TPO: Current efforts, ideas and plans for annualization, sampling strategies Participation and response by industry

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July 14, 2016 Atlanta, GA

Current efforts

- Wrap up legacy effort on national compilation system: led by FIA information management group
- Address action items from National TPO redesign meeting (Oct. 2015)
  - Revisit single Federal survey form.
  - Developing a national mill list.
  - Develop and test candidate sample designs for implementation.
  - Identify larger companies with the capacity and willingness to provide automated updates
  - Develop a marketing strategy for TPO.
  - Continue to develop interagency and external relationships.
- Harvested Wood Products Carbon estimation and projections
- Harvest probability modeling
- RPA land use change and forest dynamics forecasting

Ideas and plans for annualization

- Annual design will be sample-based
- Sample design will be flexible to allow different state-level industry dynamics (e.g. pulp mill vs small hardwood mills)
- Sample design will include a non-response plan
- Design needs to be operationally feasible
- Design will based compatible with small area estimation techniques
- Success of an annual design will be based on industry participation
- Need clear signals from industry partners on willingness to be ‘sampled with certainty’ – perhaps with automated data transfer

Sampling Strategies: A sampling frame is requisite

- A national mill list is needed for an annual sample design
- Mill list must have some measure of size associated with each mill (e.g. capacity)
- Mill list needs to be updated at some frequency
  - Out of date or incomplete mill list = frame error.
  - How much frame error is acceptable? Depends.
- Three key sources are being examined
  - FIA compiled mill list
  - Purchased mill list from University of Georgia
  - Working with US Endowment for Forestry & Communities on cost sharing updates to Wood2Energy mill list.
- Key issue regarding external sources is whether there will be sustained capacity to maintain/update mill lists

Sampling Strategies: Testing candidate sample designs

- Two designs are currently under examination
- In all cases the mills are sampled from the mill list
- Testing done based on southern TPO survey from 2011
- Simple Random Sample.
  - Equal probability
  - Serves as a benchmark
- Tille sampling
  - Unequal probability sampling
  - Requires a measure of size (MOS)
  - The MOS is used to determine inclusion probabilities. Larger mills have a greater inclusion probability (ie more likely to be sampled)
- Stratified 2 unit per strata sampling
  - Requires a MOS
  - Develop a large number of equal sized strata based on the MOS
  - Sample 2 units from each stratum
  - Common sampling approach used in Energy Information Administration surveys

Sampling Strategies: example

	Tille		Stratified nh=2		
Measure of Size	Inclustion Probability	Selection	Stratum	Selection	Inclusion Probability
10	0.73	x	1	x	0.67
9	0.66	x	1	x	0.67
9	0.66		1		0.67
8	0.59	x	2		0.40
7	0.51		2	x	0.40
5	0.37		2		0.40
5	0.37		2		0.40
4	0.29	x	2	x	0.40
4	0.29	x	3	x	0.25
3	0.22		3		0.25
3	0.22		3		0.25
3	0.22		3		0.25
3	0.22	x	3		0.25
3	0.22		3		0.25
3	0.22		3		0.25
3	0.22		3	x	0.25

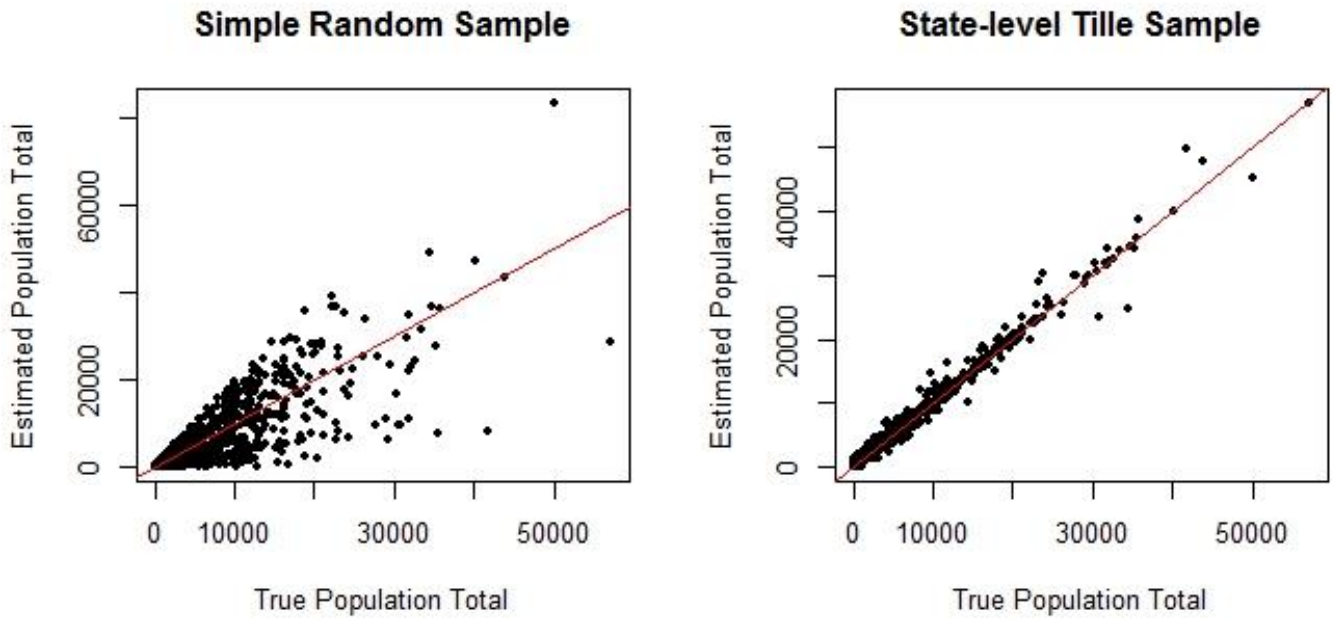
Sample Strategies testing

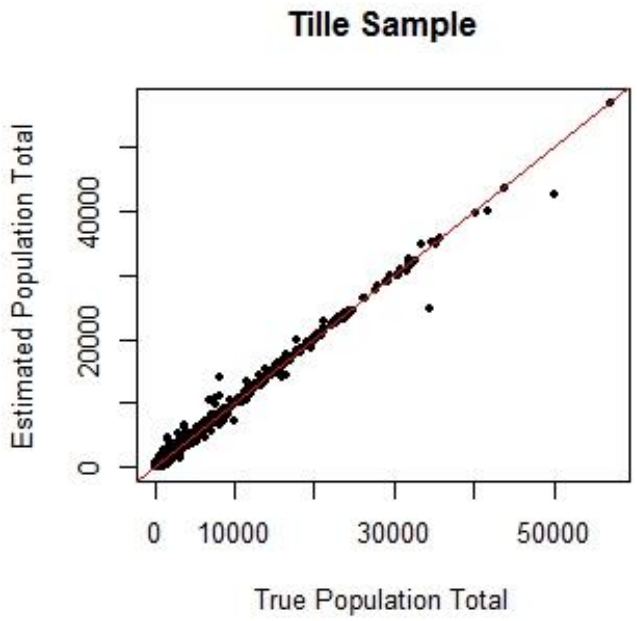
- Goal: Estimate removals going to products from each State and County in the South
- These are actually domain or small area estimates because not all mills draw from all counties
- Designs
  - SRS region wide (SRS)
  - Tille region wide (Tille)
  - Tille with separate population based on number of employees (Tille-size)
  - Tille with each State considered a separate population (Tille State)
  - Stratified nh=2 with each State considered a separate population (Stratified nh=2)

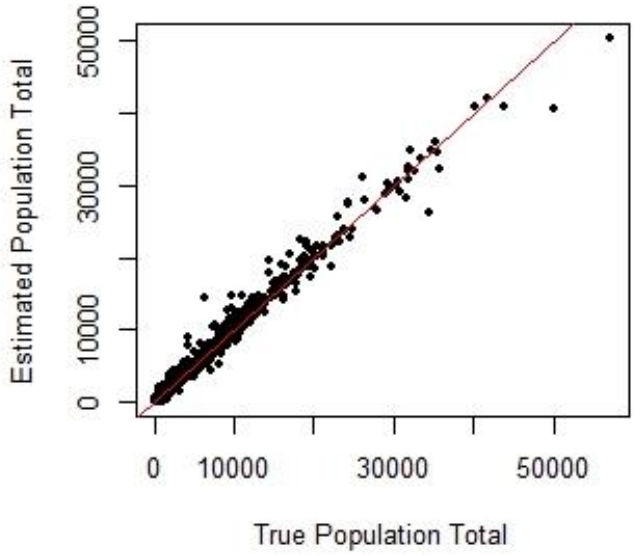
- Comparisons
  1. Based on 2011 Southern Mill Census (all mills)
  2. Two sampling fractions tested (0.25 and 0.5)
  3. For each design and sampling fraction
     - Draw sample
     - Estimate county and state cuft roundwood production totals
     - Quantify error as the difference between the sample-based estimate and the “true value” from the Census
  4. Replicate #3 1000 times
     - Calculate mean square error for each state and county
     - Calculate percent error 100*√mean square error/true value

Testing Sample Designs

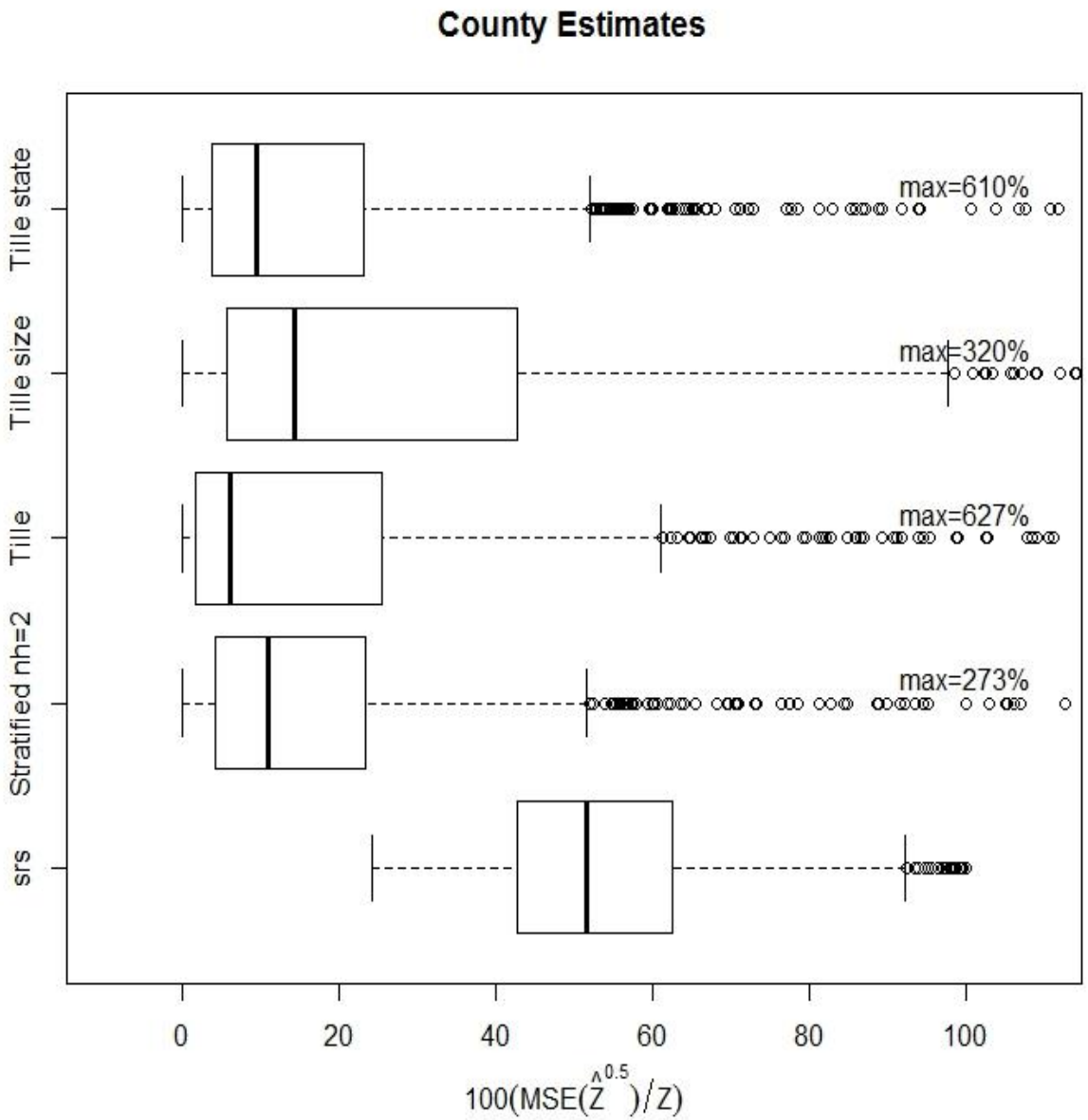
- Example of observed vs estimated total production
- Based on 1 Monte Carlo replication
- 0.5 sampling fraction

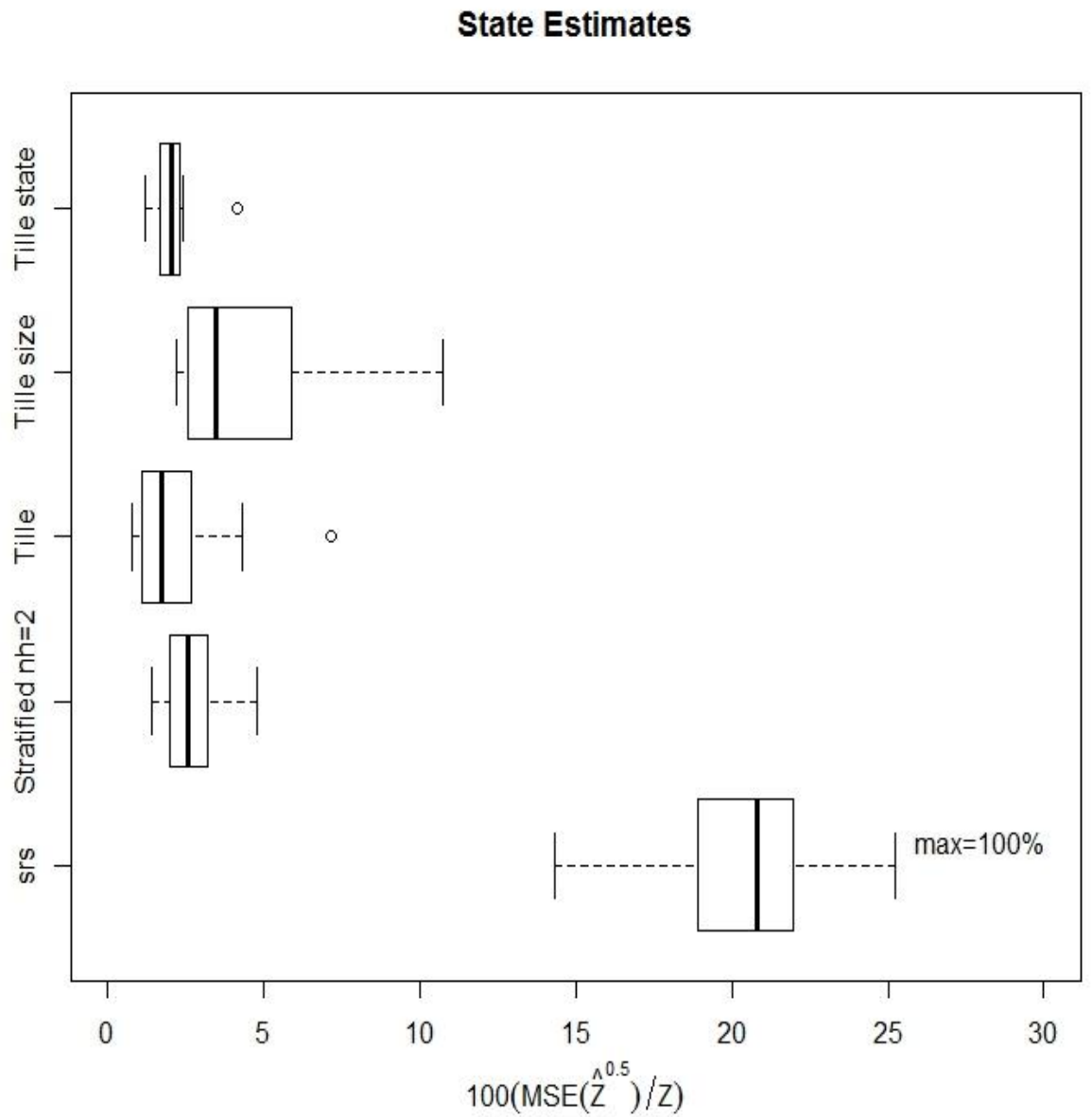






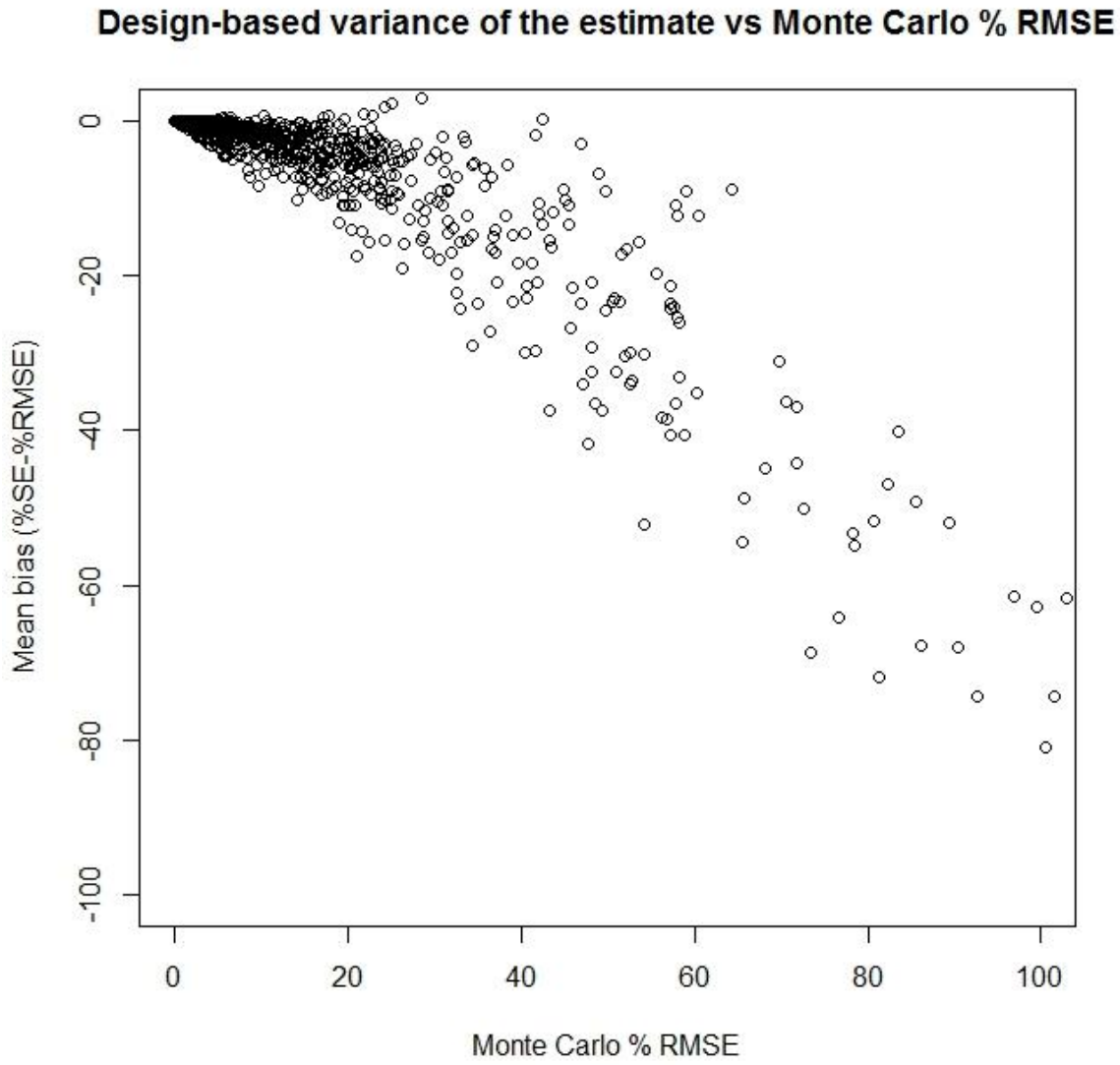
Sample Design testing: Monte Carlo results





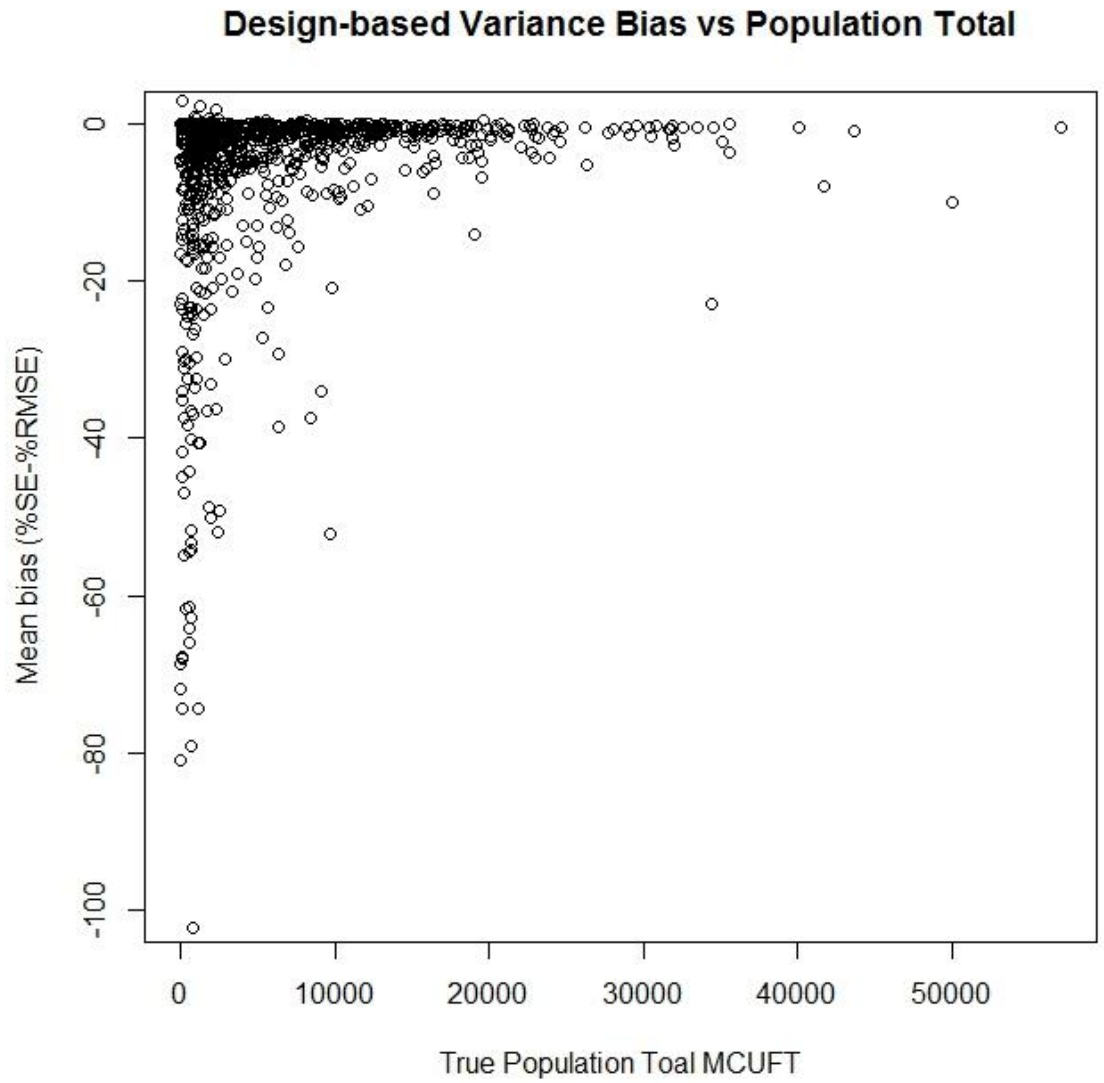
Sample Strategy testing:

- Goal of Monte Carlo analysis is to understand true MSE
- How does Monte Carlo MSE compare to design-based sampling error for small area estimates?



Sample Strategy testing:

- County level estimate estimator bias.
- Variance estimator become ~ unbiased with groups of 5-10 counties.



Sample Design: Importance of domain estimation

- Mills are sampled by some mechanism but our interest is not only in making a population inference about mills (e.g. mill receipts).
- We are interested in product domains and spatial domains
  - Sawlogs, veneer logs, etc.
  - By state, county
- Estimates for counties would benefit from small area estimation techniques
- Both the Tille approach and the stratified nh=2 approach can be stratified by State and primary mill product.
  - This is helpful for some products
- County-level estimates are small area estimates
- Current effort suggests that the design-based variance of the estimate is underestimated.
- Particular issue when a small number of mills draw a portion of their receipts from a county

Sample Design: small area estimation

- Small area estimation / synthetic estimation techniques are applicable to the TPO design.
- Regression type estimators (blup) that rely on ancillary data are being tested.
- Synthetic estimators that leverage surround area are being tested
- Ancillary data streams need to be expanded.
  - Remotely sensed ‘current’ harvest area predictions by county
  - Harvest probability models tied to FIA plot data
  - Others
- Some challenges is correctly estimating sampling error
  - Occurs because some number of mills (which are the observation) receive a portion or all of their wood from a particular county (domain of interest)

Sampling Strategy

- Initial results suggest that the stratified approach fits our design criteria
  - Relatively straight forward to implement / operationally feasible
  - Generally as precise as PPS and far superior to SRS
  - Non response can be more easily addressed by collapsing strata rather than recalibrating inclusion probabilities
  - Compatible with small area estimation techniques

Ideal annualized scheduling

- Have updated mill list in Fall
- Develop sample from the frame
- Send out surveys in January
- Surveys returned by May
- Follow-up on non-response Summer
- Load and compile data, construct estimates Fall
- This schedule would provide for estimates being available with a 1 year lag (e.g. 2017 estimates available in 2018)

Participation and Response by Industry

- Crucial for current periodic design and any annual design.
- We are pursuing automated data transfer approaches for larger companies
- We will work with NCASI and AFPA on encouraging industry to respond
  - Issue: some companies that have shown support don’t have all their mills responding
- Need to build relationships with certification groups (e.g. SFI, FSC) to understand their position and opportunities promote response

Discussion