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28th Foundation Day

ICAR- Central Agroforestry Research Institute, Jhansi celebrated its 28th Foundation Day on 8th May, 2016. Dr. V.N. Sharda, Member, ASRB, New Delhi in his foundation day lecture highlighted emerging issues in agroforestry and suggested to undertake research on agroforestry production and natural resources management & protection. He suggested to undertake long-term experiments involving all important land uses of the country and study all relevant parameters by involving scientists of different disciplines. He asked scientists to undertake research which is pro-active, anticipatory, problem-solving, result-oriented and farmer participatory, and in a network mode. He emphasized on protection and optimum utilization of natural resources as well as diversification of production while working with farmers and solving the problems in real field situations. He told that agroforestry is the only solution for bringing one-third area of land under forest cover. He advised that Sloping Agriculture Land Technology (SALT) need to be explored in agroforestry. Food, Fruit, Fodder, Fuelwood, Timber & Furniture demand of 2050 for human and animal population will be fulfilled by agroforestry, he said.

Dr. P.K. Ghosh, Director, ICAR-Indian Grassland and Fodder Research Institute, Jhansi appreciated the contributions made by the ICAR-CAFRI. He said that National Agroforestry Policy-2014 gave more challenges to ICAR-CAFRI.

Dr. O. P. Chaturvedi, Director, ICAR-CAFRI, Jhansi briefed about salient achievements and new initiatives of the Institute during 2015. He mentioned about the sustainable development, ecosystem services and rural livelihood issues in agroforestry, adopted villages in Uttar Pradesh and Madhya Pradesh under 'Mera Gaon Mera Gaurav' programme, organization of 'World Soil Day' and Jai Kisan-Jai Vigyan. Two progressive farmers were honoured for adopting agroforestry technologies. Three publications were released during the occasion. Scientists and officers from State line-departments, KVKs, NGOs, IFFCO, IGFRI, Jhansi and ICAR- IISWC, Datia participated in the event.

Identification of Tree Species through Hyperspectral Remote Sensing

Recent advances in hyperspectral sensors offer considerable potential for discrimination of earth surface materials. It is because the electromagnetic spectrum is divided into hundreds of discrete, contiguous spectral bands, sufficient to read the spectral signature of the material in the image. Hyperspectral imaging systems acquire images in over one hundred contiguous spectral bands. While multispectral imagery is useful to discriminate land surface features and landscape patterns, hyperspectral imagery allows for identification and characterization of materials (Table 1). As compared to Multi-spectral sensors, Hyperspectral sensors collect reflectance from objects simultaneously in hundreds of narrow adjacent spectral bands and thus due to their high spectral resolution, they are more efficient in discriminating soils, minerals, vegetation and man-made materials.

Hyperspectral images provide ample spectral information to identify and distinguish spectrally unique materials. Vegetation Scientists are using hyperspectral imagery to identify plant species, study plant canopy chemistry and detect vegetation stress; which is not possible with multi-spectral data. Most hyperspectral sensors are airborne, with two exceptions, the Hyperion sensor from NASA, USA on board the EO-1 satellite with 242 bands and the FTHSI sensor from the US Airforce Research Lab on-board the Mightysat- II satellite with 256 bands.

Table 1: Comparison of multispectral and hyperspectral data

Characteristics	Multispectral data	Hyperspectral data
No. of spectral bands	3 – 8	100 - 256
Spectral range	400 – 1300 nm	350 – 2500 nm
Bandwidth	Broad	Narrow, discrete
Applications	Land/ Forest cover mapping, crop area estimation, etc.	Species identification, vegetation stress detection, plant canopy chemistry, mineral mapping, etc.

Well-developed scientific application areas include geology and mineral exploration; forestry; marine, coastal zone, inland waters and wetlands; agriculture; ecology; urban; snow and ice; and atmosphere. There are also numerous military applications in camouflage, littoral zone mapping, and landmine detection. Hyperspectral sensors pose an advantage over multispectral sensors in their ability to identify and quantify molecular absorption. The high spectral resolution of a hyperspectral imager allows for detection, identification and quantification of surface materials, as well as inferring biological and chemical processes.

For all of these applications, ground truth signatures collected in the field and indexed in spectral libraries are critical for many methods of analysis. While image processing packages often include basic spectral libraries, application distinct libraries containing spectra of the specific materials occurring in the target field area greatly improves the accuracy of generated interpretations. In particular, spectra of vegetation are influenced by such a wide range of environmental conditions that it makes it difficult to adequately represent this variability without the collection of site specific field spectra. With this aim, an ICAR-Extramural project has been initiated at CAFRI, Jhansi to develop a spectral library for major agroforestry tree species.

Spectral Signature for Mango (*Mangifera indica*)

Hyperion hyperspectral data for Barabanki area has been downloaded from USGS website (http://earthexplorer.usgs.gov). USGS Hyperion product (L1R) contains 242 bands, of which 44 bands (1-7, 58-76, and 225-242) are uncalibrated bands. Also there exist spectral overlapping between VNIR and SWIR spectral range for bands 56-57 and 77-78. Therefore, out of the 198 calibrated bands, there are 196 unique spectral channels. The major atmospheric water vapour bands are centered at 940, 1140, 1380 and 1880 nm; the oxygen bands at 760 and carbon dioxide bands near 2010 and 2080 nm. The normal pre-processing of Hyperion data are: radiometric correction, atmospheric correction and geometric correction.

Downloaded data was for the period of March when fruit setting starts on the mango trees. This data has been pre-processed using ENVI software ver. 5.3 for poor band removals, de-striping, atmospheric correction, etc. Field visit was also conducted to collect reference GPS points on mango plantation as shown by yellow dots (Fig. 1). Region of interest were selected on the image with the help of GPS points (Fig. 2). The methodology for creating spectral signature for a tree species has been developed under and is being tested for other species.

Pure pixels (endmember) have been identified by pixel purity index (PPI) and n-D visualization techniques. Spectral signature created for mango species using Hyperion data is shown in figure 3. Mean spectra is shown by red line, the minimum and maximum spectra by blue and green lines. It can be observed from the signature plot that reflectance is higher in NIR spectral region (700-1300 nm) than visible region (400-700 nm). This is due to the fact absorption of sunlight is more in VIS region than NIR region. Moreover, NIR spectral region is important for vegetation analysis, but SWIR spectral region (1300-1800 nm), where water absorption bands are found; also plays an important role in differentiation of species. Beyond SWIR *i.e.* 1800 nm there is too much noise in the hyperspectral data, which result in unusual pattern (Fig. 3).

In order to harness the full potential of Hyperspectral data, development of spectral library is pre-requisite. By developing such library for a tree species, the identification and mapping of that species at a larger scale is possible.

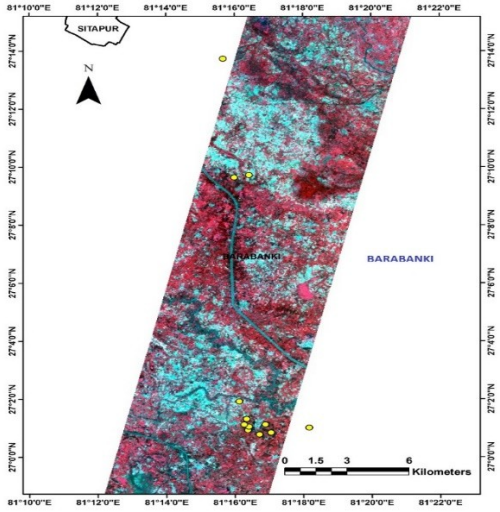

Fig. 1: GPS points collected from Barabanki shown on Hyperion image

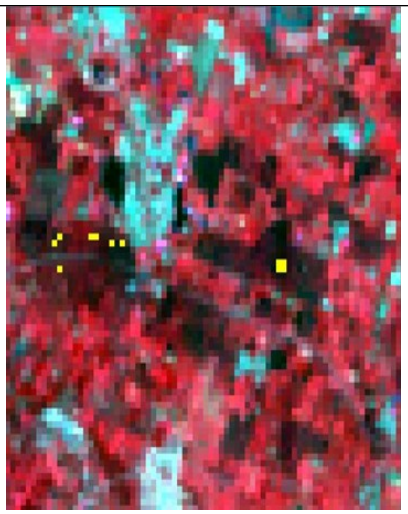

Fig. 2: Selected areas from mango plantations for signature creation

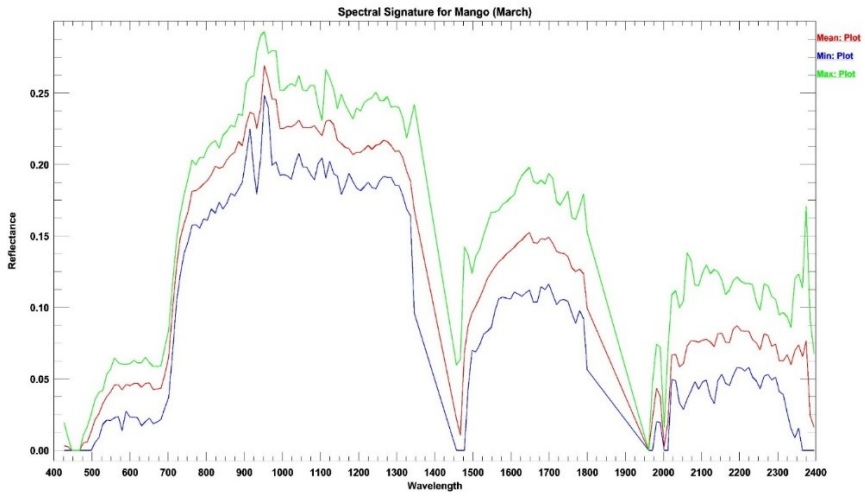

Fig. 3: Spectral signature of *Mangifera indica* generated from Hyperion hyperspectral data

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gSaa] eas Hkh LoPNrk tkx:drk ij fo"ks'k cy fn;k tk jgk gSA laLFkku lEizfr esjk xkWo esjk xkSjo ds vUrxZr 13 xkoksa rFkk ty lesV dk;Zdze ds vUrxZr 09 xkWoksa esa dk;Zjr gS vkSj xzkeh.k LpONrk tkx:drk esa viuk ;ksxnku ns jgk gSA LoPNrk i[kokM+k lfefr ds v/;{k Mk- vkj- ds- frokjh] dk;Zdze izeq[k ¼ekuo lalk/ku fodkl½ ,oa lnL;x.k Mk- vkj- ih- f}osnh] Mk- ujs"k dqekj] Jh chjs"k dqekj] Jh ch- flag ,oa Mk- lh- ds- cktis;h jgsA

Annual Group Meeting

All India Coordinated Research project on Agroforestry

(18-20th June, 2016)

Dr. V S Thakur, Hon'ble Vice Chancellor of Dr. YSPUH&F, Solan inaugurated the three days Annual Group Meeting of All India Coordinated Research Project on Agroforestry organized at Dr. YSPUH&F, Solan on 18th June, 20164. In his inaugural speech Dr. Thakur stressed upon dissemination of appropriate agroforestry models for the benefit of small and marginal farmers. He emphasized the need for integrating livelihood options in the agroforestry models. Dr. P. S. Pathak, Ex. ADG (Agroforestry), ICAR highlighted the gaps in the research programmes and future thrust areas. Dr. S. Bhaskar, ADG (Agron., AF and CC) ICAR emphasized on the need to redesign the technical programme keeping in view the current scenario and to initiate work ecosystem services of agroforestry. Dr. O.P. Chaturvedi, Project Coordinator and Director, ICAR-Central Agroforestry Research Institute, Jhansi presented the Coordinators Report and the brief summary of the research achievements of the project for the year. In the beginning, Dr. P. K. Mahajan, Dean College of Forestry of the host University welcomed the dignitaries and delegates. During the occasion four publications namely Agroforestry Technologies for different agro-climatic zones of the country, Potential Agroforestry systems for Haryana, A Profile- AICRP on Agroforestry-2016 and *Grewia optiva* an important MPTs of North Western Himalaya were released. The group meet was attended by 26 coordinating centres located in SAUs. During the meeting there were 9 Technical sessions including inaugural and plenary sessions. The Plenary session was chaired by Dr. N.S. Rathore, DDG (Education), ICAR and Dr. P. K. Khosla Ex. VC, CSKHPKVV, Palampur was the Guest of Honour. The group meet was attended by members of RAC, CAFRI namely Dr. J.C. Dagar, Ex. ADG (Agorn. &AF), Dr. M.A. Shankar, Ex. Director of Research UAS, Bangalore, Dr. V K Mishra, Ex. Dean, CoF, Solan and Dr. P. Kaushal, Regional Director, Solan. During the meeting region based new projects Terminalia based silvipasture for lower Himalayas, Salix based for Kashmir valley, Eucalyptus based agrisilviculture and Shisham multi-location evaluation for Indo-gangetic, Gmelina based system for Humid sub-humid, Ailanthus based for arid region, teak based for semi-arid region, Melia based for tropical region and *Dendrocalamus stocksii* based for high rainfall and coastal regions. The best presentation award was presented to coordinating centre, TNVASU, Kattupakkam.

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Institute Joint Staff Council Meeting

Institute Joint Staff Council (IJSC) meeting was held on 18th May, 2016 under the Chairmanship of Dr. O. P. Chaturvedi, Director. Various issues related to welfare of the staff were discussed.

Women Cell Meeting

A meeting of Women Cell was held on 18th May, 2016 under the Chairmanship of Dr. O. P. Chaturvedi, Director.

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Institute Research Council

Institute Research Council (IRC) meeting was held on 1st & 2nd July, 2016. All the Scientists of the Institute participated in the meeting and presented the progress and significant findings of their prjects. New Project Proposals were also discussed and approved.

Human Resource Development

Dr. Anil Kumar, Dr. Ram Newaj, Dr. A K Handa, Dr. Dhiraj Kumar and Dr. C K Bajpai participated in the Annual Group Meeting of All India Coordinated Research Project on Agroforestry from 18th to 20th June, 2016 at Dr. Y S Parmar University of Horticulture and Forestry, Solan (H.P.).