US Forest Greenhouse Gas Inventories and RPA Carbon Assessments

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Climate mitigation is a game of tradeoffs

- Forest carbon changes over time
- Energy from wood or oil or coal or…?
- Imports/exports of products
- Public lands, private lands
To manage carbon and GHGs, we must monitor them

- United Nations Framework Convention on Climate Change: Greenhouse Gas Emissions and Sinks Inventories—early 1990s

- Like 140 other nations, the US ratified the UNFCCC and promised, by law, to report their GHG emissions and sinks annually.
US GHG inventory covers all sectors, key sources and sinks

- US EPA lead agency
- National-level
- Base year 1990
- Annual
- Sectors: Energy; Industrial Processes; Solvent & other product use; Waste, Agriculture; Land Use, land use change, and forestry
- GHGs: CO$_2$; CH$_4$; N$_2$O; PFC, HFC, & SF$_6$
Guidance for GHG inventories evolves

- 2006 IPCC Revision Guidelines. Volume 4: AFOLU: Agriculture, Forestry, and Other Land Use
Aims/principles of NGHGI guidance apply at many scales

- **Transparency**
  -- users can replicate and assess info

- **Consistency**
  -- change real, not due to methods differences

- **Comparability**

- **Completeness**
  -- all sources/sinks considered, entire geographic land-base

- **Accuracy**
  -- neither over or underestimating as far as can be judged

  -- uncertainties reduced as far as practicable
Main equations

- Carbon stock = area * carbon/area

- Activity type equation: number of animals * emission per animal
System boundaries are key for analyzing climate mitigation activities

- A true story: Finland then and now
- All managed lands and related activities?
- All carbon pools (above, belowground)?
- Fate of carbon beyond the forest
  - Trade (imports/exports)
  - Substitution?
- Co-benefits
- Resolution
Managed land definition is key

- Affected by direct human intervention
  - Includes providing social functions for personal, community or societal benefits
- All forest land in “lower 48 states” is considered managed for the purposes of the US GHG inventories
Definition of “managed” under debate

Unmanaged lands are largely considered inaccessible due to remoteness or to limited commercial value or both

One possible outcome of managed lands in Alaska – blue managed
Forest carbon

Monongahela National Forest, WV
Forest Inventory & Analysis (FIA)
Strategic objectives

- National design standards
- Standardized estimation
- Data released at prescribed intervals
- A national database with user-friendly access
- Nationally consistent state reports (5 years)
- Peer review/publication of outputs/procedures
FIA Data include:

- Use of remote sensing
- Ground plots
- Harvested wood & products
  --Utilization Studies
  --Timber Products Output
- Ownership survey
- National Inventory & Monitoring Applications Center
% contribution to GHG inventory for land use change and forestry— all owners

Source: EPA (2008), Inventory of US GHG emissions and sinks (all are net sinks, no non-CO$_2$)
About 1/3 of net sequestration within US forests are on NFS forest lands.

While about 1/5 of forestland area is in NFS ownership. CAVEATS: implicit disturbance, products
Focus of capacity

- Inventory?
- Activity accounting?
- Life cycle assessment?
The RPA Forest Assessment is the reason the FS is the provider of US forest GHGs

- Originally used the FORCARB model linked to the RPA timber assessment models, and HARVCARB for harvested wood products

- Advantages:
  - \( C = [f(\text{biomass/ac}) = f(\text{volume/ac})] \times \text{acres} \)
  - The Climate Action Report needs projections
  - Special analysis
  - Needed to start in 1990
New RPA models due 2010

- Plot level resolution, 5-10 year projections, will include explicit fire disturbance

- Vs older system: region level resolution, 5 or 10 year projections

- Both based to great degree on FIA and economic data
C stock change differences between 2007 RPA scenarios & base, National Forest only --forest land only.

Note: these are Cumulative differences.
Carbon stock change differences between 2007 RPA scenarios & base, all owners

Productive forestland only

[Graph showing carbon differences between scenarios over time]
Privately owned, productive forest land, Base scenario (2007RPA)
Age class distribution in terms of area (Mha)
Natl Forest System, productive forest land, Base scenario
Age class distribution in terms of area

![Age class distribution graph](image)
Summary of items to consider

- System boundaries
- Managed land definitions
- Geographic and temporal scale
- Acceptable levels of uncertainty/scope
- Relationship to other efforts
- Improve as we go, how often update analysis
- Management affects carbon whether we manage for carbon or not
THANK YOU!