Reconciling estimates of the contemporary North American carbon balance among terrestrial biosphere models, atmospheric inversions and a new inventory-based method

Hayes *et al*. (2012), *Global Change Biology*, 18 (3), DOI: 10.1111/j.1365-2486.2011.02627.x
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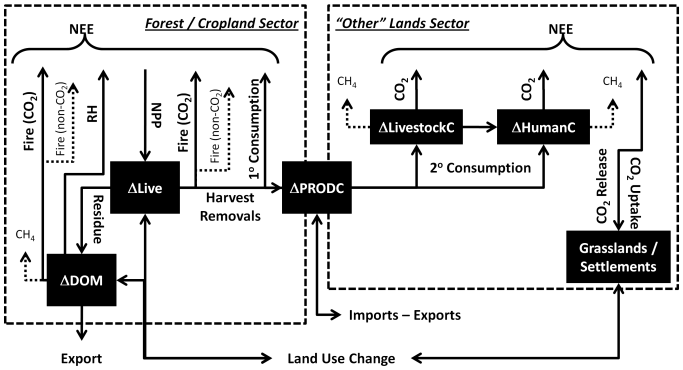

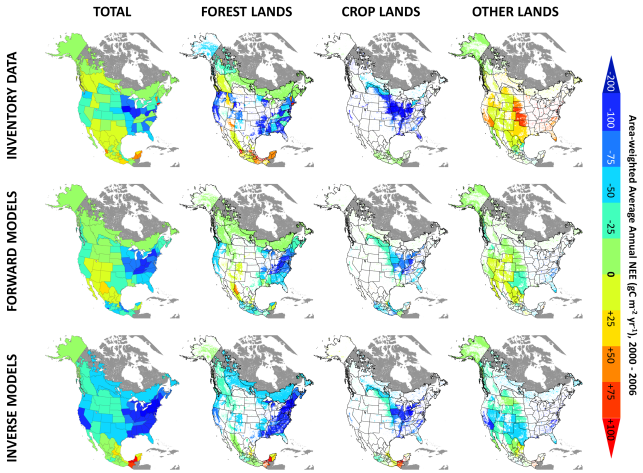

Objective

- Report on state-of-the-science estimates of the strength of the North American (NA) CO_2 sink derived using multiple approaches.

New Science

- We compared model estimates of the NA carbon sources and sinks to new estimates derived from an evaluation of the components of national greenhouse gas inventories where the spatial distribution of both vertical exchanges and lateral transfers of carbon are resolved (figure 1).
- Our study highlights consistencies and mismatches between model- and inventory-based estimates on sources and sinks at sub-national scales and across different sectors (forest, crop and other lands; figure 2).

Significance

- *Top-down* approaches (i.e., inverse models) produce greater estimated sink strength than do *bottom-up* approaches (biosphere models and inventories).
- Although dependent on the approach used, C sinks are estimated to offset 25 to 50% of total NA fossil fuel emissions.
- Each approach has its own strengths, weaknesses and uncertainties.
- Confidence in our ability to understand and predict the role of the NA carbon cycle in the global climate system will increase as the estimates from these different approaches begin to converge and are combined in integrated modeling systems.

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Figure 1.

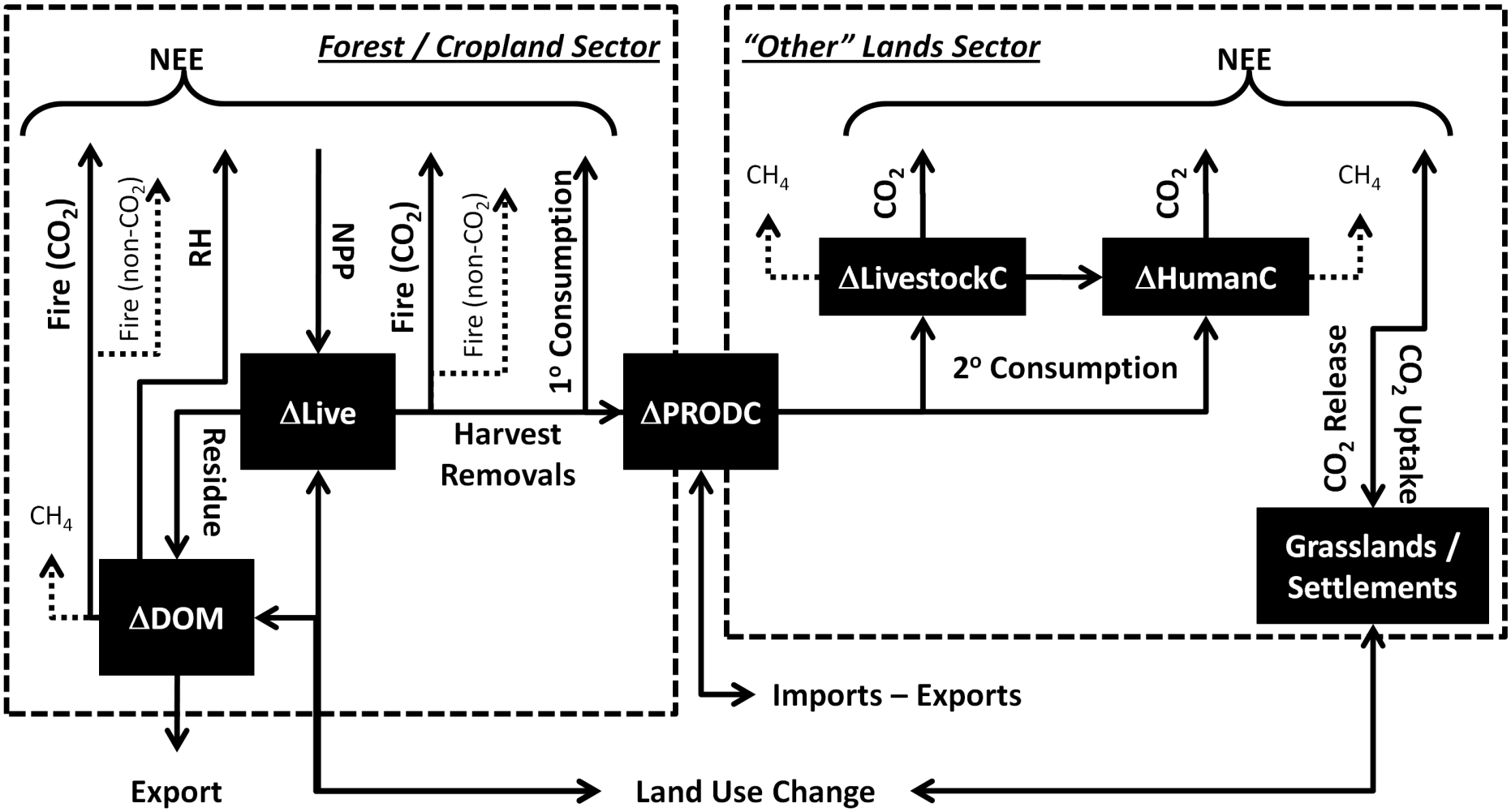

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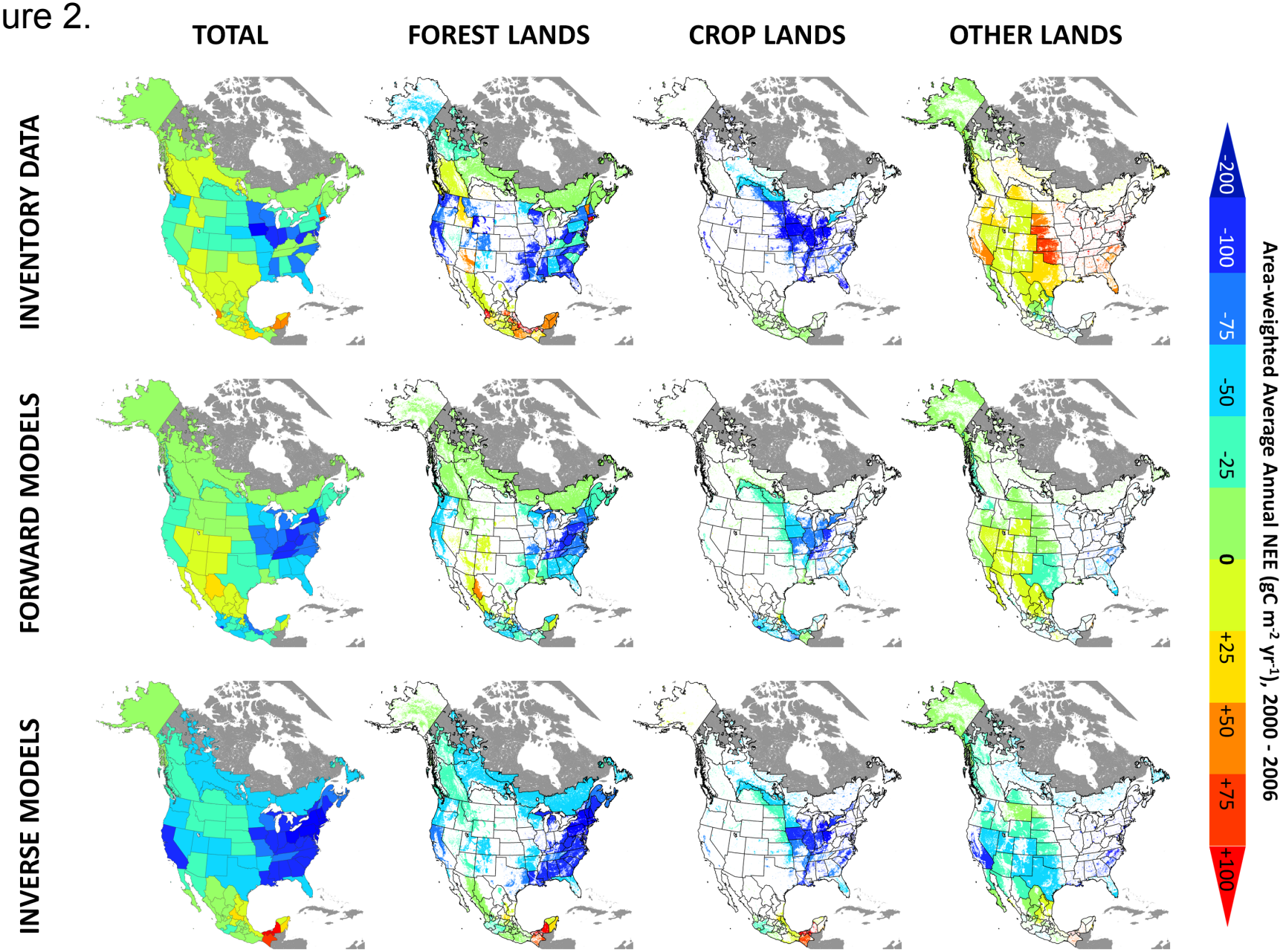
Figure 2.



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