Dear Dr. Ellison:

We are submitting for your consideration our manuscript, “Change in Composition, Density, and Biomass since the Settlement Era (1800s) in the Upper Midwestern United States.”

This paper presents a major new analysis and synthesis of settlement-era forest composition, stem density, basal area, and biomass, based on Public Land Survey (PLS) data from the Upper Midwestern United States. Our analysis substantially advances from prior PLS-based work by developing new methods for correcting for surveyor bias, particularly with respect to estimating stem density (and thus basal area and biomass) in a way that accounts for changing survey design throughout the region. This paper is also the first to provide PLS-based estimates of historical forest biomass at this broader regional scale.

We apply the new PLS-based dataset to contrast forest structure and composition prior to Euro-American settlement with modern forest structure from the Forest Inventory and Analysis database. Key findings include:

1. Contemporary forests in the upper Midwest have higher stem density and total basal area than settlement-era forests, but lower biomass, likely because of the larger size of individual settlement-era trees.
2. Almost 30% of the modern forested landscape of the upper Midwest is compositionally novel relative to the PLS data, while 25% of forests in the PLS era have no modern analogues.
3. The loss of PLS forests is concentrated in central Wisconsin, near the Tension Zone, and is associated with a weakening of ecotones and an overall homogenization of forest cover across the region.

We anticipate that these PLS-based datasets will become the new standard for settlement-era forest composition and structure, and we are working closely with terrestrial ecosystem modellers to use this as a baseline dataset for a series of historical-to-21st-century experiments and modeling intercomparison protocols.

**Data notes**: In this submission all the code required to run the analysis is provided as Supplement 1. Supplement 1 also includes files necessary to generate several of the figures used in this paper, including files from NaturalEarthData.org. The final submission will be accompanied by a public GitHub repository, and these NaturalEarth files will not be included since we do not have permission to distribute them. In their place will be direct web-links to the files. In addition, this submission contains only a subset of the full PLSS data. This subset should be sufficient to test the code and replicate most of the analysis. We have permission to use the PLS data from Wisconsin, Michigan and Minnesota, but do not have permission to distribute this data. Our final repository will include links to these datasets, along with the code necessary to link the data files together.

Thank you for your time and consideration.

Sincerely,

Simon Goring

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