



Annualization of timber products monitoring

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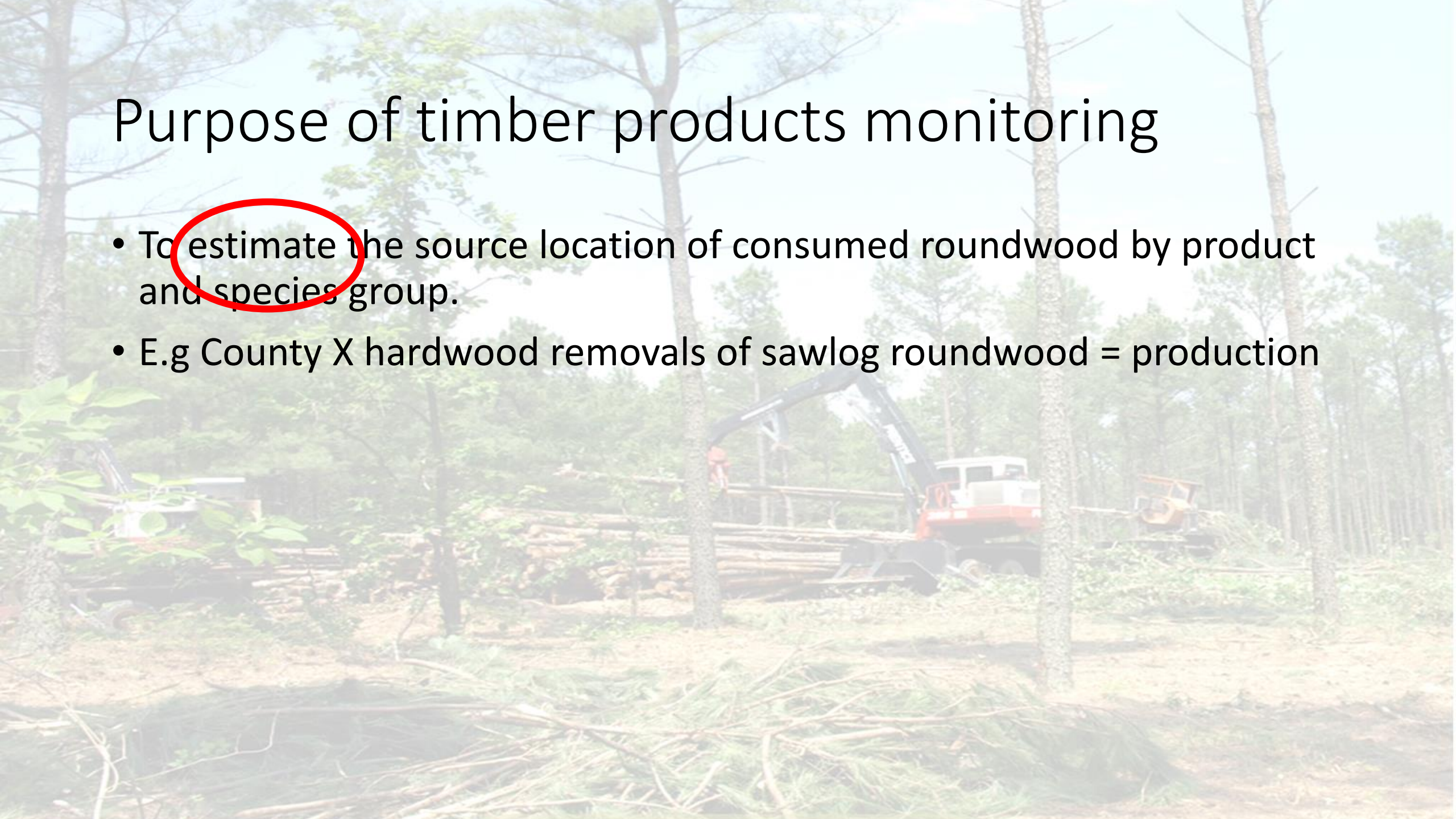
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Why is timber products monitoring important?

- Inventory can tell you removal by species but not product or specific time
- Remote sensing can tell you timing of removals but not product, species, or perhaps volume
- A well executed TPO can provide annual removals for products, species, and source location for a specific year
- These data support many analytical endpoints (e.g)
- wood basket analyses, market analyses, sustainability analyses, policy analysis, projections of supply and demand, carbon sequestration in harvested wood products, wood flows among states and regions.
- BTW – TPO data in a small area estimation model significantly increases precision of county-level FIA harvest area and removal estimates.

Purpose of timber products monitoring

- To estimate the source location of consumed roundwood by product and species group.
- E.g County X hardwood removals of sawlog roundwood = production



Context for timber products monitoring

- Three components of FIA program
- Goal of the FIA inventory
 - Estimate forest population parameters (e.g. total volume) and land use parameters (e.g. land use change rates)
 - Estimate urban forest/tree population parameters (e.g. carbon stock)
- Goal of the National Woodland Owners Survey
 - Estimate forest and woodland ownership parameters (e.g. average age of forest owners)
- The goal of each of the three arms of FIA is to provide estimates

Estimation

- Requires
 - identifying the population
 - Constructing a sample frame
 - Implementing a sample design
 - Constructing estimates via an estimator
- National Inventory and NWOS
 - Have a defined population
 - Have an area sample frame
 - Leads to equal probability sampling for forest and land use/cover inventory
 - Leads to ~pps sampling for NWOS
 - Have design-based estimators
 - Have core measurements
 - Have an implementation strategy
- These statistical components are a core competency of FIA
- TPO historically does not have all of these components

Annualization of TPO

- Focusing on FIA core competencies is key
 1. Define population
 2. Develop national sampling frame
 3. Develop sampling design
 4. Develop/identify design-based estimators
 5. Develop/identify small area estimators
 6. Core measurements already identified
 7. Develop implementation strategy

Progress on Annualization

- ✓ Define population: primary wood using facilities procuring wood from the United States
- ✓ Sample frame: 4300 wood using facilities
- ✓ Sample design: stratified simple random. Leads to ~ pps design
- ✓ Design-based estimators
- ✓ Small Area Estimators. Leads to ~25% reduction in CI width across sampling intensities
- ✓ Core measurements

$$\widehat{y}_d^{Dir} = \mathbf{x}_d^T \boldsymbol{\beta} + u_d + e_d;$$
$$e_d \sim N(0, \varphi_d); u_d \sim (0, A)$$

- Model relates direct estimates (y) to ancillary data (\mathbf{x})
- $\boldsymbol{\beta}$ are fixed effects (population); u_d are random (domain) effects
- When fit as an empirical best linear unbiased predictor (EBLUP)
 - EBLUP will approach direct estimate when direct estimate is reliable (small φ_d compared to A)
 - When direct estimate unreliable (large φ_d compared to A) EBLUP will approach the regression estimate.

Implementation Strategy: costs

- 40% stratified sample capture ~`94% of total product
- US testing on design suggest at 40% sample the SE ~5% per 10 million cuft per year of production by product and county.
- For context Inventory volume estimates target SE 5% 1 billion cuft of standing inventory.
- Approximated cost?
- $4300 \text{ mill} * 300 \text{ \$/mill} * 0.4 = \$516\text{K}$ annually **for mill survey only**
- How much is currently spent on mill survey's?
- Not reported in annual business report (except agreement with U MT contractor, new agreement with LSU)
- Mill survey expenditures with Federal Funds and State contributions need to be tracked as a line item in the business report.

Implementation Strategy: logistics

- Logistic challenges
 - Generally \$300 per sampled mill does not support 1 FTE
 - May be an issue with some state partners
 - State capacity/infrastructure is important to maintain this effort
 - In places where it makes sense – partner with other cooperators (e.g. U MT contractor) to collect needed information
 - Federal Workforce?

Implementation strategy: moving forward

A photograph of a logging operation in a forest. In the foreground, there is a large pile of cut pine branches and needles. In the middle ground, a red and white skidder is positioned near a log loader. The background shows a dense forest of tall pine trees under a clear sky.

- Some key items
 - Identifying costs and procuring requisite funding
 - identifying actual cooperators
 - Develop national core QA/QC
 - Maintaining and updating national sample frame

What national annual sample-based design looks like?

- Fall:
 - Update sampling frame (mill list)
 - Sample from the frame using an chosen statistical design
 - Distribute the sample to those collecting the data (in house, state agencies, etc.)
- Jan:
 - Survey forms sent out to sample mills
- April:
 - Survey responses return
- Summer:
 - Load data from surveys
 - Follow-ups (unit and item non-response)
- Fall:
 - Produce, review and distribute estimates