MEETING REPORT

Forest fires*

Every year forest fires cause great loss to the forest ecosystem, diversity of flora and fauna, and economic wealth. Forest fires annihilate large tracts of virgin forests and cause irreparable damage. Forest fires in Uttarakhand have till now been fought with age-old methods. However, scientists have made considerable advancement in monitoring and warning regarding the outbreak of forest fires with the help of GIS and satellite technology. A workshop was recently organized to discuss and disseminate the remote sensing and GIS technology that has been used to detect forest fires and how modern communication system can send an early warning to prevent fire outbreaks at the remotest corners of the highly inaccessible mountain terrain of Uttarakhand. Delegates from different institutions participated in the workshop along with staff of Uttarakhand Space Application Centre (USAC, Dehradun) and Uttarakhand Forest Department.

The workshop started with the welcome address by M. M. Kimothi (Director, USAC). He briefed the participants on the mandate of USAC, about how his centre will contribute to natural resource management, infrastructure and developmental planning, environment and climate change. The Centre will also contribute towards disaster forewarning, risk zonation, development of communication networks, telemedicine, education and training. He also described how forest fire risk zonation mapping is the way to initiate preventive measures in different risk areas. Risk zonation mapping involves studying the parameters responsible for ignition (such as dry biomass), combustion and spread of forest fire. Remote sensing and GIS technology would be used for classification of forest cover/type. Integration of forest types and topographical variables would be carried out using GIS for developing fire risk zonation model.

Opening remarks were presented by B. S. Burfal (Principal Chief Conservator of Forests, Uttarakhand Forest Department). He brought to the notice of all participants that the date of commencement of the workshop coincided with the date of start of forest fires in Uttarakhand, i.e. 15 February. Generally, the period of forest fires spans from 15 February to 15 June/July, on an average, every year. He stressed the need for advanced tools to detect forest fires at the earliest, for preventing its spread. He also informed that forest maps have been digitalized and need further refinement. He stressed on the need for an increase in frequency of fire photographs sent from space. S. S. Negi (Director, Forest Research Institute (FRI), Dehradun) mentioned that the forest was a good servant but a bad master therefore, forest fires should be prevented first and then controlled. He emphasized on the role of the local community and pointed the need for joint forest management and more involvement of the locals.

J. S. Parihar (Indian Space Research Organization (ISRO), Ahmedabad) detailed the role of remote sensing, about how it started in India in the 70s, how our satellite programme has advanced with more wide-field sensors, and how the INSAT system can give weather parameters for predicting forest fires. He mentioned that a database on forest roads needs to be built. He enlightened the audience about how using data sent by the INSAT satellite, early detection, pointed location, fuel load assessment, etc. of forest fires were now possible. He stressed on the fact that data need to be generated much faster. There was also need for more advanced geostationary satellites.

There were eight presentations in the 'Technical session'. Sushma Panigrahy (SAC) delivered the keynote address. She explained in detail how fire is monitored from space. The detection and monitoring of active fire has limitations. She also explained how assessment of scar, combusted biomass/carbon, gas emission from fire, forest-fuel load and ecological impact analysis can be done through satellite in detail. She also stressed that only certain crucial points will be provided from space. Sushma Panigrahy explained the thermal radiation principle and how it is used for active fire detection – INSAT 3D, channels 3, 5 and 6 send images and three sensors are used. Because of very long wavelength of thermal radiation, scattering is minimal. She explained the various algorithms used like NOAA/NESDiS, ATSR, MODIS (day pictures), DMSP (Defense Meteorological Sensor Programme (night pictures), INFFRAS (Indian Forest Fire Response Alert System). Maps of fire-prone areas were shown. A number of fire events have been recorded, which showed that March and April are the peak fire months throughout India. Data for greenhouse gas emission from biomass burning and progress of fire have been recorded. Digital elevation model is available for Uttarakhand, as there is variation due to elevation. The Alakananda watershed has been mapped with respect to road buffer, fire risk zone, habitation, vegetation cover, slope range and fuel moisture content. Gases like carbon monoxide (CO) from smouldering fire and carbon dioxide from active fire are detected using MOPITT sensor. Temporal pattern of CO across India has been mapped, which shows that there is increasing trend in CO from 2002 to 2006. Coincidentally, there is also an increasing trend in forest fires.

G. Rajashekar (National Remote Sensing Agency, Hyderabad) spoke on 'Satellite remote sensing inputs for forest fire detection and monitoring'. He described the various tools, e.g. IFFRAS application for pre-, during and post-fire. MODIS sends daily forest-fire alerts. He showed the progress on fire-frequency mapping and classification of area. Forest fire and biomass recovery map was also shown. Bulk of forest fires was detected in the late afternoon. Maximum fire was reported from Nainital District, Kumaon region (885 events) and Pauri district, Garhwal region. He stressed that the frequency of alerts needs to be increased. Uttarakhand maps showed more fire in Tarai region. Chir pine area showed maximum fires and 40% of broadleaved forest was prone to fire due to high temperature. Data on burnt area, longevity of fire, type, dis-

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tance, and recurrence are available, but administrative boundaries are currently not available. How much area is affected is important and ecological damage assessment needs to be done based on historical data and loss assessment. Rajashekar also mentioned that quicker methods need to be devised to send data.

Sunil Chandra Dangwal (USAC) spoke on how satellite data can be disseminated to the Forest Department and other users in Uttarakhand. He mentioned that 3.73 m ha of forest in India was affected due to fire. Raw images of direction of fire, smoke and hotspot detection can be sent to the Forest Department with the help of satellite data from MODIS/Resource Sat-P6/AWiFS, which sends data twice a day from NRSA to the Forest Department by e-mail and fax. A joint collaboration has been agreed upon between FRI and the Indian Institute of Remote Sensing (IIRS), Dehradun for the study of fuel load, surface temperature, ecological parameters, identification of vulnerable species, change in climate, ecological and biological characteristics, damage assessment, identification of moisture stress, etc. A detailed study has been done for Nainital District, as an initial study. A 3D model of Uttarkashi has been done. On 13 January 2008, a major forest fire was prevented at Gwaldam using the new technology. Controlled fire can be detected from threshold temperature. Dangwal mentoned that early warning system should take into account the history, as occurrence of fire is more due to anthropogenic reasons. A citizen's charter prepared by USAC was released on Bhilangana block in Garhwal Himalaya.

M. C. Porwal (IIRS, Dehradun) spoke on 'Forest fire risk zonation, a geospatial approach'. The objective was to identify fire-prone areas using satellite remote sensing and GIS. He explained the fire triangle with the three main factors, i.e. heat, fuel and air, and how they have modified it to include dry load of fuel, surface temperature and moisture stress. His team has done some modelling exercise by studying contour maps and road networks and has prepared a fuel type index. They have prepared a flow diagram for fire risk model based on elevation, slope, aspect, accessibility, fuel type, road and settlement, etc. There are 12 fuel models based on vegetation type.

P. Soni (FRI, Dehradun) spoke about 'Forest fire: a boon or bane'. She mentioned that forest fire impacts economic losses, regeneration of propagules, and soil physico-chemical and biological components. She emphasized the need to understand the role of forest fire in the conservation and management of forest ecosystem. Prescribed fire helps in the return of habitat, reduce fuel load, growing season, encourage hardy species, fire breaks population of spruce bud worms, helps in opening of cones and germination of seeds. Soni mentioned that natives have more knowledge on fires and therefore for the protection of forests from fires, the locals should be taken into confidence.

Vasisht (FRI) presented a case study on forest fire and spoke about 'Forest fires in India and their ecological concerns'.

Anil K. Gupta (National Institute of Disaster Management (NIDM), Ministry of Home Affairs) spoke on 'Forest fire: A disaster?'. He made the participants aware that according to the Disaster Management Act 2005, forest fire has been categorized as a disaster for the first time, because it involves hazard, vulnerability, and causes heavy damage and loss. He explained how disaster is managed from top to down in the administration. He also informed that a new ENVIS, called ENVIS-NIDM will soon come into being, which will deal with all sorts of disaster. He emphasized that for any disaster, accounting for damage assessment was important. It should be holistic, detailing all the tangible and non-tangible losses. All losses in the environment, natural resources, relating to loss in livelihood, losses incurred by the Government and community should be recorded in detail. For this, there has to be a pre-disaster assessment. For prevention and mitigation there should be preparedness, planning and monitoring, and forecast warning. During a disaster, there should be resources in standby and coordinations reporting. Post-disaster action should be rehabilitation and detailed post-mortem. There is need to identify risks spatially and temporally, including history, probability and extent. There should be record of buffer/waterbodies, ecological fire blocks, community blocks and civil/industrial blocks and emergency response system. He also informed that a national strategy is being prepared, and that NIDM and the Indian Council for Forestry Research and Education have formed a consortium for preparing a protocol on disaster management and documentation and post-mortem of forest fires. He also stressed the need for indigenous disaster management programmes. Parul Srivastava (Forest Survey of India, Dehradun) spoke on 'Near real time forest fire monitoring – an endeavour by FSI'. She presented some good data on different aspects of forest fire collected by FSI.

A large number of scientists and Forest Department officials from Uttarakhand participated in the panel discussion. The Forest Department officials were optimistic that they will now be able to move away from the jhapa (a twig used to douse forest fire), and have sophisticated tool for managing forest fires. Regarding compensation after the fire, as to how to assess the extent of damage and declare it as a disaster, there was a general consensus that more time, case studies and experts were needed for further deliberation. The concluding remarks were presented by Parihar in which he noted that GIS and satellite technology will play an important role in controlling forest fires through satellite monitoring and early warning, and help in conserving the precious natural assets in Uttarakhand.

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