TO: INFORMATION SECTION
NORTHERN FORESTRY CENTRE
5320-122 STREET
EDMONTON, ALBERTA T6H 3S5

WORKING GROUP REPORT ON FORESTRY

Chair: *Dr. Michael Apps*
Forestry Canada

Rapporteur: *Don MacIver*
Environment Canada

Introduction

Within the boundaries of the Great Plains in North America, forests are a significant land use which occurs in many forms from that of the natural unmanaged forest to commercial timber stands and plantations to windbreaks and shelterbreaks and urban "green" spaces. In each case, multiple benefits are provided by the forest resource sector. For example, windbreaks and shelterbelts are effective solutions to combat soil erosion; conserve soil moisture; increase crop yields; reduce home heating and air conditioning energy costs; improve landscapes; enhance wildlife habitats; and sequester carbon from the atmosphere. Likewise, the harvesting and renewal of the timber land base contribute significantly to the economic and social infrastructures of the Great Plains.

Global warming scenarios have raised serious concerns regarding the sustainability of existing forest resources and the populations that depend upon them. The potential displacement of the southern boundary of the Boreal Region of Canada to a new location hundreds of kilometres north, within one biological rotation of most tree species, poses many questions.

State of Knowledge

We know that man is a powerful eco-force and exerts a major influence (eg. logging, fire) on the distribution and functioning of a forest. In turn, man is also influenced by external forces that result in changes in ecosystem dynamics with consequent changes in the dynamics of the forest. Changing political, social and economic policies have direct impacts on forest management and conservation (eg. land use changes). For example, forested watersheds on the Great Plains are a major supply of water. The manipulation of these areas can directly influence the management of water (eg. shelterbelts, watersheds), as can changes in water supply management decisions influence the distribution of forests. Forests are an integral part of resource management systems with the result that changes in the forest component are directly translated into changes in the energy, water, momentum and element exchanges with the atmosphere.

Carbon dioxide levels in the atmosphere are increasing with a probable increase in temperature of 2-6 degrees (globally) within the next century. Understandably, some forest species are likely to be sensitive to this changing climate. In some cases, we understand the adaptive character of species and their response to a new equilibrium climate,

including the ecological amplitude of some major tree species. Similarly, we understand the role of fire and extreme weather events as major determinants of forest ecosystem succession, especially the relationship between fire behaviour and atmospheric processes (eg. weather elements, blocking highs). Within this context, forests also play a major role in the carbon cycle as both a source and sink of carbon into and from the atmosphere, respectively.

The multiple benefits provided by trees are well-documented at the microsite scale (eg. shelterbelts, urban forests) with the suggestion that forests also modify mesoscale climates.

Knowledge Gaps

The global warming issue highlights our inability to define the criteria for forest management intervention. For example, what are the tolerable levels of change in a forest? Are these levels determined by the socio-economic forces driving land use conflicts? Will issues such as ecosystem preservation within the traditional timber land base be displaced by agriculture under a changing climate? What will be the new role of the forest in integrated resource management?

The potential threat of climate change and the possible catastrophic impacts on the forest sector in the Great Plains has increased our awareness of the gaps in our knowledge.

This lack of knowledge in some basic processes (eg. physiological and genetics) limits our ability to evaluate and project the adaptation and responses to climate change. Essential to this evaluation is the need to provide benchmark references for assessing the impact of current managerial decisions and monitoring the needs for adaptive managememt. Some of these concerns are addressed by the questions listed below:

- What is the potential maximum productivity for a region (climatic)?
- How much climate change can be accomodated by genetic adaptation?
- How can we improve the temporal/spatial distribution of the projected precipitation and temperature changes and their magnitudes?
- What will be the effect of global warming on fire severity and behaviour?
- What is the current lightning distribution and the relationship to fire (monitoring networks) and how will this change?
- What are the socio-economic needs and constraints for management of wilderness areas (eg. fighting fires in non-commercial areas)?
- What are the carbon dioxide enrichment effects on forest growth and water use efficiency?
- What will be the carbon benefits associated with afforestation (tree-planting programs) and other carbon sequestering programs (eg. urban forests, shelterbelts)?
- What will be the impacts of forest practices on the carbon cycle (pools and fluxes), especially soil carbon content, and how will these be affected by climate change?

- How do we evaluate the new role of forests in integrated resource management and the change in the commerical and non-commercial uses of forests in a changing environment? How are economic impact assessments to be undertaken?

- What is meant by "sustainable development" in a system that is changing in response to a changing environment - what are the benchmarks?

- What is the definition of biological diversity and integrity in the Great Plains?

Recommended Research Initiatives

(A) Improve climate projections

(1) Improve projections of regional climates by developing hybrid, paleoclimate and other analogue models to complement Global Circulation Models (GCMs) and validate these "forecasts" with real data.

(2) Incorporate terrestrial ecosystem processes into GCMs.

(B) Targetted biological process research

(1) Assess the interaction of the forests of the Great Plains with atmospheric processes under different management and climate regimes by:

- estimating carbon pools and fluxes

- asessing the potential modification of temperature, water/energy balances, and wind with traditional and non-traditional uses of the forest.

- evaluating the impacts on essential eco-physiological processes and biodiversity.

(2) Foster sustainable development of forests and related sectors.

(C) Monitoring for change and adaptive management

(1) Establish an ecological and climatological network at forest sites.

(2) Monitor the response of the forest ecoystems to climate change and management actions, and aid in the establishment of environmental, social and economic criteria for decision-making.

(D) Develop decision support systems (DSS)

(1) Develop Decision Support Systems to aid integrated resource management decisions for forests that take into account the uncertainties associated with climate change.

Department of Geography Publication Series, Occasional Paper No. 12
University of Waterloo

SYMPOSIUM ON THE IMPACTS OF CLIMATIC CHANGE AND VARIABILITY ON THE PRAIRIE PROVINCES

Sponsored by

Canadian Climate Centre
Inland Waters Directorate
U.S. Department of Commerce
National Oceanic and Atmospheric Administration
High Plains Climate Center, University of Nebraska