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Burning issue

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The still raging blaze in Tirumala hills in Andhra Pradesh has devastated thousands of hectares of forest besides putting at risk innumerable wildlife. While it is good to see the initiative shown and response of the state in bringing in air force helicopters and other firefighting equipment to control the spread, the reality is that a lot of damage is already done. A natural forest shaped by millions of years of evolution and with a value far beyond the human measures is most likely irrevocably lost. The hills and the surrounding forests are home to about 1,700 species of plants and a variety of wildlife, including endemic and rare ones such as red sanders and golden gecko.

Climate costs

In addition to Tirumala hills, there are also fires at NSTR near Srisailem and Karnataka's Bandipur tiger reserves, which are equally sensitive ecological places. It is estimated that, in just this one week in March, about 500,000 tonnes of CO2 emissions have resulted due to these forest fires. To put this emission rate into perspective let's compare the annual equivalent emission rates with a city like Mumbai. It turns out that it takes about 25 years longer for Mumbai (with two million vehicles on the road) to cause equivalent carbon damages. Inadequate forest protection is a real smack in the face of India's sustainable growth strategy and the agenda of National Action Plan on Climate Change (NAPCC).

The global impact of such fires must certainly have been on the American mind when Nasa warned India almost 15 days ago. The warning was allegedly ignored. These incidents damage India's reputation and cast doubts on the country's seriousness in dealing with the climate change issues.

The natural resource value of the forest cover lost in this one week alone is valued approximately at Rs 3,000 crore or about \$500 million. For comparison purposes, if we look at yearly rates, the damage costs approach about Rs 1.5 lakh crore, not very far from the annual budget of AP. A high price indeed for a country with rising poverty levels and precarious finances. According to one estimate, the present rate of forest fires and illegal deforestation, if continues unchecked, will halve the size of our forests by 2030. Forest fires represent a constant threat to ecological systems and natural resources on which our human survival is dependent on and, therefore, requires urgent attention.

Prevention and detection

Prevention is the most important aspect that needs to be considered when managing fire risk in forest areas. Since the majority of the forest fires are not due to natural causes such as lightning, but by human encroachers in the forest area, it is important that forests are monitored for illegal human activities. Gone are the days when forest guards on foot patrol were able to deal with the

intruders. With changing times and diminishing natural resources, we need to find more efficient ways of mitigating risks to forests by focusing on increased vigilance as a pre-requisite for prevention of forest fires and crimes.

The other effective way to minimise damage caused by forest fires is their early detection followed by quick response. Efforts are, therefore, needed to achieve early forest fire detection, which is traditionally based on human surveillance. Forest fires are most difficult to even locate in the deep uninhabited forest areas, let alone extinguish and control. Quick response requires trained personnel and availability of fire fighting helicopters with access to large supply of water near to every critical forest area.

While traditional methods such as watch towers have a role to play, they have many limitations as is evidenced by the recent fires. Some shortcomings include tough living conditions in the remote forests for observers and topographical limitations for observations. Fire lines and trenches are the other methods that are extremely useful in controlling the spread of fires. However, in order to be effective they need to be regularly maintained.

Technology to rescue

Technically more advanced forest surveillance systems is based on video camera monitoring units mounted on strategic spots that enable distant monitoring via IP based communications. While they solve some of the earlier issues, they are prone to omissions and also to naked eye fatigue because of high dependence on human operators.

The next advancement is in the introduction of automation in forest surveillance and fire detection systems installed at ground based stations. These rely on infrared, laser and/or smoke-plume detection with visual cameras with some kind of mechanism for communication of alerts to staff (SMSes, for instance). While better than the earlier ones, these systems have drawbacks such as the limited coverage, high number of false negatives and the lack of reliability of the automatic detection in changing environmental conditions.

'Eco' drones

In order to overcome these drawbacks, drones, commonly referred to as unmanned aerial vehicles (UAV) are the only option. They have been the source of attention for their use in military applications. But with the evolution of UAV technologies, especially the miniaturisation of the sensors and cameras and the new advances in communication and control systems, scientists and researchers are discovering their value in environmental and conservation projects, from tracking the effects of climate change to monitoring and surveillance of forests, along with a host of other civilian applications such as law enforcement, agriculture pest monitoring and natural disaster management. In the present context, drones have been well recognised as low-cost and effective solution to automatic forest fire detection, surveillance and protection efforts. Drones used for these purposes are referred to as 'eco-drones' or 'conservation drones'.

Moreover, cruising at low altitude, they can be flown in all seasons, and perceive significant amounts of detail. The manoeuvrability of UAVs makes them suitable to obtain better points of view and precise location of fire points. UAVs can carry enough computer power on-board for automatic detection and measurement of fire properties and for sending data and images to the ground control station, which make it possible to avoid the human risk inherent in manned aerial vehicle at much lower costs and without compromising on the quality.

The present no-fly zone at Tirumala presents another unique and interesting situation with respect to air surveillance. The present restrictions are based on the Hindu scriptures that prohibit manned aircraft from flying above the sacred abode of gods. However, with UAVs, as these are unmanned, the compliance with religious principles is ensured.

In addition to fire detection, drones can also be used for forest surveillance and monitoring for poachers and smugglers in ecologically sensitive areas. Identification of smugglers and fire criminals for evidence gathering and better prosecution for forest crimes is in fact a major benefit of UAVs. In most situations, the mere knowledge of being watched from above is enough of a deterrent to smugglers and fire criminals.

Misconceptions

One of the popular misconception regarding drones is that they are expensive. This is far from truth. To illustrate the point, let us take the case of Red Sanders, an endemic and endangered tree species of Tirumala hills, only region in the world where it grows naturally. It takes about 60-70 years in the wild for the tree to reach a harvestable size. Because of its high value in the east Asian countries, the tree has attracted the attention of smugglers.

Given this background, a high quality Israeli UAV can be purchased for about the same price of seized red sanders lorry (\$200,000 or approximately Rs 1 crore). Considering the rate at which red sanders loads are being seized (about one truck every month) in the past few years, the drones are a bargain, even without considering their fire risk reduction benefits and associated climate change mitigation benefits. Because of the inefficiency of ground based traditional methods, the seized trucks represent only a tiny fraction of the actual smuggling that happens. With drones, this ratio will change drastically and the last remaining endemic red sanders of the world have a better chance to be protected. The investment in drones pays for itself multiple times in a short time, as it, most importantly, helps in preventing the trees to be cut in the first place compared to the present focus on seizures of chopped trees. An ounce of prevention is worth a pound — or a tonne of red sanders, in this case — of cure, as the saying goes.

The other misconception is that drones are technically complex and not practical in Indian field conditions. However, contrary to the popular notion, there is no $E=mc^2$ type of work required here. Significant benefits can be achieved and real time monitoring of the forest conditions can be performed using basic off-the-shelf and readily available commercial technologies and also integrating UAVs with traditional methods. Advanced uses are also possible by models based on geographical information systems (GIS), 3D technologies and real time information crunching of the satellite data, though there are still a few challenges and concerns to be surmounted. Simply put, if drones are already being used in the country to monitor naxalites and other extremists in remote forest areas, why not against forest smugglers and fire fighting?

Government support

Given the seriousness of the forest protection issue in the country, a proactive approach is urgently needed to loosen the bureaucratic and policy hurdles for the use of UAVs for forest protection by a separate drone policy for forest protection. The government needs to look at these incidents as an opportunity to overhaul the complete process for forest fire prevention and surveillance management. The process should include establishing intelligent detection and automated early warning systems for poaching and fire incidents and ensuring quick and efficient response mechanisms. Last, but not least, it should also include the strengthening of legal policy so that deliberate forest fire crimes are tried as terrorist acts. ZZ

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