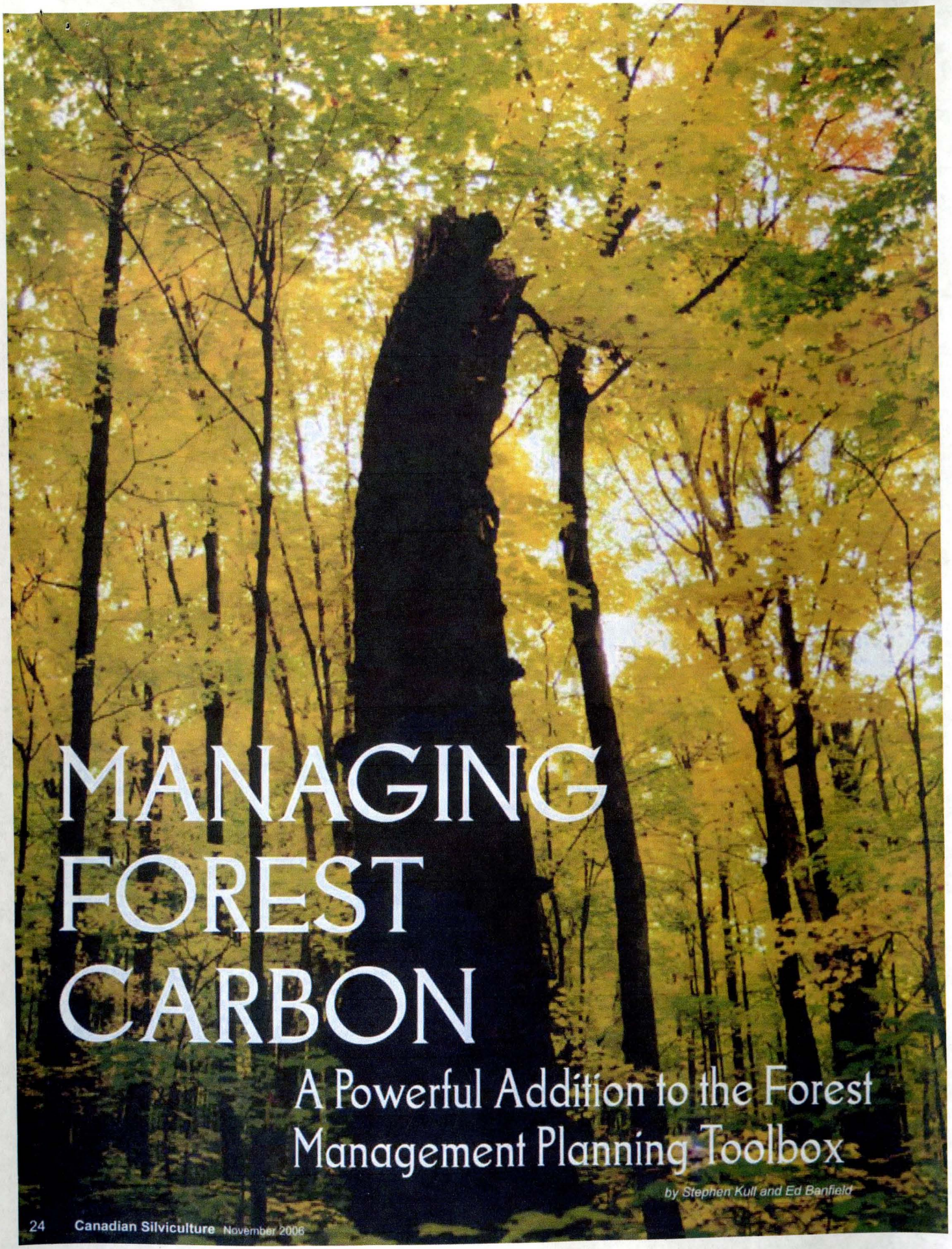

MANAGING FOREST CARBON

A Powerful Addition to the Forest Management Planning Toolbox

by Stephen Kull and Ed Banfield

Various national and international processes recognize the important role that forests and forestry play in the global carbon cycle. These processes include the Canadian Council of Forest Ministers (CCFM) Criteria and Indicators (C&I) initiative, and the National Forest Strategy (national reporting), the Montreal Process, the United Nations Framework Convention on Climate Change (international reporting), and the Kyoto Protocol. As a result, there is a growing need for forest managers to be able to consider how their activities affect forest carbon dynamics on their land base.

Forest managers need a tool that is not only practical, but is also scientifically well-grounded, in order to assess forest carbon dynamics, to report on indicators, or to explore possible ways to decrease carbon sources and increase carbon sinks. In response to this need, the carbon accounting team (CFS-CAT) of Natural Resources Canada's Canadian Forest Service in partnership with Canada's Model Forest Network, through the Local Level Indicators Strategic Initiative, developed a new tool for the national and international forest management community and released it in 2005.

The Operational-Scale Carbon Budget Model of the Canadian Forest Sector (CBM-CFS3) is a stand and landscape-level modelling framework to simulate forest carbon dynamics. The CBM-CFS3 is currently the central model of Canada's National Forest Carbon Monitoring, Accounting and Reporting System that is used for national and international reporting of the greenhouse gas balance of Canada's managed forest. The tool is also applicable to the National Forest Strategy, as it can be used to address the

carbon and climate change related objective and action item under the strategic theme on "Ecosystem-based management." The CBM-CFS3 is compliant with requirements under the Kyoto Protocol and with the Good Practice Guidance for Land Use, Land-Use Change and Forestry (2003) report published by the Intergovernmental Panel on Climate Change (IPCC).

About the Tool

To make it easy for foresters to use, the CBM-CFS3 has been designed to use as much of the same information required for typical forest management planning activities as possible (e.g., forest inventory data, tree species, growth and yield curves, natural and human-induced disturbance information, a forest harvest schedule, and land-use change information). Additional data is supplied with the model, including ecological parameter sets and volume-to-biomass conversion equations appropriate for Canadian species and forest regions.

Tools in the model assist users with importing required data from common timber supply models such as Remsoft®, Spatial Woodstock™, and the Strategic Forest Management Model© (SFMM), or from user-developed data files. With this sophisticated but user-friendly software tool, forest analysts apply their own stand or landscape-level forest management information to calculate carbon stocks and stock changes for the past (monitoring) or into the future (projection).

From a forest management planning standpoint, the CBM-CFS3 can be used to create, simulate, and compare various forest management scenarios in order to quantify the impacts on forest carbon, providing useful information for the forest management planning process. In Canada, many jurisdictions require that forest management plans report on ecological criteria and indicators, including those related to forest contributions to global cycles (including the carbon cycle), in order to comply with sustainable forest management guidelines. Similarly, forest certification organizations, such as the Canadian Standards Association (CSA) and Forest Stewardship Council, are incorporating reporting requirements on forest ecosystem carbon.

Indicator Reporting

The indicators used to assess carbon for local, national, and international processes, although similar, are not necessarily identical. For example, though the CSA Z809 Sustainable Forest Management (SFM) standards build on the CCFM Criterion 4 (Forest Ecosystem Contributions to Global Ecological Cycles), a specific, measurable indicator for CSA reporting is not stipulated. The CSA element pertaining to forest carbon uptake and storage (Element 4.1) states that a forest manager must "Maintain the processes that take carbon from the atmosphere and store it in forest ecosystems", leaving the choice of specific indicator to the practitioner. Given a choice, a good option is to draw upon the existing national CCFM C&I framework, which has 4 specific, measurable indicators under Element 4.1: Carbon Cycle. These are:

4.1.1 Net change in forest ecosystem carbon
4.1.2 Forest ecosystem carbon storage by forest type and age class
4.1.3 Net change in forest products carbon
4.1.4 Forest sector carbon emissions

Although national-level indicators were not designed to directly address the forest management unit level, drawing on established national and local C&I initiatives in the development process provides a good foundation for local indicator selection and

change over time

ensures consistency between local and national indicators.

The tool will also assist in meeting the National Forest Strategy theme on "Ecosystem-based management" objectives and the theme's climate change action item: "Objective D: On a national basis, maintaining carbon reservoirs and managing the forest to be a net carbon sink, over the long term; and, "Action item 1.4: Develop a better understanding of the effects of climate change and the Kyoto Protocol commitments on the forest ecosystem and incorporate these into forest policy and forest management planning".

Managing a national carbon reservoir as a sink will require managers understanding the dynamics of each of their managed forest areas. The CBM-CFS3 produces results for a wide variety of categories and variables that can be used as indicators. Categories include carbon stocks, stock changes, ecosystem indicators, ecosystem transfers, emissions, and disturbance transfers. The specific indicator(s) chosen depend on the reporting criteria of interest.

Given the variability of forest conditions, including the current age-class structure and natural disturbance rates, an indicator should be assessed in relation to the regional situation. A decline in carbon stocks and a resultant net loss to the atmosphere over several years may be unavoidable in some regions due to the older declining forest conditions and increased natural fire or insect outbreaks. On the other hand, forest carbon stocks may be increasing, not necessarily due to management intervention but because of a generally younger forest sequestering carbon at a high rate or because of a temporary lull in natural disturbances.

Forest carbon stocks change over time, and variations from year to year are to be expected. To provide a basis for evaluation, a baseline scenario can be used, for example, carbon dynamics in the absence of management. With scenario analyses and comparisons like these, forest managers can not only assess carbon indicators, given current management practices, but can also assess the impact of different management strategies on the indicator(s) and implement the best adaptive management response.

Additional Applications

Forest analysts can also use the CBM-CFS3 for research and analyses. The impacts of different silviculture and management activities as well as natural disturbances can be assessed on a single stand basis as well as on the overall landscape. Default dead, organic matter parameters, biomass parameters, and climate data for the user-selected province or territory and Canadian terrestrial ecozone can be editted if the user has better data or wishes to see how sensitive an indicator is to a given parameter.

As our scientific knowledge of the global carbon cycle continues to progress, forest management reporting pertaining to carbon can be expected to follow suit, and the CFS-CAT will continue to update and improve the CBM-CFS3 to adapt to these changes and provide support to the growing user community. The model and user's guide are currently available free of charge via the Canadian Forest Service's Forest Carbon Accounting website at www.carbon.cfs.nrcan.gc.ca.

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