सत्यमेव जयते

# FOREWORD

**प्रकाश जावडेकर**
**Prakash Javadekar**
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्री
Minister of Environment, Forest & Climate Change
भारत सरकार/Government of India

In the recent years, there is a growing recognition of the vital role played by forest ecosystems in ensuring the ecological security of the world. The ecosystem services that forests provide are essential for the existence of life on the Earth. The changes in forest ecosystems are highly dynamic in nature and therefore there is a need for regular monitoring to ensure balance between conservation and development. It gives me a deep sense of pride to inform citizens of this country and world at large that India is the only country in the world which carries out nation-wide assessment of its forest resources in biennial cycle using modern techniques.

Forest Survey of India, an organisation of this Ministry, has been carrying out the gigantic task of nationwide biennial forest cover monitoring and assessment since 1987. For over three decades now, FSI has kept pace with the advancement of technologies for such assessments and created a niche for itself in this specialized field. This 16$^{th}$ India State of Forest Report, besides providing regular information on forest resources of the country, has also brought out findings of a few special studies which are important for the policy makers, planners, forest managers, researchers and students having interest in conservation of natural resources. It is also a pleasure to inform that FSI has been strengthening its methodology in remote sensing based forest cover mapping and national forest inventory based assessments of forest resources which is in accordance with the Hon'ble Prime Minister's vision of 'Digital India'.

It gives me satisfaction to note that despite the immense biotic pressure on the country's forests, the forest and tree cover continues to show an increasing trend over the years. This is the result of sustained conservation, protection and afforestation efforts implemented on the ground under the policies of the National Government and State Governments. It also reflects the direct impact of various Government schemes in the recent years, like "Pradhan Mantri Ujjwala Yojana" which has considerably reduced the dependence of rural households on forests for fuelwood.

It is heartening to note that FSI has also been making significant contribution towards international commitments by reporting and complying various requirements under GFRA, REDD+, UNFCCC, UNCCD etc. Recently, FSI has also carried out a comprehensive study to assess the magnitude and scale of actions required to create an additional carbon sink of 2.5 to 3 billion tonnes of $CO_2$ eq by 2030 through additional forest & tree cover, which is one of the commitments made in India's NDC.

I am also happy to inform the readers that since 2001, FSI has been assessing the tree cover outside the forests which is a major source of meeting the local demands of timber, fuelwood and fodder. Such assessments quantify the contribution of forestry sector to the nation's GDP.

I congratulate the Director General, FSI and his team for bringing out this highly useful and informative India State of Forest Report 2019 and wish them all the best in their endeavours towards providing qualitative and quantitative information at the national level for planning the sustainable management of the vast forest resources of the country.

(Prakash Javadekar)

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**बाबुल सुप्रियो**
**Babul Supriyo**
पर्यावरण, वन एवं जलवायु परिवर्तन राज्य मंत्री
Minister of State for Environment, Forest & Climate Change
भारत सरकार/Government of India

More than ever before, the entire world is looking at forests for providing solutions to the adverse impacts of climate change. In such a scenario, it is heartening to note that the results of the 16th biennial assessment report (ISFR 2019), published by the premier organisation of this Ministry, are indicating positive trends of forest and tree cover in the country. This clearly validates the sustainable development path charted by the government. It is not a minor achievement that despite the huge anthropogenic and other demands on natural resources, our country has been successful in achieving a balance between developmental needs and conservation. Further, the results of the Forest Fringe Village study undertaken by FSI are encouraging and show signs of the environmental benefits of the welfare schemes like Ujwala Yojana, fodder enhancement and other rural development programmes in obviating pressure on forests.

I have been informed that in keeping pace with the rapid advancements in geospatial technology, FSI has also adapted itself suitably, which is evident in improvement in methodology, application of SAR technology for biomass mapping of country, forest fire monitoring programmes, use of PDA devices with specialized applications for collection and processing of inventory data on real time basis, Drone applications and allied techniques. The use of new NFI design data in the current report for assessment of growing stock, carbon accounting and other parameters has yielded results with greater precision. I also take this opportunity to congratulate the entire FSI team for coming out with useful technical information through their publications on forest fire and strategy for achieving NDC commitment of the country on forestry.

The current ISFR provides relevant information pertaining to each State such as biodiversity assessment, slope and altitude wise forest cover etc. which the States will find very useful in formulating policies and strategies for conservation, management and enhancement of their forest and tree resources.

On the whole, the current ISFR is a treasure trove of information which I am sure will be of great relevance to the entire spectrum of stake holders from the policy makers, academicians, administrators, forest managers, and community based organizations to the citizens of the country at large.

The entire FSI team deserves congratulation for their dedicated efforts for taking out this exhaustive report on time and I look forward to many more such achievements in future also.

(Babul Supriyo)

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**सी. के. मिश्रा**
**C.K. Mishra**
सचिव
Secretary
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय
Ministry of Environment, Forest & Climate Change
भारत सरकार/Government of India

In today's situation, when the country is on the path of rapid all round development and the pressure on our natural resources is high, it becomes essential to keep an eye on the changes taking place in the forests of the country. Forest Survey of India (FSI), for the last three decades, has been carrying out the remote sensing based biennial forest cover assessment of the country, validated by wide spread ground truthing. FSI also implements the National Forest Inventory involving survey and enumeration on more than 16000 sample plots distributed all over the country every year. The findings of these two major activities, along with several other studies, are published in the biennial India State of Forest Report (ISFR). So far, 15 reports have been published and this is the 16$^{th}$ such report. These reports are widely acclaimed nationally and internationally and provide very useful information on the forest resources and on many other parameters which are relevant for nation-wide planning for the forestry sector.

It is heartening to note that as per the ISFR, 2019, the forest and tree cover of the country continues to show a rising trend despite immense pressure on our forests. The credit should go to various State/UT Forest Departments for their continuous efforts in implementing sound policies of conservation, sustainable management of forests and promotion of Trees Outside Forests. The report indicates that the positive changes in Government's policies relaxing restrictions on felling of trees from private lands and easing of transit rules, have generated the right atmosphere for planting more trees on private lands, leading to improved livelihoods and income opportunities. This strategy will also result in additional benefits in terms of enhanced carbon stock and ecosystem services.

I am happy to know that in the current ISFR, digitized forest boundaries of 23 States and UTs have been used to assess the extent of forest cover within the recorded forest areas. I urge the remaining State/UT Forest Departments to take up this activity on priority and provide the digital forest boundaries to FSI. This will help the States to plan appropriately for areas within and outside recorded forest areas.

This report, besides providing regular information on forest cover, mangroves, growing stock of timber within and outside forests, contains dedicated chapters on Bamboo Resources, Forest Fires, Carbon Stock, People and Forests and Forest Types and Bio-diversity. It is thus a storehouse of useful data for meeting the information needs of different stakeholders of the forestry sector.

I am pleased to know that the forest fire alerts provided by FSI have been found very useful by the State Forest Departments for undertaking immediate onsite control measures. Similarly, Decision Support System and e-Green watch systems operational at FSI are of immense help to the Ministry in taking objective decisions in FC matters and monitoring of CAMPA activities. The information from FSI regarding the Carbon Stock in Country's Forests is very important for formulating and finalizing the strategy for creating an additional Carbon sink of 2.5 to 3 billion tonnes of $CO_2$ eq by 2030 through additional forest and tree cover, which is one of the commitments made in India's NDC.

I am sure that FSI would continue to strive hard to maintain and surpass the credibility it has achieved over the last three decades. I wish the organisation would continue to evolve with the changing times for providing more comprehensive information for sustainable management of forests in the country. I wish the organisation greater success in future. Lastly, I congratulate Director General, Forest Survey of India and his competent team for this comprehensive ISFR 2019.

(C.K. Mishra)

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**सिद्धांत दास**
**Siddhanta Das**
वन महानिदेशक एवं विशेष सचिव
Director General Forest & Special Secretary
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय
Ministry of Environment, Forest & Climate Change
भारत सरकार/Government of India

Over the years, the release of the biennial India State of Forest Report (ISFR) published by Forest Survey of India is one of the most awaited events in the forestry sector in India. With the release of the 16th biennial assessment report i.e. ISFR 2019, the country has completed more than three decades of regular assessment of its forest resources.

With 2.5% of total land surface supporting 16% of human and 18% of cattle population of the world, it is not a small achievement that the country has been able to maintain a balance between conservation and development. In the current cycle, there has been an increase of over 5000 sq km of forest and tree cover as compared to the previous assessment. The impact of sustained conservation efforts over the years, agro-forestry practices, fodder improvement and renewable energy programmes have contributed in maintaining, a positive trend of forest cover.

Improvement and standardization of forest cover mapping methodology by FSI and publishing a manual for the same, nation-wide study for estimating dependence of people in forest fringe villages on forests, forest biomass mapping using SAR technology, launch of advanced Forest Fire Alert System, mapping of fire prone forest areas are indeed commendable initiatives of FSI. I have also been informed that keeping in pace with the advancement in technology and modernization, FSI has introduced a state of the art web GIS based PDA devices with specialized applications for collection and processing of inventory data on real time basis. For the first time, data from the new NFI design introduced in 2016 has been used for assessment of growing stock, forest carbon stock and several other parameters reported in the ISFR 2019. In addition to the above, inclusion of information on forest plant diversity in different forest types, impact of forestry interventions in Ganga Basin, information on invasive species and NTFPs and several other features in the ISFR 2019 have added value to its content. New information on forest cover distribution in different slope classes presented in this report will help the State Forest Departments in developing strategies for catchment area afforestation and restoration of open forests on the slopes to check soil erosion, conserve water and harness other multiple ecosystem benefits including enhanced carbon sequestration.

Assessment of dependence of people living in forest fringe villages on forests for fuel wood, fodder, small timber and bamboo will provide important insights for planning suitable measures to reduce pressure on forests. These estimates also provide an understanding of unrecorded removals from forests, which have a bearing on the lower growing stock and productivity of our forests.

In addition to contributing towards reporting for various international commitments under GFRA, REDD+, BUR and NATCOM, FSI has also come out with various technical information reports. Recently released Technical Information Series on the forestry target under the Nationally Determined Contribution (NDC) committed by India, has presented an in-depth analysis on the possibilities, scale and costs for strategy formulation for creating an additional carbon sink of 2.5 to 3 billion tonnes of $CO_2$eq through additional forest and tree cover.

Finally, I take this opportunity to congratulate the Director General, Forest Survey of India and his entire team for an excellent job done and hope that they will continue to enrich information content on forest resources of the country, in future also.

(Siddhanta Das)

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# PREFACE

**डॉ0 सुभाष आशुतोष,** महानिदेशक
**Dr. Subhash Ashutosh,** Director General
भारतीय वन सर्वेक्षण
Forest Survey of India
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय
Ministry of Environment, Forest & Climate Change
भारत सरकार/Government of India

Forest is a dynamic natural resource because of the ecosystem cycles as well as its anthropogenic interfaces. In our country, the dynamism of forests is greatly influenced by forest-people interaction. There is a large scale demand on forests for ecosystem services, meeting needs of people living close to forests for fuel wood, fodder, timber, NTFPs etc and for development. Climate change on the other hand is causing increasing stress on the ecosystems. The significance of assessment and monitoring of forests has never been so high as in the present times. India took an early lead in remote sensing based forest cover monitoring as well as in forest inventory; these activities by FSI have completed over 30 and 50 years respectively. FSI has always endeavoured to use the latest technologies and improved methodologies in forest monitoring and assessment.

ISFR 2019 presents the results of forest cover mapping with a refined methodology, though consistent with the past assessments. A manual for forest cover mapping has been prepared for the first time. Similarly, it is the first presentation of estimates from the new grid based forest inventory design adopted by FSI in 2016 with higher sampling intensity and precision. Several new studies have been undertaken like assessment of biodiversity in the country's forests, assessment of people's dependence on forests for fuel wood, fodder, small timber and bamboo, forest cover on slopes and wetlands in forests. New set of information from forest inventory on invasive species, important NTFPs, dia-class distribution of important forest species in each State has further enriched the primary database on forests of the country for formulation of policies, strategies and sustainable management of forest resources. Improvement in forest fire alert system and the mapping of fire prone areas have equipped the States to better manage and control forest fires. Forest carbon estimates of each State & UT and the country as a whole have been calculated with higher sampling intensity and an analysis has been done for evaluating possibilities to achieve the NDC target of creating additional sink of 2.5 to 3 billion tonnes of $CO_2$eq through additional forest & tree cover in the country by 2030.

Forest Survey of India has enjoyed the full support and guidance from the Ministry of Environment, Forest & Climate Change, Government of India in accomplishing the tasks mandated to it. I express my heartfelt gratitude to Shri Prakash Javedkar, Hon'ble Minister, Environment, Forests & Climate Change, Government of India, Shri Babul Supriyo, Hon'ble Minister of State, Environment, Forests & Climate Change, Government of India, Shri C. K. Mishra, Secretary, MoEF&CC, Govt of India and Shri Siddhant Das, Director General of Forests & Special Secretary, MoEF&CC, Govt of India for their valuable guidance and continuous support. I am thankful to Smt Bharati, IGF (SU) and Shri Rohit Tiwari DIGF (SU) for their continued help and support to FSI. Mapping of forest cover of the country and forest inventory in a two-year cycle is a herculean task, which is made possible with the dedicated efforts of the officials of FSI at different levels, both at the headquarters and in the zones, working as a team in a professional manner. I express my appreciation for their total devotion and hard work in completing the assessments in a time bound manner for preparation of India State of Forest Report 2019.

Presenting ISFR 2019 is a matter of pride and immense satisfaction to the organization and it also motivates us to continue our endeavour to excel and serve the forest & environment sector of the country.

(Dr. Subhash Ashutosh)

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