mobile apps and online platforms engage citizens in reporting wildlife sightings and illegal activities, generating real-time data for conservation authorities. ZSI's Geo-fauna app documents the distribution of Indian fauna with real-time data.

Adding to this, Prof. Afifullah Khan, helped identify the following three dimensions of digital innovation in Wildlife Conservation:

1. Apps help gather data and information accurately for the forest department. These apps assist in accurately identifying species and gathering important data, which is then centralised for efficient use.
2. Digital innovation has benefited students, researchers, and scientists in their study of wildlife. For instance, advancements in telemetry enable researchers to track bird migration patterns globally.
3. Digital innovation has made conservation education more accessible through websites and interactive apps.

Conservation Success Stories in India

There are several real-life examples that highlight the importance of wildlife conservation. One such example is



A Bengal tigress in Pench Tiger Reserve

"India is home to the largest population of Bengal tigers in the world. The country has 55 tiger reserves to protect these majestic creatures."



Indian Rhinoceros at Kaziranga National Park

the success story of the Indian tiger population. In the early 20th century, rampant hunting and habitat destruction had pushed tigers to the brink of extinction in India. However, the tiger population has seen a remarkable recovery with strict conservation measures, including establishing protected areas and anti-poaching efforts. According to the latest tiger census, India is home to nearly 70% of the world's tiger population. This achievement showcases the effectiveness of conservation efforts in safeguarding endangered species.

Another example is the conservation of the Indian rhinoceros, also known as the Greater One-horned Rhinoceros. They are found in the northeastern region of India. Kaziranga National Park in Assam has the highest population of these magnificent creatures, contributing to their conservation efforts. They were once on the verge of extinction due to poaching and habitat loss. However, concerted conservation efforts, including setting up national parks and strict anti-poaching measures, have significantly increased their population.

Also, the Asiatic lion population was once severely depleted due to hunting and habitat loss. However, with the establishment of the Gir Forest National Park in Gujarat and strict anti-poaching measures, the population of Asiatic lions has made a remarkable recovery. Today, the park is home to over 500 lions, showcasing the success of conservation efforts in protecting this endangered species.

With approximately 50% of the global population, India is home to the largest number of wild elephants. The conservation of the Indian elephant is also a significant example. The conservation efforts have contributed to the gradual increase in the Indian elephant population and the protection of their habitats.

The Great Indian Bustard is one of the most endangered bird species in the world, with habitat loss and hunting being the primary threats to its survival. Conservation efforts, including protected areas, community-based conservation initiatives, and captive breeding programmes, are being

“The Western Ghats in India are recognised as one of the world’s biodiversity hotspots. They are home to numerous endemic species, including the lion-tailed macaque, Nilgiri tahr, and the Malabar giant squirrel.”



Family of Asiatic Lions at Gir National Park



Male Indian Elephant at Bandipur National Park

undertaken to save this magnificent bird from extinction.

Lastly, the conservation of the Olive Ridley sea turtle is another crucial example. These sea turtles face numerous threats, including entanglement in fishing nets, habitat destruction, and pollution. However, by implementing conservation measures such as the protection of nesting beaches, reduction of plastic pollution, and community involvement, the Olive Ridley sea turtle population has shown signs of recovery along the coasts of Odisha and Tamil Nadu.



The Indian context also includes the preservation of biodiversity-rich ecosystems such as the Western Ghats and the Sunderbans. These regions are home to a wide range of plant and animal species, many of which are endemic and found nowhere else in the world. Prof. Afifullah Khan points out that “The forest department is putting chips on trees and animals, so these chips basically help them identify if there is a tree which is cut and sold in the market and confiscated, then whole data can come through Radio Frequency Identification or RFID. That is a deterrent for the poachers and smugglers; if you touch a tree in which a chip is inserted, then you are likely to be caught. This has been quite effective. Trees like sandalwood and others, rare and of high economic value, are all protected this way.”

Citizen Science Initiatives in India

Citizen science plays a vital role in India’s conservation efforts. Projects like the Save Our Tiger campaign, the Wild Seve project in Karnataka, the Mysore Butterfly Park, the Marine Turtle Conservation Project in Odisha, and the Hornbill Nest

“The Great Indian Bustard, one of the heaviest flying birds in the world, is found in the deserts and grasslands of India. It is critically endangered, with less than 200 individuals remaining in the wild.”

IIT Delhi collaborates with IIT Jodhpur and the University of South Florida towards camera-based long-term monitoring of large flocks of migratory birds at nesting and feeding sites in Rajasthan. These techniques can help provide statistics about changes in population and behavioural and breeding patterns that may help ecologists and climate scientists draw more insights about the impact of climate change on migratory bird species.

Adoption Programme in Nagaland actively involve local communities in wildlife monitoring and protection. These initiatives demonstrate the power of collective action in conservation.

Renowned wildlife conservationist Latika Nath, also known as the “Tiger Princess of India,” backs the digital innovation in wildlife conservation. “Tiger conservation in India was revolutionised by the use of camera trapping devices that allowed for better identification of individual animals. Using this technology to replace the old pug mark technique has allowed the government to better monitor populations of tigers across the country round the year. Today, with the use of satellite tracking devices, camera traps, drones, genetic testing, and computer aided animal identification software, wildlife conservation has entered a new space. Infra-red and night vision cameras and binoculars allow for observation of nocturnal animal behaviour in a manner that was not possible earlier.”



She even highlights specific digital tools or technologies that have the potential to revolutionise wildlife conservation in future.

- It will not be too long before we can use technology to identify animals remotely using their individual body heat patterns, allowing for real-time monitoring without invasive methods.
- In veterinary science, handling of injuries and disease will be revolutionised by remote consultations, remote surgeries, and access to databases on medicine, disease and treatment procedures.
- Wildlife photography will change with cameras and lenses becoming more powerful and lighter. Already, with the use of new digital cards, it has become possible to record longer and better quality videos of animal behaviour.

Digital Innovation in Human-Wildlife Conflict Management

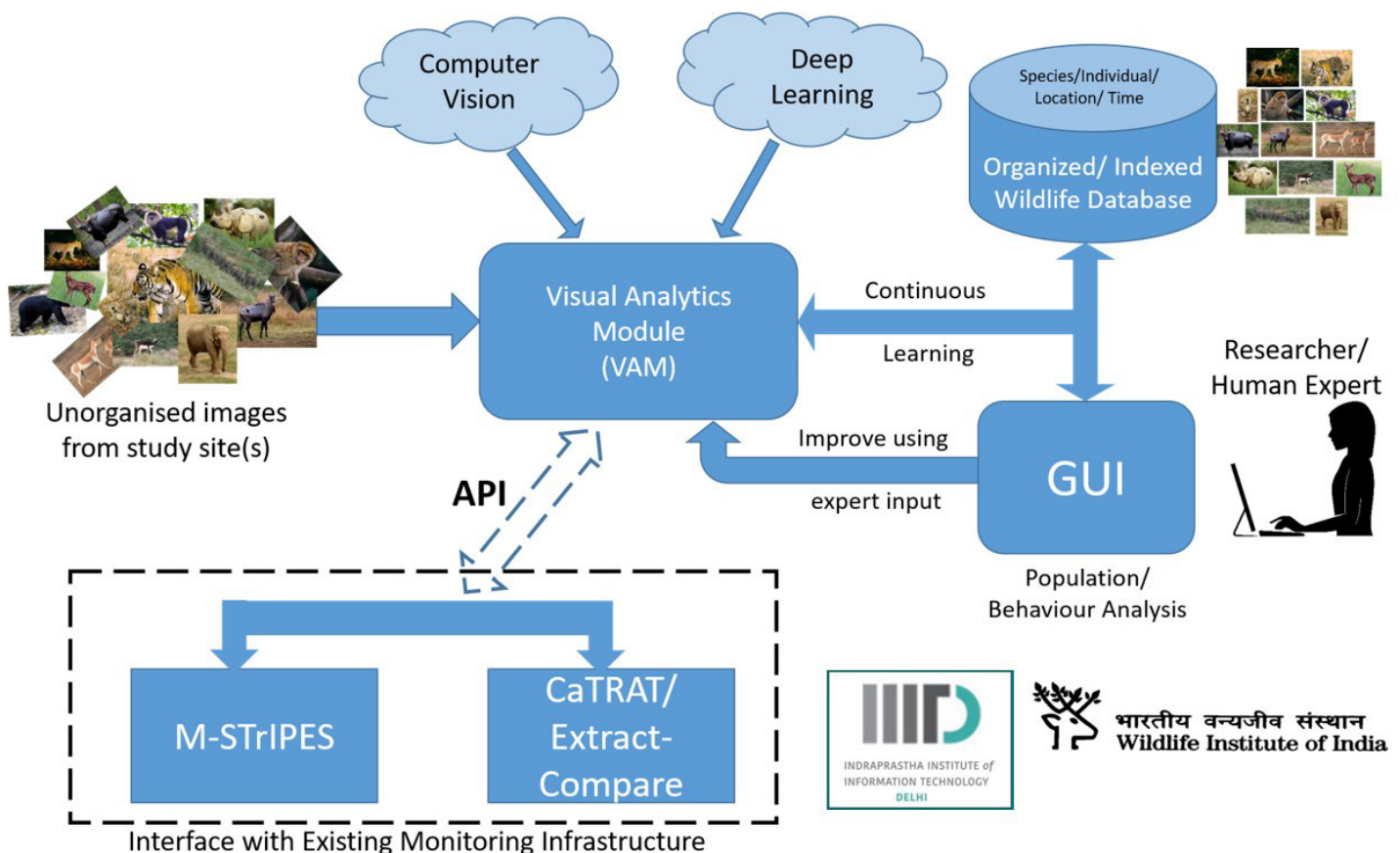
Ecologists worldwide have been using various forms of digitised data and analytics for monitoring populations, designing conservation policies, and more. India has also been at the forefront of using technology for conservation. The All India Tiger Estimation (AITE) is the world's largest effort to monitor and estimate the wild tiger population in India. Led by the National Tiger Conservation Authority

(NTCA) and the Wildlife Institute of India (WII), the AITE uses camera traps and the MStrIPES (Monitoring System for Tigers: Intensive Protection and Ecological Status) mobile app to collect digital data. They also utilise GIS technology and are exploring the use of AI to address conservation challenges. Several other non-governmental organisations working in wildlife conservation (e.g., WWF, WCS, etc.) also use similar technologies for wildlife conservation and conflict management.

AI in Wildlife Conservation in India

AI is proving to be a game-changer in protecting and preserving endangered species. With its rich biodiversity, India has also embraced AI technology to safeguard its wildlife. With increasing digitisation and data recording, AI techniques are being used to analyse this data to extract meaningful insights.

1. AI analyses satellite imagery to monitor forest cover and detect deforestation.
2. AI algorithms identify high-risk areas for habitat loss and enable proactive protection measures.
3. AI tracks and studies migratory species' movement patterns for effective conservation strategies.
4. AI enhances public awareness and engagement in wildlife conservation through social media analysis.





5. AI helps organisations and policymakers understand public perceptions and develop effective communication strategies and policies.

Tools like the Deep Neural Network-based tool developed by IIIT Delhi for segregating camera-trap images exemplify the efficient use of AI in conservation efforts. Saket Anand, Associate Professor at Indraprastha Institute of Information Technology (IIIT), Delhi, explains, “The first version of the tool will be a library with an Application Programming Interface (API) that will take a set of images as input and generate a database indexed by species. It will also have models for re-identification of tigers and leopards, which will take two tiger (or leopard) images as input and predict whether they are the same individual or not. In a future version, we will extend the re-identification capabilities to cater to other kinds of species, e.g., macaques, hyenas, and cheetahs.”

“The plan is to provide WII with the AI tool for processing camera-trap images and automatically organising them based on species and individual tigers, leopards and hyenas. This tool will be made freely available upon request to other organisations working on wildlife conservation or human-wildlife conflict management. This tool will automate

the repetitive, tedious and time-consuming task of image segregation, thereby helping conservation biologists save their time and energy for gaining important insights that may lead to improved policy for conservation and conflict management.”

The use of AI in wildlife conservation extends beyond India’s borders, with researchers from around the world contributing to this field. For instance, Conservation Metrics, an organisation based in the United States, has developed AI algorithms that analyse satellite imagery to track wildlife populations and their habitat changes. This technology enables conservationists to monitor species’ movements, identify critical habitats, and make informed decisions for their protection.

A remarkable AI-based tool used in wildlife conservation is the Protection Assistant for Wildlife Security (PAWS), developed by researchers at Harvard University. PAWS has been adopted by various national parks across the world, including in India, to enhance patrolling efforts and combat poaching attacks. Using AI algorithms, PAWS analyses data from multiple sources, such as satellite imagery, acoustic sensors, and camera traps, to identify potential threats in real-time. It can detect unusual activities, such as the movement of poachers or suspicious vehicles, and alert park rangers, enabling them to respond quickly and effectively.

In Africa, the company WildTrack is using AI to combat wildlife trafficking. By analysing footprints left by endangered animals, such as rhinos and elephants, their AI software can identify individual animals, track their movements, and even determine their age and gender. This information helps authorities identify poaching hotspots and develop targeted conservation strategies.

Celebrating World Wildlife Day in India**

Celebrate World Wildlife Day by visiting sanctuaries, learning about endangered species, volunteering with conservation organisations, and spreading awareness on social media.



These are just a few examples of how AI is being applied in wildlife conservation. As technology continues to advance, we can expect even more innovative solutions to emerge.

Augmented Reality (AR) and Virtual Reality (VR) in promoting wildlife conservation in India

AR and VR technologies can potentially enhance public understanding and engagement in wildlife conservation by providing immersive experiences. These tools can transport people to different ecosystems, enabling them to experience the wonders of wildlife without disturbing the natural habitats. By creating immersive and interactive experiences, these technologies can educate them about the importance of conservation and instil empathy towards wildlife.

AR can overlay digital content on live video footage so that viewers can get a closer look at the behaviour and habitat of various species. While VR can transport users to virtual environments. With the help of VR headsets, individuals can explore different ecosystems, interact with virtual animals, and learn about their conservation needs. This technology proves to be particularly useful in engaging young learners.

These technologies can also be used to raise funds for conservation efforts. However, it is essential to note that while AR and VR can significantly promote wildlife conservation in India, they should be used in conjunction with traditional conservation methods.



As time progresses, technology keeps advancing, opening up new possibilities for innovation and collaboration in wildlife conservation. As we commemorate World Wildlife Day in 2024, let us welcome the harmonious union of technology and traditional conservation approaches in safeguarding India's abundant wildlife legacy for future generations.

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