

Environmental Science

Karan Deo Singh

# Capacity Building for the Planning, Assessment, and Systematic Observations of Forests

With Special Reference  
to Tropical Countries

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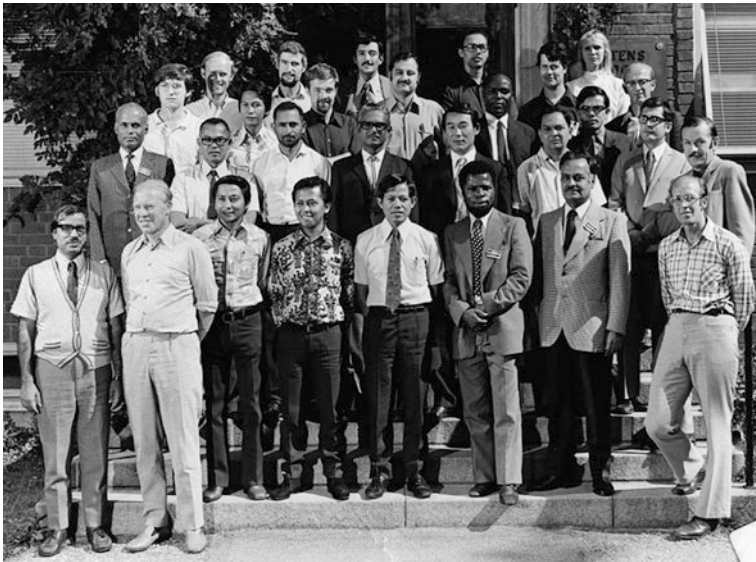
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*to Indira*



Participants of the first FAO/SIDA Training Course on Forest Inventory held in Sweden, 1974

# Foreword

It is a great pleasure to write a few words on the book and on the author, with whom I have been associated for over 50 years. When reading the text now I put some questions to myself. Is the book only a survey into the history of international forestry cooperation that is of relevance only for persons like me, who have been involved in the capacity development since the early 1960s? Does the book contain knowledge that is worth preserving for future generations? My answer is both.

My first experience of international forestry cooperation started with the Joint Meeting of the European Forestry Commission of the FAO and the Timber Committee of the UNECE in October 1963, in connection with the presentation of new European Timber Trends and Studies. The primus motor of the discussions in this joint meeting was Jack Westoby of FAO. His name is worth mentioning in this foreword since both the author of this book and many others including myself have been greatly stimulated by him in their professional work within or outside the FAO.

I visited the GOI/FAO Pre-Investment Survey of Forest Resources Project for the first time in 1966 as a forest inventory consultant. K. D. Singh had just taken over as the Senior Statistical Officer in charge of the data processing unit after completing doctoral studies in Germany. In those days, as there were very few electronic data processing facilities available in Delhi, we initially undertook data processing in Sweden. Soon, when the IBM 1620 Computer of the Planning Commission became available to the Project, the Indian Team shuttling between Dehradun and Delhi and working late in the night developed the entire EDP system. At least four of the junior forest officers got opportunities for studies in the USA and they became all important actors within international forestry. I visited PIS finally in 1978, when it hosted a Regional Workshop on Forestry and Land-Use planning and soon after it became the Forest Survey of India. I consider PIS a good example of national/international capacity building initiative.

Regional Training Courses and Fellowships have been used as other forms for technology transfer. FAO/SIDA sponsored several training courses during 1972–1978 hosted by the Department of Forest Survey of the SLU where I was in charge since 1958. For one of these courses, we made a sabbatical arrangement for

K. D. Singh for one year, partly to carry out the preparatory work for a training course and partly for him to undertake independent research on tropical forest assessments. Such twinning arrangements and training courses seem to offer a very useful approach for individual capacity building measures while the South–South Cooperation seems to make a more lasting impact and provide problem-oriented solutions, as demonstrated by the FAO/SIDA CCB Project, during 1995–1998, with FAO Rome as HQ and working with a number of Lead Centers in the different tropical regions.

During 1988–1998, I visited the FAO HQ several times for evaluating the donors' supported components of Global Forest Resources Assessment (FRA) and CCB Project. I observed that most of the FRA staff had been one-time associate professional officers, deputed by donors to work and learn in the FAO Field Projects in the developing countries. This past investment in capacity building was now paying back. During my tenure as head of the Department of Forest Survey in Sweden, two of my colleagues Klaus Janz and Reidar Persson also worked as Associate Professional Officers in the FAO World Forest Inventory Unit and made important contributions to the Global FRA process later.

Capacity development, retaining expertise, and continuity in forest assessments seem as important a need in the countries as at the FAO HQ, which is facing high expectations of the international community for reliable global level data on a continuing basis. The UNCED Agenda highlights the need for capacity building of countries as well as international institutions and donors. Global assessments and country capacity buildings are interrelated challenges for which appropriate strategy and international cooperation has to be evolved. I believe that this book will make an important contribution toward achieving these objectives.

Avesta, Sweden, February 2013

Nils-Erik Nilsson



# Preface

The purpose of the book is to contribute to establishing/strengthening capacities in the planning, assessment, and systematic observations of forests in the framework of UNCED Agenda 21, Programme Area D of [Chap. 11](#) Combating Deforestation. Following the Rio Conference, a number of countries, donors, and international organizations have implemented capacity building projects with varying degrees of success. A main reason for the varying success rate seems to lie in the design of technical assistance programmes, which have been formulated on the traditional lines mainly to generate forest resources information or transfer of technology; whereas Agenda 21 requires fundamental changes in a country's institutions and approach to plan and implement the conservation and sustainable development of forests through a process of continuing research and analysis.

States, according to the legally non-binding Forestry Principles, have the sovereign and inalienable right to utilize, manage, and develop their forests. Accordingly, they have to take the first charge of establishing institutions and strengthening of their capabilities; international and regional cooperation can only build on the national initiatives. With these considerations in mind, the presentation in the book has been divided into two parts. [Chapters 1–10](#) in the first part cover topics related to country led initiatives in planning and implementation of forest inventories; and [Chaps. 11–20](#) in the second part describe areas for regional and international cooperation to advance the country capacity building process. This division of contents is expected to delineate areas of national and international action for capacity building; and basic and more advanced areas of forest inventories.

The book places emphasis on South–South Cooperation as a means to rapid strengthening of country capacity. The tropical forest formations are homologous across the continents, with remarkable similarities in ecological conditions, structure, and physiognomy of the vegetation, as social and economic conditions. Sharing of knowledge and data among countries of the region has great value for modeling and survey studies to meet the research and development needs of countries. Such a cooperation has proved most valuable for the temperate and boreal zone countries, where UNECE/FAO has been playing an important role

since 1945 in sharing of knowledge, harmonization of assessment techniques, and consensus building on important forestry issues in the industrialized regions.

The international organizations have a catalytic role to play in realizing the UNCED Agenda 21 Objectives. Since its foundation in 1945, FAO has been contributing to development and dissemination of knowledge in the field of forest inventories and providing technical assistance to member countries (on request). FAO HQ, unquestionably, is the most important repository of knowledge on tropical forests. This fact coupled with its presence in most tropical countries, lends the Organization a unique advantage to contribute to country capacity building on a continuing basis, using mechanism such as South–South Cooperation. This will also significantly improve the quality of global forest assessments, which is an important mandate of the Organization. The preamble of Agenda 21 states the role of international cooperation clearly: “No nation can achieve this on its own. Together we can, in a global partnership for sustainable development”.

New Delhi, February 2013

Karan Deo Singh

# Acknowledgments

This book is an outcome of the continuing engagement of the author with the subject for over 50 years starting with his appointment in 1960 as Assistant Silviculturist, Uttar Pradesh Forest Department, India, which had traditions for systematic observations of forests using permanent sample plots dating back to 1925. The posting as Senior Statistical Officer in the Pre-investment Survey of Forest Resources, Dehradun, initially a FAO/UNDP/GOI Project and later transformed into Forest Survey of India, gave the opportunity to work on theoretical and practical aspects of forest inventory in different parts of the country with many national and international experts and, in particular, Nils-Erik Nilsson, FAO Data Processing Consultant to the Project, which grew into a long lasting association.

Short-term FAO assignments as Data Processing Consultant to other countries helped to widen the knowledge base of the author and also promote South–South Cooperation. The continuing assignment at Rome, in 1979–1998, provided an excellent opportunity to progressively improve FAO Regular Programme activities in forest inventory, technical backstopping of country projects, organize several national international training courses, and undertake the challenge of Global Forest Resources Assessment 1990. The teamwork of the FRA staff, concerned FAO officers Mr. J. P. Lanly and Mr. Klaus Janz, and a network of international and national experts made possible to complete the FRA1990 report on the state of world forests and ongoing changes; and a paper on the state of tropical forests and country capacity in planning and forest assessments presented at UNCED 1992. A concrete outcome of the latter was international support to Programme Area D of [Chap. 11](#) of Agenda 21 and the Interregional Project on Country Capacity Building in Forest Resources Assessment, Planning and Evaluation, 1995–1998, funded by the Government of Sweden. After a research fellowship on biological diversity at the Harvard Center for International Development, USA, it is a great pleasure to work again at home on local forestry and livelihood issues.

The book reflects the long innings of work on forest inventory problems of India, other countries of the tropics, and FAO HQ Rome. I take the opportunity to express my sincere thanks to countries, donors, and all colleagues and in particular the staff of the Pre-Investment Survey of Forest Resources, GOI, Dehradun, and

Global Forest Resources Assessment, FAO, Rome, for the pleasure of working together to enrich the knowledge base for planning and assessments and country capacity building in the tropical regions for sustainable forest management, a common obligation set forth in [Chap. 11](#) of UNCED Agenda 21.

# Abbreviations

APM	Area Production Model
ARD	Afforestation, Reforestation, and Deforestation
AVHRR	Advanced Very High Resolution Radiometer
CBD	Convention on Biological Diversity
CCB	Country Capacity Building
CGIAR	Consultative Group on International Agricultural Research
CIFOR	The Center for International Forestry Research
CTFS	Center for Tropical Forest Science
CTFT	Centre Technique Forestier Tropical
DBH	Diameter at Breast Height
ECE	Economic Commission for Europe
EFZ	Ecofloristic Zone
FAO	Food and Agriculture Organization of the United Nations
FDP	Forest Dynamics Plots
FINNIDA	Finnish International Development Authority
FORIS 1990	Forest Resources Information System 1990
FRA 1990	Forest Resources Assessment 1990 Project
FSI	Forest Survey of India
FORIS	FAO Forest Resources Information System
GIS	Geographic Information System
GOFC GOLD	Global Observations for Forest Cover and Land Dynamics
GOI	Government of India
IIASA	The International Institute for Applied Systems Analysis
ICIV	Institut de la Carte Internationale de la Végétation
IPI	Indian Photo-Interpretation Intitute
IRS	Indian Remote Sensing Satellite
ITTO	International Tropical Timber Organization
IUCN	International Union for the Conservation of Nature

IUFRO	International Union of Forest Research Organizations
LANDSAT MSS/TM	LANDSAT Satellite Multi-spectral Scanner/Thematic Mapper
LCCS /GLCN	Land Cover Classification System / Global Land Cover Network
LIL	Low Intensity Logging
RIL	Reduced Impact Logging
NFMA	National Forest Monitoring and Assessment
NTFP	Non-Timber Forest Produce
NASA	National Aeronautics and Space Administration (United States of America)
OECD	The Organisation for Economic Co-operation and Development
PIS /FR	Preinvestment Survey of Forest Resources, India
PSP	Permanent Sample Plots
REDD	Reduction of Emission from Deforestation and Forest degradation
RPF	Relative Production Function
RS	Remote Sensing
SFM	Sustainable Forest Management
SIDA	Swedish International Development Agency
TCDC	Technical Cooperation among Developing Countries
TFAP	Tropical Forests Action Programme
TOF	Trees Outside Forests
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
UNESCO	The United Nations Educational, Scientific and Cultural Organization
UNEP	United Nations Environment Programme
UNFCCC	UN Framework Convention on Climate Change
UNFF	United Nations Forest Forum
UNIDO	United Nations Industrial Development Organization
USGS EDC	US Geological Survey / EROS Data Center
WCMC	World Conservation Monitoring Centre
WFI	World Forest Inventory
WWF	World Wide Fund for Nature

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# Part I

## Building Forest Inventory Institutions

**Abstract** This part presents cornerstones of the country capacity building in forest assessments and planning to meet the growing demand of information about multiple functions of forests at the national and global levels. The measures include: (1) Enhancing ability to understand and analyze the decision problems and formulate them in forest inventory terms; (2) Building capacity to organize and use the existing information for solving decision problems and in planning of new surveys; (3) Acquisition of appropriate technology like GPS, Remote Sensing, and GIS in solving inventory problems; and (4) integrating inventory information with the medium and long-term forestry planning.

# Chapter 1

## The Growing Mandate of Forest Inventories

### 1.1 Emerging Environmental Problems

This introductory chapter will briefly describe the rapid emergence of a new genera of problems, like climate change, biodiversity loss, land degradation, etc., not much heard of say 40 years back. These problems are not only conceptually complex, but international in scope, calling for consistent information at national, regional, and global levels in the form of a time series. This poses a problem to tropical countries as many of them lack institutional capacity as well as financial resources to collect and provide information. Techniques and technology are advancing fast to ameliorate the situation, but in turn, they also create problems for continuity and compatibility of national/global assessments. The twin issues, viz., strategy for national/global forest assessments and strategy for country capacity development for the purpose, are the main concerns of the book.

The Stockholm Conference on Human Environment 1972 sowed the seeds of change by bringing environment issues in the global focus. In the background was the report: "Limits to Growth", published a year before by the Club of Rome, which questioned the sustainability of exponentially rising trends of consumption of the planet's limited resources, arising from the unprecedented population growth, rising per capita income, fuelled by scientific and technological advances (Meadow et al. 1972). Forests and forestry dominated the debate.

The Conference recommended countries to:

- Strengthen basic and applied research for improved forest planning and management with emphasis on environmental functions of forests;
- Modernize forest management concepts by including multiple functions and reflecting the cost and benefits of amenities which forests provide; and
- Introduce a minimum of management plans where none currently exist and where governments already committed, should increase their efforts.

The Conference recommended the UN Secretary General to take steps to ensure that:

- UN Bodies cooperate to meet the needs for new knowledge to incorporate environmental values in the national land use and forest management; and
- Support continuing surveillance of the world's forest cover through establishment (in countries) of appropriate monitoring systems.

Though many of the global problems, like climate change and biological diversity, were not explicitly mentioned, the basic direction for the national action and global thinking was well laid at Stockholm. The ensuing account will present the rising importance of environment in the global development debate.

## 1.2 The Road from Stockholm to Rio

The two important outcomes of the Stockholm Conference were: (i) Establishment of United Nations Environmental Programme (UNEP) in 1972 at Nairobi, Kenya; and (ii) Decision to undertake FAO/UNEP Tropical Forest Resources Assessment 1980 Project with the following objectives:

- (a) Assess, at regional and global levels, the present state of closed tropical forests and woodlands and the rate and pattern of their depletion and degradation, as a prerequisite for the definition and implementation of the appropriate measures;
- (b) Determine the methodology and the means needed for the continuous updating of this first assessment.

The FAO/UNEP Project made an in-depth assessment and produced the most quoted statistics those days on the annual rate of tropical deforestation, viz., 11.3 million ha. The findings sent an alarm signal worldwide about the state of tropical forests and contributed to two developments : (i) Initiation in 1985 of the Tropical Forestry Action Plan (TFAP) to promote sustainable management of tropical forests; and (ii) Starting again the Global Forest Resources Assessments (FRA), discontinued in 1968, with 1990 as the reference date.

FRA1990 was implemented in three phases, viz., the updating of the 1980 assessment for tropical part by FAO Rome and the temperate and boreal parts by UNECE/FAO Geneva; and making of a global synthesis by FAO Rome. FRA1990 for the tropical part, while maintaining continuity of concepts and definitions used in the earlier assessment, made use of two complementary approaches for estimating the rate of tropical deforestation: viz., (i) a model-based assessment using reliable country data; and (ii) a statistical assessment using a stratified random sample of 117 high resolution satellite data spread over the entire tropics for the reference years 1980 and 1990.

FAO Rome completed the tropical assessment and released a report on the state of tropical forests coinciding with the United Nations Conference on Environment and Development (UNCED) 1992 at Rio. The annual forest loss during the decade