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International Women's Day

The event was organized on 8th March, 2019 at the Institute. On the occasion Hon'ble PM's address was telecasted. Staff of the Institute participated in the discussion on the theme "Think equal, build smart and innovate for change". Ms. Shelja Tamrakar and Ms. Kaushalya Devi expressed their views on gender issues and general atmosphere in offices and society regarding working women. Every one realized that there is sufficient change in mind set of both men and women yet lot more change is desirable to encourage women in different walks of life. It was unanimously agreed that women power will add to prosperity and progress of society in general and country as a whole. The programme was attended by all staff members and workers.

31st Foundation Day

ICAR-CAFRI, Jhansi celebrated its 31st Foundation Day on 8th May, 2019. Dr. S Bhaskar, ADG (Agron.,/AF &CC), NRM Division, ICAR, New Delhi was the Chief Guest of the function. Dr. Shiv Kumar Dhyani, Sr. Agroforestry Specialist, ICRAF, New Delhi, Dr. Sreenath Dixit, Theme Leader, ICRISAT Development Center (IDC), ICRISAT, Patancheru and Dr. A K Mishra, Director, ICAR-IGFRI, Jhansi were the special guests of the function. They appreciated the contributions made by the ICAR-CAFRI, Jhansi. During the function 09 number of publications were released by the chief guest.

Farmer's Workshop

A Farmers' Workshop entitled "**Xkq.koRrk ;qDr ikS?kksa }kjk cqUnsy[k.M {ks= esa Ñf'kokfudh dk foLrkj**" on 8th May, 2019 was also organized. The workshop was organized in collaboration with World Agroforestry Centre, South Asia Regional Office, New Delhi, ICRISAT, Hyderabad, ICAR-CAFRI, Jhansi and ISAF, Jhansi. About 200 farmers from seven district of Bundelkhand region of U. P. participated in the workshop.

Farmers' Workshop

One day workshop on "World Day to Combat Desertification and Drought" was organized jointly by ICAR-CAFRI, Jhansi, ICRISAT- Hyderabad, ICAR-IGFRI, Jhansi and Forest Department, Lucknow, Uttara Pradesh at Central Agroforestry Research Institute, Jhansi on 17th June, 2019. Presentation on different aspects like interventions by Forest Department towards addressing desertification and drought in Bundelkhand, importance of soil and water conservation measures in relation to DFI and to combat desertification and drought, agroforestry for diversification and sustainable yield, grassland production and management in non-arable lands and overview of different activities undertaken by ICAR-CAFRI, Jhansi etc. were made. About 120 participants from Bundelkhand region including farmers participated in this workshop.

Exhibition

ICAR-CAFRI, Jhansi participated and exhibited agroforestry stall in Krishi Kumbh-2019. The ICAR-Mahatma Gandhi Integrated Farming Research

Institute, Motihari, ICAR-RCER, Patna and Dr. RPCAU, Pusa, Samastipur jointly organized a three days Mega Agriculture Show, Krishi Kumbh - 2019 at Gandhi Maidan, Motihari, Bihar from 9th to 11th February - 2019.

National Productivity Week

ICAR-CAFRI organized National Productivity Week during 12-18 Feb, 2019. On the occasion Dr. Mahendra Singh, Pr. Scientist (Agril. Econ.) highlighted need for circular economy for enhancing the productivity and sustainability. Dr. Rajendra Prasad, Pr. Scientist (Soil Sci.) deliberated on recycling of materials for input cost reduction and environment protection in agriculture sector for benefit of future generation. Dr. Naresh Kumar, Sr. Sci. (Forestry) highlighted vision of Mahatma Gandhi which formed basis for orienting economic development strategy to focus on circular economy. The function was attended by all staff members.

Research Advisory Committee

21st RAC meeting of ICAR-CAFRI was held during 12th -13th March, 2019 under the chairmanship of Dr. K. Gurumurthi, Ex. Director, IFGTB, Coimbatore; Dr. S. Bhaskar, ADG(A, AF/CC), NRM Division, ICAR, New Delhi; Dr. S. K. Dhyani, Senior Agroforestry Expert, World Agroforestry (ICRAF), New Delhi; Dr. S. D. Bhardwaj, Ex- Dean, Y S P University of Horti. & Forestry, Solan; Dr. A. K. Mandal, Ex. Director, TFRI, Jabalpur; Dr. B. N. Patel, Principal and Dean, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari; Dr. R. C. Dhiman, Ex. General Manager, WIMCO Seedling Limited, R&D Centre, Bagwala, Kashipur Road, Rudrapur; Sh. Ashok Kumar Rajput, Dr. Anil Kumar, Director (A), ICAR-CAFRI, Jhansi and Dr. Inder Dev, Pr. Scientist & Members of RAC participated in the RAC meeting. The Committee interacted with the Scientists and reviewed the ATR of previous RAC. The RAC also visited the Agroforestry based Parasai-Sindh Watershed developed by the Institute.

Training Programme

A training programme on "Agroforestry Development" was organized for Farmers and Field officers from Jhansi, Mahoba and Chitrakut on 26th March, 2019. The training was sponsored by Uttar Pradesh Krishivaniki Mission, Lucknow (U.P.) and 56 farmers as well as field officers participated.

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Exposure visit of ICRAF-Odisha stakeholders

ICAR-CAFRI, Indian Society of Agroforestry and ICRAF, South Asia Office, New Delhi organised an exposure visit of ICRAF-Odisha stakeholders, which included the key nodal officers from line departments for Agroforestry & NRM activities in ICAR-ICAR-CAFRI during 28th -30th May, 2019 at ICAR-ICAR-CAFRI, Jhansi. During the exposure visit interaction meeting with all the scientists and ICRAF-Odisha stakeholders took place. Field visits to Research Farm of ICAR-ICAR-CAFRI, Parasai-Sindh and Garhkundar Dabar watershed were also organized during the exposure visit.

Visit Abroad

Dr. A K Handa, Principal Scientist and Dr. Asha Ram, Scientist participated in the 4th International Agroforestry Congress

NEW Scientist

- Sh. R Vishnu, Scientist (Agroforestry)
- Ms. Alka Bharti- Scientist (Agril. Biotechnology)
- Sh. Y N Venkatesh- Scientist (Agril. Entomology)

Assessment of Poplar (*Populus deltoides*) Area in Punjab state using High Resolution Remote Sensing

The accurate assessment of area under agroforestry systems in different agro-climatic regions of India can be done with the help of geospatial technologies like GIS/GPS and Remote Sensing. Under NICRA project, area under agroforestry systems in different agro-climatic regions is being mapped and estimated. Agroforestry area in 12 agro-climatic regions has been estimated to be 23.25 million ha, which is 8.49 percent of the geographical area (Rizvi et al., 2019). But this estimated area does not include area under major agroforestry tree species on farmlands. In Indo-Gangetic region, Poplar (*Populus deltoides*) species based agroforestry systems are prevalent in Punjab, Haryana, western Uttar Pradesh, Uttarakhand and Bihar.

Mapping and estimation of area under Poplar species is essential for the planners to know wood production from this species to meet domestic requirement. With this, a CAFRI-ICRAF collaborative project on "*Mapping Poplar Species in Indo-gangetic Plains of India*" has been initiated in 2018. For this purpose, two types of remote sensing data: LISS IV (spatial resolution- 5.8m) for district level mapping and Sentinel 2A (spatial resolution- 10m) for state level mapping. Sentinel data was freely downloaded from USGS Earth Explorer website (https://earthexplorer.usgs.gov).

Methodology Adopted for Mapping Poplar Species

District-level Poplar Mapping

For mapping of poplar at district level, high resolution LISS-4 data (spatial resolution- 5.8m) has been used. Preprocessing of this data includes layer stacking, mosaicking and clipping of district area with the help of boundary. From district area, forest cover was then masked and remaining area was analyzed in ERDAS Imagine software. For identification of Poplar species, object-oriented classification technique was applied using IMAGINE Objective tool. Object based image analysis (OBIA) segments the pixels into different objects and groups them according to objects. This method utilizes the NDVI image and computes single feature probability (SFP). OBIA method was found better than pixel based classification methods as far as mapping trees on farmlands is concerned. Methodology for mapping Poplar plantations on farmlands have been developed (Figure 1).

State-level Poplar Mapping

In case of state, Sentinal-2 data (spatial resolution- 10m) has been used. This data is available in 12 different spectral bands. Top-of-atmospheric (ToA) correction was applied on this data to get the reflectance values for each pixel. Then the images are mosaicked, clipped from state boundary and false colour composite (FCC) was generated. Forest cover area has been masked with the help of FCC and remaining area has been analyzed. Reflectance values for Poplar species were determined with the help of GPS points collected during field survey. By applying the range of reflectance values in knowledge classifier, Poplar area has been identified. The resultant images were subjected to correction for removing undesired area along roads, canals and within urban areas. Finally the accuracy was assessed and area statistics was calculated for the state.

Mapping & Estimation of Poplar Area in Punjab

Field survey has been conducted in Ludhiana, Shahid Bhagat Singh Nagar, Rupnagar and Hoshiarpur districts of Punjab. GPS data on Poplar (*Populus deltoides*) plantations from these districts have been collected. Some tracks of Poplar plantations were also taken through GPS. Poplar area in terms of hectare was highest in Hoshiarpur district (10573.13 ha) followed by Rupnagar district (5495.20 ha), but in terms of percent highest area was found in Rupnagar district i.e. 4.09 percent (Table 1). Poplar based agroforestry systems accounted for more than 50 percent of total agroforestry area in Rupnagar and Hoshiarpur districts (Figures 2, 3 & 4). Poplar mapping at state level was also done with Sentinel-2A data using the methodology described above. Estimated area under Poplar species in Punjab was found to be 0.276 million ha (5.63%) with a reasonably good accuracy of 81 percent (Figure 5).

Table 1. Estimated total agroforestry and Poplar area in four districts of Punjab

Parameter	Ludhiana	SBS Nagar	Hoshiarpur	Rupnagar
Agroforestry area (ha)	11691.85	5501.00	19600.38	9567.30
Poplar area (ha)	3698.67	534.00	10573.13	5495.20

Poplar area (%)	1.02	0.43	3.19	4.09
Poplar area as % of agroforestry	31.6	9.71	53.90	57.43

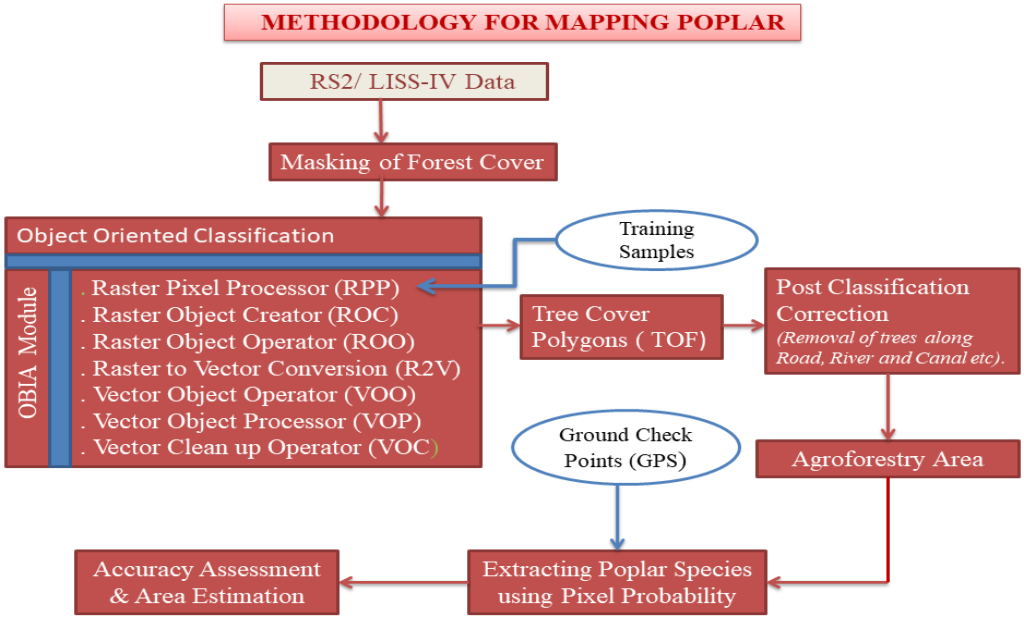

Fig. 1: Methodology for mapping Poplar species using OBIA method

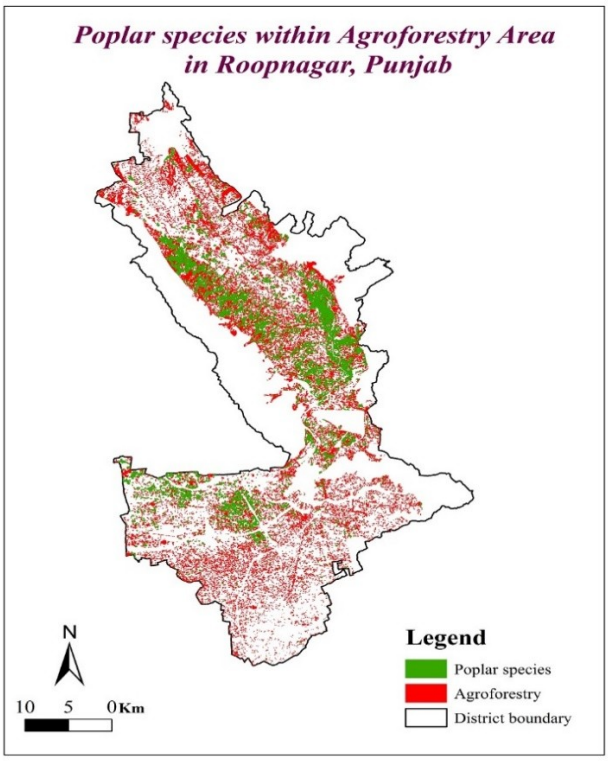

Fig. 2. Poplar area in Rupnagar district of Punjab

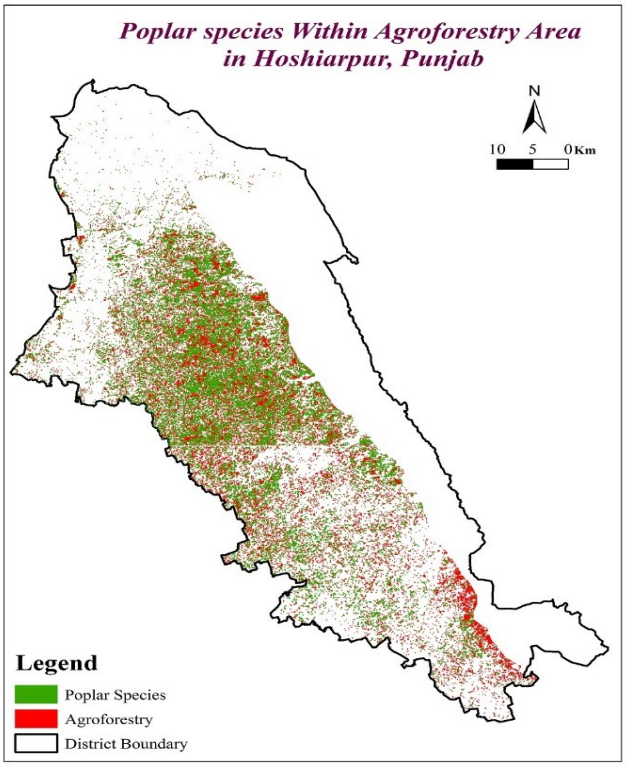

Fig. 3. Poplar area in Hoshiarpur district of Punjab

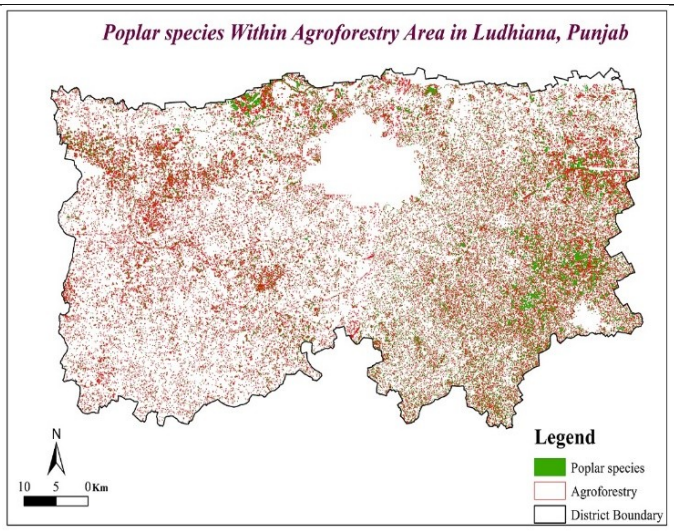

Fig. 4. Poplar area in Ludhiana district of Punjab

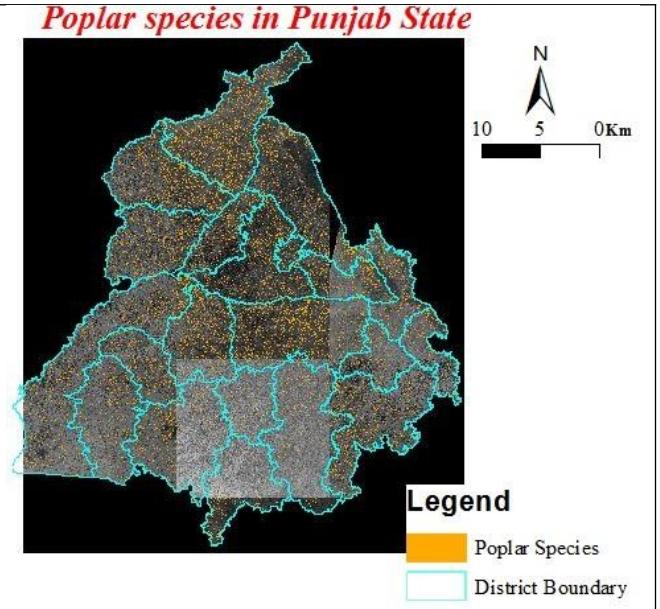

Fig. 5. Poplar area in Punjab state of India

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Plant Phenomics: An emerging science to study abiotic stress in trees in agroforestry systems

Drought is undoubtedly the most important abiotic stress having huge impact on growth of tree species. The situation has aggravated due to progressive changes in global climate. By 2050, a rise in day temperature of 3-5°C and night temperature at least 2°C are being widely predicted which is a serious concern. Drought stress adversely affects many physiological parameters namely seed germination, photosynthesis, respiration, transpiration, membrane stability, fertilization, dry matter partitioning, maturation, quality of seeds, nutrient absorption, protoplasmic movement, transport of materials and also modulates the level of hormones, primary and secondary metabolites and growth duration. Therefore, it is very important to understand the physiological mechanisms to cope with drought stress for better survivability of trees species under current global climate change.

Traditional phenotyping mostly focused on yield and yield-related traits of crops. With the advent of new physiological tools such as high-throughput plant phenomics, it is feasible to phenotyping of various adaptive traits of tree species under abiotic and biotic stress. High-throughput plant phenomics is a non-destructive imaging technique which allows a temporal resolution and monitoring of the same plants throughout the experiment. Digital images have several advantages such as accurate recording, transmission, and storage in a database. Imaging technology can be best to use for characterizing traits *e.g.* canopy architecture as NIR radiation can be transmitted from the upper leaves of the canopy to the lower leaves, which can reflect the photons back to the upper part of the canopy. As a consequence, leaf and canopy architecture, such as leaf thickness and growth habit can be studied. Laser triangulation has emerged as an accurate and fast method to measure plant size and determine plant architecture. The complexity of quantitative and adaptive traits such as root growth and its function, seedling vigour, plant architecture, leaf area and senescence,

leaf water potential, chlorophyll content, canopy temperature can now be well studied by using high-throughput phenomics platform.

Tissue water content and stability of PSII complex are the two important selection traits for drought tolerance in tree species. In this context, to explore the potentially of plant phenomics to dissect the various traits for drought tolerance, an experiment was conducted to study for drought response in mango tree by imposing desiccation stress using phenomics platform at ICAR-NIASM, Baramati during three month professional attachment training program. There was a gradual decrease in tissue water in mango twigs over a period of desiccation. The digital imaging systems and sensor technologies involving high-end sensors, spectral imaging systems, robotics and automation in phenomics platform have made it possible to monitor water level in mango twigs using NIR reflectance characteristics (Figure-1).

Plant photosynthetic activity is characterized by variable changes in maximum photochemical efficiency (Fv/Fm). Using chlorophyll fluorescence imaging system to measure change in Fv/Fm, it was found that mango leaves maintained maximum PSII efficiency during non-stressed condition. Thereafter, it gradually decreased slowly over a period of time (Figure-2).From our findings, it was noted that mango tree can sustain drought stress which has a paramount importance in agroforestry perspective.

Traits dissection by high-throughput phenotyping could provide a significant new opportunity in the understanding of tree responses to abiotic stresses, elucidating the genetic bases for these responses, and then introgressing these traits into appropriate combinations to improve performance of the tree species under global climate change condition.

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Participation in Workshop/Coordination/Meetings/Symposia

- Dr A K Handa, Principal Scientist participated in the biennial workshop of AICRP on DA held at UAS, Bangalore from 16-19 January, 2019 and Co-Chaired one of the Technical sessions.
- Dr A K Handa, Principal Scientist participated in XXV meeting of Regional committee VI of ICAR on 4-5 February, 2019 held at AAU, Anand.
- Dr A K Handa, Principal Scientist participated in Second Meeting of State Level Standing Technical Committee for UP Agroforestry Mission at Lucknow on 18 February, 2019.
- Dr. Rajendra Prasad, Dr. Sudhir Kumar, Dr. Mahendra Singh & Dr. K Rajarajan attended the XIV Agriculture Science Congress 2019 on “Innovations for Agricultural Transformation” during 20th -23rd February, 2019 held at NASC Complex & IARI Campus, organized by National Academy of Agricultural Sciences, New Delhi and ICAR- Indian Agricultural Research Institute, New Delhi.

Swachh Bharat Abhiyan

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