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, information management, compilation, and analysis.

### Quality Assurance Program

**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.

### Quality Assurance Triangle

- **Prevention**
- **Correction**
- **Assessment and Appraisal**

Regional Urban FIA collaboration exercise

### 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 collect and produce 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 from each unit, across the nation, meet frequently to review and update training programs and materials to ensure national consistency. In addition to meeting regularly, pre-season training sessions are held when possible. During these pre-training sessions, regional trainers from each unit “calibrate” with each other and produce training materials that will be used nationally to ensure national consistency and comparability.

### 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 frequency at which the types of checks are performed are related to resource availability and complexity to complete. 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. This is the least complex and resource intensive to complete as the inspector usually accompanies production crew.
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. This check is a bit more complex and resource intensive than the hot check in that the inspector makes a separate trip to research location.

Blind Check—a complete remeasurement of the plot performed by a different production crew. The remeasurement is done without access to the previous 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. This is the most resource intensive of the data quality checks. A production crew that works in a different region must travel and accrues associated costs to perform blind check. This results in lost productivity for crew that performs the blind check as well as additional expenses for travel.

Universal National Information Management

Information management is a key element in the FIA QA program. The Universal National Information Management System (UNIMS) 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 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

It is the goal of FIA to address uncertainty in data by conducting 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).

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. One goal for FIA and the Techniques Research Band is for continual evaluation of the statistical procedures used to collect QA data. Interactive hands-on field checking of crews provides for consistency in field data collection, while pre-training provides for interregional calibration of training standards. These processes tend to improve the quality of data collected within the program. Frequent meetings with production crews and supervisors throughout the field season, as well as frequent (e.g., monthly) interregional QA meetings provide feedback mechanisms for continual improvements in the data collection and quality control processes.

Measured Data—Measurements of continuous data such as DBH, length, azimuth, and distance to trees are evaluated based on percent attainment of measurement quality objectives. Statistical significance of differences (bias) is tested between Quality Assurance (QA) crews and Production crews.

Categorical 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, are nominal data. Data of these types are evaluated based on tests of inter-rater agreement relative to the level of agreement between the QA crew and Production crew 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 QA crew and Production crew came from the same population and that differences are due to random variation.

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

Co-Authors: Jim Pollard and Summer Dunn