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Leveraging drones for forest conservation: Preserving India's natural ecosystem

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Forest conservation is essential for our fight against climate change. They act as carbon sinks and help foster biodiversity. However, human activity and rising emissions have broken this delicate balance. Flooding, drought, and habitat loss are a result of this phenomenon.

India must achieve a steep climate target within this decade. We need to accelerate our carbon offsetting and sequestration efforts if we intend to reduce our carbon emissions by one billion tonnes by 2030. A Global Forest Watch report states that we have lost over two million hectares of tree cover in the last 21 years. On average, we are losing approximately one lakh hectares of tree cover every year. In this context, tree cover refers to any vegetation that exceeds a height of five meters.

Interpreting the available forest data is also a challenge. According to the Indian State of Forest Report, the country's forest cover has marginally increased, but the increase accounts for plantations and patches as well. Thus, collecting accurate and highly granular forest data is extremely important for safeguarding them. More importantly, making this data accessible to

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multiple stakeholders at once will further accelerate conservation efforts.

Another issue that threatens our biodiversity is topsoil erosion. Nutrient-rich topsoil is a crucial layer of the earth without which flora, fauna, and our entire agricultural ecosystem would not exist. Unfortunately, climate change is washing away this essential layer. India loses approximately 16 tonnes per hectare of topsoil annually. This is much greater than normal levels; in foothill regions, the loss increases by 25 times.

We must understand how this affects the lives of citizens. Apart from the devastating impact on our environment, this has a huge effect on the livelihoods of the rural population. Lack of topsoil means that forests and arable lands will not be able to retain water, which further leads to flash floods, unpredictable droughts, and several other problems. The agricultural industry is the worst affected. Due to low ground-water reserves, irrigation becomes a challenge. And consistently degrading crop yields result in huge economic losses. A study published in the Journal of Agricultural Research estimates a loss of over 200 billion rupees annually due to topsoil erosion.

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However, solving such a complex and multifaceted issue requires multiple interventions. Both from the technological front and policy-wise. Watershed development is one such method that helps tackle both these problems together.

How Watersheds Can Make a Difference

Government initiatives such as the National Afforestation Program (NAP) and Integrated Watershed Management Program (IWMP) are underway to help increase the forest area. In India, watershed development (WSD) projects are heavily funded by governments. But the scale of these projects, the awareness around WSD, and the approach is a constant challenge.

WSDs can help the flora and fauna of an area thrive while mitigating the devastating impacts of climate change. The urgency to develop WSD across the country's green areas has skyrocketed and we require the right technology to fulfil such a goal.

Before learning how we can integrate drone technology to save our forests, it is essential to understand watersheds first. Watersheds are

crucial for low-lying areas as they regulate water flow, prevent flash floods, and protect the topsoil from surface runoff.

Effective watersheds contribute in several ways to society. Firstly, they help harbour a lot of biodiversity that is essential to saving our forests. Secondly, they have a direct impact on the lives of the rural population. From water availability to agriculture, they provide numerous benefits. WSD often involves building conservation structures such as check dams and reservoirs. This not only employs manual laborers but also promotes horticulture and aquaculture activities. Therefore, indirectly, watersheds could help strengthen the hyper-local economy and prevent high migration to cities.

Using Drones to Save Our Forests

Drone technology has matured by a significant margin in the last decade. From just tools of surveillance and photography, they have evolved into complete aerial intelligence systems. The data collected by drones is several times more detailed and cost-effective when compared to traditional survey methods. For example, by

surveying a patch of forest land the level of detail you get with drones is not feasible by manned aircraft and impossible manually.

Presently, manual ground-based surveys and satellite imagery are used to develop watersheds. These methods have several drawbacks. Firstly, they are expensive as they require large teams, sophisticated equipment, and a lot of processing. Additionally, they have a much higher turnaround time with less accuracy. It is impossible to traverse every square inch of land on foot but with drones, we can do that. Right now, surveying our forest lands fast and accurately is of paramount importance. The faster we can understand their terrain, the faster we can start developing watersheds. This is one of the best methods to save existing forest lands.

Thus, drones have emerged as an optimum solution. Drones can capture ultra-high resolution aerial images, LiDAR data, and multispectral data at a fraction of the cost and time. Drone survey data is also of better quality as it has billions of data points. By collecting high-resolution forest data, we can get deep insights into the state of our forests. For example, we can

ascertain the contours and slope of a region, conduct hydrological analysis to identify all the streams, etc.

A hydrological analysis is a very versatile tool that provides a range of information about forest land. Experts use aerial data to create a simulation of all the hydrological processes that occur in a particular region. This helps them mathematically represent everything that happens and could happen on a particular terrain. For example, processes such as groundwater recharge, surface runoff, and stream routing can all be simulated on a computer model very efficiently.

These insights further allow the authorities to perform watershed modelling, conduct runoff estimations, and critical water resources planning. If we need to construct check dams or bunds, dig irrigation channels and trenches, or do floodplain zoning, this drone data is critical. Forests act as sponges that absorb rainwater which in turn provides us with water for domestic, agricultural, and industrial use. Therefore, watershed development ensures that

forests continue absorbing and routing rainwater in the best possible manner.

Alongside increasing afforestation, we should be focusing on retaining the existing green cover. As rains, tree cover loss, and climate become unpredictable, the topsoil of these areas is under serious threat of being washed away. Lack of topsoil directly results in uncontrolled flooding during rains and droughts during summers. This has a cascading effect on not just biodiversity but also our food systems.

Achieving India's Climate Goals Through Collaboration

Eleven state governments including Rajasthan, Maharashtra, Goa, Odisha, Punjab, Karnataka, Telangana, and more have already used drone technology for watershed development activities. The turnaround time for these projects has been a significant advantage. Using drones and cloud-based processing we can survey and analyse thousands of square kilometres in months instead of years.

Several organizations are realizing the potential of drones in this sector. Having holistic aerial data