

Statistics in Forestry: Methods and Applications

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STATISTICS IN FORESTRY: METHODS AND APPLICATIONS

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Foreword

Tropical Forest Research Institute (TFRI), Jabalpur brings the present volume entitled "*Statistics in Forestry: Methods and Applications*" as an outcome of three days National Seminar on "Recent Advances in Applied Statistics and its Application in Forestry" held during 15-17 April, 2013 at TFRI in the International year of Statistics-2013. Forest resources have an important bearing on the ecological security, well being of the country and its dependent communities. Our forests are considered as unique because of its rich floral and as well as faunal diversity. However, these valuable natural resources are subjected to tremendous biotic pressure. Forestry research may help in countering the emerging problems and sustain our forests for posterity. Statistics plays a vital role in forestry research starting from planning of experiments to the analysis of results. Statistics and statistically constructed estimates provide a strong foundation for policy; planning, management and research besides providing guidelines for optimizing the utilization of resources. In recent years, there has been phenomenal advancement of knowledge and technology in the form of user friendly software for assisting research. I am sure the present book deals with the most current issues pertaining to statistical methods and applications would go a long way as a useful reference to the researchers engaged in forestry research.

I would like to place on record the efforts of Dr. S. A. Ansari (Director, IFP, Ranchi), Shri. P. Subramanyam (GCR), Dr. Girish Chandra, Scientist (Statistics), Dr. Naseer Mohammad (In charge, IT) and his team of TFRI for their sincere tirelessly efforts in bringing out this book in the present form.

(Dr. U. Prakasham)

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Preface

Role of applied Statistics in Forestry research is very crucial starting from the data collection, drawn inferences to the conclusion and interpretation of the valid results of specified objective under procedurally and economically optimized way. In forestry science, forest biometry has a pervasive influence in the development and application of statistical methods to assess, estimate, and evaluate biological characteristic and process of forests. Sampling techniques in order to estimate the abundance of one or more forest resources ranging from simple random sampling to multistage/multiphase designs and other recent designs including ranked set sampling, adaptive cluster sampling, network sampling etc. and making use of auxiliary information from aerial photography and satellite imagery are recipes for effective results in forestry research and management. Statistically designed experiments with models are important in field experiments in order to gain a better understanding of trees, stand, and forest responses and minimized the biasness's and experimental error. An accurate assessment of forest and tree resources is essential for formulating sound strategy in forestry sector.

The present book is an outcome of 3 days national seminar organized at Tropical Forest Research Institute, Jabalpur during April 15-17, 2013. It consists of 20 chapters including interesting invited talks presented during the seminar. To enlarge the scope of the book, few papers were invited which were not presented during the seminar. Most of the papers relate to recent development and application of applied statistics in forestry research. Some of the papers involved the applied statistical techniques and others are case studies in forestry research. For example, Growth and yield modelling is an essential prerequisite for evaluating the consequences of a particular management action on the future development of forest ecosystem. A brief account of modelling approaches in forest plantations is presented in Chapter 1. Some of the statistical designs useful for forestry experiments have been discussed with optimization techniques in chapters 2-3. In chapter 4, the importance of statistical software in survey data analysis with focus on freely available software R has been given. To achieve the correct price trend of the timber, Jackknifing method has been used in Chapter 5 to solve the problems with reduction of bias in the price. The time series analysis of Bamboo Sector of Kerala has been carried out in Chapter 6. To demonstrate the utility of small area estimation techniques and remote sensing & GIS in forestry, an overview with case studies has been given in Chapter 7-9. Chapter 10 focused on multivariate techniques in a case study. The methods of ranked set sampling in parameter estimation and allocation models of symmetric distributions have been developed in chapters 11-12. Important papers related to survey sampling methods including controlled selection which may be very useful in forestry related problems are given in chapters 13-16. The application of quantitative techniques in technology forecasting along with some case studies are given in chapter 17. Chapter 18-19 contains the case studies of forest entomology and ecology. The last chapter 20 consists on Bayes Prediction for super population regression models. Each chapter incorporated in the book was prepared on the basis of presentation and

discussed during the seminar and the scope for the interested researchers of forestry research. The editors feel that the book will benefit researchers and students of different disciplines for improving research through the practical knowledge of applied statistics.

We would like to express our deep sense of gratitude to higher authorities of ICFRE for their kind permission in bringing out the present book. The help rendered from Dr. U. Prakasham, Director, TFRI, Dr. S. A. Ansari, former GCR and their administrative support are gratefully acknowledged. We have no words to thank to Dr. Rajesh Kumar Mishra, TFRI for his continuous assistance during completion of the book. The financial assistance provided by MOSPI, CSIR, MPCST, SPSS, Systat and Union Bank of India are gratefully acknowledged. Finally, we extend our thanks and appreciations to the referees for their useful comments and authors for their continuous support during finalization the book.

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