Annualization of timber products monitoring

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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

\[ \hat{y}^{\text{Dir}}_d = x^T_d \beta + u_d + e_d; \]
\[ e_d \sim N(0, \varphi_d); u_d \sim (0, A) \]

- Model relates direct estimates (y) to ancillary data (x)
- \( \beta \) 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 \( \varphi_d \) compared to A)
  - When direct estimate unreliable (large \( \varphi_d \) 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 mill * 300 $/mill * 0.4 = $516K 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

• 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