Appendix H. Forestry

Overview

Forestland emissions refer to the net CO_2 flux[1] from forested lands in Vermont, which account for about 78% of the state's land area.[2] Forestlands are net carbon dioxide sinks for Vermont, with live trees estimated to remove about 6 $MMtCO_2e$ per year (see Table H1). Another key pool of forest carbon, harvested wood products and landfilled forestry waste sequesters 1.7 $MMtCO_2e$/yr.

Emissions Inventory and Reference Case Projections

CO_2 flux from forests was estimated using data on forest carbon pools from the U.S. Forest Service (USFS).[3] The carbon pool data are taken from the Forest Carbon Model (FORCARB), which are in turn derived from the USFS Forest Inventory & Analysis (FIA) survey data. Carbon pool data for three FIA survey cycles (two time periods) were available. These included FIA surveys covering 1983, 1997, and 2004. Based on discussions with state forestry officials, CCS only used the data for the 1983-1997 period to estimate CO_2 flux, since the 2004 survey cycle data are not yet complete.[4]

For each of the forest carbon pools listed in Table H1, the annual flux estimate was determined from the increase/decrease in forest carbon between FIA cycles divided by the number of years between the cycles. The forestry sequestration estimates for Vermont are driven both by an increase in forested area from 1983 to 1997 (about 182,000 acres) and an increase in live tree biomass during this period (12% increase in biomass density).

In addition to the forest carbon pools, additional carbon is stored as biomass is removed from the forest for either the production of durable wood products or landfilling of wood waste. An estimate of these removals was provided by the USFS.[5]

The methods used to construct the inventory for Vermont are aligned with those used to produce EPA's national inventory. Additional details on these methods can be found in Annex 3 to EPA's 2006 GHG inventory for the U.S.[6] Other losses of forest carbon, such as through wildfires/prescribed burns are accounted for in the carbon pools accounting methods described above (i.e. losses of forest carbon due to large wildfires would show up in lower biomass estimates in the succeeding FIA survey).

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[1] "Flux" refers to both emissions of CO_2 to the atmosphere and removal (sinks) of CO_2 from the atmosphere.

[2] Source: *The Vermont Forest Resource Plan* 1999-2008, VT Department of Forests, Parks & Recreation, http://www.vtfpr.org/forplan/index.htm.

[3] Jim Smith, USFS, personal communication with S. Roe, CCS, August 24, 2006.

[4] Sandy Wilmot, VT Department of Forests, Parks & Recreation, personal communication with S. Roe, CCS, August 30, 2006.

[5] Jim Smith, USFS, personal communication with S. Roe, CCS, August 18, 2006.

[6] Annex 3 to EPA's 2006 report can be downloaded at: http://yosemite.epa.gov/oar/globalwarming.nsf/UniqueKeyLookup/RAMR6MBLNQ/$File/06_annex_Chapter3.pdf.

For the 1990 and 2000 historic emission estimates as well as the reference case projections, the levels of forest CO_2 sequestration were assumed to be at the same the 1983-1997 levels. Hence, there is no change in the estimated future sinks. These assumptions could change based on feedback from VTDEQ, the advisory or technical workgroups, and other state forestry experts.

Table H1. Annual CO2 Sequestered in Forests and Wood Products, 1983-1997

Carbon Pool	$MMtCO_2e/yr$
Live Trees	-6.3
Standing Dead Trees	-0.3
Live Understory	-0.03
Down and Dead Trees	-0.4
Forest Floor	-0.5
Soils	-0.7
Harvested Wood Products & Landfilled Forestry Waste	-1.4
Total	**-9.7**

Key Uncertainties

Key uncertainties in the current estimates of forest sinks are mainly attributable to the lack of complete data for the 2004 FIA cycle. Hence, data from the 1983-1997 time-frame were used to construct estimates of both historical and future sequestration rates. When the 2004 survey data are complete, a more up to date estimate of current sequestration can be made.

When the 2004 data are available, differences in survey methods between the different FIA cycles can drive additional uncertainty in sequestration rates. For example, surveys since 1999 include all dead trees on the plots, but data prior to that are extremely variable. This is mostly because dead trees were not timber and not the focus of data collection. Also, according to USFS, the first FIA survey missed much of the non-NFS reserved lands, so these areas may need to be left out of the estimation of flux. Finally, different FIA cycles have used different forest cover definitions, which lead to differences in the estimated acreage of forests (post 1999 FIA data are based on a 5% forest cover definition as compared to the earlier 10% definition). The effect of these changes will probably be difficult for the USFS to estimate.

In order to provide a more comprehensive understanding of GHG sources/sinks from the forestry sector, CCS is conducting an assessment of methane and nitrous oxide emissions from wildfires and prescribed burns. This analysis is being conducted as part of a regional study for a group of western states. Based on estimates for the State of Montana, where there is significant wildfire activity, the levels of methane and nitrous oxide emissions were found to be very low (<1% of the CO_2 sequestration rate). Therefore, assessment of these emissions in Vermont does not seem warranted.

The estimates provided here for VT compare to previous sequestration estimates made by DEC of 11 $MMtCO_2e/yr$ in 1990 and 17 $MMtCO_2e/yr$ in 1997.[7] The DEC estimates were made using different methods based on forested area and biomass growth rates and exclude sequestration in harvested wood products and landfilled forestry waste.

[7] Vermont Statewide Greenhouse Gas Emissions Inventory Estimates, J. Merrell, VTDEC, April 2005.