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URBAN PARK TREE INVENTORIES

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Summary

A survey of published reports on urban park tree inventories in the United States and the United Kingdom reveal two types of inventories: (1) Tree Location Inventories and (2) Generalised Information Inventories. Tree location inventories permit managers to relocate specific park trees, along with providing individual tree characteristics and condition data. In contrast, generalised information inventories do not allow for specific tree relocation, and often use sampling procedures to obtain stand characteristics and condition information. Various methods and specific examples of the two inventory types are discussed with the purpose of helping the reader decide which methods are most useful.

Introduction

An initial step of a park management plan is a tree inventory to establish the characteristics and condition of park trees, thereby facilitating planning and maintenance. In residential and commercial areas the street grid provides a useful framework for conducting inventories and organising data, but in parks and more natural areas other approaches must be used. The purpose of this paper is to review and contrast various methods of urban park and natural area inventory systems. We focus on the approaches used in inventories rather than on specific data collected. Information on the collection of tree characteristics and condition data has been reviewed by BASSETT (1976, 1978), CRAMER *et al.* (1976), PIRONE (1978), and GREY and DENEKE (1986). Various inventory techniques are also given by MILLER (1988).

Types of inventories

One of the first decisions a greenspace manager must make in conducting an inventory is whether the information collected should just capture general characteristics of park stands or specific information on individual

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trees. This decision will determine what type of inventory procedure will be used.

If the inventory's objective is to obtain specific information on individual trees, a tree location inventory should be used. This inventory procedure, in collecting information on individual trees, utilises methods that allow for the relocation of each tree. This type of inventory can be used for maintenance work scheduling. Since computerisation allows individual tree data to be easily acquired, retrieved and updated, there is a compelling argument for tree location inventories. Numerous park inventories utilise specific tree location information. A selection of these are listed, with their main attributes, in Table 1.

The alternative is to utilise generalised information inventories which sample park trees without regard to location and will provide an overview of park stand composition and condition (e.g., for budgeting). Generalised information inventories, while comparatively inexpensive, are not intended to yield individual tree data, only stand characteristics. Examples of generalised information park inventories are given in Table 2.

Base maps are an essential component to any urban park inventory, but engineering blueprints of the landscape or aerial photographs can be substituted. Nevertheless the map is extremely useful for locating individual trees, for laying out sample plots, and for dividing the park into separate areas (i.e., park stratification).

Stratification is more commonly used in large park inventories and simplifies tree location and sampling techniques by breaking the park into more manageable and easily identified units. Tree location inventories are commonly stratified by geographical location, using roads, fences, etc. as boundaries, while generalised information inventories tend more to be stratified by land use or forest types.

Tree location inventory methods

Data collected in tree location inventories include information on tree characteristics (e.g., species, size, condition, and maintenance needs), location characteristics, and occasionally on environmental characteristics (e.g., soil conditions). Five types of tree location inventories are described below with examples of their application.

Non-stratified direct tree mapping

Non-stratified direct tree mapping involves locating each tree to be

TABLE 1. Tree location inventories or inventory systems*

Inventory Agency or System	Park location	Park size	Method of tree location	Trees inventoried	Data collected	Reference
ACRT	Throughout eastern & mid-western U.S.	Variable	Direct tree mapping	Maintained trees	Tree data Condition data Maintenance needs Location info	Joehlin, 1986
Morton Arboretum (Thomas Green)	Grace Unity Methodist Church, Naperville, IL	4 ha*	Direct tree mapping	All trees	Tree data Condition class Location info	Green, 1986
West Chicago Park District & Morton Arboretum	Reed-Keppler Park West Chicago, IL	16 ha	Grid reference system (30 × 30 m grid cells)	All trees	Tree data Condition class Location info	Green, 1984
Utah State University and Utah Division of State Lands & Forestry	State Arboretum of Utah, Utah St. Univ. Logan, UT	10 ha	Grid reference system (6 × 6 m grid cells)	All trees	Tree data Condition data Maintenance data Location info Cover types Planting data	McPherson, 1984 McPherson et al., 1985
Central Park Conservancy	Central Park, NYC, NY	340 ha	Grid reference system (15 × 15 m grid cells)	All trees > 6" diameter	Tree data Condition data Location info Env. data	Weinstein, 1983 McPherson et al., 1985
Iowa Public Tree Inventory System	Iowa	Variable	Systematic technique	Open-grown trees	Tree data Condition data Location info	Iowa St. Univ., 1983 Jungst, 1983
Westonbirt Arboretum	Westonbirt Arboretum, England	69 ha*	Three cocked hat method	All trees	Tree data Location info	White, 1983

*estimate

TABLE 2. Generalised information inventories or inventory systems

Inventory Agency or System	Park location	Park size	Sampling method	Area(s) sampled	Data collected	Reference
ACRT	Throughout eastern & mid-western U.S.	Variable	Stratified random	Maintained trees	Tree data Condition data Maintenance needs	Joehlin, 1986
Iowa Public Tree Inventory System	Iowa	Variable	Stratified random	Forested	Tree data Condition class Plot location Location info	Iowa St. Univ., 1983 Jungst, 1983
Friends of Mountain Lake Park	Mountain Lake Park, San Francisco, CA	5.9 ha	Stratified complete inventory	All trees	Tree data Condition data Stand characteristics Env. characteristics Understory vegetation	McBride, 1981 McBride, 1982
Joe R. McBride Consulting Forester	Presidio, San Francisco, CA	600 ha	Stratified systematic	Forested	Tree data Condition data Stand characteristics Env. characteristics Understory vegetation	McBride, 1983
Park Personnel; Cal. Dept. of Forestry; U.S. Forest Service	Golden Gate Park San Francisco, CA	410 ha	Stratified systematic	Forested	Tree data Condition data Maintenance needs Stand characteristics Env. characteristics	Smith et al., 1980 McBride, 1982

included in the inventory, assigning it a number (occasionally with an aluminium tag), and plotting the tree as a number at the appropriate location on the base map. This procedure is manageable in small parks with relatively low tree density.

Grace Unity Methodist Church Inventory. Eighty-nine trees were inventoried on the church property of approximately 4 ha (GREEN, 1986). With such a small inventory, tree locations were mapped directly on the base map by walking the grounds in a systematic fashion. Data were collected on condition class (5 classes: young trees through deteriorating trees), pruning requirements (routine vs. hazardous), DBH, species, reference number, and specimen tree (yes or no based on tree status and value).

Stratified direct tree mapping

Stratified direct tree mapping starts with subdividing the park by stand type, the physical layout of the road system, or by boundaries determined by recreational activity zones. Stratal boundaries are best determined by interfaces that are easily identifiable in the field. Strata delimitation should consider tree density and adjust stratal size to optimise efficiency of data collection and tree relocation.

Once an area is subdivided, tree location and number (occasionally tagged on the tree) are plotted upon the base map within each stratum. The initial stratification makes this approach useful in large parks, but limitations imposed by high tree density may limit its practical application in many parks.

ACRT Inventories. A private firm, ACRT (Appraisal, Consulting, Research and Training) inventories parks of various sizes, mainly throughout the eastern and midwestern United States. Most inventories ACRT conducts are in large parks and are based on stratified direct tree mapping (JOEHLIN, 1986). ACRT generally uses engineering blueprints of the landscape or aerial photographs to locate trees and to stratify the park by geographical location. Their inventories include only maintained trees. These trees are occasionally tagged and the tree number is plotted on the base map. Data are collected on general tree characteristics, condition and maintenance needs.

Systematic location without mapping

The systematic location technique involves a replicating inventory technique. Individual trees are not mapped but are relocated by following the original inventory data collection pattern. Some disadvantages of this technique are that tree relocation can be confounded if tree removals are not noted and relocation efforts are increased as number of trees per strata increases. The advantage lies in not having to record tree locations and using a systematic location technique that is easy to follow. This technique is best utilised within small parks or small park strata of low tree density.

Iowa Public Tree Inventory. The systematic technique was designed to inventory open-grown park trees (IOWA STATE UNIVERSITY, 1983; JUNGST, 1983). The park is stratified by existing use (e.g., ballfields, hiking, etc.) into small zones so that relatively few trees are present within each zone. Each zone is inventoried by starting at the same side of the zone and working through each zone in the same manner. The starting point in each zone is noted on the base map. Trees are numbered sequentially (on data forms) from each starting point and data are collected on tree characteristics and condition, but the tree's location is not mapped. A tree is relocated by finding its specific park zone and replicating the original pattern of data collection until the tree is located. This systematic inventory was designed for use in a computerised public tree inventory system.

Grid reference system

Grid reference systems involve plotting tree locations within grid cells created by overlaying a grid on the park base map. The selection of a grid cell size will depend upon the park size and tree density. The grid must either be surveyed in the park or drawn upon base maps and estimated on the ground in conjunction with recognizable objects. Once the grid is established, individual tree locations are mapped within each grid cell. Grid reference systems are compatible with geographic information systems which allow other types of data (e.g., geology, soils, topography, recreational use, etc.) to be stored and retrieved. The growing availability of geographic information systems software and their applications to forestry and land use planning suggest that grid reference systems be given serious consideration by individuals and agencies involved in urban park inventories.

The many advantages in terms of efficiency and accountability to a geographic information system (DANGERMOND, 1982) include, but are not limited to: 1) data can be maintained and extracted at a lower cost per unit of data handled; 2) various computerised tools allow for a variety of types of manipulation including map measurements, map overlays, transformations, graphic designs, and data base manipulations; 3) change analysis can be efficiently performed for two or more different time periods; and

4) there is a resultant tendency to integrate data collection, spatial analysis, and decision-making processes into a common information flow context.

Utah State Arboretum Inventory. The Utah State Arboretum inventory (MCPHERSON, 1984; MCPHERSON *et al.*, 1985) determined its initial grid cell size by the overall tree spacing (most trees were more than 6 m apart). Once the grid size was determined (6 × 6 m), trees were located on a gridded base map using aerial photographs and an existing tree plan. Tree locations were verified and updated during a field inventory that included tree characteristics and condition.

Reed-Keppler Park Inventory. In the Reed-Keppler Park inventory, volunteers paced off 30 × 30 meter grid cells and mapped the approximate location of trees within each grid cell in conjunction with fixed objects (e.g., parking lots, statues) (GREEN, 1986). The mapped tree locations were checked for accuracy using 1:400 scale aerial photographs. Tree mapping was performed in this fashion due to the unavailability of small-scale aerial photography. Tree condition classes (1–6) characterized the size and relative health of existing trees (GREEN, 1984). In mapping the trees, the number of each mapped tree was given a condition class superscript (1–6) and was colour-coded to indicate species. A representative canopy was drawn on mylar overlays. Trees of Condition Classes 1 and 2 (young, developing trees) were drawn on one sheet, Class 3 (mature trees) on another, and Classes 4–6 (declining or removed trees) on a third. These plastic overlays gave a comprehensive overview of park tree conditions and allowed for the interpretation of patterns.

Triangulation techniques

Triangulation involves locating a tree (or other object) from two or more known reference points. Surveying equipment (staff compass, transect, theodolite, etc.) is used to measure azimuths from the tree to known reference points (resection) or from known reference points to the tree (intersection) (DAVIS *et al.*, 1981; Jarvis, 1983). Tree locations can be plotted from reference points on a base map. Direct plotting can be done in the field using a plane table and an appropriate device for measuring azimuths. Triangulation is more efficient where park trees are spaced far enough apart to allow a line of sight to a few reference points. As tree density and/or park size increases it is necessary to establish additional reference points with clear lines of sight to the trees. Distance from each tree to its reference points can also be added to insure greater mapping accuracy.

Westonbirt Arboretum Inventory. A variation on the intersection technique, known as the "Three Cocked Hat Method", has been used to inventory the Westonbirt Arboretum in the United Kingdom (JARVIS, 1983; WHITE, 1983). With this method, compass bearings from three reference points on a measured baseline provide a 'fix' on each tree. Baselines are located throughout the arboretum and where specimens are less than 8 meters from a baseline, single distance measurements were taken at a 90° offset. An identification number embossed on aluminium tape was fixed to each tree and supplemental management information was obtained.

The three selected baseline points must be spaced far enough apart to allow for maximum separation in the azimuths from each point to the tree. The baselines must also be accurately located upon a base map before trees can be mapped.

Generalised information inventory methods

Generalised information inventories do not map individual tree locations. Instead, this type of inventory yields only general information about park stand characteristics and conditions. This general information can be most useful in developing management plans, but is less useful in developing detailed tree maintenance programs. However, generalised information inventories are often the only cost effective means of inventorying large urban parks or parks with high tree densities.

Most generalised information inventories use a sampling approach for data collection. Data collected from field samples are averaged and extrapolated to larger areas to produce information on general park tree characteristics and conditions. The sampling approach need not be used where park size or availability of labour allows for a 100 percent tree inventory. Non-stratified sampling is most appropriate in parks or public open spaces supporting a single cover type with relatively uniform conditions.

Stratified random sampling

Stratified random sampling involves park strata identification and demarcation (by stand type, geographical location, recreational use, etc.) followed by a random distribution of samples within each stratum (CUNIA, 1984). Sample randomisation procedures have been discussed by NASH (1965). The number and size of sample plots should be based on local conditions, especially strata size and variation in stand conditions. Statistical procedures for allocating the number and size of samples are summarized in HUSCH *et al.* (1972).

ACRT Inventories. The type of inventory ACRT uses depends on client funding. Stratified random sampling is used where funds are insufficient for a 100 percent tree location inventory. Specific sampling techniques (plot size and number of plots per hectare) vary depending on the park (JOEHLIN, 1986). The parks are generally stratified by land use and each stratum is randomly sampled (e.g., by randomly choosing 5×5 cm squares on the park map). The number of samples and plot size are chosen to obtain a sample variation of ± 5 to 10 percent of the mean of measured variables. To determine sampling information in this manner, it is necessary to have a knowledgeable estimate of the mean and variance (or coefficient of variation) of the measured variables (WENSEL, 1977). All maintained trees within the sample plots are inventoried and information is noted on physical tree characteristics, condition, and maintenance needs.

Iowa Public Tree Inventory. The Iowa Public Tree Inventory System (IOWA STATE UNIV, 1983; JUNGST, 1983) uses stratified random sampling only within park stands with high tree density. Open-grown trees are inventoried using the systematic technique of tree location described previously. Park areas with high tree density are divided into strata with relatively similar characteristics (e.g., species, age, etc.), and circular plots are randomly located throughout each stratum. Attempts are made to sample as many plots as possible, but a reasonable rule of thumb offered by the Iowa Public Tree Inventory is to sample five percent of each area.

After the plot centre is located in the park stand, two concentric circular plots are measured. On the smaller plot (generally 0.004 ha), all trees less than 7.6 cm in diameter are recorded, while on the larger plot (generally 0.04 or 0.08 ha), all trees 7.6 cm and larger in diameter are recorded. Data are recorded, by plot size and location, on individual tree species, diameter class, general condition (good, fair or poor), and specific conditions (e.g., types of insect and disease damage). For trees to be harvested, data are collected on: product indicator (firewood, sawtimber, or veneer), diameter (DBH), merchantable height, and total height.

Stratified systematic sampling

In stratified systematic sampling, grid line intersections or fixed spacing are often used to locate sample plots (NASH, 1965; HUSCH *et al.*, 1972). Systematic sampling provides efficiency in laying out and locating sample plots. The collected data are averaged to determine general information (mean values) about each stratum.

A systematic sample really consists of a single selection from the population, thus there is no satisfactory and valid method for computing variance since variance computations require a minimum of two randomly selected sampling units (HUSCH *et al.*, 1972). However, strata variance is normally calculated using the simple random sampling formula. The simple random variance estimate for a systematic sample of a random or ordered population, is at least as good as a variance estimate using random sampling (WENSEL, 1977). If a periodic population (cyclical variation) is suspected, random sampling or systematic sampling with multiple starting points should be employed. Statistical tests, such as t-tests, computed with the simple random sample estimate of variance can be performed, but should be annotated to indicate that the values are only approximate.

Presidio of San Francisco Inventory. Stratified systematic sampling was used to inventory the U.S. Army Presidio of San Francisco, California (MCBRIDE, 1983). The Presidio is the largest open space area in San Francisco, of which 125 hectares (21 percent) supports tree cover. All forest stands over 0.04 ha were mapped by comparing recent (1980) aerial photographs with previously prepared maps of tree cover. These stands were then stratified by dominant species and adjacent boundaries (e.g., roads, parking lots, sidewalks). Sample plots were located at the intersection of grid lines overlayed on each stratum. The grid and plot size varied depending on stand size: 0.05 ha circular plots on 63 × 63 m centres for stands greater than 2.0 hectares; 0.01 ha circular plots on 32 × 32 m centres for stands for 0.4 to 2.0 ha; one 0.04 ha circular plot for stands less than 0.4 ha; and measurement of all trees in stands less than 0.4 ha that were too small or narrow to accommodate a 0.04 ha circular plot. These sample sizes and densities resulted in a 10 percent area sample of all stands greater than 0.4 ha and a 10 to 100 percent area sample of stands less than 0.4 ha.

The purpose of the inventory was to determine tree characteristics and conditions, tree density and size, regeneration, fuel condition, and understory vegetation. Height, species, and DBH were recorded for each sampled tree. Stand age was determined from increment cores of three randomly selected trees in each stand. This small sample was considered adequate since all stands were forest plantations. Tree vigour and defects were both given a rating of "high", "medium", or "low" based on tree appearance. Tree regeneration and ground cover were recorded for each plot. Percentage of live crown was measured for every tenth tree sampled.

The inventory also analyzed the present mosaic of forest stands to identify each stand's primary function (wind protection, visual screen, noise abatement). This analysis was conducted as part of the field reconnaissance as well as by evaluating aerial photographs.

Golden Gate Park Inventory. The Golden Gate Park survey (SMITH *et al.*, 1980) divided the 410 ha park into five strata (forested, water, open [lawn], roadway, and administrative [buildings, etc.]). Aerial photographs helped delimit each stratum, with forested strata required to be at least 0.4 ha. A 101 × 101 m grid (ground distance), based on the adjacent street grid, was placed over the park map. The grid lines ran north-south and east-west, with the north-south grid lines placed in line with the north-south streets outside the park. Plot centres (based on a systematic selection of grid intersections) located in forested strata were identified for field sampling. Circular plots (0.08 ha) were used. Plot centres outside of forested strata were tallied by strata type. These tallies were used to estimate each stratum's total acreage.

The survey was designed primarily to provide information on tree vigour and defects. Tree vigour was based on a point system with points scored for live crown ratio, crown class, foliage colour, and defects. Defects were categorised by plant part (branches, trunk, roots) and type (wounds, rots, bark beetles, large dead limbs, and leaning trees). Diameter, species, height, vigour, maintenance needs, and defects were recorded for each sampled tree. Approximate tree locations, from the plot centre, were mapped on the data forms. Data were also recorded on environmental factors (e.g., slope, aspect, etc.) and stand characteristics (e.g., crown cover, regeneration potential, etc.).

Stratified complete inventory

A stratified complete inventory differs from the other types of generalised information inventories because it does not obtain field data from sample plots. Instead, each stratum's entire tree population is inventoried. Stratal characteristics are determined by averaging the data collected in each stratum. This labour intensive approach yields a complete data set.

Stratified complete inventories, which do not map individual tree locations, develop data for general management plans rather than specific tree maintenance. The information obtained is more accurate than information obtained using sample plots. Use of the stratified complete inventory method will depend upon budget limitations; however, it may be applicable when a volunteer labour force is available.

Mountain Lake Park Inventory. An inventory of Mountain Lake Park (5.9 ha), San Francisco, California was designed to survey all park trees (MCBRIDE, 1981). The park was initially stratified by forest type. Each stand (geographically separated by roads, etc.) in each stratum was completely inventoried by a team of three volunteers for The Friends of Mountain Lake Park, a neighbourhood association dedicated to the park's improvement. Fifty-one people volunteered approximately 135 hours over three consecutive Saturday mornings. The volunteers also participated in a one-hour training program prior to the inventory.

A data form for each tree included information on tree characteristics (species, DBH, height), tree condition (live crown ratio, angle of lean, evidence of insect or disease, occurrence of large lateral branches), and understory and ground layer cover.

A key was prepared to assist the volunteers and a professional forester was present at all times to answer questions. Volunteers numbered each tree with a removable tag as they inventoried each stand. The professional forester checked the data while removing the tags. During the check he made follow-up observations on trees indicated to have evidence of insect, disease, or structural problems.

Discussion

In choosing a park inventory method, efficiency (area inventoried/unit of time) and information accuracy are the two prime considerations. For tree location inventories, information accuracy is measured in terms of tree location/relocation accuracy. For generalised information inventories, information accuracy is measured in terms of sample data accuracy (how well the sample represents the population). For all inventory methods, efficiency increases as tree density decreases and/or park size increases. Although it is impossible to quantify absolute efficiencies in relation to park size from the published data available, it is possible to suggest the relative efficiencies of different inventory methods (Figures 1 and 2).

For all tree location inventory methods, efficiency rapidly increases with increased park size and eventually levels off. Efficiency increases with increased park size because the large initial time investment (e.g., base map acquisition, stratification, training) is spread out over a larger park area. Efficiency also increases with increased park size because inventory crews ordinarily become more efficient as they become more familiar with the inventory method. Efficiency curves level off when maximum data collection efficiency is reached and when increased park size will have little effect on the initial time investment.

The more efficient a tree location inventory method is, in relation to other tree location methods (regardless of park size), the less accurate it is in terms of tree location/relocation information (Table 3). Time spent measuring variables that increase accuracy result in decreased efficiency.

Systematic location without mapping is the most efficient of the tree location inventory methods because mapping of individual tree locations is

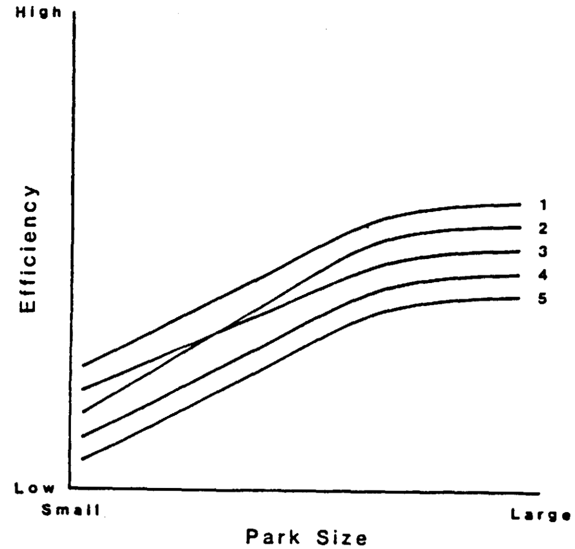

FIGURE 1. Relative efficiencies of generalised information inventory methods (1 = location without mapping; 2 = stratified direct free mapping; 3 = non-stratified direct tree mapping; 4 = grid reference system; 5 = triangulation techniques).

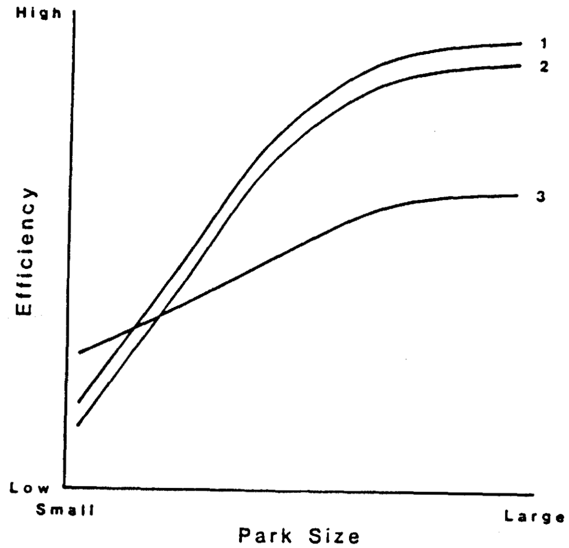

FIGURE 2. Relative efficiencies of generalised information inventory methods (1 = stratified systematic sampling; 2 = stratified random sampling; 3 = stratified complete inventory).

TABLE 3. Comparison of relative efficiency (area inventoried/unit of time) and tree location/relocation accuracy of tree location inventory methods.

Tree location inventory method	Order of efficiency*	Order of accuracy*
Systematic location w/o mapping	1	4
Direct tree mapping	2	3
Grid reference system	3	2
Triangulation technique	4	1

*Ordered on a 1 to 4 scale: 1 = Most, 4 = Least.

not required. However, omission of tree location mapping makes this method the least accurate. The next most efficient method is direct tree mapping. Efficiency is lower and accuracy higher for direct tree mapping (in relation to systematic location without mapping) because the individual tree locations are mapped.

Non-stratified direct tree mapping is more efficient than stratified direct tree mapping for small parks, but this efficiency difference reverses as park size increases. The initial cost of stratification is unwarranted for small parks because stratification will decrease efficiency with little or no gain in accuracy. As park size increases, the stratification investment pays off with both increased efficiency and accuracy.

Efficiency is lowered and accuracy is increased for the grid reference system (in relation to direct tree mapping) because of the grid location investment. Unlike stratal boundaries which are visible in the field, grid cell boundaries must be located (e.g., by pacing and/or physically marking grid intersections) before individual tree locations can be mapped. The grid reference system allows for more accurate tree relocation.

The least efficient yet most accurate of the tree location inventory methods is the triangulation technique. Accuracy is increased, by azimuth and distance measurements, at the expense of a far greater investment in time (decreased efficiency).

Efficiency and accuracy comparisons differ for generalised information inventories where information accuracy is considered in terms of how well the sample represents the population. The efficiency curves of generalised information inventories (Figure 2) resemble the tree location inventory efficiency curves (Figure 1) for the same reasons previously described. Stratified random and systematic sampling efficiencies increase more rapidly than normal with increased park size because relatively little time is needed to collect data that can be extrapolated to larger areas.

Stratified complete inventories are the most accurate of the generalised information inventories but are only the most efficient for very small parks. Stratified complete inventories are the most accurate because the

population means are known when the entire population is sampled. Accuracy is diminished by using sampling techniques because statistical parameters (e.g., variance, standard deviation) must be used to evaluate population characteristics; however, sampling techniques are very efficient for large parks.

Stratified systematic sampling has greater efficiency than stratified random sampling regardless of park size. This increased efficiency results from the greater ease of locating field plots. Stratified systematic sampling is also usually more accurate than stratified random sampling; however, systematic sampling does have disadvantages (e.g., poor precision when unsuspected periodicity is present) (COCHRAN, 1959).

Contrasting the accuracy two inventory types is unreasonable because of the major difference in their focus (specific information on individual trees vs. general information on forest stands), but relative efficiencies can be compared. Any generalised information inventory will typically be more efficient than a tree location inventory but at the cost of being unable to relocate individual trees. The most useful information for tree maintenance programs can be obtained from tree location inventories, while the efficiency of inventorying larger parks using generalised information inventories must be considered when urban forest management planning is the objective.

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