Forest Inventory and Analysis
Quality Assurance

FIA Fact Sheet Series

The Forest Inventory and Analysis (FIA) Program of the USDA Forest Service is committed to achieving a high level of consistency through well planned Quality Assurance (QA) activities in all stages of its national core inventory system – planning, data collection, photo and image interpretation, information management, compilation and analysis.

Quality Assurance Program. All elements in the FIA program include QA operational techniques designed to assure and improve the quality of FIA data. These include: planning, method documentation, training for data collectors, checks of data quality, evaluation of uncertainty in survey data, peer review of analysis products, and continuous feedback to ensure that the data collection and processing system improves over time.

QA Triangle

The following definitions provide a conceptual framework for QA operations within FIA:

Quality Assurance - The overall system of management activities designed to assure quality data are generated

Quality Control - Operational techniques and activities that are used to control the data acquisition process.

Quality Assessment and Evaluation - Application of statistical tools to determine that the uncertainty associated with the data is minimized and that the data are of sufficient quality to support programmatic decisions.

Planning. Quality Assurance planning is accomplished through preparation of formal system management and field implementation plans. The plans are compliant with the American National Standards for QA systems document parts A (Management Systems) and B (Collection and Evaluation of Environmental Data). All QA planning is reviewed by the system of FIA bands (see our FIA Bands Fact Sheet), and regional and national managers approve final plans.

Documentation of Methods. All phases of the FIA program produce extensive documentation of methods. A substantial amount of effort is expended in controlling the data acquisition process. The Data Acquisition Band has the primary responsibility for documenting methodologies and implementation of quality control during data collection activities. These documents are updated regularly and continually reviewed by the various bands. For example all core field data collection methods are standardized in a National Field Methods Manual. This document is updated with refinements and improvements to the field data collection process.

Training. Production crews are trained, tested, and certified for their ability to generate data that conform to the measurement quality objectives and tolerances established for the program. In addition, experienced crew members are typically paired with new crew members to provide additional on-the-job training during the field season. Regional trainers meet annually during a national pre-training session, to review and update the training programs for the various indicators. During these pre-training sessions, the regional trainers are "calibrated" with each other to assure national comparability of regional training operations.

Regional Calibration Exercise

Checks for Data Quality. Data quality checks are performed to provide for quality control during field operations. In addition, data are collected during field operations for data quality assessment and evaluation. The following types of checks and remeasurements are performed in the FIA program:

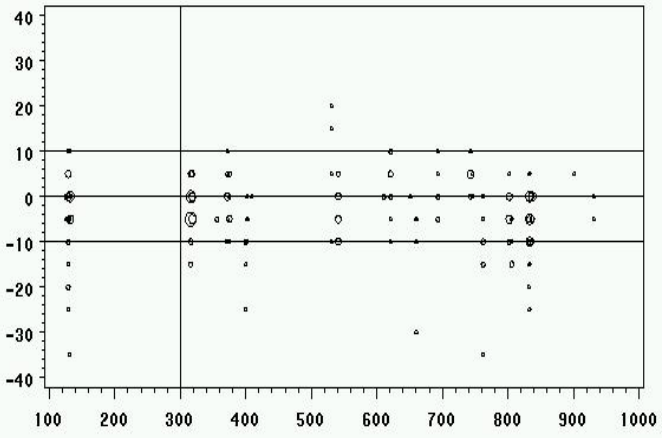
Hot check - an inspection normally done as part of the training process. The inspector is present on the plot with the trainees and provides immediate feedback about their performance.

Cold check - an inspection done either as part of the training process, or as part of the ongoing Quality Control program. Normally the production crew is not present on the plot and the inspector has the completed crew data in-hand at the time of the inspection. The inspection can include the whole plot or a subset of the plot and is designed to provide regional field

supervisors with QC information to assist in management of the inventory.

Blind Check - a complete remeasurement of the plot performed by a qualified inspection crew. The remeasurement is done without access to the production crews' data. The two data sets are maintained separately and no production data are corrected as a result of these remeasurements. These checks are performed for the sole purpose of obtaining an estimate of measurement uncertainty for the program.

Example Control Chart of Transparency QA, 1999 data. X axis represents Species Number; Y Axis Represents % Differences; Horizontal Lines Represent MQO's



National Information Management. Standardized information management is a key element in the FIA QA program. The National Information Management System (NIMS) will implement all nationally recognized equations and algorithms such as forest type, stand size and stocking in a consistent manner. The list of acceptable codes for a variable will be enforced by the database system (referential integrity). There will be a set of nationally consistent and agreed upon edit checks for data quality

Analysis and Reporting. Assuring national consistency of analysis and reporting of FIA data is the task of the Analysis and Reporting Band. National consistency in reporting is assured by development of core tables and other reporting formats which will be included in regional reports.

Quality Assessment and Evaluation. Uncertainty in FIA data is assessed by analysis of remeasurement data (Blind Checks). Graphical and tabular presentations of QA data are provided which evaluate regional and temporal differences (drift) and compliance with National Measurement Quality Objectives (MQO's).

Statistical procedures for evaluation of QA data will be reviewed by the Statistics Band, and documentation for submition to a peer reviewed QA journal will be prepared.

Measured Data - Measurements of continuous data such as DBH, Height, Azimuth, and Distance to trees are evaluated based on percent attaiment of measurement quality objectives. Statistical significance of differences (bias) is tested between auditors and production crews.

Catagorical Data - Attributes such as Crown Ratio, Foliar Transparency, and Crown Dieback, Percent Rotten or Cull, and Percent Crown Cover are determined by ocular estimation (ordinal data). Other attributes such as species, tree damage, stand condition, stand disturbance, and are nominal data. Data of these types are evaluated based on tests of inter-rater agreement relative to the level of agreement between auditors and crews due to random chance. The significance of lack of agreement is based on whether the data is ordinal or nominal.

Independent measurements - In some instances (e.g. bioindicator plants, seedling counts) it is not possible for the auditor and crew to measure attributes from the same plant. In those cases data quality is evaluated based on the probability that distribution of values obtained by the audit and crew came from the same population and that differences are due to random variation.

Continuous Feedback. Continuous improvement in the FIA program is assured by a variety of internal feedback procedures. The band system provides a regionally representative process for internal review of FIA procedures and products. Interactive hands-on field checking of crews provides for consistency in field data collection, while pre-training provides for interregional calibration of training standards. Both processes tend to improve the quality of data collected within the program. Annual meetings with production crews and supervisors following the field season, as well as annual interregional QA check crew meetings provide feedback mechanisms for continual improvements in the data collection and quality control processes.

References:

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For more information about the FIA Program:

- See our "FIA Contacts" Fact Sheet
- Visit our national FIA website: http://www.fia.fs.fed.us