Multi-resource Survey Design

Learning Objectives ...

- Appreciate that planning an inventory to account for multiple environmental components can be complex

- Know the steps involved with inventory planning

- Know what is involved with statistically sampling a well-defined population
Multiresource inventories

Relative priority for assessing each resource (Low, Med, High) depends on the inventory objectives:

<table>
<thead>
<tr>
<th>Survey Objective</th>
<th>Area Est.</th>
<th>Owner Patterns</th>
<th>Accessibility</th>
<th>Vol. Est.</th>
<th>Growth &amp; Drain</th>
<th>Critical Habitat</th>
<th>Scenic Views</th>
<th>Other Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stumpage</td>
<td>H</td>
<td>L</td>
<td>H</td>
<td>H</td>
<td>L</td>
<td>M</td>
<td>L</td>
<td>L</td>
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<tr>
<td>Recreation</td>
<td>M</td>
<td>H</td>
<td>H</td>
<td>L</td>
<td>L</td>
<td>H</td>
<td>H</td>
<td>M</td>
</tr>
<tr>
<td>Mgt. Plan</td>
<td>H</td>
<td>M</td>
<td>M</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>M</td>
<td>M</td>
</tr>
</tbody>
</table>

Stumpage Appraisal: assessment of sale value of standing timber – depends on species, size (volume), quality of timber, accessibility, and distance to primary markets.

Inventory Planning Checklist

A comprehensive plan ensures all facets of the inventory are considered:

- data to be collected
- financial support needed
- logistical support required
- compilation procedures
Inventory Planning Checklist

Be sure to consider the following

1. Purpose of the inventory
2. Background information
3. Description of Area
4. Information required in final report

5. Sample survey design
   - Define target population
   - Define sample unit
   - Define required accuracy and precision
     - Will need to construct confidence interval
     - estimate ± “t-multiplier” x standard error of estimate
     \[
     \bar{y} \pm t \cdot s_{\bar{y}}
     \]
   - Decide how samples will be collected
   - Decide how many sample units will be measured
   - Know budgeting limitations for field work
Inventory Planning Checklist

6. Photo, satellite, other remotely sensed info. interpretation procedures
7. Fieldwork procedures
8. Compilation and calculation procedures
9. Final report
10. Maintenance

5. Sample Survey Design (reprise)

- Define target population
  - All red squirrels in a certain watershed area
  - All invasive vegetative species
  - All conifers in a certain project area with minimum DBH of 5.6"
- Specify units of measure:
  - “…bd.ft. volume of all conifers …”
  - “… total biomass of invasive vegetation …”
5. Sample Survey Design (reprise)

- Define sample unit
  - Fixed-area plots: 1/5, 1/10, 1/20, 1/40-acre sizes common for overstory trees; 1/200-acre, or less for seedling regeneration
  - Variable area plots
  - Transects: lower canopy vegetation, downed woody detritus
  - Individuals: a deer, a tree, a log, a hiker on a trail
  - Groups: herd of deer, truckload of logs, group of hikers

- Define required accuracy and precision
  - Depends on survey objectives (and convention)
  - Management plan / multiresource surveys
    - Designed to provide info on timber and non-timber info
    - Generally low intensity – info collected to make broadly-based management decisions for long range planning
    - Want est. of mean within 10 –20% of pop. mean w/ 70 – 90% C.I.
5. Sample Survey Design (reprise)

- Define required accuracy … (cont’d)
  - Timber sale / Land acquisition surveys
    - Designed to provide info on net volume or value of merchantable trees growing in "operable" areas
    - Land acquisition requires additional info on site quality, soil characteristics, proximity to markets, info on other environmental services
    - Want est. of mean within 2 – 5 % of pop. mean w/ 90 – 99% C.I.

5. Sample Survey Design (reprise)

- Define required accuracy … (cont’d)
  - Special surveys (timber trespass, regen, insect/disease)
    - Varies with application –
      - Regeneration survey
      - Timber trespass survey
      - Availability of browse, mast, etc. for wildlife
      - Etc.
5. Sample Survey Design (reprise)

- Decide how sample units will be selected
  - Simple Random Sampling (SRS)
  - Systematic sampling
  - Ratio / Regression estimation
  - Double sampling (sampling for a ratio or regression)
  - Stratified random sampling
  - Two-stage, Multistage sampling
  - Cluster sampling

- Decide how many sample units will be measured
  - Know what equations will be used to compute estimates
  - Use of statistical formulas preferred
5. Sample Survey Design (reprise)

- Know budgeting limitations for fieldwork
  - Simple cost model for SRS:
    - \( C_t = C_o + n C_1 \), where
      - \( C_t \) = Total cost of survey
      - \( C_o \) = Overhead cost, e.g. planning, organization, etc.
      - \( C_1 \) = Cost per sampling unit
      - \( n \) = number of sampling units to be measured
  - Number of sample units is then limited by:
    - \( n = \frac{(C_t - C_o)}{C_1} \)

Summary Remarks

- Sound data enables sound stand, forest, and landscape management decisions
- Multiresource Inventories should include consideration of
  - data to be collected
  - financial support needed
  - logistical support required
  - compilation procedures
Summary Remarks

✓ There are 10 steps to address during inventory planning
✓ Statistical sampling (step 5) involves
  • Defining the target population
  • Choosing the sample unit
  • Defining required accuracy & precision
  • Deciding how samples will be selected
  • Choosing a sample size
  • Knowing budgeting and logistical constraints