ICFRE
VISION 2030

INDIAN COUNCIL OF FORESTRY RESEARCH & EDUCATION, DEHRADUN

(An Autonomous body of Ministry of Environment, Forest and Climate Change, Government of India)

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ICFRE
HEADQUARTER

Foreword

सत्यमेव जयते

डॉ. सुरेश गैरोला, भा.व.से.
महानिदेशक, भा.वा.अ.शि.प. तथा कुलाधिपति,
वन अनुसन्धान संस्थान–सम–विश्वविद्यालय

Dr. Suresh Gairola, IFS
Director General, ICFRE
and Chancellor, FRI University

पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय, भारत सरकार
भारतीय वानिकी अनुसन्धान एवं शिक्षा परिषद्
(आई एस ओ 9001:2000 प्रमाणित संस्था)
पो. ओ. न्यू फॉरेस्ट, देहरादून – 248 006

Ministry of Environment, Forest and Climate Change,
Government of India
Indian Council of Forestry Research and Education
(An ISO 9001 : 2000 Certified Organization)
P.O. New Forest, Dehra Dun - 248006

It gives me immense pleasure in presenting ICFRE Vision 2030 which aims to place the Council as one of the world leaders in the global forestry arena by contributing towards long-term sustainable development in the field of forestry research, education and extension. ICFRE Vision 2030 has been prepared taking into account the goal and objectives of National Forest Policy, National Forestry Research Plan, India@75, United Nations Sustainable Development Goals and national commitments which envisages safeguarding the ecological and livelihood security of people of the present and future generations based on sustainable management of forests for flow of ecosystem services. This vision document details the forestry research, education and extension plans of ICFRE, grouped into thirty five priority areas, i.e. twenty seven research and eight non research priority areas, which are to be implemented over the next decade.

In this vision document, new initiatives of ICFRE viz., 1. Launching of All India Co-ordinated Research Projects, 2. Creation of Forest Expert Forum, 3. National Subject Matter Co-ordinators for preparation of state of the art reports, 4. Organization of periodic research seminars, 5. Strategic MoUs with National and International education and research institutions, 6. ICFRE Human Resource Development Plan and 7. ICFRE Extension Strategy and Extension Action Plan to meet the future challenges of biodiversity conservation, forest management for economic growth and livelihood support, forest genetic resource management and tree improvement to address numerous issues related to forest conservation, meet bulk of country's wood demand and mitigation and adaption to climate change have also been addressed aptly.

I sincerely believe that this vision document will give a new orientation to the planning and implementation process of research, education and extension programmes at ICFRE and guide the future efforts. I appreciate the efforts and the valuable inputs provided by Shri Vipin Chaudhary, former DDG (Extension), Shri S.D. Sharma, DDG (Research), Ms. Kanchan Devi, DDG (Extension), Dr. Shamila Kalia, ADG (Media & Extension), Shri R.K. Mishra, CTO, Directors of all ICFRE institutes and scientific & technical staff of ICFRE.

10th December 2019

(Dr. Suresh Gairola)

Contents

1 Preamble

A Visionary Approach

> "In order to carry a positive action we must develop positive vision."

The globalization and rapid economic integration in this fast changing world is also putting enormous pressure on the natural resources. Consequently the role of forests too has become very crucial. Forestry seems to be the most suitable option for the multifunctional role to address the following major challenges:

1. Sustained environmental goods and services from forests
2. Recharging groundwater tables and maintain the hydrological cycle
3. Mitigating the effects of climate change
4. Regeneration of forest fringe areas and sustaining food and wood security
5. Protection forestry in combating, degradation of landscapes, disaster management and pollution abatement

During the journey (1986 estd., Autonomous 1991) ICFRE and its institutes have laid the foundation of scientific research in forestry, which is recognized and appreciated globally. With increasing pressure on India's forests and ever-growing expectations from the society, responsibility of ICFRE has increased manifold.

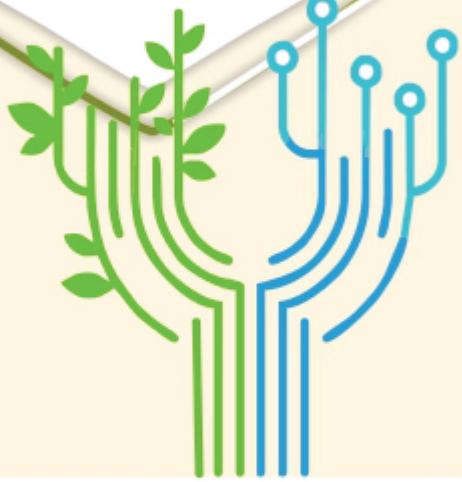
Indian Council of Forestry Research and Education (ICFRE) developed National Forestry Research Plan (NFRP) in 2000, with a functional relation with the National Forestry Action Plan (NFAP) and Five Yearly Plans of the country. The NFRP was drawn for 20 years with a built in mechanism for periodical reviews after every five years. In line, Directorate of Research, ICFRE also took up the task of preparing a comprehensive 'Vision Document'. The 'ICFRE VISION 2040' was therefore prepared in the year 2015 to guide the forestry research for the next twenty five years in ICFRE. To cater to new emerging forestry challenges and to meet the aspirations of the society, a mid-term correction was felt necessary and it was decided to revise and prepare a more comprehensive draft. Therefore Vision 2030 envisaged and prepared. This document also addresses the new initiatives like All India Coordinated Research Projects (AICRPs) representing the 27 priority research areas, Human Resource Development Plan, Extension Strategy and Extension Action Plan for ICFRE 2018-23 etc. which have been conceptualized and implemented in recent past.

WHY ICFRE VISION 2030

The globalization and rapid economic integration in this fast changing world is also putting enormous pressure on the natural resources. Consequently, the role of forests too has become very crucial. Forestry seems to be the most suitable option for the multifunctional role to address the following major challenges:

A blend of bottom-up and top-down approach lies in the design of this visioning exercise. The roadmap of each of areas of research would provide Existing Status, Future Projections and the Gaps or Challenges, besides plotting the future technology trajectories.

The Vision is to be directed by expectations and aspirations of society at large and also response to the major changes in economic situation, geopolitics and technology domain at a global level.



"Your vision will become clear only when you can look into your own heart.

The emergence of new national/ international forestry agendas are necessitating transformation of forestry research. Such rolling exercise would enable a more calibrated approach to evolution of technology related to the national planning process. This is essential as new discoveries, innovations in technologies, growing population and consumption would lead to ever increasing environmental burden.

ICFRE Vision 2030 is expected to provide efficiency and speed that the previous version never promised.

Develop innovation ecosystem that links entrepreneurs, industry and society.

Where would we like to be positioned in 2030 both by ourselves and on the world map? This can perhaps now be stated with a certain degree of clarity with the vision statement 2030, which is forward looking, aspirational but firmly rooted on the ground.

Who looks outside, dreams; who looks inside, awakes."

VISION, MISSION & OBJECTIVES

VISION

To achieve long-term ecological stability, sustainable development and economic security through conservation and scientific management of forest ecosystems.

MISSION

To generate, advance and disseminate scientific knowledge and technologies for ecological security, improved productivity, livelihoods enhancement and sustainable use of forest resources through forestry research and education.

01 Undertake, aid, promote and coordinate forestry research, education and extension.

02 Align forestry research programmes with Sustainable Development Goals (SDGs).

07 Develop state of the art research infrastructure, including human resource.

08 Promote forestry education in the country and facilitate universities in improving quality of education.

OBJECTIVES

03

Scientific advice and policy support to the central and state governments.

04

Provide technical assistance and support to states.

05

Develop appropriate forest based technologies, processes and products.

06

Provide livelihood support to forest dependent communities.

09

Further develop and maintain National Forest Library and Information Centre (NFLIC).

10

Develop environment and forest extension programmes.

11

To provide consultancy and capacity building services.

12

Conduct other activities incidental and conducive to attain above mentioned objectives.

The Challenges

Inadequate research infrastructure and human resource. Upgradation to state of the art research infrastructure and skilling human resource will be a key challenge.

Long generation time of tree crops which makes technology development (both products and processes) time consuming and costly. Long term project support is also a challenge.

Lack of synergy between ICFRE and State Forest Departments (SFDs) is leading to not so impressive, research planning, coordination and implementation of research results.

Large-scale private forestry (TOFs) is hampered by regulatory restrictions, which in turn affecting private adoption of ICFRE technologies.

Inadequate research funding.

ICFRE TODAY

ICFRE has made crucial contribution to the national economy by way of enhancing the green cover in the country in forest landscapes as well as under agroforestry; increasing wood productivity through improved clonal plantations; enhancing conservation and sustainability of forests by improving wood durability through preservation techniques and developing composite woods; enhancing local livelihoods, etc. Highlights of some of these contributions are given below:

- Enhancing Green Cover and Wood Productivity

- Technologies Developed and Patented

- Short-Term Professional Assignments and Services

- Forest Extension

Quality Research- pushes the knowledge frontiers forward and explores potential applications.

ENHANCING GREEN COVER AND WOOD PRODUCTIVITY

EUCALYPTUS

- 11 clones
- > 3000 Sq. km
- *Eucalyptus camaldulensis* having genetic gain of 17% in H, 14% in DBH

ICFRE has popularized Eucalypts and Poplar based agroforestry system over more than 3000 km^2 area.

ICFRE has developed many high yielding and disease resistant hybrid clones of Eucalypts. Eleven clones of *Eucalyptus camaldulensis* has been released between 2011 and 2014.

CASUARINA

- 14 Clones
- >9000 Ha.
- *Casuarina equisetifolia*
- *Casuarina junghuhniana*
- Productivity gain of 13-28% recorded

Under the Casuarina Breeding Programme, second generation Seedling Seed Orchards and Clonal Seed Orchards have been established. Also, 7 high yielding clones of each *Casuarina equisetifolia* and *Casuarina junghuhniana* have been released. The clones of *Casuarina junghuhniana,* especially 'CJ9,' have proved to be very fast growing and are much sought after. The rotation age has come down from 5 years to 3 years with improved seed. Improved germplasm in the form of seed and clonal material has been used in establishing plantations over more than 9,000 hectares.

POPLAR

- 4 Clones
- S7C8
- 82-35-4
- 113324
- G48
- Free from Leaf Blight disease
- 15-20% higher yield

ICFRE has introduced many improved and disease resistant clones during the year 2000 viz. S7C8, 82-35-4, 113324 into large scale Poplar plantations and re-evaluated performance of G48 clone. G48 clone alone constitutes more than 50% of the total Poplar being planted in North-West India.

SHISHAM

- Disease resistant clone DS-4 of *Dalbergia sissoo*

ICFRE has released a disease resistant clone DS-4 of *Dalbergia sissoo*.

MELIA DUBIA

- 10 Cultivars
- Average yield > twice the average population yield

ICFRE has identified and tested 10 *Melia dubia* cultivars with long straight boles and an average yield that is more than double the average population yield.

TECHNOLOGIES DEVELOPED AND PATENTED

Developed technologies for rural & tribal livelihoods support

Bio-polymer based binding material (Jigat) for incense sticks

ICFRE has developed a bio-polymer based binding material (Jigat) for incense sticks from the locally available bio-resources (environmentally safe and produced at about 60% of the cost of the imported binding material). About 36,000 metric tonnes of binding material (Jigat) worth Rs. 432.0 crore (Rs. 120.0 per kg) is being used every year by the Industries.

'SAMRIDHI' - A new silkworm rearing technique

A new silkworm rearing technique named 'Samridhi' has been developed, which reduces the cocoon spinning period to just 15-18 hours.

Lac cultivation technique on *Flemengia semialata*

ICFRE has standardized lac cultivation technique on *Flemingia semialata*, an evergreen native shrub, resulting in much higher yield per acre and average annual returns of about Rs. 80,000.

Preservative to treat bamboo culms

ICFRE has developed a simple equipment and an environmentally safe preservative to treat bamboo culms.

Bio-Growth Enhancers

- Tree Rich Bio-booster
- Vermico-IPM
- N-Fixer

ICFRE has developed bio growth enhancers under brand names 'Tree Rich Bio-booster', 'Vermico-IPM' and 'N-Fixer' (with Frankia). 'N-Fixer' with Frankia is especially very useful in raising successful Casuarina nursery and plantations.

Crawl Clean - A green Insecticide

ICFRE has developed 'Crawl Clean' - a green insecticide developed from leaf powders of 5 plant species (*Melia dubia, Pongamia pinnata, Aristolochia bracteata, Adhatoda vasica* and *Vitex negundo*) - to control Papaya Mealy Bug on forestry tree species like Teak. Also, a pesticide formulation based on Karanja (*Pongamia pinnata*) and Ritha (*Sapindus mukorrosi*) has been developed to manage shoot borers.

Production and Distribution of Biofertilisers

Production and distribution of biofertilisers of microbial origin (Non-Commercialised Technology)

Integrated Pest Management (IPM) of white grubs in Teak nurseries

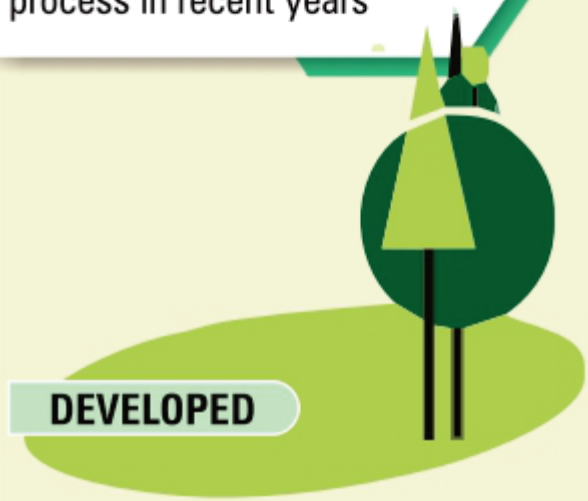
Integrated Pest Management (IPM) of white grubs in Teak nurseries in Central India (Non-Commercialised Technology)

Biological Control of insect pest of teak

Biological control of insect pest of teak through TFRI – Tricho-cards in plantations (Non-Commercialised Technology)

TECHNOLOGIES PATENTED

Important patents granted/in process in recent years



DEVELOPED

APPARATUS FOR TREATMENT OF GREEN BAMBOO

An apparatus for treatment of green bamboo (granted)

WOOD PRESERVATIVE (ZiBOC)

An eco-friendly, economical and non-hazardous wood preservative (ZiBOC) (granted)

UNDER PROCESS

1

VACUUM KILN

PHYTO ECDYSTEROIDS
A process for obtaining phyto-ecdysteroids from plants of Amaranthaceae family for the synchronized maturation of mulberry silkworm

2

3

EuGalLure
A Plant volatile for trapping Eucalyptus gall wasp, *Leptocybe invasa*

COMPOSITION OF SOAP

4

ADHESIVE COMPOSITION
An adhesive composition comprising defatted *Shorea robusta* (Sal) seeds

5

SURFACTANTS FROM NON-EDIBLE OIL SEEDS
A pesticidal formulation based on surfactants from non edible oil seeds

6

7

Arbor Easy® DNA ISOLATION KIT

UNDER PROCESS

SHORT-TERM PROFESSIONAL ASSIGNMENTS AND SERVICES

Carrying Capacity Study of Saranda Forest, Jharkhand

ICFRE has conducted carrying capacity study of Saranda Forest in Jharkhand to bring balance between mining with conservation (for MoEF&CC).

Forestry Interventions in 5 Riparian States

Detailed project report on forestry interventions in five riparian states (for Ministry of Water Resources, GoI).

Survey-cum Study of Medicinal Plants in the Country

Survey-cum-study of medicinal plants in the country to assess their commercial demand (for National Medicinal Plants Board).

Identified Pests/ Pathogens of Deodar and Willow in HP

Identified the pests/ pathogens of Deodar and Willow in Himachal Pradesh, Shisham in northern Indian States, Chir pine in Haryana, Anogeissus in Rajasthan.

Package of Practices for Medicinal Plants/Bamboo

Developed packages of practices for propagation of medicinal plants, bamboo propagation and its management.

Mine Reclamation & Rehabilitation Plans

Mine reclamation and rehabilitation plans in respect of iron ore mines operating in Karnataka.

Protocol for Thermal Modification of Wood of 5 Tree Species

Developed protocol for thermal modification of wood of five tree species viz.,Eucalypts, Poplars, Shisham, Melia and Mango (for Punjab Forest Department).

Environmental Audit of Coal Mines

Environmental audit of coal mines across the country (for Coal India Ltd.).

47 EIA Studies

Provided 47 major consultancy services in environment management including EIA studies, carrying capacity studies, monitoring of green conditions of environmental clearances, preparation of reclamation and rehabilitation plans for mines, biodiversity studies etc.

Services for CAMPA

Evaluation of CAMPA programmes in different states of India.

FORESTRY EXTENSION

Van Vigyan Kendras (VVKs)

- Established 29 VVKs
- Published 441 Publications
- Offered 328 Trainings
- Established 26 Nurseries
- Dissemination of technologies to the user groups

Established 29 VVKs with the objective of dissemination of technologies to the user groups.

Demo Villages

- Established 9 Demo Villages, 73 Trainings
- Demonstration of technologies developed by ICFRE

Nine Demo Villages have been established for demonstration of technologies developed by ICFRE for sensitizing the stakeholders.

Networking of Van Vigyan Kendras (VVKs) with Krishi Vigyan Kendras (KVKs)

- To fill the gap between the need and resource, networking of VVKs with KVKs have been started.

Tree Growers Mela (TGM)

- IFGTB, Coimbatore had taken an initiative in this regard by organizing Tree Growers Melas, Since 2009, it has become a regular feature in all other institutes.

ICFRE VISION 2030 IS BASED ON THE FOLLOWING ASPECTS :

THE VISION STATEMENT

"By 2030, ICFRE would be positioned as one of the world leaders and Centre of Excellence in forestry research and education. Research in ICFRE will be aligned with national priorities, international commitments, public concerns and aspirations of the people. In addition to the core areas of forestry research, ICFRE will also address the issues of land degradation, river systems, climate change, hydrological problems, natural disasters, biodiversity loss, deteriorating urban landscapes, pollution, livelihood and sustainability in a holistic and inclusive manner."

2 Alignment of ICFRE Research

WITH SUSTAINABLE DEVELOPMENT GOALS AND NATIONAL PROGRAMMES

SDG	NATIONAL PROGRAMME	ICFRE VISION 2030
1 NO POVERTY 	Mahatma Gandhi National Rural Employment Guarantee Programme	**Green Skill Development Programme (GSDP)**
	National Rural and Urban Livelihood Mission	**Demo Villages with emphasis on ICFRE Technologies providing livelihood**
	Pradhanmantri Jan Dhan Yojna	
	Skill Development Programme	
	Soil Health Cards	• **Forest Soil Health Cards** • **Research on Watershed Treatment Models** • **Research on Effective Soil and Moisture Methods**
2 ZERO HUNGER 	National Food Security Mission	• **Value Addition to NWFP's** • **Research on shifting cultivation**
	Doubling the Farmer's Income	• **Agroforestry Research** • **Release of New Varieties and clones of Tree species**
3 GOOD HEALTH & WELL BEING 	National Health Mission	• **Documentation of Traditional Health Formulations/ Practices, research on medicinal plants**

The health of our waters is the principal measure of how we live on the land.

SDG	NATIONAL PROGRAMME	ICFRE VISION 2030
4 QUALITY EDUCATION	National Education Mission	• FRI DU Forestry Education Programme • Green Skill Development Programme • 'Prakriti'- A scientist-student connect programme
5 GENDER EQUALITY	Beti Bacho Beti Padao	• Women Cells against workplace crimes • Fee waiver for women • Maternity Leave
6 CLEAN WATER AND SANITATION	• Swach Bharat Mission • National Rural Drinking Water Mission	DPR on Ganga and 13 Major Rivers systems of India
	• Jal-Van-Jan • Zero Polythene	Composting Technology for wastes
7 AFFORDABLE CLEAN ENERGY	Pradhan Mantri Ujjawla Yojna	Making briquettes from Pine Needles, Invasive weeds Bio-fuels

Water is the lifeblood of our bodies, our economy, our nation and our well-being.

SDG	NATIONAL PROGRAMME	ICFRE VISION 2030
8 DECENT WORK AND ECONOMIC GROWTH	• National Rural and Urban Livelihood Mission • Skill India	Self Employment through GSDP
9 INDUSTRY INNOVATION & INFRASTRUCTURE	• Pradhan Mantri Awas Yojna • Pradhan Mantri Gram Sadak Yojna	Houses made of treated bamboo-Seasoning and treatment of wood
10 REDUCED INEQUALITIES	-	Research on Tribal Culture, Medical Practices, Food and Crafts
11 SUSTAINALBLE CITIES AND COMMUNITIES	-	Research on Urban Forestry
12 SUSTAINABLE CONSUMPTION & PRODUCTION	-	Research on Timber Technology and Wood Science

SDG	NATIONAL PROGRAMME	ICFRE VISION 2030
13 CLIMATE ACTION 	National Mission for Green India	REDD + Strategy, REDD+ plans for States Research on Carbon estimation, carbon sequestration, adaptation and mitigation
14 LIFE BELOW WATER 	-	Studies on Mangrove Forests Wood biodegradation
15 LIFE ON LAND 	-	Biodiversity Studies Afforestation Models
16 PEACE, JUSTICE AND STRONG INSTITUTIONS 	-	Creation of Policy Research Division
17 PARTNERSHIPS FOR THE GOALS 	-	MoUs signed with line Institutions and leading Universities

In one drop of water are found all the secrets of all the oceans.

3 ICFRE Focus Areas

SDGs AND ICFRE'S FOCUS – 2020 to 2030

ZERO HUNGER

- Focused research on edible fungi, edible algae
- Improving shelf life of NTFPs, wild fruits

GOOD HEALTH & WELL BEING

- Strengthen the pharmaceutical applications of 'active constituents/ principles' in medicinal plants where propagation technologies have been standardized

QUALITY EDUCATION

- Strengthen the Higher Education in Forests and Environment- Sponsor Short Duration Targeted Courses
- Develop curriculum for introducing basic forestry and environmental knowledge at school level
- Strengthen informal education programme "Prakriti"

CLEAN WATER & SANITATION

- Jal-Van-Jan, develop watershed afforestation models for water recharge, improve hydrological cycle and involve all sections of society
- Start wetlands research for conservation of water bodies
- 'Single use plastics' – minimize the use of plastics and work on finding ecofriendly alternatives and replacing the plastic wastes with biodegradable organic substitutes
- Research on recycling of wastes, waste disposal through microbes/ flora (Bioremediation)

INDUSTRY, INNOVATION AND INFRA-STRUCTURES

- Research on low cost houses, specially in forest fringe areas using treated wood, bamboo and other wood products in place of iron, cement, concrete and plastics
- Develop models for green highways
- Set targets for innovative research and 'patents'
- Strengthen ICFRE – Industry Interface and research on Industry related problems and solutions

SUSTAINABLE CITIES & COMMUNITIES

- Develop models for urban greening
- Research on lung spaces and urban forests
- Research on carrying capacities of cities in terms of ecological parameters and limiting factors like population, industries, vehicles, green spaces etc.
- Control of pollution through development of city biodiversity indices

Knowing trees, I understand the meaning of patience. Knowing grass, I can appreciate persistence.

SUSTAINABLE CONSUMPTION AND PRODUCTION

- Conduct studies on patterns of consumption of ecological services provided by forests and nature
- How to reduce wastes and recycle
- Research on efficient and non-polluting utilization of 'Stubble' the wheat and rice butts post harvest for making paper/composite wood

CLIMATE ACTION

- Fulfill the aspirations of the country as "Centre of Excellence for Land Degradation Neutrality" by further strengthening research in this field
- National REDD+ Strategy and State REDD+ Action Plans
- Impetus to research on 'C' sequestration
- Develop adoptable site specific models for climate change mitigation and adaptation
- Research on Resilient Ecosystems to face droughts, floods, cyclones and landslides

PARTNERSHIP FOR GOALS

- ICFRE as world leader in forestry research to work in tandem with global institutions through subject specific studies
- As Centre of Excellence for land degradation neutrality for South – South Cooperation

Arable land is disappearing 30-35 times faster than it has historically.

LIFE BELOW WATER

- Food and nutrients from aquatic algae and flora
- Carbon sequestration potential of aquatic and mangrove ecosystem

LIFE ON LAND

- Studies on sustainable management of forests and terrestrial ecosystems
- Studies on grasslands and pastures
- Models for combating desertification and reverse land degradation
- Research on models for biodiversity conservation in "biodiversity hot spots"

Oceans absorb 30% of the Co2 that humans produce.

4 Priorities

RESEARCH AREAS, CONCEPTS AND STUDIES

- Climage Change
- Forest Ecosystem Services
- Biodiversity Conservation
- Development of Bamboo Industry & Usage
- Hydrology of Forests
- Forest Health
- Forest Management
- Forest Policy Research
- Trees Outside Forests (ToFs)
- Wood Utilization and Panel Products
- Bioprospecting of Forest Resource
- Enhancing Forest Productivity
- Conservation of Forest Genetic Resources
- Non Wood Forest Produce
- Research on River Systems, Aquatic Ecosystems – Jalshakti
- Management of Weeds and Invasive Alien Species
- Application of Biopesticides and Biofertilizers
- Improving the Wildlife Habitat
- Livelihood through Forests
- Greening Railways and Highways
- Zero Waste Economy
- Research on Native Species
- E-protection of Valuable Species
- Research on Grasslands, Pastures & Fodders
- Research on Forest Fires, Drought, Floods and Landslides
- Research on Pollution – Clean Air, Clean Water, Single Use Polythene
- Nanotechnology

CLIMATE CHANGE

Vulnerability assessment of forest ecosystems and species	✓	✓		
Preparing vulnerability maps				✓
Estimating 'C' sequestration potential of forest types	✓	✓		
Develop short term and long term adaptation/mitigation models for forests				✓
Develop climate resistant species by genomic tools				✓
Assessment of role of wetlands, lakes and mangroves in 'C' seqestration				✓
Satellite telemetry to study species movement, migration and distribution				✓

✓ **Legend**

Studies completed | Studies to be scaled up (2yrs.) | Studies need further R&D (4yrs.) | Studies of future (10yrs.)

The climate is a common good, belonging to all and meant for all.

FOREST ECOSYSTEM SERVICES

◆ Valuation of ecosystem goods and services from forests, grasslands, pastures, agroforestry systems etc., special focus on water and clean air			✓	
◆ Valuation of ecosystem goods and services of urban forests			✓	
◆ Valuation of forests and trees as natural healers for ailments			✓	
◆ Payment of ecosystem goods and services			✓	

BIODIVERSITY CONSERVATION

◆ Consolidation of Knowledge on rare, endangered and threatened species	✓		✓	✓
◆ Prepare recovery plans and package of practices for ex-situ and in-situ conservation			✓	✓
◆ Focussed studies on conservation of mangrove, grasslands, sacred groves and wetland ecosystem			✓	✓
◆ Assessment of urban biodiversity			✓	✓

Climate change and land degradation will adversely affect the biodivesity in 30.6% of forests by 2035 and 45.9% by 2085

✓ **Legend**

Studies completed | Studies to be scaled up (2yrs.) | Studies need further R&D (4yrs.) | Studies of future (10yrs.)

And into the forest I go, to lose my mind and find my soul.

DEVELOPMENT OF BAMBOO INDUSTRY & USAGE

Mapping of commercially important bamboos in Govt. and Private lands, density wise, species and production potential wise			✓	
Developing models for large scale commercial plantations for bringing down the cost of QPM and raising plantations			✓	
Prescribe the species and area specific propagation techniques and silvicultural prescriptions	✓	✓	✓	
Introduction of selected bamboo species of other countries and standardize their cultivation				✓
Develop and promote engineered bamboo products like timber, panels, flooring and structural material		✓	✓	
Establish primary processing centers, improvement of machinery, tools and related technologies			✓	✓
Using bamboo for low cost house constructions	✓	✓	✓	✓
Establishing certification and grading standards for bamboo and bamboo products			✓	✓
Improving the quality and diversity of the design and uses of bamboo products		✓	✓	✓
Designing equipments for fast and economic harvesting of bamboos	✓	✓	✓	✓
Develop bamboo market information system and linkages			✓	✓
Refining treatments of bamboo to increase life	✓	✓	✓	✓

India has largest area under bamboo in the world, yet it is a net importer of bamboo & rattan products

✓ **Legend**

Studies completed | Studies to be scaled up (2yrs.) | Studies need further R&D (4yrs.) | Studies of future (10yrs.)

HYDROLOGY OF FORESTS

Studies on water use efficiency of various tree species			✓	✓
Screening of agroforestry species for ground water depletion			✓	✓
Long term studies on hydrological parameters in treated and non treated watersheds			✓	✓
Best practices for treating watersheds including impact of forestry, agriculture, horticulture and other activities			✓	
Studies on water holding capacity of forest ecosystems			✓	✓
Dew harvesting and moisture tapping				✓

FOREST HEALTH

Eco-friendly management of insect-pests and diseases	✓	✓		
Mass multiplication techniques for applied biological control in plantations and forests			✓	✓
Impact of climate change and habitat fragmentation on the bio-control agents			✓	
Assessment of forest soil health and identification of suitable species with reference to specific forest types			✓	
Devising control measures that are easy to apply on tall trees like poplar to tackle problems of insect pests and diseases in plantations			✓	

✓ **Legend**

Studies completed | Studies to be scaled up (2yrs.) | Studies need further R&D (4yrs.) | Studies of future (10yrs.)

Water is the soul of the Earth.

FOREST MANAGEMENT

Development and documentation of improved and site specific eco-rehabilitation technologies for degraded areas, pasture lands, stress sites, wastelands. Restoration of abandoned Jhum areas	✓	✓		
Strategy to improve natural and artificial regeneration of identified species in different climatic zones		✓	✓	
Drivers of forest degradation and develop strategy to mitigate them	✓	✓	✓	
Study the effect of forest fire in different forest types, quantification of economic loss thereof in different forest types of India	✓	✓	✓	
Developing effective technologies for predicting and controlling forest fires			✓	✓
Management of tree health in urban areas			✓	✓
Habitat/ landscape and corridor management			✓	
Development of high yielding varieties/ clones of fodder trees species	✓	✓	✓	
Models and techniques for vulnerable degraded forests			✓	
Develop plantation techniques to reclaim saline wastelands			✓	
Develop forest based models for livelihood creation, ecological security and reduction of human animal conflict	✓	✓	✓	
Restoring and reclaiming degraded mangrove wetlands, dense shelterbelt of mangroves			✓	✓
Study ecological impact of forest fire, grazing and collection of non-wood products on regeneration and growth			✓	✓
Restoration of community pastures to enhance traditional livelihoods and diverting grazing pressure from forestlands while ensuring livelihoods			✓	
Development of eco-restoration model for region specific mined out areas	✓	✓	✓	✓
Documentation and dissemination of existing approaches and models available for restoration of different degraded areas in India and handing to stakeholders	✓	✓	✓	

✓ **Legend**

Studies completed | Studies to be scaled up (2yrs.) | Studies need further R&D (4yrs.) | Studies of future (10yrs.)

Forests are the lungs of our land, purifying the air and giving fresh strength to our people.

FOREST POLICY RESEARCH

◆ Trees outside forests refining production marketing and removal of legal impediments	✓	✓	✓	
◆ Develop policy to enhance use of wood and bamboo			✓	
◆ Draft policy for trade and production of agarwood			✓	
◆ Suitable legislation for extraction, procurement, quality and promotion of large scale cultivation of NTFPs to meet the industrial demand			✓	✓
◆ Impact of Forest Rights Act on livelihoods, fragmentation and health of forests.			✓	
◆ Estimation of fuel wood and fodder production	✓	✓	✓	
◆ Ecological impact study of eco-tourism activities and suggest measures to sustain			✓	
◆ Develop policy on certified planting material			✓	
◆ Certification of forest tree seeds			✓	
◆ Studies on economic analysis of agroforestry systems and ToF	✓	✓	✓	✓
◆ To assess and document balance of trade of forestry commodities and suggest measures to improve the situation	✓	✓	✓	✓

Forest policy research setting of goals to meet the needs and aspirations of the stakeholders and establishing strategies and instruments to implementations.

✓ **Legend**

Studies completed | Studies to be scaled up (2yrs.) | Studies need further R&D (4yrs.) | Studies of future (10yrs.)

I never see a forest that does not bear a mark or a sign of history.

TREES OUTSIDE FORESTS (ToF)

Preparation of volume /biomass/ carbon tables and allometric equations for ToF			✓	✓
Improved agroforestry models for maximizing output and enhancing carbon sequestration	✓	✓	✓	✓
Screening of pollution and heat tolerant/ absorbent native wood species for urban green spaces having low water requirement.			✓	✓
Development of integrated farming system, silvi-pasture, horti-pasture and agri-horti models in North East India			✓	✓
Models for creation of fuelwood lots			✓	✓

WOOD UTILIZATION AND PANEL PRODUCTS

Promoting skill development programmes	✓	✓	✓	
To develop modern hand-held tools and machines for quality products	✓	✓	✓	✓
Refine and extend technologies such as wood polymer composite; thermal modification; chemical modification of wood	✓	✓	✓	✓
Develop biodegradable composites	✓	✓	✓	
Develop commercially feasible and reliable non-destructive technique for assessment of wood quality parameters	✓	✓	✓	✓
Use of non-conventional timbers through value addition using chemical modification			✓	✓
Develop and upscale eco-friendly wood preservatives, efficient and less time consuming seasoning techniques	✓	✓	✓	
Explore applications of nano-technology in wood utilization	✓	✓	✓	
Develop efficient wood processing by utilizing solar energy	✓	✓	✓	

✓ **Legend**

Studies completed | Studies to be scaled up (2yrs.) | Studies need further R&D (4yrs.) | Studies of future (10yrs.)

Even if I knew that tomorrow the world would go to pieces, I would still plant my apple tree.

BIOPROSPECTING OF FOREST RESOURCE

Upscaling the bio-prospecting studies to screen for novel and useful bio-active compounds	✓	✓	✓	✓
Use of invasive species for handmade papermaking and other products	✓	✓	✓	✓

ENHANCING FOREST PRODUCTIVITY

Productivity estimation of forests and plantations at national level			✓	✓
Improvement in seed storage, nursery and propagation techniques for production of quality planting stock	✓	✓	✓	
Identification of superior genotypes assemblage, germplasm and establishing multi-location trials	✓	✓	✓	
Research on species for adapting to biotic and abiotic stresses and use marker assisted selection for adaptive traits	✓	✓	✓	✓
Phyto – remediation of soil for productivity enhancement	✓	✓	✓	✓

CONSERVATION OF FOREST GENETIC RESOURCES

Capacity building and establishing networking for operational synergy for forest genetic resource assessment and conservation		✓	✓	
Developing appropriate conservation strategy depending upon the species	✓	✓	✓	✓
FGR conservation of orchids, bryophytes, pteridophytes, ferns, mosses		✓	✓	✓
Characterization of genetic resources of forest tree species by DNA based molecular markers		✓	✓	✓
Biodiversity-based livelihood through involvement of local communities		✓	✓	✓
Logistic application and lab to land transfer of micro-propagation of vulnerable tree species	✓	✓	✓	✓
Whole genome sequencing (WGS) programmes in few selected keystone indigenous tree species		✓	✓	✓

✓ **Legend**

Studies completed | Studies to be scaled up (2yrs.) | Studies need further R&D (4yrs.) | Studies of future (10yrs.)

Nature always wears the colors of the spirit.

NON WOOD FOREST PRODUCE

◆	NTFP management, conservation and sustainable harvesting strategies	✓	✓	✓	✓
◆	Survey and assessment of valuation of NTFPs at National level		✓	✓	✓
◆	Development of models of value addition and marketing strategies of NTFPs	✓	✓	✓	
◆	Promotion of cultivation of commercially important NTFPs in horticultural and agro-forestry plantations	✓	✓	✓	✓
◆	Develop participatory management models taking into account traditional/ local knowledge		✓	✓	
◆	RS-GIS mapping of MAPs & NTFP resources		✓	✓	✓
◆	Identification and documentation of superior populations of MAPs & NTFPs		✓	✓	✓
◆	Creation of Medicinal Plant Conservation Areas (MPCAs)	✓	✓	✓	✓
◆	Forest Gene Banks for conservation and manipulation of resources for judicious utilization	✓	✓	✓	✓
◆	DNA fingerprinting, chemical profiling, sustainable harvesting protocols for highly traded and conservation- concerned species		✓	✓	
◆	Bioprospecting		✓	✓	
◆	Setting up Value Addition Centres especially by community enterprise		✓	✓	
◆	Development of nursery techniques of high altitude medicinal and aromatic plants along with maintenance of germplasm	✓	✓	✓	
◆	Developing non-destructive sustainable harvesting models and capacity building to encourage farmers to take up medicinal plants cultivation	✓	✓	✓	
◆	Develop complete package of practice for cultivation, harvesting, extraction and marketing of agar. Creating awareness on harvesting and trade related issues. Studies on host-pathogen compatibility	✓	✓	✓	✓
◆	Studies on long-term storage and shelf life of wild fruits and their products	✓	✓	✓	✓

NTFP is one of India's largest unorganized sectors contributes to about 20% to 40% of the annual income of forest dwellers.
Sector alone is able to create about 10 million workdays annually in the country.

✓ **Legend**

Studies completed | Studies to be scaled up (2yrs.) | Studies need further R&D (4yrs.) | Studies of future (10yrs.)

The clearest way into the universe is through a forest wilderness.

RESEARCH ON RIVER SYSTEMS, AQUATIC ECOSYSTEMS – JALSHAKTI

◆ Develop plans and methodologies for rejuvenating of our major river systems	✓	✓	✓	
◆ Rejuvenation and bio-remediation of water bodies and aquifers			✓	✓
◆ Studies on the role of forests in aquifer recharge, springs flow and water purification			✓	✓
◆ Studies on removal of sand and silt from river beds			✓	✓

Oceans absorb about 30% of CO_2 that humans produce.

MANAGEMENT OF WEEDS AND INVASIVE ALIEN SPECIES

◆ Spatial mapping of major Invasive Alien Species	✓	✓		
◆ Research on control of Invasive Alien Species and their management and economic utilization	✓	✓		

APPLICATION OF BIOPESTICIDES AND BIOFERTILIZERS

◆ Application of biofertilizers for restoration of degraded lands	✓	✓		
◆ Field evaluations, economic application and delivery system of biopesticides and bio-fertilizers developed		✓	✓	

IMPROVING THE WILDLIFE HABITAT

◆ Studies on severity of the area specific problems due to change in habitat		✓	✓	✓
◆ Natural regeneration studies and enrichment planting models of preferred species for habitat improvement		✓	✓	✓
◆ Socio-economic studies and solutions to the man-animal conflicts		✓	✓	✓

✓ **Legend**

Studies completed | Studies to be scaled up (2yrs.) | Studies need further R&D (4yrs.) | Studies of future (10yrs.)

LIVELIHOOD THROUGH FORESTS

◆ Conversion of non edible plants including sea flora into consumable products			✓	✓
◆ High value nutrients and medicines from sea weeds and algae		✓	✓	✓
◆ Conversion of C3 plants to C4 plants			✓	✓

One out of nine people on earth go to bed hungry every night.

GREENING RAILWAYS AND HIGHWAYS

◆ Develop models of sustainable greening along the railways and highways		✓	✓	✓

ZERO WASTE ECONOMY

◆ Develop eco-friendly biological waste treatment technology			✓	✓

Make the goals a reality

RESEARCH ON NATIVE SPECIES

◆ Identification and promotion of lesser known tree species	✓	✓	✓	✓

E-PROTECTION OF VALUABLE SPECIES

◆ Development of e-protection techniques for sandalwood, red sanders, teak and other important species	✓	✓	✓	✓

✓ **Legend**

Studies completed | Studies to be scaled up (2yrs.) | Studies need further R&D (4yrs.) | Studies of future (10yrs.)

Life is 10% what happens to you and 90% how you react to it.

RESEARCH ON GRASSLANDS, PASTURES & FODDERS

Restoration of community pastures for reducing pressure on forests		✓	✓	
Research on fodder species	✓	✓	✓	✓
Increasing fodder availability through silvi-pastoral systems	✓	✓	✓	✓
Effective models for rotational grazing	✓	✓		

RESEARCH ON FOREST FIRES, DROUGHT, FLOODS AND LANDSLIDES

Vulnerability maps for natural disasters on the basis of vegetative growth and other biological indicators	✓	✓	✓	
Develop climate smart forestry models		✓	✓	✓
Develop homeostatic diamond trees/ artificial trees			✓	✓
Sensor based forest fire mitigation				✓
Forestry to minimize the damage by tsunamis, cyclones			✓	✓
Estimation of losses by forest fires	✓	✓		
Restoration of fire ravaged areas			✓	✓

✓ **Legend**

Studies completed | Studies to be scaled up (2yrs.) | Studies need further R&D (4yrs.) | Studies of future (10yrs.)

The secret of getting ahead is getting started.

RESEARCH ON POLLUTION – Clean Air, Clean Water, Single Use Polythene

◆ Air quality monitoring through bio-indicators	✓	✓	✓	✓
◆ Aquifer monitoring through bio-indicators	✓	✓	✓	✓
◆ Bio-remediation of waste water treatment	✓	✓	✓	✓
◆ Technology for run-off control, water harvesting and in-situ water purification		✓	✓	✓
◆ Dew harvesting			✓	✓
◆ Carrying capacity of major cities		✓	✓	✓
◆ Studies on green urban lung spaces and cleaning air			✓	✓
◆ Recycling of urban wastes through biological treatments		✓	✓	

Water scarcity affects more than 40 percent of people around the world

NANO TECHNOLOGY

In the forest products utilization the manipulation and utilization of materials at the nanoscale is expected to be a driver of economic growth and development over the last few years globally, the potential for nanotechnology development in the forest sector has become apparent and realizable. The areas are:

◆ Development of pest resistance, decrease in UV degradation and moisture resistance in wood			✓	✓
◆ Development of new generation fiber based products, pulp, paper, composite wood, processes and many more	✓	✓	✓	
◆ Utilization of plant accumulated nano particles in medicinal and other uses			✓	✓
◆ Increase efficiency of nutrients in water use			✓	✓

✓ **Legend**

Studies completed | Studies to be scaled up (2yrs.) | Studies need further R&D (4yrs.) | Studies of future (10yrs.)

When one person's livelihood changes, it can impact an entire family, then a whole community.

FORESTRY EDUCATION

- Adopt accreditation system on the pattern of NAC (National Accreditation Committee) and ICAR are to be in place to ensure quality of forestry education. This will enable excellence, high institutional quality and uniformity in the course curriculum/ forestry programme
- Forging global linkages with institutes of excellence in higher education in forestry
- Upgradation of FRI deemed university as an institute of excellence on the lines of IIM and IIT
- Forging linkages and tie-ups for better employability of the forestry professionals
- Start and introduce online short term forestry courses

FORESTRY EXTENSION

- Intensification of 'Direct to Consumer' scheme to demonstrate research outputs to the user groups
- Increase the number of Van Vigyan Kendras to all blocks in the country and develop sound linkages with Krishi Vigyan Kendras
- Use of information technology for faster and cheaper dissemination
- Opening of comprehensive Intellectual Property Rights Cell
- Develop incubation centers for upscaling, financing and commercialization of technologies
- Adopt aggressive extension

CREATION OF ACTION GROUP – 'Innovative Ideas and out of Box Thinking'

- To improve the research system, ICFRE initiated discussions and deliberations on contemporary research issues by forming different groups like Think Tank, Ginger Group, National Subject Matter Coordinators (NSMCs) and Forestry Experts Forum
- These forums would provide necessary inputs for shaping the forestry research

STRENGTHENING OF SCIENTIFIC MANPOWER IN ICFRE

- Infusing young talent by deputation of scientists to ICFRE from other premier Institutes

INFRASTRUCTURE SUPPORT

- After the setting up of the Council, the mandate increased manifold, whereas the infrastructure facilities have remained stagnant. With the passing of time and new emerging fields of research, it has been felt that there is an urgent need to strengthen infrastructural support for the council and its institutes
- An urgent need to address the issue of upgradation of old machines and instruments and state of the art technology is to be used for research
- Upgradation and renovation of laboratories and buildings
- Each Institute of ICFRE would be encouraged to prepare a "Perspective Plan" to enable development of its core competencies and to evolve into a centre of excellence

HUMAN RESOURCE DEVELOPMENT (HRD)

- New HRD plan has been formulated for creating an inhouse pool of trained researchers and managers to achieve scientific breakthrough in the face of complex forestry challenges of today

CREATION OF CORPUS FUND

- The corpus fund would enable ICFRE to take up research problems in networking with industries, universities, IITs/IIMs, Civil Societies and others

CONSORTIUM OF NGOs

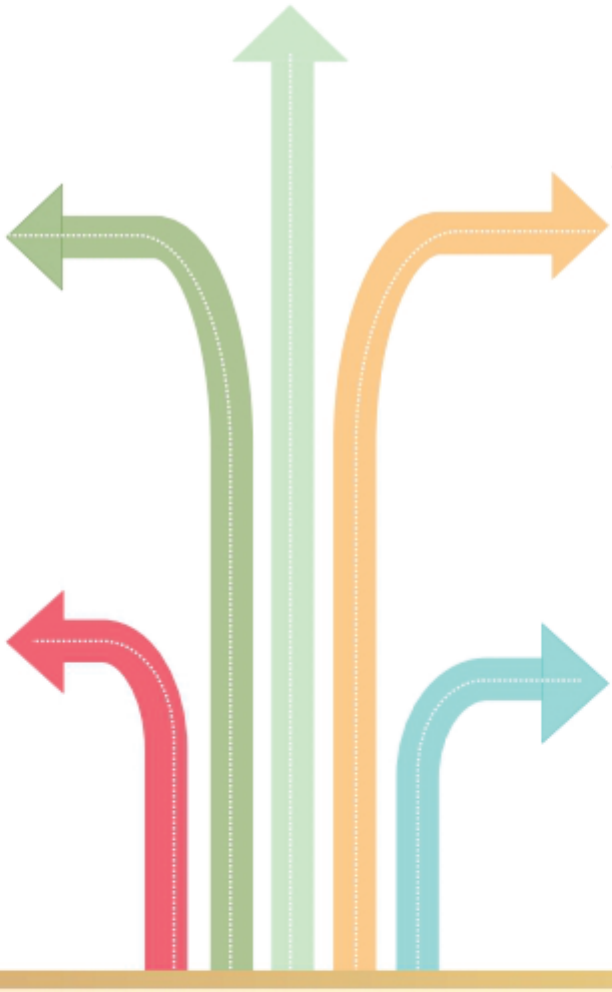
- Research findings of ICFRE needs to reach to the stake holders efficiently for better and focussed extension of developed technologies, a consortium of NGOs may be helpful. This could bridge the gap between the researchers and stakeholders.

Do not go where the path may lead, go instead where there is no path and leave a trail.

5 WAY FORWARD

This document envisions a path towards achieving our national goals and fulfilling commitments thereon and to develop an inclusive, sustainable and progressive environment to address the challenges in forestry sector, nationally as well as globally. While implementing ICFRE vision 2030 the following are to be remembered as the spirit of our actions:

Fundamental research is basic in achieving ICFRE Vision 2030 but it has to be open ended and curiosity driven. It will be a blend of bottom up and top-down approach.



Core competence of ICFRE and trained scientific community will be further strengthened so that we maintain lead in niche research domains and technologies.

An environment will be created to recognize and tap the innovations already done and being done for technological empowerment of ICFRE.

ICFRE will develop and deploy technologies to solve human, social and environmental problems for which priority has to be given to "skills over knowledge" and "doing over proving".

Work - life balance, stress management and art of living will be integrated in HRD for a healthy and ambitious working environment to develop "Brand ICFRE".

'Build on what we have learned' & 'efficiency and speed' are the watchwords

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