

**Proceedings and Recommendations of ICFRE-North
India Regional Research Conference held on 20th
April at Himalayan Forest Research Institute,
Shimla**



**Indian Council of Forestry Research & Education,
Dehra Dun- 248 006 (Uttarakhand)**

The ICFRE- North India Regional Research Conference was held at Himalayan Forest Research Institute, Shimla on 20th April 2018. Dr. Sanjeeva Pandey, IFS, PCCF, Himachal Pradesh, Director General, ICFRE, Deputy Director General (Research), Director, FRI, Dehra Dun, Director, HFRI, Shimla, ADG (RP), ICFRE, Senior Officers from the state forest departments of Himachal Pradesh, Uttarakhand, Punjab, Haryana, Uttar Pradesh and union territory of Chandigarh, senior professors from Universities of Forestry, Nauni and SKUAST-K, GB Pant Institute, Mohal, Kullu, NBPGR, Shimla, NGOS (HRG & HIMOARD), progressive farmers and Panchayat representatives. About 60 participants attended the conference (Annexure-I).

Inaugural Session

Dr. Sanjeeva Pandey, PCCF, HP was the Chief Guest of the function while, Sh. Ashok Kumawat, APCCF, Haryana was the Guest of Honour and Dr. S.C. Gairola, Director General ICFRE presided over the function. Shri S.D. Sharma, Deputy Director General (Research) and Dr. V.P. Tewari, Director, HFRI Shimla were other dignitaries present on the dias.

Dr. V.P. Tewari, Director, HFRI, Shimla welcomed the chief guest and other dignitaries on the dias and all other participants and thanked Director General ICFRE for giving the opportunity to HFRI, Shimla to hold this prestigious event. Sh. S.D. Sharma, DDG (Research), ICFRE gave introduction about the workshop and its genesis.



*Dr. V.P.Tewari, Director, HFRI,
delivering Welcome address*



*Shri S.D. Sharma, DDG (Research)
ICFRE addressing the delegates*

Sh. Ashok Kumawat, APCCF, Haryana talked about the productivity of forests, highlighted the significance of such conferences and stressed the need to hold such conferences on regular basis. Dr. S.C. Gairola, Director General, ICFRE emphatically stressed on the ICFRE initiatives of holding such conferences and monthly seminars at each of the regional research institutes of ICFRE for better understanding and liaising with sister organizations and stakeholders.



Sh. Ashok Kumawat, APCCF, Haryana



Dr. S.C. Gairola, DG, ICFRE

The Chief Guest, Dr. Sanjeeva Pandey, PCCF, HP talked about the Biological Diversity and the need for its conservation in the light of changing climatic conditions. He exhorted the participants to deliberate meticulously on the thematic issues for crystallizing agenda for future research and also to work out the modalities of inter-institutional and inter-disciplinary workable programmes. Dr. KS. Kapoor, GCR, HFRI, Shimla proposed the vote of thanks to all the dignitaries and the delegates of all the participating states, union territories and other research organizations.



Dr. Sanjeeva Pandey, PCCF delivering the Inaugural Address



Dr. KS. Kapoor, GCR, HFRI, Shimla proposed the vote of thanks to all the dignitaries and the delegates of all the participating states, union territories and other research

organizations.



Dr. K.S. Kapoor, GCR, HFRI, Shimla

Following the inaugural session, presentations and deliberations were held under the following sessions

Session I: Forestry research problem and issues of the State/UT Forest Department

Session II: Forestry research in the Northern Region of the country

Session III: Interactive session with stakeholders

Session IV: Working Groups on developing research needs

Session V: Working Group Presentations

SESSION I: Forestry research problem and issues of the State/UT Forest Department

The first technical session on “**Forestry Research Problems and Issues of the States/UT Forest Department**” was chaired by Dr. S.C. Gairola, Director General, ICFRE and co-chaired by Dr. O.P. Chaurasia, Director, DIHAR, Leh (J&K). The chairman of the session, **Dr. S.C. Gairola, DG, ICFRE**, invited the representatives from the states of Uttarakhand, Himachal Pradesh, Haryana, Uttar Pradesh, and Punjab and Union Territory of Chandigarh to talk about the forestry research achievements, problems and issues in their respective states. In this session, six presentations were made.



Dr. S.C. Gairola, DG ICFRE, Chairman

Dr. O.P. Chaurasia, Director, DIHAR, Leh - Co-Chairman

Sh. J.C. Joshi, IFS DCF, Uttarakhand started with the brief history of forestry research in the state and threw light on vision, mission, objectives and research activities of the Uttarakhand forest department. He elaborated upon productivity enhancement in natural forest, agroforestry, conservation and promotion of RET species, medicinal and aromatic plants and others NTFPs, enhancement of the livelihood of forest fringe communities, forest fire in Chir pine areas, conservation of water resources in hilly areas, climate

change, man-wildlife conflict, quantification of the intangible/tangible benefits of the forests and migration of rural people. Sh. Joshi also talked about forestry research problems of lack of sufficient and timely release of funds, lack of incentives in research, stability of working staff and shortage of experts in the department. Initiating the discussion, Dr. Gairola, questioned about the seed requirement of the state in the light of seed production areas that the state has developed. **Sh. Joshi** responded by informing that they are not timely getting demand of seeds from field, hence the seed requirements are met from private seed suppliers. He also talked about suitability & comparative trials of *Melia composita*, *Eucalyptus* and Tejpatta. Dr. Gairola, DG, ICFRE enquired about the mechanism of dissemination of research knowledge to which Sh. Joshi responded that annual reports, trainings and leaflets etc. are the means of dissemination of research knowledge. In the end, **DG, ICFRE**, informed the speaker about ICFRE's initiative of holding monthly seminar every institute of ICFRE and department should participate at FRI, Dehra Dun for identification of forestry research needs and their solutions. **Sh. Jagdish Chandra, CCF**, Haryana added that energy plantation species mentioned by the speaker are slow growing and suggested plantation of fast growing species *Salix sp*, *Arundo donax* etc.



Shri J.C. Joshi, DCF, Uttarakhand

Representative from Himachal Pradesh forest department **Sh. H.S. Dogra, IFS, APCCF** informed about various ongoing project activities of HPSFD in collaboration with research organizations like HFRI, UHF Nauli and IHBT Palampur. He threw light on the problem of climate change and informed about the work being done by HPSFD in collaboration with HFRI to study the High altitude transition zones of H.P. for long term studies to assess the effect of global warming. Sh. Dogra talked about the need for the development of nursery techniques of high altitude medicinal and aromatic plants and lesser known forestry species of Himachal Pradesh along with maintenance of germplasm. At the end of his presentation Co-chair, **Dr. O.P. Chaurasia, Director, DIHAR**, Leh queried about the status of research

on Sea buckthorn and other high altitude plants viz. *Picrorhiza kurroa*, *Betula* spp, *Quercus* spp, *Picea smithiana*, *Rhododendron* spp.



Shri H.S. Dogra, APCCF, Himachal Pradesh

Sh. Jagdish Chandra, CCF, Haryana State Forest Department highlighted the current forest scenario of Haryana and talked about the potential of agroforestry trees viz., *Cedrella toona*, *Prosopis cineraria*, *Melia dubia*, *Grewia optiva*, *Eucalyptus* sp and *Populus* sp in livelihood of rural people. Sh. Chander also showed concern about the insect pest attack in *Eucalyptus* sp, *Populus deltoids* and *Dalbergia sissoo* the important commercial timber trees of Haryana. He also talked about the problem of drying of Chir pine in Morni Hills of the state and problem of phytoplasmas in *Cedrela toona* as 70 % trees are sick & diseased because of these phytoplasmas. At the end he stressed on the appointment of nematologists to study forest nematodes and ended his presentation with highlighting research need of. long term monitoring of climate change, conservation, propagation, germ-plasm collection and development of micro-propagation protocols for all important species.



Shri Jagdish Chander, CCF, Haryana

Sh. N. Ravindra, CCF representing Uttar Pradesh forest department, talked about the history of forestry research in Uttar Pradesh, objectives, thrust areas and vision of UPFD and highlighted the importance of issues of large scale production of certified quality planting material of important forest species, development of suitable Agro-forestry models for different Agro-climatic zones for adoption by the local people, facilitation of suitable species migration as per the requirement of shifting climates, modernization of planting techniques and mechanization of forestry practices, reclamation of ravine and other barren lands through suitable forestry practices and certification of the plantations raised by public and private participants and flagged them as major research areas for next 20 years. Sh. Ravindra also informed that the problems of lack of sufficient and timely release of funds is resulting in discontinuation of works as forestry research being long term activity needs continuity in implementation of the programmes. Further, he also stressed on the requirement of dedicated field staff and researchers for effective implementation of long term research programmes as lack of incentives and frequent transfers adversely affect the output.



Shri N. Ravindra, CCF, Uttar Pradesh

Sh. T.C. Nautiyal, CF representing Chandigarh forest department, highlighted the problem of invasion of *Prosopis juliflora* and stressed on initiating research programme for its management. He also raised issues of nursery problems, constraints in establishing Butterfly Park, man-animal conflict and declaration of certain plants as heritage plants. At the end of his presentation, **DG, ICFRE** again highlighted the importance of monthly seminar of the institutes for flagging of such issues on priority basis.



Shri T.C. Nautiyal, CF, Chandigarh

Representative of the Punjab forest department, **Sh. Tushar Kanti Behera, CF** informed that they are working with only *Eucalyptus* and *Populus* species in Punjab under agroforestry and gave stress on other potential species like Sandalwood. He also raised the problem of management of *Prosopis juliflora* and waterlogged areas of lower belt due to over exploitation of canals irrigation system.

At the end of the session co-chair **Dr. O.P. Chaurasia, Director, DIHAR**, Leh (J&K) in his concluding remark stressed on the involvement and integration of other institutions to deal with above mentioned forestry research problems and suggested to consider the opinion of the farmers for the improvement of livelihood.

SESSION –II: Forestry Research in Northern Region of the Country

This session was chaired by **Sh. Ashok Kumawat, APCCF, Haryana** and Co-chaired by **Sh. H.S. Dogra, APCCF, HP**. In this session six presentations by various research institutions were made. These presentations were by *Indian council of Forestry Research & Education, Dehradun, Forest Research Institute, Dehradun, Himalayan Forest Research Institute, Shimla, G.B. Pant National Institute of Environment & Sustainable Development, Kullu, Dr. Y.S. Parmar University of Horticulture & Forestry, Nauni, Solan and Central Arid Zone Research Institute, Regional research station, Leh.*



Shri Ashok Kumawat, APCCF, Haryana, Chairman
Shri H.S. Dogra, APCCF, Himachal Pradesh Co-Chairman

Dr. Vimal Kothiyal, ADG (RP), ICFRE presenting the overview of forestry research programme in ICFRE informed about the new initiatives of ICFRE of formulation and implementation of All India Coordinated Research Projects (AICRP), conducting theme based Regional and National Conferences, Restructuring of Centers and Divisions of various institutes of ICFRE, starting centre for Policy Research and revision of National Forestry Research Plan. He further informed that a total of 22 AICRPs on species as well as in thematic areas were approved by the Council for implementation this year onwards. Highlighting research achievements of ICFRE he elaborated that for enhancement of productivity five clones of *Casuarina*, three clones *Eucalyptus tereticornis* and two varieties of *Rauwolfia* were released by the ICFRE institutes in Feb, 2017 A total of 47 clones have been released by ICFRE Institutes since 2010. Similarly, clones of *Dalbergia sissoo*, *Melia dubia* and Poplar were also released by the ICFRE. The testing of the clones for the species of Teak, Acacia, Gmelina is in progress. He also informed about the

introduction of *Santalum album* in Punjab, Gujarat and Rajasthan for testing the performance of the species. The various technologies like cultivation of lac on *Flemingia sp*, Wood Polymer composites, thermally modified wood, DUS guidelines for *Casuarina*, *Eucalyptus*, Deodar and Chirpine etc. were developed by the various institutes of ICFRE. Besides, research on various important areas like Climate change, Sal borer, Forest invasive species, Rehabilitation of problem areas, Agroforestry models, Green felling, EIA study etc. are also underway in ICFRE institutes.



Dr. Vimal Kothiyal, ADG (RP), ICFRE

Dr. Savita, Director, FRI, Dehradun presented the research achievements of FRI with respect to thrust area, staff strength and achievements. She presented the technologies developed by FRI on Eco-restoration of mined out area, use of *Lantana camara* for preparation of products, development of new wood preservative, solar kiln, natural dyes from forest biomass etc. She also highlighted the release of 13 varieties of various species for increasing productivity, work on digitization of forest flora of Chandigarh, Haryana and Bihar state. She informed about the preparation of DPR of river Ganga and submission of the concept note for preparation of DPR of Yamuna River and successful organization of Common Wealth Conference in which about 800 delegates from various countries participated. She informed that FRI also published the Technical Reports on Forest Plus, Demand and Supply Status of Wood in Punjab, NRAA Project, Assessment of Trees of Rashtrapati Bhawan, New Delhi and Monitoring and Evaluation of the plantations raised under CAMPA in Punjab state. She informed that the institute is implementing 44 ICFRE funded and 38 Externally Aided projects. The work on digitization of FRI herbarium is in progress. The institute also conducted various training programme under skill development programme for capacity building and livelihoods.



Dr. Savita, Director, FRI, Dehradun

Dr. V.P. Tewari, Director, Himalayan Forest Research Institute, Shimla deliberated upon research achievements of HFRI, especially the work done on natural regeneration & transplanting techniques of Fir and Spruce, studies on seed and nursery techniques of broadleaved species. He informed about the establishment of SPAs, SSOs, VMG of Shisham during the World Bank Project. He also talked about various technologies developed like DUS guidelines for Deodar & Chirpine, Juniper seed germination technology, Production of Tall plants, Standardization of nursery technique of Cold Desert species, Mass multiplication of *Valeriana jatamansi* and *Picrorhiza kurrooa* etc. Further he elaborated upon the work on Eco-restoration of lime stone mined out area, alpine pasture management, assessment of plant diversity of wildlife sanctuaries, assessment of carbon stock of forest types of Shimla forest circle, nursery propagation of medicinal plants, intercropping study in orchards, studies on poplar shoot borer, Chirpine borer, Kail mortality, willow mortality, oak defoliator etc. Dr. Tewari informed about the establishment of Western Himalayan Temperate Arboretum (WHTA) in which 107 tree species have been planted. Informing about the extension activities, Dr. Tewari elaborated upon various training programmes, workshop/conference, exposure visits and Kisan Melas for the stakeholders.



Dr. V.P. Tewari, Director, HFRI, Shimla

The research activities of G.B. Pant National Institute of Himalayan Environment and Sustainable Development, Kullu, Himachal Pradesh were presented by Dr. S.S. Samant, Scientist In charge, Kullu. Dr. Samant talked in detail on theme, thrust area and activities of the institute and informed that the institute has conducted plant diversity studies in 10 wildlife sanctuaries of HP, Sacred Groves, Watersheds, National Parks, Biosphere Reserve. Studies on biodiversity assessment also included the status of medicinal plants, phyto diversity, utilization pattern, phyto-chemistry, propagation protocol etc. Further he informed that the institute is also conducting study on climate change, alien species, EIA, Environment physiology, value addition of products etc. The institute also developed Arboretum and conducting various training programmes for different stakeholders.



Dr. S.S. Samant, GBPNIHESD, Kullu

Forestry Research Needs and Research Initiatives of Dr Y S Parmar University of Horticulture and Forestry, Nauni, Solan was presented by Prof. Kulwant Rai Sharma, College of Forestry. Dr. Sharma talked about the mandate of the University including work undertaken with respect to education, research and extension. He informed that University has Germplasm of *Swertia chirata*, *Stevia sp*, *Gloriosa superba*, *Hypericum perforatum* and has also developed the multiple bore hole method for resin taping, evolved half sib progeny of Chirpine, Extract of *Lantana camara* as insecticide. He informed about the tree improvement work on *Salix sp*, *Grewia optiva*, *Populus deltoides*, *Bauhinia variegata*, grafting technique of Harad and Bahda, layering technique in Deodar, Rhododendron and various agroforestry models like Agri-Silvi, Silvi-Pastoral, Horti-Silvi. The department of environment sciences working on green house inventory, species for Industrial area, soil conservation works etc.



Dr. K.R. Sharma, Dr. YSP, UHF, Nauni, Solan

Research activities and initiatives taken up by CAZRI Regional Research Station, Leh (J&K) were presented by Dr. Sanjeev Chauhan Head RRS, Leh. He emphasized that for the development of Leh region the research activities like development of sustainable farming options, location specific technologies, soil conservation techniques, research on availability of fodder, fuel & energy, pasture development, analysis for agro system for economic value and soil conservation techniques should be carried out by the research organizations. He also told that research on apricot oil for livelihood, value addition for wild rose oil, Mushroom cultivation and insect-pest & disease of willow should be taken on priority basis. There is also need to conduct the work on traditional knowledge, technology for Juniper plantation and pasture improvement.



Dr. Sanjeev Chauhan, Head- CZRI, RRS, Leh

Session III: Interactive session with stakeholders

The third technical session was chaired by Dr. Savita, Director, FRI, Dehra Dun and co-chaired by Sh. Jagdish Chander, CCF, Haryana. During this session various research organizations like National Bureau of Plant Genetic Resources, Phagli, Shimla, Sher-E-Kashmir University of Agriculture Science & Technology, Kashmir, NGOs Himalayan

research Group and HIMOARD, Rampur, progressive farmers and retired eminent professors talked about their work and emerging issues in forestry sector.



*Dr. Savita, Director, FRI, Dehradun , Chairperson
Shri Jagdish Chander, CCF, Haryana, Co-Chairman*

Dr. Mohar Singh, Scientist In-charge, NBPGR, Shimla delivered a talk on **Management and Use of Genetic Resources: Our Preparedness**. He explained that India is one of 12 world mega biodiversity centers, has 3 hot spots of Biodiversity with 10% of world's microbes, 6% of insects, 12% of birds and 20% of lower plants. He said that Genetic resources are basic to gene discovery and their use in crop improvement including transgenic development is important. As these resources are patentable hence genetic wealth can be protected. NBPGR has already made the beginning for patenting their genetic resources and his organization initiated All India Coordinated Research Network on Underutilized Plants. NBPGR has state-of-the-art facilities of international standards to screen for various traits for genetic improvement and this facility is available to cater the needs of researchers of India and it will add value to the genetic resources and hence increase their utilization and conservations.

Prof. T. H. Masoodi, Dean Faculty of Forestry, SKUAST-K, presented an overview of **Forestry Sector in Jammu & Kashmir**. Describing potential land resources of Jammu and Kashmir which stands at 3.781 million ha, the per capita availability of forest land is 0.15 ha only. The prominent non coniferous tree species of Willow, Poplar, Robinia, Walnut, Elm and Ailanthus cover an area of about 221.40 million ha (TOF). While talking about potential challenges of low forest productivity, climate change, species range shift in Himalayas, Prof. Masoodi cited an example of *Myrica esculenta*, which shifted from 1900 m altitude to 2100 m altitude. He emphasized upon the bigger role of ICFRE in Forestry research and education by

- Providing sufficient funding to strengthen infrastructure in forestry research/ education across the country and take a lead role/coordinate in developing common curriculum for under and post graduate programmes in Forestry.
- Making universities partners by signing MOUs for coordination and Linking all wood based industrial sector for assured employment to forestry technocrats.

- Devise research policy at country level and prioritize region specific and species specific research and provide funding and coordinate research in Forestry throughout the country.
- Develop and create of AICRPs/New Centers of excellence throughout the country in various fields of Forestry. Link all forestry related institutions (including those in SAUs) across the country.

He also said that Extension is the weakest link in forestry sector. No effective mechanism exists that could disseminate the adaptable research findings to the user groups. To strengthen extension, ICFRE must take a lead role to create a platform where both Scientists and officials of Forest Department frequently interact in various decision making processes related to forestry. Promote and develop a linkage with forest based industries so as to create opportunities for research and vice-versa capacity building. Develop modules and provide funding for skill development programmes in forestry sector. ICFRE should sanction Van Vigyan Kendras (VVKs) to SAUs.



Prof. T.H. Masoodi, Dean, SKUAST-K

Dr Lal Singh from HIMALAYAN RESEARCH GROUP, Shimla delivered a talk on **Innovative Technology Models to Meet Basic Needs of the Mountain Communities**. Dr. Sing while explaining the migration from Rural to Urban areas for employment and livelihood, stressed for immediate innovation for development in rural sectors for employment and enterprises to absorb young population. He cited examples of the innovations developed by his organization on Domestic Solar Water and Space Heating Systems. He also told the participants that the way forward to face the challenges of unemployment is to manage water, biodiversity including agro biodiversity, tourism and agriculture in rural India. This is an era of knowledge and its application in the field for solving everyday life needs and conservation of natural resources. Application of need based science and technology at the grassroots can lead to the desired development and pledged for collaboration for providing technology solutions in the region.



Prof. K.R. Sharma, UHF, Nauli, Solan

Dr. O.P. Chaurasia, Director, Defense Institute of High Altitude Research (DIHAR), Leh emphasized on documentation of high altitude medicinal plant diversity, their conservation and development of cultivation practices. He elaborated upon the utilization of *Hippophae* spp. their products and medicinal value which is providing income generation avenues to the local populace of cold desert of Leh – a place devoid of natural resources. He added that R&D activities on Seabuckthorn (The Golden Bush) are being carried out by his organization and its products are helping in improving livelihood generation through extension programmes involving Hill Council, SFD and NGOs. He further said that R&D activities on Seabuckthorn will definitely help in developing high yield varieties in near future.



Dr. O.P. Chaurasia, Director, DIHAR, Leh

Dr. R.S. Minhas, NGO (HIMOARD) representative talked on organic farming and organic certification. He informed the participants that how the works of his organization on sensitization of farmers on organic farming is helping them to garner more income and also providing opportunities of income generation avenues. He cited examples of rare variety of Hazelnut found in Pangti valley and medicinal value of walnut found in mountain areas of Himachal Pradesh.

His expectations from research organizations were to develop improved varieties of such species and involve communities for overall development and growth through income generation. He further added to grow wild edible trees to contain the monkey menace by

forcing them to stay in forest through food availability by planting these trees and involving them in their plantation programme.



Dr. R.S. Minhas, Chairman, HIMOARD

Sh. Baldev Thakur, Pradhan, Nauri Panchayat and progressive farmers appreciated the efforts of HFRI, Shimla by involving local farmers in such scientific programmes. He also thanked the govt. organization for providing opportunities through sensitization programme by their active participation. Further, he desired the research organization to work for improving the livelihood of the villagers by transferring the technology and demonstrating them in the farmers' fields.



Shri Baldev Thakur, Pradhan, Nauri Panchyat

Shri Sabla Ram Chauhan, progressive farmer said that there is need to revive the forest fire line in the forest to prevent the forest fire. He opined that the Government should make efforts to lift the Ban on green felling as it will help in Conservation of Biodiversity.



Shri Sabla Ram Chauhan, Progressive Farmer

Prof. T.N .Lakhanpal said that all departments must work in coordination mode, so that society must get in deliverable form.



Prof. T.N. Lakhanpal (retd.) HPU, Shimla

Prof. S.P. Bhardwaj said that the state forest department must promote the indigenous trees, bushes and grasses species for plantation and extend their propagation technology to farmers and tree growers.



Prof. S.P. Bhardwaj (retd.) UHF, Nauri, Solan

At the end, Dr. Savita IFS, Director, FRI and Jagdish Chander, IFS, CCF closed the session and thanked the presenters and participants for their valuable contribution for the advancement of forestry research in this part of country especially Himalayan region.

Proceedings of the Session V: Working Group Presentations

The session-V was Chaired by Dr. S.C. Gairola, DG, ICFRE and Co-chaired by Sh. S.D. Sharma, DDG, ICFRE. The recommendations were presented by group leaders

Theme I: Productivity Enhancement

Group Leader: Dr. Sanjeev Chauhan, Head CAZRI-RRC, Leh

Group Facilitator: Dr. Rajesh Sharma, HFRI

- The recommendations of group meeting were presented by Dr. Rajesh Sharma, Scientist-G, HFRI, Shimla
- Sh. S.D. Sharma, DDG(R) ICFRE said that in the state government, the targets are not clear regarding the collection of seeds and production of quality material.
- According to Prof. Kulwant Rai, UHF Nauni, seed are most important part in producing quality planting stock, but it is very hard to take seeds from good quality plant and the productivity goes down.
- Dr. S.P. Bhardwaj was of the opinion that plus/ mother trees should be selected.
- Sh. Jagdish Chander was of opinion that since plus trees are very less for seed collection to meet required demand, hence seed orchards should be created.
- Dr. V.P. Tewari was of view that suitable silvicultural practices should be adopted. The productivity of the forests are declining, if are not managed properly.
- Dr. S.C. Gairola, DG ICFRE suggested to make focused and specific recommendations. According to him seeds are most important part to produce quality planting stock. Forest depart is planting million of trees per year and we have to find ways to improve their quality. He was of the view that establishment of seed orchards is time consuming and it is better to go for seed production areas covering more species for which existing SPA areas can be extended. He also suggested the development of model nurseries and also suggested to adopt workable models of model nurseries of forest department.

Theme II: Biodiversity and Climate Change

Group Leader: Dr. S.S. Samant, Scientist Incharge, GBPNIHESD, Kullu

Group Facilitator: Dr. K.S. Kapoor, HFRI

- The recommendations of group meeting were presented by Dr. S.S. Samant, Scientist-Incharge, GBPNIHESD, Kullu.
- Dr. V.P. Tewari emphasized on different issues of climate change and stressed upon vulnerability issues, potential hazards and management of associated risks. In

response, Dr. K.R. Sharma informed that these issues were discussed during the deliberations but somehow missed while compiling the recommendations.

- DG, ICFRE informed house that we have eight national missions on climate change and Green India mission is one of them. Our priority should be to address the Green India mission, which was started in 2012 and end in 2020. He was of opinion that recommendations should come to address our international commitment on climate change. As per our nationally determined contributions, we lack 2.5-3.0 billion tons of CO₂ equivalent by the year 2020-2030, which need lots efforts, we have to take lot many policy level decisions, management level decisions, technical kind of initiatives, all those should find place in recommendations. ICFRE has recently submitted a document called national red plus strategy, the draft document is available and can be consulted for some of recommendations. Lot of protocols have been developed, standardized and refined but there is need for their implementation in field and impact assessment. Recently, ICFRE has prepared a report on bamboo and found that many institutes, even within ICFRE have developed protocols for various bamboo species, being adopted by farmers, industry or forest department. But one institute does not know what other institute has developed. He was of opinion that what have been done so far more than standardization, the technology should be documented in usable form and taken to the stakeholders and refinement aspect can go simultaneously. In his overall remark suggested to see where we have to go as a nation, we have ambitious biological diversity act in which we not make much head way in last ten years. Why we not make any head way and what is required to done should be part of the recommendations.

Theme III: Trees Outside Forests and Urban Forestry

Group Leader: Shri Jagdish Chander, CCF of Haryana

Group Facilitator: Dr. Sandeep Sharma HFRI

- The recommendations of group meeting were presented by Shri Jagdish Chander, CCF of Haryana. He said that both of these topics are different, one related to agroforestry and other to urban forestry, but due to scarcity of time we have combined everything in recommendations.
- Dr. V.P. Tewari, Director, HFRI told that the assessment and monitoring of TOF at the local, regional and State level is important but still we do not have robust technology. The monitoring and assessment also includes estimation of productivity and biomass accumulated by them. Remote sensing is not answer for each and everything. Choice of species is different for urban, peri-urban and rural area and it is required to identify area/ trees for big cities to reduce heat island and improve environment. The recommendations should include these aspects. In response to heat island effect mitigation by the urban trees, Sh. Jagdish Chander informed that some time we forgot some selection criteria e.g. in Haryana baby bay tree introduced earlier is started reaching buildings and causing hazard to life.
- Dr. S.D. Bhardwaj suggested to include the plants which are attracts honey bees. DG, ICFRE informed that production of honey reduced drastically due to non-availability of honey producing plants.

- DG, ICFRE informed that transit rules have been debated for so many years, the position of Punjab and Haryana is different because the cover is very less, you can afford to free all the agroforestry species from transit pass. The issue can be debated, but it will be difficult for the states having 20-35% forest area, where we can suggest suitable model with liberal agroforestry policies, but at same time ensure the protection forests. The dilemma of most of forest department is that if we make all species free from transit pass, the species will be depleted in forest. Regarding the minimum support price, he was of opinion that we need to have both forward and backward integration if we take country as whole. In urban forestry setting, the potential of different species to control pollution (air and noise pollution) probably have not studied to desired level, therefore it is required to suggest models with best kind combinations of different species to bring down pollution.

Sh. S.D. Sharma, DDG (Res.), ICFRE in his concluding remarks suggested to include the socioeconomic modeling in forest productivity section. He was of opinion that when we talk about general terms like ecological monitoring plots/ forests, we should clearly define the roles of actors involved i.e. what is expected from research institutes, forest department, industry etc. There should be proper documentation, monitoring etc. which can be utilized in tackling the issue of climate change.

Ultimate recommendations should find logical conclusion with action plan decided and there may be many more other things coming in your mind, which not belong to these three categories, they also should be in suitable categories including the regional problems. The seed are properly certified for agriculture crops, similar act may be brought for the seeds of forestry species and recommendations may include these aspects. These recommendations will be guiding our projects for at least for twenty years.

DG, ICFRE, while giving his concluding remarks, thanked all the participants and experts for their presence and valuable inputs. He was of the opinion that this interactive conference is just a beginning to show the way and he requested Director, FRI and Director, HFRI to continue this interaction with stakeholders like forest department, wood based industry in future also. He also requested all the facilitators and directors of both institutes to compile the recommendations at the earliest, because it will form part of our revised national research plan. He also suggested that while making the recommendations, keep in mind the concerned states and stakeholders and make relevant recommendations.

The RRC ended with the formal vote of thanks extended by Dr. V.P.Tewari, Director, HFRI, Shimla to all the participants.

FINAL RECOMMENDATIONS

Theme I: Productivity Enhancement

- Prioritization of native tree species for plantation activities
- Improvement in seed, nursery and propagation techniques for production of quality planting stock
- Technologies for eradication, control, management and utilization of invasive alien species
- Effective technologies for predicting & controlling forest fires
- Eco-friendly management of insect-pest and diseases
- Utilization of ITK practices available and their up-scaling
- Technological innovations for Combating desertification and eco-restoration of Cold Deserts
- Improved & site specific eco-rehabilitation technologies for degraded areas, pastures lands, stress sites and wastelands

Theme II: Biodiversity and Climate Change

- Establishment of Forest Observational Studies (FOS) network for long-term ecological monitoring and impact of climate change
- Standardization of propagation protocols and packages of practices for *in-situ* and *ex-situ* conservation of native and overexploited species
- Establishment and maintenance of functional gene banks across the altitudinal zones.
- Assessing vulnerability, potential hazards and associated risk in forest ecosystems, especially in high altitude transition zones of Himalayan region

Theme III: Trees Outside Forests and Urban Forestry

- Development of advanced tools & techniques for monitoring & assessment of TOF
- Trees at the rural-urban interface: study on relationship between green areas and biophysical & socio-economic features
- Preparation of volume/biomass/carbon tables for TOF
- Improved agroforestry models for maximizing output and enhancing carbon sequestration & other ecosystem services under REDD+ scenario
- Valuation of ecosystem goods & services of urban forests and recreational use value of urban green spaces
- Studies on policy issues for TOF and urban forests

- Screening of pollution & heat tolerant/absorbent native woody species for urban green spaces
- Research on multipurpose native tree species having low water requirement for urban and peri-urban areas

List of Participants

List of ICFRE Officials and SFD participants

S.No.	Name of the officer	Organisation
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13.	Shri Sanjeev Chaturvedi, IFS	CF, Uttarakhand
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