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Assessing and Addressing Nonresponse for the National Woodland Owner Survey (NWOS)

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Why is nonresponse a problem?

“...survey nonresponse is of practical concern for several reasons, including (1) biases in point estimators, (2) inflation of the variances of point estimators, and (3) biases in customary estimators of precision.” – Groves et al. 2002

“We are left in the position of relying on some guess about the size of the bias, without data to substantiate the guess.” – Cochran 1977

Types of nonresponse?

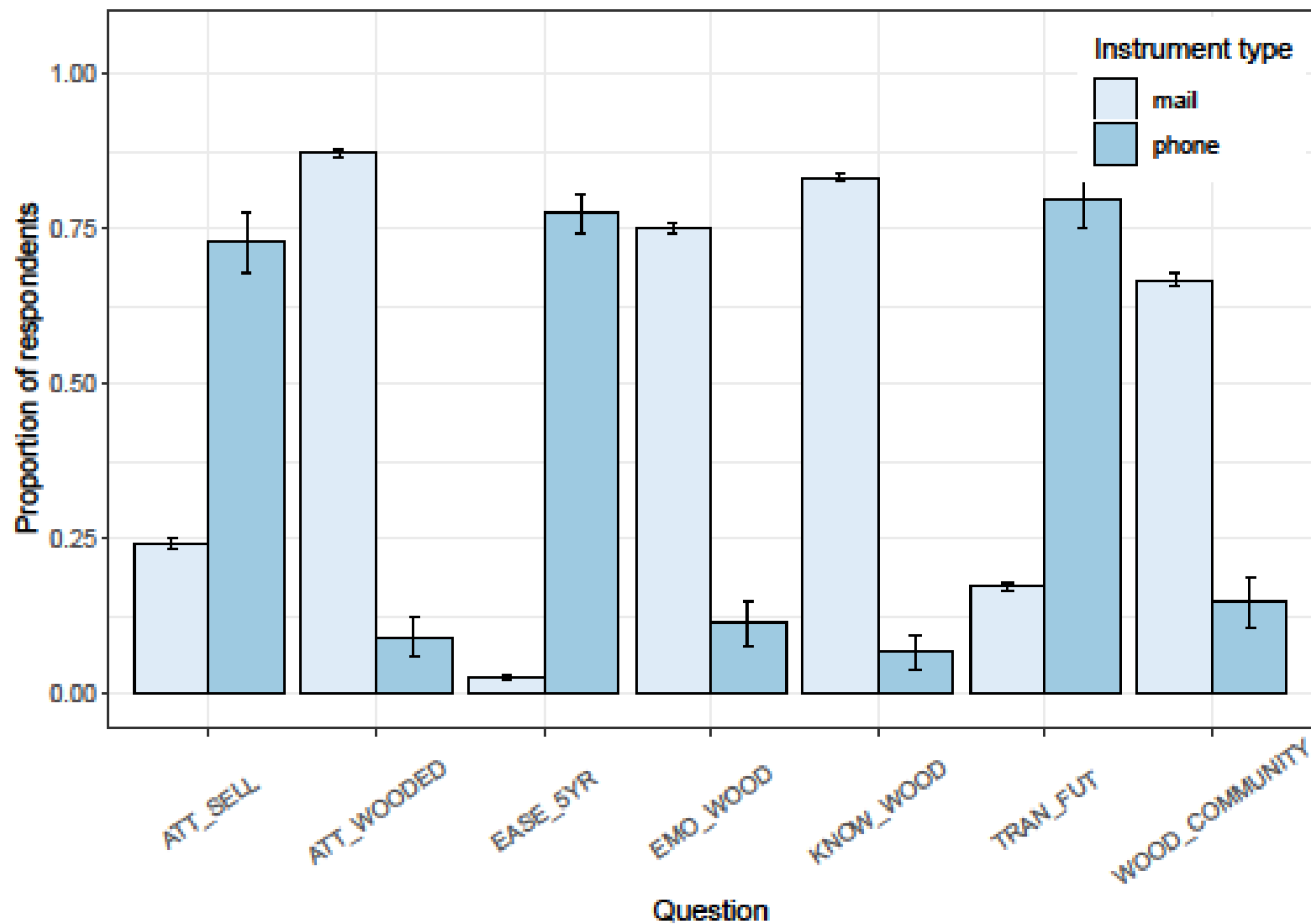
- Unit nonresponse
 - *“...occurs when the person or organization that constitutes the sample unit, fails to respond to a survey.”*
– Groves et al. 2002
 - Types
 - Refusal (simple nonresponse)
 - No address / bad address / failure to contact
 - FIA unsampled (COND_STATUS_CD='5')
 - 4% of non-augmented sample in 2018
- Item nonresponse
 - *“...unit response is obtained, but the respondent does not answer all of the questions.”* – Groves et al. 2002

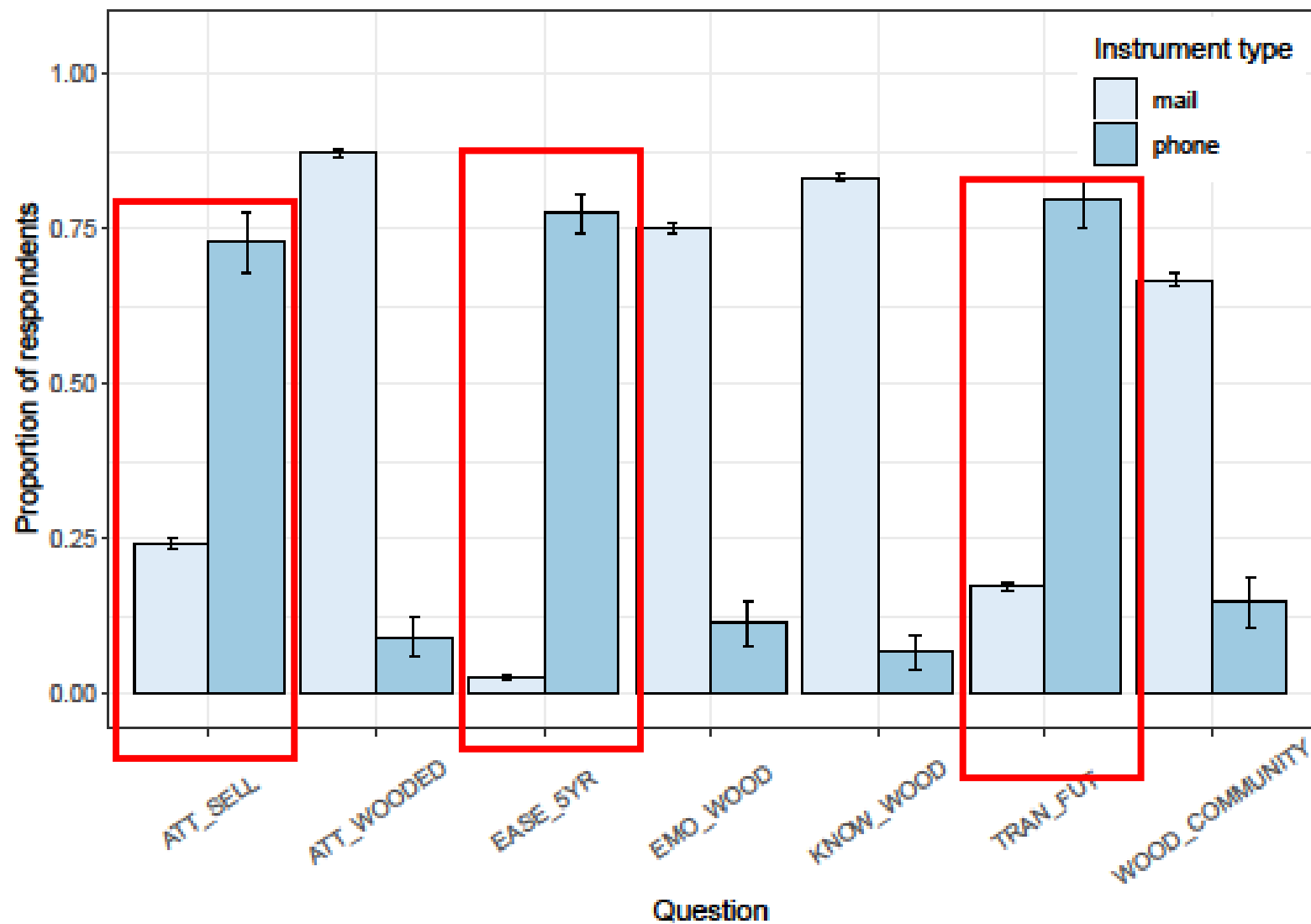
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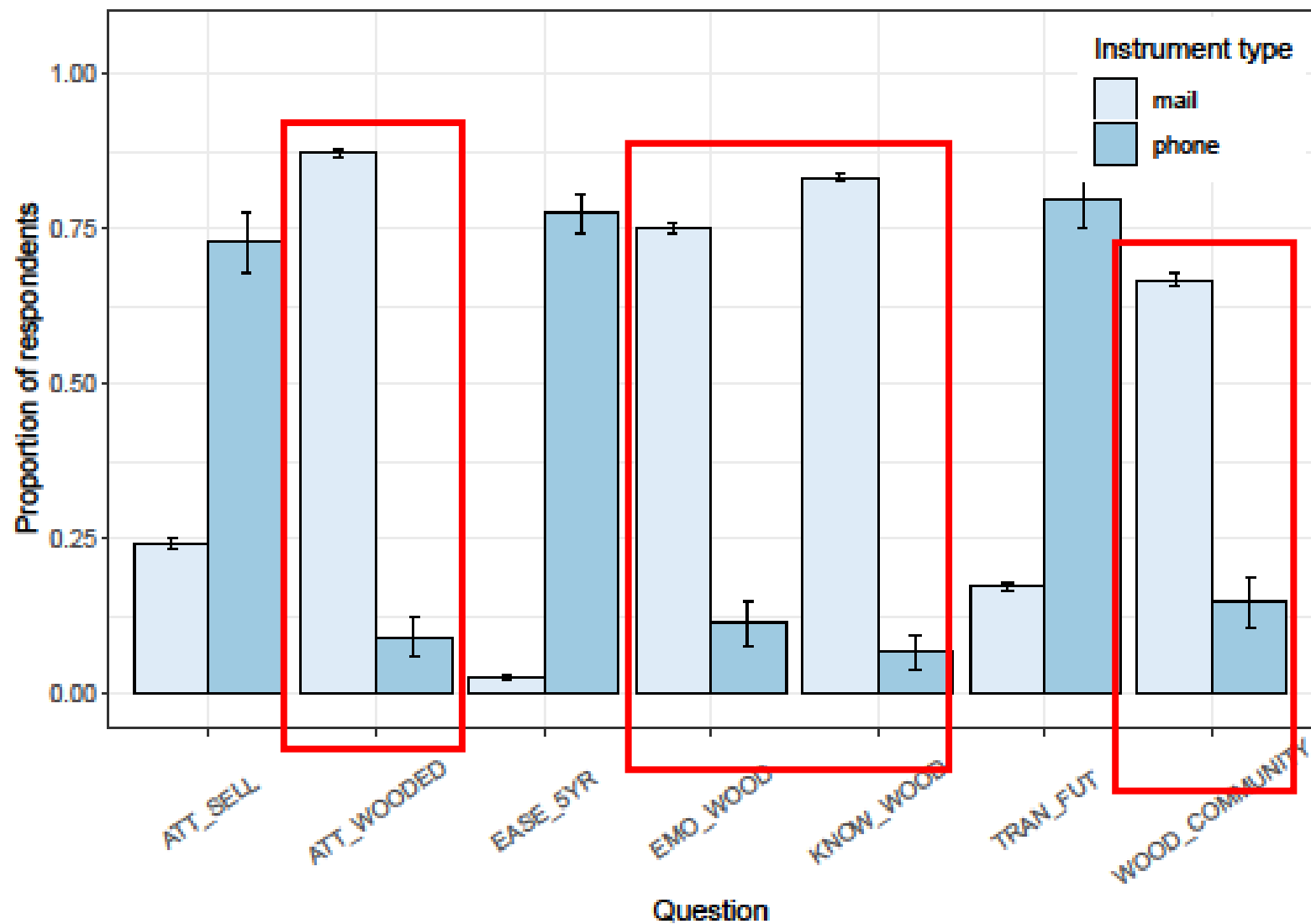
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Unit Nonresponse

- Response versus cooperation rate
 - 2018 response rate: 26% (Butler et al. *in process*)
 - Cooperation rate: 39.7%
- Comparison of mail responses against telephone
 - Target of 1000 nonrespondents called (1048 completed)
 - 132 variables in common with the mail survey
 - Chi-square and Mann-Whitney U tests
 - 81 variables did not differ significantly ($p \leq 0.05$)
 - 44 differed with a negligible/small/medium effect
 - 7 differed with a large effect (Cohen's $d \geq 0.8$)





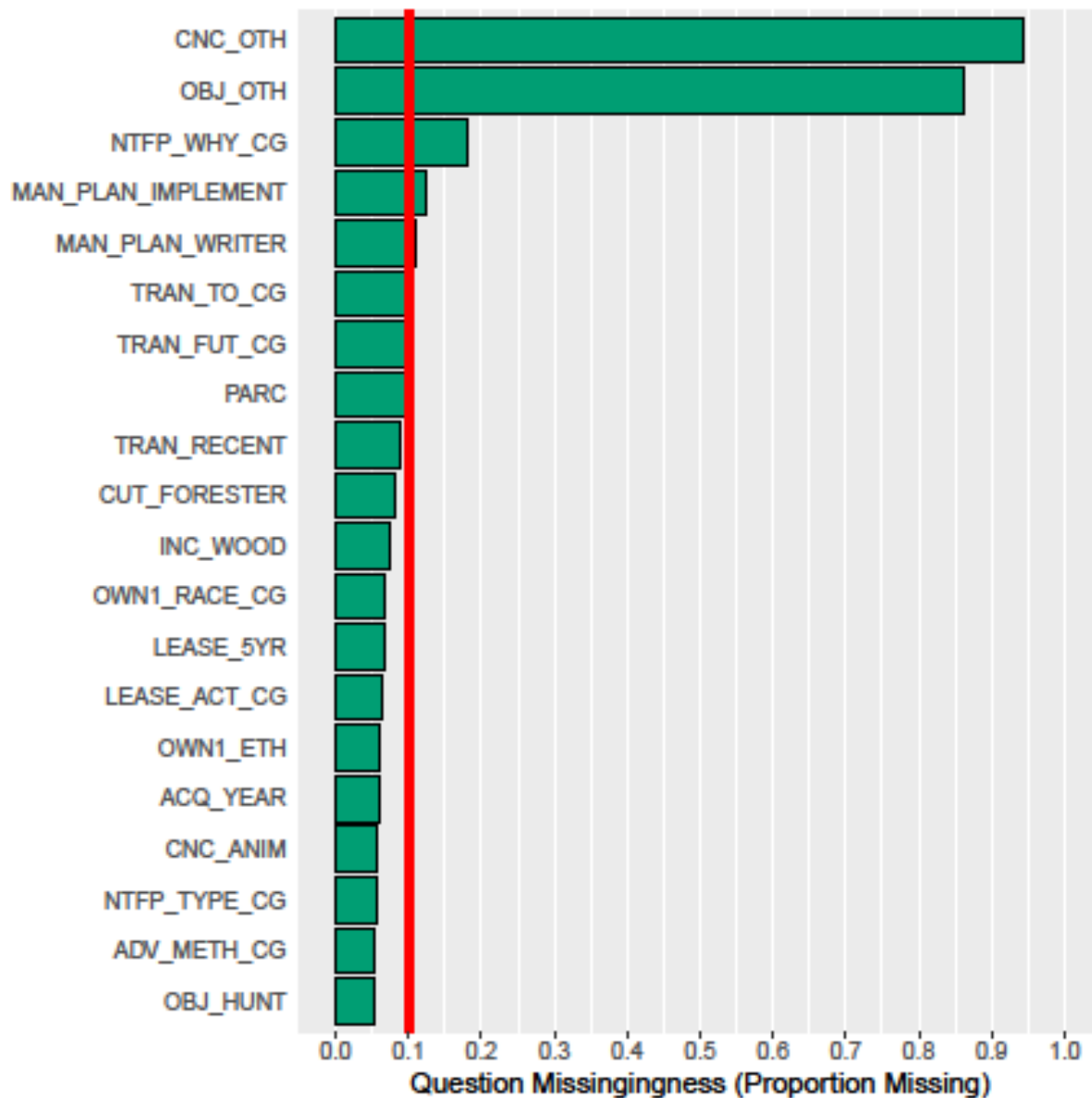


Unit Nonresponse

- Response modeling
 - Propensity scoring methods (Brick et al. 2013, Buskirk et al. 2015)
 - Random forests models predicting response based on data origin, population density, ecoregion, and parcel size.
 - Origin was (somewhat) consistently the most important variable.

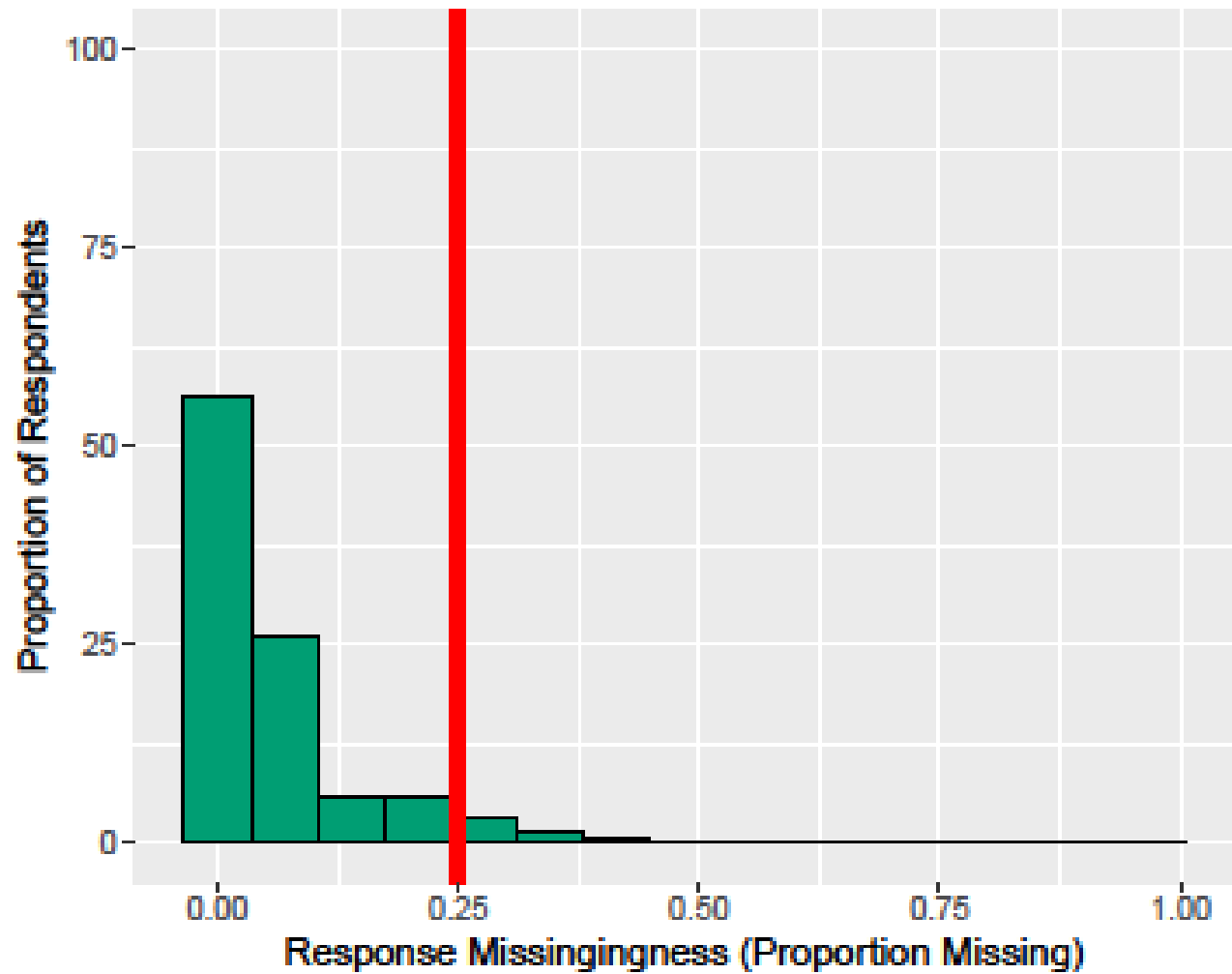
Item Nonresponse

- How did nonresponse vary among questions?
- Surveys that were missing AC_WOOD (4.3%) were entirely dropped from the sample (i.e. recoded as unit nonresponse).
- Check bank (“check all that apply”) questions were treated as a unit.
- Nonresponse at the individual question level ranges from 0.00 to 0.94 with an average of 0.06 (SE = 0.13).
- Survey-level “missingness” ranged from 0.01 to 0.98 with a mean of 0.07 (SE = 0.09), with a threshold at 25%.



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How do we address nonresponse?

- Unit

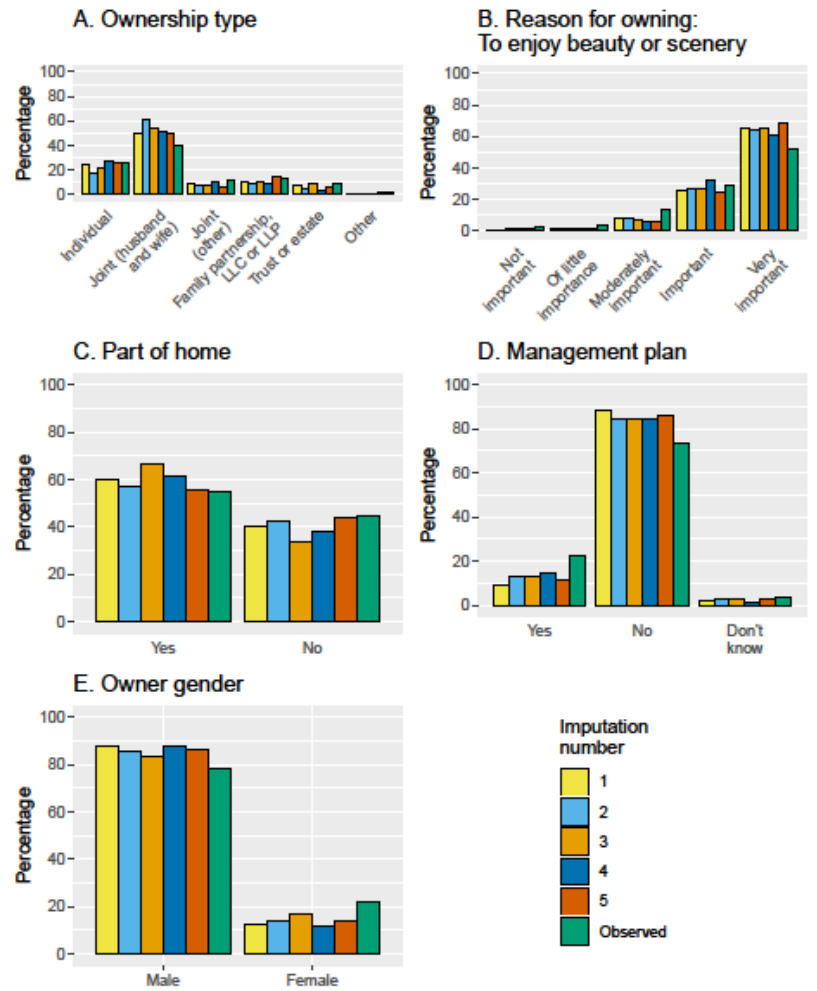
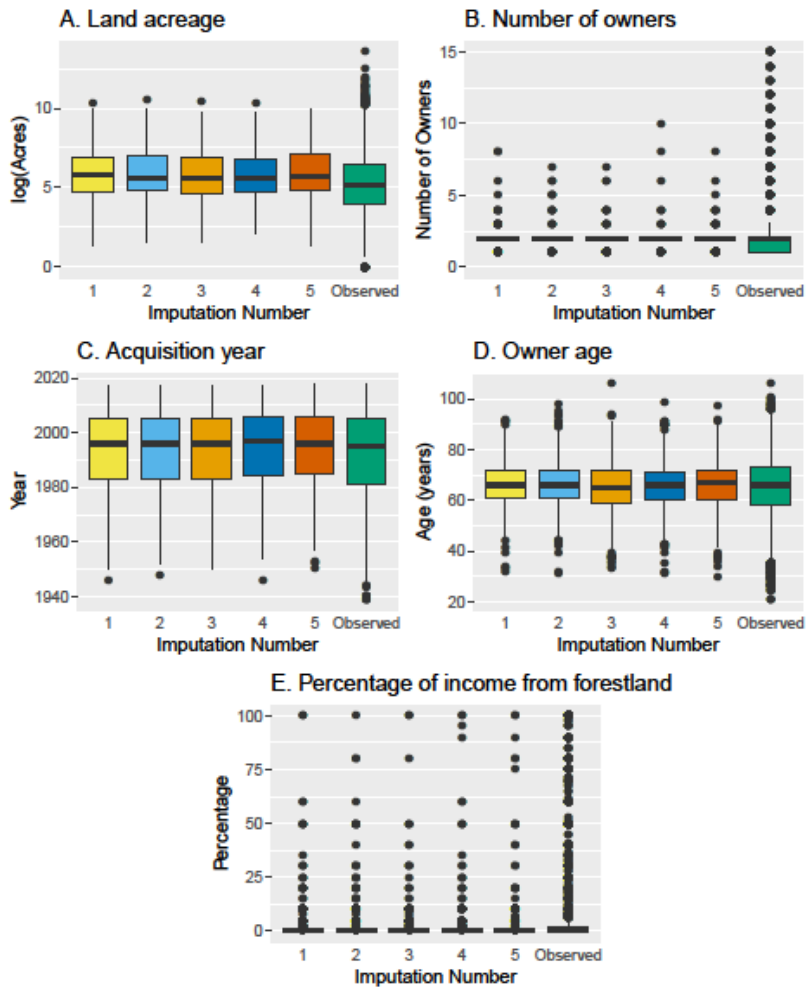
- Adjusted sampling weights (Butler *in process*) using the results of the state-level response models.
- In those states where the goodness-of-fit of the model was adequate (Tjur statistic ≥ 0.01)
- Weights were adjusted proportionately to the inverse of the predicted response probability

- Item

- Multivariate imputation using chained equations (Van Buuren 2018)
- Imputed missing values for those surveys that were at least 75% complete ($< 25\%$ “missingness”), $\sim 95\%$ of surveys

How do we address nonresponse?

- Item (continued)
 - Random forests was chosen as the modeling method.
 - Five imputation sets were generated.
 - On average, 3.7 percent (SE = 2.8) of the values for a given variable were imputed.
 - There is a tendency for some imputed variables to be biased towards the median (or modal) values of the observed data. This is a common issue with many models of categorical variables and is the preferable direction of a bias for imputed values.
 - Logic checks on imputed values



Questions?

References

- Brick, J.M. (2013). Unit Nonresponse and Weighting Adjustments: A Critical Review. *Journal of Official Statistics*, Vol. 29(3), 329-353.
- Buskirk, T. D. & Kolenikov S. (2015), Finding Respondents in the Forest: A Comparison of Logistic Regression and Random Forest Models for Response Propensity Weighting and Stratification. *Survey Insights: Methods from the Field, Weighting: Practical Issues and 'How to' Approach*. Retrieved from <http://surveyinsights.org/?p=5108>
- Butler et al. (In Process). Family Forest Ownerships of the United States, 2018: Results from the USDA Forest Service, National Woodland Owner Survey.
- Butler, Brett J. In process. “Weighting for the U.S. Forest Service, National Woodland Owner Survey.” U.S. Forest Service, Northeastern Research Station.
- Cochran, William G. *Sampling Techniques*. New York: Wiley, 1977.
- Groves, Robert M., Don A. Dillman, John L. Eltinge, and Roderick J. A. Little, eds. *Survey Nonresponse*. New York: Wiley, 2002.
- Buuren, Stef van. 2018. *Flexible Imputation of Missing Data*. Boca Raton, FL: CRC Press.