

## **Report of the three days National Workshop on Recent Advances in Statistical Methods and Applications in Forestry and Environmental Sciences 2018**

The National Workshop on 'Recent Advances in Statistical Methods and Applications in Forestry and Environmental Sciences 2018' (RASMAFES 2018) was held at the auditorium of Indian Council of Forestry Research & Education (ICFRE) from 23<sup>rd</sup> to 25<sup>th</sup> May, 2018. Ninety Five participants representing 24 institutes all over the country participated in the workshop which was divided into 12 technical sessions besides inaugural and panel session. Seventeen invited and fifteen contributory papers were presented.



In the inaugural session, Sh. Raman Nautiyal, convenor, RASMAFES presented the overview of the workshop organized under five thematic areas. Sh. A.S. Rawat, Deputy Director General (Admin), ICFRE welcomed the participants and delegates present from across the country. Sh. Sandeep Kujur, Assistant Director General (Admin), ICFRE felicitated Dr. L.M. Bhar, Director, Indian Agricultural Statistical Research Institute (IASRI), Guest of Honour of the workshop. Dr. Bhar, in his address, gave the glimpse of statistics in general and application in forestry, in particular. He said that huge data is generated every day and integration of the data from various fields is required to make valid conclusion. Computational program and artificial intelligence may help in such data analysis. He emphasised on genetic data analysis, sophisticated model such as linear, quadratic and time series model for analysing genetic variance. In the inaugural address, Dr. Suresh Gairola, Director General, ICFRE emphasised on various activities taken care by Division of Forestry Statistics, ICFRE. He described the general perception about Statistics and its importance. Dr. Girish Chandra, organizing secretary, RASMAFES presented vote of thanks to researchers, scientist, foresters, research scholars, local organizing committee, media and other peoples which are directly or indirectly involved in the conduction of this workshop.



In his keynote address, Dr. L.M. Bhar emphasised on statistical analysis for valid inference was given. The importance of assumptions for any for parametric tests and regression analysis while fitting the models was explained. He said, the identification of Outlier(s) should be taken care in forest surveys because observations appear to be inconsistent with the remainder of that dataset.



In the thematic area *Recent Advances in Sampling Techniques*, first invited session was chaired by Prof. Anoop Chaturvedi (Department of Statistics, University of Allahabad). Sh. Rajesh Kumar, Forest Survey of India (FSI), Dehradun delivered lecture on Revision of National Forest Inventory Befitting Changing Requirements. He speaks about the two-stage sampling design initial adopted for national forest inventory (NFI) with its limitations. Dr. Hukum Chandra (National Fellow, ICAR-IASRI, New Delhi) emphasis on small area estimation techniques of forestry parameters which is necessary due to small or even negligible sample sizes. He discussed the case study of forest type wise tree, shrubs and herbs basal area cover of Maharashtra state. Dr. Raosaheb V. Latpate (Department of Statistics, Savitribhai Phule Pune University) delivered talk on Inverse Adaptive Stratified Random Sampling for the rare and patchy population and verify the efficiency of proposed design in Western Ghats. T.

Second invited session on the same thematic areas was chaired by Dr. L. M. Bhar. Prof. B.V.S. Sisodia (Narendra Dev University of Agriculture Science and Technology, Faizabad)

speaks about the newly developed calibration estimators of the population mean under two-stage stratified random sampling when auxiliary information is available at primary stage unit level and suggested to use in forest surveys for precise estimates. Dr. Piyush K. Rai (Banaras Hindu University, Varanasi) also delivered on the calibration estimators, however, the presented estimator is more suitable for the dual frame sample surveys. Dr. Rajesh Tailor (Vikram University, Ujjain) suggested improving the estimates when more auxiliary variables are available with the researcher. Dr. Sushil Kumar (IASRI, New Delhi) delivered his talk on application of small area estimation approach for spatial disparity in rural indebtedness in Bihar.

Under the contributed paper session which was chaired by Dr. Hukum Chandra, Prof. Manoj Kumar states the exponential type of estimator in two phase sampling for estimation of population mean with auxiliary information. Ankuri Agrawal, (Research Scholar, Kumaun University, Campus-Almora) delivered her talk on variable selection and model building problems in multiple regression model for small area estimation. Shachi Pandey (Research Scholar, Forest Research Institute, Dehradun) states an improved controlled selection strategy for estimating ecological parameters. Santosh Kumar Yadav (Research Scholar, FRI, Dehradun) suggested to use stratification criterion in leaves of whole plants in for estimating chlorophyll content.

After the conducting all the technical session of Day 1, a Cultural Evening was organized by Ministry of Culture, Govt. of Uttarakhand.

In the second day of the workshop, one-hour special lecture on thematic area *Advanced Statistical Computations using R Software* was delivered by Dr. Hukum Chandra.

Under the thematic area *Modern Developments in Exploratory Data Analysis*, first invited session was chaired by Prof. Neeraj Tiwari (Kumaun University, Campus: Almora). Prof. Anoop Chaturvedi (Department of Statistics, University of Allahabad) stated about the data mining tools in general and mainly focused Artificial Neural Networks (ANN) in the forestry research. Dr. S.B. Lal (Centre for Agricultural Bioinformatics, ICAR-IASRI, New Delhi) speaks about the new concept Internet of Things (IoT) which used in collecting, processing and analyzing data streams in real-time and facilitate provision of smart solutions. Sh. Anoop Singh Chauhan (ICFRE) shared glimpses of A Historical Voyage in Indian Forestry from the formation of Imperial Forest Research Institute in 1906. Dr. Krishan Lal (IASRI, New Delhi) suggested on mixture experiments with process variable in forestry experiments for finding precise results of the laid experiments.

The contributed session on the same thematic areas was chaired by Dr. S.B. Lal (IASRI). Shipra (Research Scholar, Jawahar Lal Nehru University, New Delhi) told about the variation in species composition and soil properties along different slope aspects in Sirmour of Western Himalayas. Dr. Shailendra Kumar (Scientist, FRI) carried out Grey Relational Analysis (GRA) to improve design of solar wood dryer. Similarly, Dr. Kartik Uniyal (FRI) also explained the role of GRA for the selection of pathogenic isolates of *Alternaria alternata* of Poplar.

The invited session on the thematic area *Recent Advances in Applied Statistics* was Chaired by Prof. B.V.S. Sisodia. Prof. Manish Sharma (SKUSAT-Jammu) discussed the role of ridge regression model for the estimation of total carbon sequestered by forest species. Dr. Jitendra Kumar (Central University of Rajasthan, Ajmer, Rajasthan) discussed the Bayesian Computation and Analysis of C-Par (1) time series model with structural break in mean, error variance and covariate series. Sh. Raman Nautiyal told about the Mapping Associations of Forestry Tree Species (Sal, Teak, Shisham, Oak and Pine) using Multivariate Techniques by the demonstration of truncated dataset from a study conducted to gain information on the support of the species by the soil type formed by the rocks such as lime stone, quartzite, shale, slate, dolomite.

Contributed Paper Session on the same thematic area was chaired by Dr. Raosaheb V. Latpate. Dr. M.S. Bhandari (Scientist, FRI) discussed geographical distribution and ecological niche modelling of trees. Kuldeep Joshi (Research Scholar, G.B.P.U.A. & T., Pantnagar) discussed the effect on herbage and oil yield in different *Mentha* species intercropped with poplar and found significant reduction in the yield potential of *Mentha* species due to allelopathic effect shown by poplar. Rahul Yadav (Research Scholar, FRI, Dehradun) analyses trends in global average temperature and atmospheric concentrations of CO<sub>2</sub> using time series models (TSM). Debjyoti Raha (Research Scholar, Dr. Hari Singh Gour University, Sagar) carried out comparative study of floristic diversity and tree biomass in two different i.e., dry deciduous teak forest and dry deciduous *Boswellia* forest, sub-types of central India using non-destructive method. S. Suresh Ramanan (Research Scholar, SKUSAT-Jammu) reviewed on Fusing Classical Theories and discussed the Biomechanics into Forest Modelling.

The 3<sup>rd</sup> day of the workshop was started with one-hour special lecture on thematic area *Advanced Statistical Computations using SPSS Software* and delivered by Prof. Manish Sharma (SKUAS&T – Jammu).

The invited session on the thematic area *Recent Advances in Sampling Techniques* was chaired by Dr. Krishan Lal. Dr. Girish Chandra explained about the use and importance of ranked set sampling for estimating forestry parameters when the measurements of the units are costly/difficult in comparison with the ranking of units without actual measurements. Dr. Kaustav Aditya (IASRI) shared an experience on the Mobile Assisted Personal Interview (MAPI) software for collection of surveyed data. Dr. Ritesh Tailor (IWST, Bangalore) suggested an improved estimator for finite population mean.

Sh. Rajesh Kumar chaired the contributed paper session under the same thematic area. Vandita Kumari (ICAR-IARI) delivered her talk on the development of the calibration estimation of regression coefficient using multi auxiliary variables. Tapas Ray (Research Scholar, Dr. Hari Singh Gour University, Sagar) estimated the greenhouse gas emission from vegetation fires in central India and conclude that forest fires emitted maximum GHGs. Swati Gupta (IASRI, New Delhi) discuss the disparities in poverty in rural area of eastern Indo-Gangetic plain.

The panel session of the three day workshop along with the question-answer session was chaired by Dr. Neelu Gera (Deputy Director General, ICFRE). The panellist of this session were Sandeep Kujur, Raman Nautiyal, Krishan Lal, Sh. Rajesh Kumar and Prof. B.V.S. Sisodia. Many question were raised by the participants and accordingly answers and discussion were taken place. Dr. Girish Chandra presented the important recommendations of the three day workshop and thereafter the some more suggestions by the panellist were incorporated.



Some important recommendations are as under:

- The problem of outlier should be addressed while analysing the forestry data.
- The techniques of small area estimation, ranked set sampling, adaptive cluster sampling should be incorporated according to the situations.
- Self-similarity in the form of sample size is a representative of population mean need to be elaborated.
- During data collection integrity should be ensured besides data sharing between sister organisation must be signed.
- Software based workshops should be organized for the researchers.