

Dr. Raman Nautiyal

Consultant Statistician

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Personal Details

Date of Birth: 8th September 1971

Place of birth: Mussoorie, India

Educational Qualifications

1. Doctor of Philosophy in Statistics (2022) from Kumaun University, Nainital
2. Master's degree in Statistics (1995) from HNB Garhwal University, Srinagar, Uttarakhand, India
3. Bachelor's degree in Statistics, Mathematics and Economics (1993) from HNB Garhwal University, Srinagar, Uttarakhand, India

Positions held / holding

11th February 1998 to 1st August 2019

Scientist in Indian Council of Forestry Research and Education (ICFRE), Dehradun, India

February 1998 to May 2003: Institute of Forest Genetics and Tree Breeding (IFGTB), Coimbatore, an institute of ICFRE

May 2003 to July 2019; ICFRE HQ Dehradun

1st August 2019 onwards

Consultant Statistician

Work experience of 21 years in Forestry and Environment Domain related to Statistical Applications, summed up in brief

February 1998 to May 2003

As a freshly inducted scientist, I was exposed to forestry research at the Institute of Forest Genetics and Tree Breeding (IFGTB), Coimbatore. Here I was mostly involved in research design and data analysis related to Forest Genetics, Biotechnology, Agro-forestry, Silviculture, etc. I was also involved in creating IFGTBNET, an intranet information system that was an initial step towards paperless office. I had a dual role in managing computer and IT infrastructure along with Statistics. Most of my time was devoted to designing field experiments, lab experiment, learning GENSTAT, imparting training, etc.

Executed a project on modelling the growth of Eucalyptus growing in Tamilnadu. This was the first research project and I learned the finer sides of executing projects through it.

May 2003 to August 2019

Transferred to ICFRE HQ and Joined the Assistant Director General (Statistics) at ICFRE HQ, Dehradun. The unit was mandated to collect, collate and disseminate forestry statistics of India. This mandate was fulfilled by publishing a biennial flagship issue – **Forestry Statistics India** and a quarterly **Timber Bamboo Trade Bulletin**. Apart from this overarching aim, imparting statistics course work in various courses of Forest Research Institute (a deemed to be university) was also one of the responsibilities.

While working on the mandated tasks, in these 16 years, interactions with almost all the state forest departments of India made me gain knowledge about their reporting systems, annual administrative reports, annual statistical reports, systems of information flow, some well-defined while others needing a change or a momentum to work. Having seen diverse reporting systems form those that seem to no longer work to systems that are highly efficient made me rich in experience of the reporting systems of forestry sector in India. It also made me informed about the information needs of the sector, both nationally as well as internationally. Several issues of the publication Forest Statistics India were taken out – 2003, 2005, 2007, 2009, 2011, 2013. Each issue was based on data related to the forestry sector (including wildlife) pertaining to two years (financial years, starting April 1 and ending March 31 of the next year).

During this period I was also a part of some interesting studies related to the forestry sector, as a team member or as a lead person, in addition to the research activities concerning general forestry science. Those related to economics of the forestry sector are given in brief

Studies/Activity/Project

Details

Impact of Imported timber on Indian Timber with specific reference to Agro-forestry

In 2003, one of the members of the Board of Governors of ICFRE desired ICFRE to carry out a study to assess the impact of imported timber on the market of Indian timber and if the farmers practising agro-forestry were impacted. The survey was carried out in specific areas of the country with the help of the institutes of ICFRE. The study helped me to gain insight into a large part of the plywood industry, how it operates, what are the species used and processes, having witnessed the process in Yamuna Nagar, Haryana, one of the largest hubs of plywood manufacturing in India. Statistically analyzed data collected from the points scattered all over the country pointed out to the supply – demand of tree component of agro-forestry with an indication of increasing dependence upon imports.

A sample survey to update rates and ratios of timber and non-timber forest products in India

The Central Statistical Office under Ministry of Statistics and Programme Implementation, Government of India. is the main agency responsible to estimate the GDP of various sectors of the Indian economy. Forestry sector being one of under-reported sectors is usually represented in rates and ratios. A small scale sample survey funded by CSO was undertaken to update the rates and ratios of the timber and non-timber forest products. This project helped me gain experience in identifying and developing sampling strategies for various forest products. It gave me an insight into what components are measurable through a census and what through a survey.

Combined with lessons learnt from other studies, it was possible to suggest how the parameter estimation should be carried out. The difficulties in sampling from forest areas vis-à-vis that from agriculture lands were also visible and it gave us a new line of thought which helped in preparing efficient sampling plans for forest areas, resulting in guiding an M.Sc. Dissertation on Controlled Selection for estimating basal diameter of trees in natural forests. This estimation can help in growth modelling of forests.

Establishment of a network to collect, process and disseminate statistics pertaining to the tropical timber and other forestry parameters in India	The almost lack of knowledge about the possible data sources in the forestry sector and many forest related activities with other sectors made us think of creating a network of identified sources. With International Tropical Timber Organization (ITTO) in agreement, it funded a two-year study on the issue. Under this project, we were able to bring all the state forest departments, central government offices and other non-government organizations on a common platform. The information needs of the forestry sector, at regional, national and international levels were assessed and mapping of data sources was done. It also helped us to divide the parameters into three broad categories, (1) statutory – those that require annual reporting, mostly related to GDP, in monetary terms (2) policy – those that require reporting in 3 to 5 year frame and (3) explanatory – those that may be reported to enrich the existing databases, example species wise plantations raised. It also helped us to do a gap analysis and think of systems that can plug the gaps in the information flow from the forestry data sources. The project helped gain visibility to ICFRE and resulted in contributing a chapter in the International Forestry Review. The project helped in gaining rich experience and disseminating the findings through a series of workshops including the international workshop on Forest Product Statistics held at New Delhi and funded by ITTO. The policy makers also started thinking on the development of a National Forest Database Management System. A thorough study of the forest based industries was also conducted.
Forest Sector Reports	The experience gained while interacting with state forest departments and other stakeholders gave the opportunity of preparing the first forest sector report of India – Forest Sector Report India – 2010 based on the data from 2005 to 2010 and then the second one FSRI – 2019 based on data from 2010 to 2018. The process of preparing these reports further enriched the knowledge about the forestry sector (including wildlife) of India at all levels, namely, state government, central government and industries.
NTFP watch	Non-Timber Forest Products are important for the forest dependent communities as well as some industries, at micro, cottage and large scale. A system that could disseminate the prices of NTFPs across India was developed and put online for the stakeholders.
Other projects	Other projects that have been executed by me as a team member or lead person include creating a photogallery of Forest Research

Institute, documenting the architecture and research of FRI and ICFRE, the biodiversity present in the campus of the institutes of FRI and likes. These projects have given me knowledge of how the forestry research and education emerged in the country.

Apart from the selected studies given above, the experience gained in forestry statistics, both in information management and forestry research gave me an opportunity in teaching and disseminating what I learned. Primary among them are listed below.

Programme / Organization	Topic
Compulsory course of officers of Indian Forest Service at Kerala Forest Research Institute, Peechi, Kerala, India	Gap analysis of forest statistics possible solutions
Forest Research Institute (a deemed to be university)	Forestry Statistics and Bio Statistics in master's programme in Environment Management and Wood Science & Technology and Compulsory course work in Statistics for the PhD programme
Forest Survey of India	(i) Statistics in Forestry and Role of ICFRE to probationers of Indian Statistical Service (ii) Sampling Plans for Forestry (iii) Delivered a talk during a workshop on wood balance study – experiences while implementing the sample survey funded by CSO
School on Environment and Natural Resources, Doon University, Dehradun, India	Was a visiting faculty to teach statistical methods to PhD and M.Tech programmes in Environment
Indira Gandhi National Forest Academy	Lectures in Forest Statistics to the probationers of Indian Forest Service
GB Pant National Institute of Himalayan Environment	Resource person for statistical methods in ecology and environment (both at Headquarters, Almora and Sikkim Unit)
Indian Council of Forestry Research and Education	(i) Organized training workshops for scientists in statistical methods, experimental designs, research methodology (ii) Course Director of a mid-term training programme for Indian Forest Service Officers on Statistics and Research Methodology
Special Issue of ENVIS bulletin on Forestry Statistics – Guest Editor	ENVIS programme, a flagship programme of Ministry of Environment, Forest and Climate Change on disseminating environment related information, brought out a special issue of forestry statistics covering information management and research.
Mentoring fellowships and students	(i) Mentored an ITTO fellow on forest based livelihoods in the hilly regions of India – Himachal Pradesh and Uttarakhand

- (ii) Mentored a woman scientist under the Women Scientist Scheme of Department of Science and Technology, Government of India on Pine Briquette manufacturing process.
- (iii) Co-guide of PhD students (one has completed his PhD on Forest Fires in pine zone of Uttarakhand while one on assessing vulnerability of watershed to soil erosion has been submitted)
- (iv) Have mentored students on term papers, dissertations, etc. covering a wide spectrum of forestry and environment science.

Members of groups / Teams	<ol style="list-style-type: none"> 1. Member of various Environmental Impact Assessment Teams of ICFRE 2. ITTO Task force of MoEF & CC 3. National Forest Database Management System of MoEF & CC 4. A team member of a study related to REDD+, in Indira Gandhi National Forest Academy
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2nd August 2019 onwards

On 1st August, 2019, I quit ICFRE and started my own consultancy. Presently I am working on the following:

- (i) As a Consultant Statistician with Uttarakhand Council of Science and Technology in their Centre of Excellence on Forest-based Livelihoods. Here my main task is to plan sampling strategy and analyze data collected from the field.
- (ii) With medical researchers from various medical institutes to standardize health protocols.
- (iii) Co-authored a report on the present timber situation in India and likely situation a decade from now, for International Tropical Timber Organization, Japan.
- (iv) As a consultant statistician in a project that aims to establish linkages between forest dependent population and biodiversity in Telangana, India. (Completed)

Proficiency in Software:

Proficiency in the following statistical software (Working and teaching):

1. SPSS
2. STATISTICA
3. MINITAB
4. SYSTAT
5. GENSTAT and DATAPLUS

Major fields of experience

- Providing statistical input in research methodologies particularly forestry and environment
- Developing new and adapt existing statistical methodologies in forestry research

- Providing teaching inputs in applied statistics
- Implementing ISO 9001: 2008 Quality Management System
- Maintaining databank in respect of statistics pertaining to the forestry sector of India and providing data for international commitments of India

Research Interests

A. Mathematical Statistics

- Sample surveys
- Multivariate Analysis

B. Forestry and Environmental Statistics

- What and how much forests produce? Timber, NTFPs, Contribution of forestry sector to GDP
- Demand and supply of timber and other forest products
- Sampling strategies for estimation of forestry parameters
- Valuation of eco-system Goods and Services
- International Trade of Forest Products
- Statistical Ecology

C. Applied Statistics

- Research design and analysis of research projects, particularly on forestry and environment sector, Education, Medicine
- Application of Bayesian techniques in estimation and inference

Selected Research Literature Produced

During this period of around 22 years, research literature in the form of books, chapters, articles, etc was produced. A truncated list comprising literature encompassing the spectrum of my research and work experience, as an indication of the variety of applications of statistics, is given below.

Selected Books / reports

- Kant. P and **Nautiyal. R.** 2021. India Timber Supply and Demand 2010-2030: An analysis of supply, demand and end-use of timber in India and projection to 2030. 57pp. International Tropical Timber Organization.
- Editor of book **Statistical Methods and Applications in Forestry and Environmental Sciences** published by Springer Nature Singapore Pte Ltd. In 2020
- Edited a book on **Statistics in Forestry: Methods and Applications** published by Bonfring publications, Coimbatore
- **100 years of FRI** (collection of photographs related to the evolution of FRI)
- Edited a book **FRI: Glimpses of a century**
- **Edited** a book **Van Dharohar: 75 years of FRI Building**

Selected Publications

1. Pandey, S., Kumar, P., Panwar, V.P. and **Nautiyal, R.** 2022. Prioritization of Soil Erosion-Susceptible Sub-Watersheds Using Multi-Criteria Decision Method in the Lesser Himalayas. In book Prevention and Management of Soil Erosion and Torrential Floods. DOI: 10.4018/978-1-7998-8459-0.ch004
2. **Nautiyal, R.**, Tiwari, N. and Chandra, G. 2021. Quantile Estimation of Skewed Distributions Using Unbalanced Ranked Set Sampling, *Communications for Statistical Applications and Methods.* 463-473
3. **Nautiyal, R.**, Tiwari, N, Chandra, G, Kershaw, J and Shaktan, T. 2021. Alternate Ranked Set Sampling for Skewed and Mound Shaped Symmetric Distributions: Accounting for Forestry and Environmental Research. *Mathematical and Computational Forestry & Natural-resource Sciences.* 13(2). 14-26.
4. Tyagi, R, Kumar, V, Sharma, P and **Nautiyal, R.** 2021. Hydroxypropylation of 1,2 Galactomannan by Taguchi's L9 Orthogonal Array Design. *ChemistrySelect* 6(33). 8709-8715. DOI: 10.1002/slct.202101233
5. Yadav, R, Tarachand, **Nautiyal, R.** 2021. Valuation of water purification service of Renuka wetland, India. A Ramsar Site. *Glasnik Sumarskog fakulteta* 2021(123). 219-226. DOI: 10.2298/GSF2123219Y
6. Chandra, G., Tewari, N and **Nautiyal, R.** 2021. Adaptive Cluster Sampling Based Design for estimating COVID 19 cases with random samples. *Current Science.* 120(7). 1202-1210
7. Amrutha, S., Parveen, A.B.M., Muthupandy, M., Sivakumar, V., **Nautiyal, R** and Dasgupta, M. 2019. Variation on Morpho-Physiological, Biochemical and molecular responses of two Eucalyptus species under short term water stress. *Acta. Bot. Croat.* 78(2). 125-134
8. Sharma, R., Singh, H., Kaushik, M., **Nautiyal, R** and Singh, O. 2018. Adaptive physiological response, carbon partitioning, and biomass production of *Withania somnifera* (L.) Dunal grown under elevated CO₂ regimes. *3Biotech.* 8(6). 1-10
9. Singh, S., Singh, H., Sharma, S.K. and **Nautiyal, R.** 2021. Seasonal Variation in Biochemical Responses of Bamboo Clones in the Sub-Tropical Climate of Indian Himalayan Foothills. *Heliyon.* 7. <https://doi.org/10.1016/j.heliyon.2021.e06859>
10. Yadav, S., Singh, H., **Nautiyal, R.**, Ginwal, H.S., Ansari, S.A. and Barthwal, S. Modulation of Morpho-Physiological Responses in *Populus deltoides* by Elevated Carbon Dioxide and Temperature. *Forest Science* 66(36). doi: 10.1093/forsci/fxz048
11. Tyagi, R., Sharma, P., **Nautiyal, R.**, Lakhera, A and Kumar, V. 2020. Synthesis of quaternised guar gum using Taguchi L(16) orthogonal array. *Carbohydrate Polymers.*237(9): 116136. doi: 10.1016/carbpol2020.116136
12. Sharma, D., Kumar, V., **Nautiyal, R.** and Sharma, P. 2020. Rheological and NMR spectral data sets of quaternary ammonium derivative of *Cassia tora* Linn. seed gum. *Data in Brief* 29:105271. doi: 10.1016/j.dib.2020.105271
13. Chandra, G, Tiwari, N and Nautiyal, R. 2015. Near Optimal Allocation Models for Symmetric Distributions in Ranked Set Sampling. In *Statistics in Forestry; Methods and Applications.* Eds. Chandra, G, Nautiyal, R, Chandra, H, Roychoudhary, N and Muhammed N. Bonfring, Coimbatore. 85-90.
14. Sharma, D., Kumar, V., **Nautiyal, R.** and Sharma, P. 2019. Synthesis and characterization of quaternized *Cassia tora* gum using Taguchi L'16 approach. *Carbohydrate Polymers* 232:115731. doi: 10.1016/j.carbpol.2019.115731
15. Pandey, S., Kumar, P., Zlatic, M., **Nautiyal, R** and Panwar, V.P.P. 2021. Recent Advances in Assessment of Soil Erosion Vulnerability inn a Watershed. *International Soil*

- and Water Conservation Research, <https://doi.org/10.1016/j.iswcr.2021.03.001>
16. Sharma, B., Sharma, S., Bhardwaj, S.K., **Nautiyal, R.** and Alam, N. M. 2017. Seasonal Dust Accumulation on Commonly Growing Sub-Temperate Vegetation along National Highway. *J. of Tree Sciences*. 36(1). 62-69.
 17. Sharma, B., Bhardwaj, S.K., Sharma, S., **Nautiyal, R.**, Kaur, L and Alam, N.M. 2019. Pollution tolerance assessment of temperate woody vegetation growing along the National Highway-5 in Himachal Pradesh, India. *Environmental Monitoring and Assessment*. 191(3). doi: 10.1007/s10661-019-7310-x
 18. Jain, A., Chandra, G. and **Nautiyal, R.** 2017. Valuating intangible benefits from afforested areas: A case study in India. *Economia Agraria Recursos Naturales*. 17(1). 89-100
 19. Chandra, G., Tiwari, N. and **Nautiyal, R.** 2014. Assessment of Non Timber Forest Products in India: An Adaptive 122 Cluster Sampling Approach. In book *Statistical and Mathematical Sciences and their applications*.
 20. Chandra, G., Tiwari, N and **Nautiyal, R.** 2019. Two Stage Adaptive Cluster Sampling based on Ordered Statistics. *Metodoloski Zvezki*. 16(1). 43-60
 21. Tiwari, N., Chandra, G and **Nautiyal, R.** 2019. Ranked Set Sampling: A Review with New Initiative on Extreme Ranked Set Sampling. *Statistics and Applications*. 17(1). 121-139.
 22. Chandra, G., Pandey, R., Bhoj, D.S, **Nautiyal, R.**, Ashraf, J., Verma, M.R. 2018. Ranked set sampling approach for estimating response of developmental programs with linear impacts under successive phases. *Pakistan Journal of Statistics*. 34(2). 163-176
 23. Tripathi, P., Kumar, V., Joshi, G., Singh, S.P., Panwar, S., Naithani, S. and **Nautiyal, R.** 2013 “A Comparative Study on Physico-Chemical Properties of Pulp and Paper Mill Effluent”, *Int. Journal of Engineering Research and Applications*. 811-818.
 24. Verma, A.K., Kaliyathan, N., Bisht, N.S., **Nautiyal, R.**, Sharma, S.D. 2019. Predictive distribution modeling of forest fire in pine zone of Uttarakhand Himalayas of India Autor(es). In book: *Advance in Forest Fire Research*. Columbia University Press. DOI: 10.14195/978-989-26-16-506_120
 25. Verma, A.K., Kaliyathan, N., Bisht, N.S., Sharma, S.D., **Nautiyal, R.** 2020. Forest Fire Prediction Modeling in the Terai Arc Landscape of the Lesser Himalayas Using the Maximum Entropy Method. Conference: *The Fire Continuum – Preparing for the future Wildland Fire*.
 26. Chandra, G., Tiwari, N., **Nautiyal, R.** and Gupta, D.S. 2016. On partial ranked set sampling in parameter estimation of lognormal distribution. *Int. J. Agricult. Stat. Sci*. 12(2). 99-106
 27. Tripathi, P., Kumar, V., Joshi, G., Singh, S.P., Panwar, S., Naithani, S. and **Nautiyal, R.** 2013. A Comparative Study on Physico-Chemical Properties of Pulp and Paper Mill Effluent. *International Journal of Engineering Research and Applications*, 3(6): 811-818.
 28. Bhatia, N. K., Mohammad, Y. and **Nautiyal, R.** 2013. Yield Gap Analysis of Mulberry Sericulture in Northwest India. *International Journal of Industrial Entomology*, 27(1): 131-141.
 29. Kishwan, J., Sohal, H.S., **Nautiyal, R.**, Kolli, R., and Yadav, J. 2008 . Statistical reporting in the Indian forestry sector: Status, gaps and approach. *International Forestry Review*, 10(2): 331-340.
 30. **Nautiyal, R.** 2008. Forestry Statistics Reporting System - critical process analysis towards its realization. *ENVIS Forestry Bulletin*. 8(2): 41-50.
 31. Behari, B. and **Nautiyal, R.** 2007. National Forestry database management system (NFDMS): Theme, concepts and vision. In: India. Ministry of Environment and Forests. Survey and Utilisation Division. *National Forestry Database Management System – a*

- vision. The author. pp 1-11.
32. Barthwal, S., **Nautiyal, R.**, Ganesan, M., Venkatraman, K.S., Gurumurthi, K. 2005. Effect of salt stress on rooting of Casuarina eq. Cuttings. Journal of Tropical Forest Science, 17(1): 171-172.
 33. Saravanan, S., Buvaneshwaran, C. and **Nautiyal, R.** 2004. Growth performance of Teak (**Tectona grandis**) in farmlands under different agro-climatic zones of Tamil Nadu. My Forest 40(3).227-234.
 34. Barthwal, S., **Nautiyal, R.**, Ganesan, M., Yasodha, R. and Gurumurthi, K. 2001. Clonal Descriptors for Casuarina equisetifolia. In: Casuarina: Improvement and Utilization, Gurumurthi, K., A. Nicodemus and Siddappa (Eds.). Institute of Forest Genetics and Tree Breeding, Coimbatore, India.103-110.



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