

# Biological Sinks: Canada's Potential and Technology Development Needs

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## Introduction.

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In Canada's commitment to reduce its greenhouse gas (GHG) emissions, our biosphere (the land, water and air that supports life) may either be a substantial liability or our greatest asset. This is because the biosphere is both a source and a sink for GHGs. Canada's vast forest and agricultural lands provide it with both a national opportunity and a global responsibility to manage its biosphere in a way that will reduce GHGs while providing a renewable and sustainable supply of energy, chemicals and materials.

Ensuring that our biosphere becomes a national opportunity depends upon the results of new technology development based on solid science, the actions we take in managing the biosphere, and the terms defined in international agreements on GHG accounting and carbon (C) trading.

This paper will explore the key elements and philosophy behind biosphere GHG management in Canada, and consider the technological challenges and opportunities for implementation, especially in the area of biosphere C sinks.

## Biosphere GHG Management in Canada

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Strategies for the sustainable management and reduction of GHGs can be classified under three "R's", and the biosphere has an important role to play within each:

- **REDUCE:** Canada must reduce GHG emissions at the source. Since agricultural GHGs account for 10% of Canada's total, the biosphere has a significant role to play here.
- **REMOVE:** Developing and implementing strategies to remove CO<sub>2</sub> from the atmosphere (or to prevent it from reaching the atmosphere) and sequestering it into a long term 'stores' must play a major role in global GHG management. Canada's forests and agricultural lands have the capacity to take up and hold large amounts of additional C, but we need to know how to do this sustainably, and how to quantify and verify the results of our efforts.
- **REPLACE:** Since the majority of our anthropogenic GHG emissions are associated with the production of energy, chemical and material resources from fossil fuels, major efforts are needed to replace these sources with ones that have low or no GHG emissions. Canadian biomass could go a long way to meeting our needs for a renewable and sustainable source of energy, chemicals and materials.

At the present time, Canada's biosphere C stock has been estimated at about 300 Gtonnes C, an amount of C equivalent to about 2000 years of our current fossil fuel emissions. Over the last 400 years, this C stock has been depleted by clearing forests and draining wetlands for agriculture, roads, cities and other human activities, by the tilling of agricultural land, and by our annual forest harvest. Improved management strategies and new technologies are able to put some of this C back, and - in effect - increase the 'minimum monthly balance in our national C account'. Some of the biomass could be directed to the provision of energy, chemical and materials, thereby relieving our ever-increasing demand for fossil fuels. In this way, technologies to remove GHGs and enhance biosphere C stocks can be seen as a bridge to a bio-based economy.

## Technological Challenges and Opportunities

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Biosphere GHG management, including the production and use of bio-based products, will draw on existing and new technologies to:

1. enhance biosphere C stocks in Canada's forests, wetlands and agricultural soils
2. minimize the release of CO<sub>2</sub> and other GHGs (especially CH<sub>4</sub> and N<sub>2</sub>O) from the biosphere
3. quantify and verify biosphere C stock changes associated with human activities, and the ultimate impact of these activities on the major atmospheric GHGs
4. achieve the cost effective and sustainable conversion of biomass into energy, chemical and material resources that are now derived from fossil fuels.

Examples will be provided of emerging and new technologies that are being developed to address these issues and thereby allow Canada to use its biosphere to manage GHGs and reduce the risks of climate change.