Modeling Change of Forest Carbon Stores in the St. Petersburg Region, Russia

**Project title:** Driving Forces of Change in Regional Carbon Stocks: Comparison of the Western Oregon, USA and St. Petersburg Region, Russia

PIs: Olga N. Krankina, Mark E. Harmon, Ralph Alig, Warren B. Cohen, Joseph Donnegan

1. **INTRODUCTION**

In meeting the challenge of understanding driving forces of change in regional carbon stores we:

1. Undertook a comprehensive analysis of carbon stocks in major forest regions, which is required to:
   - Develop models of change in carbon stores per ha following clearcut disturbance
   - Develop models of change in C stores per ha following clearcut disturbance
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2. **PARAMETERIZATION AND TESTING OF STANDCARB**

The StandCarb model represents changes in C stores per ha following clearcut disturbance. The StandCarb model is parameterized based on forest inventory data. The model is then trained to match changes in wood volume with stand age in local growth and yield tables adjusted for actual stand density. The parameterized model is used to simulate the carbon store in live forest biomass (left) and total ecosystem carbon (right).

3. **MAPPING OF FOREST BIOMASS, STAND AGE, AND NET CHANGE IN CARBON STORES**

Continuous Mapping of Live Forest Biomass (left) and Stand Age (right) based on 13 Landsat TM and one MSS image from 1986-1993 (Ferreti et al., In review)

4. **SPATIAL MODELING OF NET CHANGE WITH STANDCARB**

StandCarb predicts net annual change of carbon stores in live forest biomass and total ecosystem carbon for each forest pixel depending on its productivity class and age (see example below). Note that net change is in biomass remains positive for all ages: it reaches minimum at 2.12 MgC/ha at age 17 then gradually declines to 0. Net change in total ecosystem carbon is negative in forests younger than 15 years; it is at rate of 0.3 MgC/ha at age 20, then declines. Projected net change for each pixel is used to produce regional maps of carbon sources and sinks (see StandCarb).

5. **INTERCOMPARISON OF RESULTS**

Three independent estimates of forest biomass changes with age of forest stands are in good agreement (left):

1. StandCarb model predictions for medium productivity class (high and low productivity classes)
2. Chronosequence of 216 thousand stand records from routine forest inventory of 1992 (juveniles; decline after age 100 is the effect of timber harvest)
3. Landsat TM based models of biomass and forest age (modelling from a scatter of 900 randomly selected pixels)

The regional estimate of net change in live forest biomass based on forest inventory (1.5 TgC/yr average for 1988-99) is less than our model prediction (2.4 TgC/yr). However, if we adjust the inventory-based estimate for greater forest area covered by remote sensing (factor 1.13) and adjust our model prediction for timber removal (1.25 TgC/yr), estimates thus adjusted are very close (1.87 and 1.89 TgC/yr, respectively).

6. **NEXT STEPS: CHANGE DETECTION**

This stands represents magnitude of net change in carbon stores vary greatly during the first 20-25 years following disturbance (box 4, right). Thus, greater accuracy in tracking forest disturbance and mapping of young forests is critical for improved estimate of regional carbon dynamics. Clearcut harvesting is the most common type of disturbance in the region and forest cover usually regrows within 2-4 years. We plan to use change detection on a sequence of Landsat scenes spaced over 20-25 years to map forest disturbances separating elements from healed areas. This disturbance layer will be used to verify and adjust the mapping of young forests and associated carbon sources and sinks. A set of change polygons reveal in 1992 (black, right) will be used as a test set for disturbance detection.

7. **REFERENCES**


See additional information at: http://www.cof.orst.edu/cof/fs/faculty/krankina.htm