Inventory-based Carbon Budget for the MCI Interim Synthesis

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Inventory methods defined

- Approaches that closely linked to inventory data (e.g., FIA, NASS, survey data, and field measurements.
- Inventory data rarely address carbon stocks and flows directly. Models are developed and used to approximate changes in C stocks and/or CO$_2$ fluxes.
- Inventory-based models represent carbon dynamics associated with inventory data.
Data and Models Used in Inventory

**KEY DATA**
- National Resource Inventory
- National Agricultural Statistics Service
- Conservation Technology Information Center
- USDA-NRCS STATSGO soils data
- Forest Inventory Analysis
- US Census
- Additional data from USDA, DOE, and EPA

**MODELS**
- ORNL’s Land Use Carbon Accounting System (LUCAS)
- University of Tennessee’s POLYSYS agricultural economics model
- CENTURY
- VULCAN
- FORCARB2; Woodcarb2
MCI Inventory Estimates

Primary questions

• What is the bottom-up, inventory-based flux estimate?
  – What are components of the inventory?
  – Where are the sources and sinks?
MCI Inventory in most simple form

(%) = Percent of total MCI C flux in 2004

Cropland Net C Flux: (31%)
Forest Net C Flux: (4%)
Grassland Net C Flux: (0%)
Fossil Fuel Emissions: (65%)
MCI Net C Flux:

- Croplands are an apparent sink in the MCI due to harvested and removed carbon.
- Apparent sink offsets fossil fuel emissions by nearly half.
**MCI Crop Carbon Inventory**
Includes only crop carbon uptake and release in MCI

- NPP C uptake > total fossil fuel emissions
- 2002 drought is represented
- Cropland NEE in MCI is an “apparent” net sink due to harvested carbon
National Crop Carbon Inventory

Includes crop carbon uptake and release in the US

- Livestock respire most of the exported carbon in the US.
- The remaining goes to fuel, fiber, and exports
Approximate U.S. Agricultural Carbon Budget for 2004

- **NPP**: 579 Tg C yr\(^{-1}\)
  - Processing waste: 13 Tg C yr\(^{-1}\)
  - Food (Human): 20 Tg C yr\(^{-1}\)
  - Feed (Livestock): 162 Tg C yr\(^{-1}\)
  - Fuel (Corn for ethanol): 13 Tg C yr\(^{-1}\)
  - Fiber (Cotton): 111 Tg C yr\(^{-1}\)

**Carry-over from 2003**
- Beginning crop harvest stocks = 11 Tg C yr\(^{-1}\)
- Beginning non-grain stocks = 1 Tg C yr\(^{-1}\)

**Available Stock for 2001**
- Available Stocks: 250 Tg C yr\(^{-1}\)

Net C Balance = -3 Tg C yr\(^{-1}\)

**Exports**: 51 Tg C yr\(^{-1}\)
- Processing waste: 19 Tg C yr\(^{-1}\)
- Food (Human): 13 Tg C yr\(^{-1}\)
- Fuel (Corn for ethanol): 162 Tg C yr\(^{-1}\)

**Imports**: 2 Tg C yr\(^{-1}\)
- Processing waste: 2 Tg C yr\(^{-1}\)

**Soil**
- Carry-over for 2005: 11 Tg C yr\(^{-1}\)

**Results**
- Total Harvested Stocks: 262 Tg C yr\(^{-1}\)
- Total Available Stocks: 250 Tg C yr\(^{-1}\)
- Total Processing Waste: 20 Tg C yr\(^{-1}\)
- Total Food (Human): 20 Tg C yr\(^{-1}\)
- Total Feed (Livestock): 162 Tg C yr\(^{-1}\)
- Total Fuel (Corn for ethanol): 13 Tg C yr\(^{-1}\)
- Total Fiber (Cotton): 111 Tg C yr\(^{-1}\)

**UNITS = Tg C ~yr\(^{-1}\)**
Net zero balance in cropland carbon is why soil carbon is the primary carbon component considered in national carbon accounting.

Notes:

- Implementation of conservation practices and programs via carbon trading or incentives can change the soil carbon sink.
- Annual weather-related shifts acting on the labile soil carbon pool may be large sinks or sources.
County distribution of crop carbon fluxes

Carbon sources outside of the MCI are as important as the apparent C sink within the MCI.
Summary

• What’s been completed for the inventory-based MCI estimates?
  – Cropland NPP, Harvested carbon, Livestock feed/emissions, human food/emissions, Carbon exported out of the MCI, soil carbon stock changes, forest carbon stock changes.

• How do these help the MCI interim synthesis?
  – Understanding of individual bottom-up fluxes
  – Detailed fluxes that can be aggregated to courser resolution for use in synthesis projects

• What will be added/improved for 2007/2008 synthesis?
  – Monthly vs. annual estimates
  – Uncertainty estimates
  – Improved integration of satellite remote sensing for sub-county estimates of forest dynamics and improved estimates in croplands
Thank You