

**State of Wisconsin  
Department of Administration  
Division of Energy**

## **Environmental Research Program**

### **Executive Summary**

April 2004

## ***Quantifying Carbon Storage in Wisconsin Forests***

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## EXECUTIVE SUMMARY

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**Date of Report** April 15, 2004

**Title of Project** Quantifying Carbon Storage in Wisconsin Forests

### Investigators

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- Elliott Campbell- Graduate Student, Center for Global and Regional Environmental Research, The University of Iowa
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**Research Category** Carbon Sequestration/Greenhouse Gas Emissions- Carbon and Greenhouse Gases Inventory

**Project Period** Fiscal Year 2002-2003

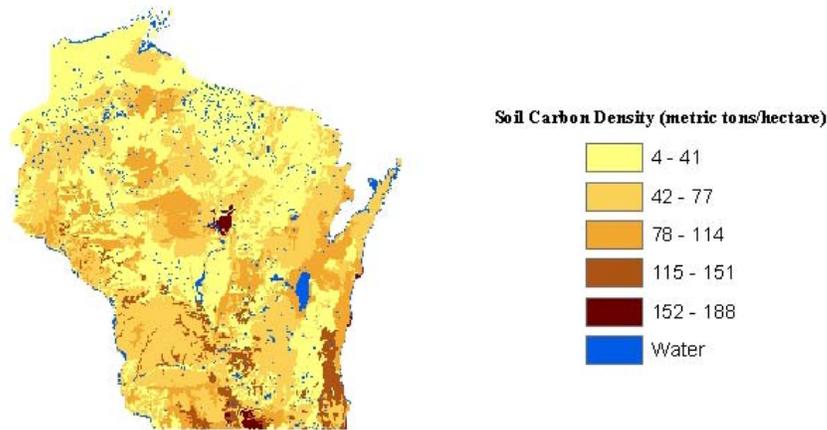
### Object of Research

State-level greenhouse gas emission inventories typically have done a good job of capturing energy-related emissions, but could use improved information concerning the carbon sequestration benefits that accrue within natural systems. The object of our research is to quantify these benefits in Wisconsin's forestlands.

Our primary goal is to determine the volume and annual change of carbon stocks in Wisconsin forestlands. To communicate these results, we provide gross statewide and mapped regional values for soil carbon and biomass carbon. Quality assurance is another goal that we seek to achieve by validating our methodology against published carbon sequestration results for different regions and methodologies.

### Summary of Results/Accomplishments:

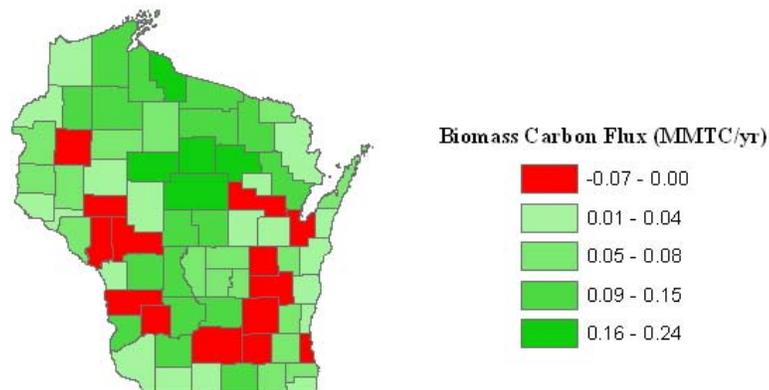
We designed a relational database to calculate the baseline carbon stocks using published methodologies and data from the U.S. Department of Agriculture and the Wisconsin Department of Natural Resources (WDNR). Soil organic carbon (SOC) was computed from soil surveys of the USDA State Soil Geographic (STATSGO) database. The SOC results were mapped (Figure 1) and overlaid onto a Wisconsin land cover map obtained from the WDNR. The baseline forestland soil carbon density was calculated for each forest type, and the overall average was 48 metric tons/hectare. Baseline forest soil carbon was calculated as 262 million metric tons of carbon (MMTC) for soil depths up to 1 meter and 160 MMTC for soil depths up to 25 cm.



**Figure 1.** Statewide soil carbon density (metric ton/hectare) for soil depths to 1 meter.

We calculate annual soil carbon stocks by multiplying the baseline density results by U.S. Forest Service Forest Inventory Analysis (FIA) forest type areas for 1983, 1996, and 2001. Soil stocks are 277 MMTC, 290 MMTC, and 288 MMTC for 1983, 1996, and 2001 respectively. A linear regression indicates a net increase in forest SOC of 0.7 MMTC/yr. It is important to note that these changes are due to a transfer between land types in addition to a transfer from the atmosphere to the soil. These validated results are significantly different from results for Wisconsin from outdated methodologies that have been published and recently cited.

The relational database was also designed to automate tree biomass carbon calculations based on biomass volume data from the FIA program. Forest biomass carbon was calculated at 283 MMTC, 345 MMTC, and 350 MMTC for FIA data from 1983, 1996, and 2001 respectively. This represents a net annual biomass sequestration of 4 MMTC per year. Sequestration rates are summarized by county in Figure 2. The biomass sequestration represents a transfer of carbon from atmospheric CO<sub>2</sub> to forest biomass and is 11% of electricity greenhouse gas emission in Wisconsin in 2000.



**Figure 2.** Biomass carbon flux (MMTC/year).

Results are verified through quality assurance measures including comparison with published results from related studies, edge matching of maps, and comparison of

SOC results with known geologic trends. The project goals of quantifying and validating forest carbon in Wisconsin were achieved. Work progressed in line with the original schedule.