



MIKRO-TEK INC.  
MICROBIAL TECHNOLOGIES FOR THE ENVIRONMENT  
AGRICULTURE • MINING • FORESTRY

## C-Trade™ Carbon Pool

Canada's Climate Change Action Plan has projected that carbon sinks will provide Canada with emission reductions of up to 20 MtCO<sub>2</sub>e (20 million tonnes) per year. Mikro-Tek is providing an opportunity for industry to offset their carbon emissions and meet their Kyoto commitments by investing in a pool of aggregated sequestration projects in agriculture, reclamation, domestic forestry, and Clean Development Mechanism forestry.

Through photosynthesis plants remove carbon dioxide from the air, give off oxygen, and store the carbon as biomass. About one half of the dry weight of plant biomass is carbon, and one tonne of carbon in biomass represents 3.67 tonnes of atmospheric carbon dioxide. Mikro-Tek's technology utilizes specific strains of naturally occurring soil-inhabiting fungi, which colonize the plant's root tissue and form a structure referred to as mycorrhizae. The resulting symbiotic mycorrhizal association allows the host plant to increase moisture and nutrient uptake from the soil, which in turn results in increased plant growth and survival. Any increase in plant growth as a result of Mikro-Tek's technology carries a corresponding increase in carbon sequestration.

There is a common set of elements that governs the creation of credible project-based emission reductions:

- Establishment of a baseline
- Proof of environmental additionality
- Evidence that the reductions are surplus to existing regulatory requirements
- Demonstration that the project will not result in emissions increases beyond the project's boundaries (leakage)
- Establishment of credible monitoring and verification procedures
- Proof of ownership of the reductions
- Proof of permanence

Five Winds International and Woodrising Consulting Inc., under contract with Industry Canada's Technology Early Action Measures (TEAM), have independently assessed Mikro-Tek's technology using field data collected from our forestry projects in both Canada and Chile. The review followed the Government of Canada's SMART Protocol (System for Monitoring and Reporting Technologies) and effectively addressed all seven of above-listed issues.

In order to ensure that an adequate amount of Emission Reductions (ERs) are generated for delivery in the first commitment period (2008-2012), and to provide investors with assurance of permanence of carbon sequestered in their projects, Mikro-Tek has formed the C-Trade™ Carbon Pool to aggregate sequestration projects. Mycorrhizal inoculation technology will be applied to fast growing trees in Clean Development Mechanism projects, as well as to slower growing species on Crown land in the Canadian Boreal forest. ERs generated in the fast growing trees will be sold forward to investors for delivery in the first commitment period. The ERs from an equal number of hectares of slower growing pine and spruce trees in Canada will remain in the Pool to be used in subsequent commitment periods, as well as to provide insurance against loss from disease or fire, and to ensure permanence of stored carbon for 45 to 95 years. Agricultural and grassland reclamation projects typically reach their maximum soil carbon content within the first five years of project initiation, so the majority of the ERs generated in these projects would be available for delivery in the first commitment period.

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C-Trade™ will aggregate mycorrhizal carbon sequestration projects from three sectors:

- **Domestic Forestry Projects:** Reforestation stands mature in 45 years for Jack Pine, 90 years for Black Spruce, and 95 years for White Spruce. Net ERs from mycorrhizal inoculation over a rotation in the Canadian Boreal forest average 26.6 tCO<sub>2</sub>e/ha (SMART Report). As of April 2004, Mikro-Tek had inoculated 16.6 million seedlings in Canada for a total of 9,760 hectares, which will be held by the Carbon Pool to be available as insurance against loss from disease or fire, and to ensure permanence of stored carbon in all projects for 45 to 95 years.
- **CDM Forestry Projects:** Faster growing tree species with a year-round growing season mature in 10 to 25 years (e.g. Eucalyptus and Radiata Pine in Chile). Net annual carbon sequestration in afforestation projects can range from 15 to 88 tCO<sub>2</sub>e/ha depending on species and site conditions. As of April 2004, Mikro-Tek had inoculated 2.9 million seedlings in Chile and can readily ramp up projects there, and in other CDM eligible countries, to meet demand.
- **Soil Organic Carbon Projects:** Currently, under contract with Sustainable Development Technology Canada (SDTC), Mikro-Tek is collecting additional field data in the agricultural and reclamation sectors in order to qualify and verify the technology for increasing soil organic carbon sequestration. Projects in this sector will include agricultural crops across Canada as well as grassland restoration on mine sites and highway / pipeline / electrical transmission right-of-way corridors. These projects have the potential to sequester 166 tCO<sub>2</sub>e/ha for agriculture and up to 500 tCO<sub>2</sub>e/ha for reclamation applications.

**Benefits of aggregated projects:**

- Diversified portfolio minimizes risk (loss of one crop from weather, disease, fire, etc.)
- Designed to meet Canadian GHG Kyoto restrictions (i.e. CDM portion up to 5% of 1990 base year emissions)
- Portion of the CDM investment stays in Canada (i.e. utilizes Canadian technology)
- Reduces transaction costs by combining a number of projects over three separate sectors
- Domestic Forestry - long term carbon sequestration projects (50+ yrs)
- CDM Forestry - medium term carbon sequestration projects (10-25 yrs)
- Soil Organic Carbon - short term carbon sequestration projects (2-10 yrs)
- Permanence of long term carbon storage is ensured

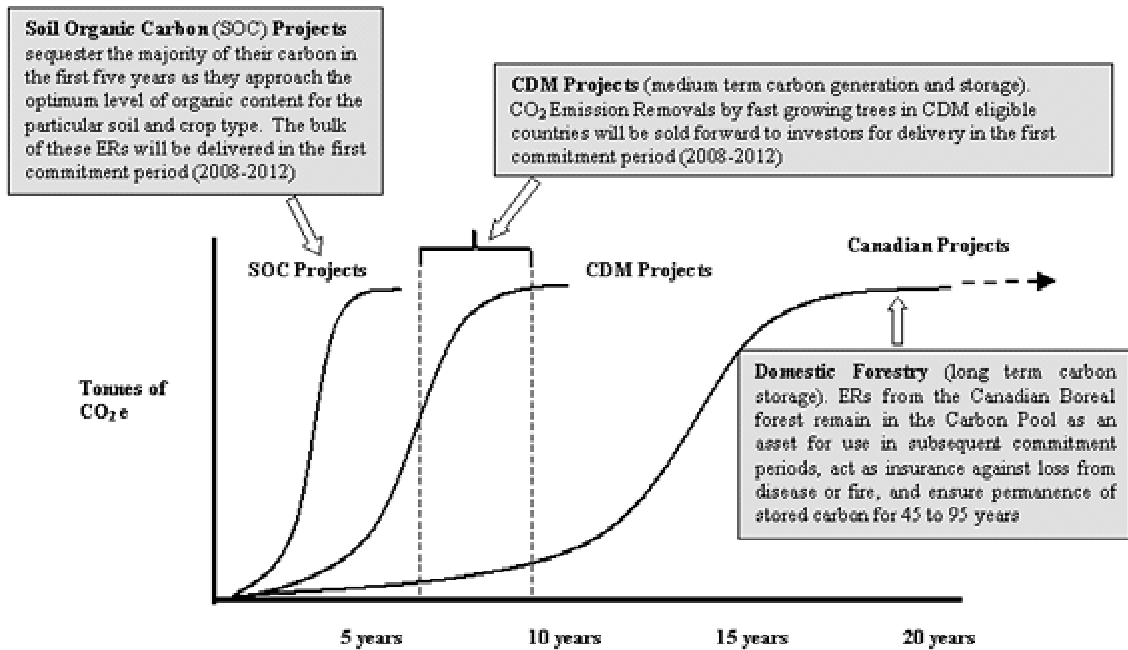
**Sustainable Development Benefits:**

In addition to increased carbon sequestration, Mikro-Tek's technology provides many other benefits that contribute to sustainable development. Increasing soil organic carbon (SOC) generally enhances plant productivity and soil quality. Higher levels of SOC improve soil structure, increase soil porosity and water holding capacity, and improve biological health of the soil, enhancing land sustainability, wildlife habitat and water quality. In most locations, especially environmentally sensitive settings, practices that increase SOC also result in decreased wind and water erosion which normally degrade soil carbon stocks further. Economic and environmental benefits also include reduced use of fertilizers (and the associated GHG emissions produced during their manufacture and application), reduced use of diesel fuel for farm machinery, increased crop yield, and in the forestry sector, increased timber or fibre production on a set land base.

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**C-Trade™ Current CO<sub>2</sub>e Assets**  
**April 2004**

Project Type	Species Planted	# Seedlings Inoculated	Hectares Planted	Total tCO <sub>2</sub> e Sequestered
Domestic Forestry (Canada)	Boreal Species	16,600,000	9,760	260,000
CDM Afforestation (Chile)	Radiata Pine	1,779,000	1,423	508,000
CDM Afforestation (Chile)	Eucalyptus	1,172,000	938	703,000
<b>Total tCO<sub>2</sub>e:</b>				<b>1,471,000</b>



**CO<sub>2</sub>e calculation notes:**

- Boreal species have been modeled for net emissions over a rotation at 23.5 tCO<sub>2</sub>/ha for jack pine, 24.7 tCO<sub>2</sub>/ha for black spruce, and 31.8 tCO<sub>2</sub>/ha for white spruce with rotation ages of 45, 90 and 95 years respectively.<sup>1</sup> For our estimations we used an average rate of 26.6 tCO<sub>2</sub>/ha and an average planting density of 1,700 seedlings per hectare.
- Eucalyptus species are reported to sequester 10-24 tC/ha/yr<sup>2</sup> (or, converted to CO<sub>2</sub> equivalent at 36.5 to 88 tCO<sub>2</sub>/ha/yr) and have an average rotation age of 12 years. For our estimations we use the midpoint of the range at 62.3 tCO<sub>2</sub>/ha/yr and an average planting density of 1,250 seedlings per hectare.

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- Radiata pine are reported to sequester 15-20 tCO<sub>2</sub> /ha/yr<sup>3</sup> and have an average rotation age of 20 years. For our estimations we use the midpoint of the range at 17.5 tCO<sub>2</sub>/ha/yr and an average planting density of 1,250 seedlings per hectare.

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<sup>1</sup> *An Assessment of Carbon Sequestration Benefits from Mikro-Tek's Mycorrhizal Inoculation Project*, in SMART Report for the Mikro-Tek TEAM, INT 024. Prepared by [Woodrising Consulting Inc.](#) for [Five Winds International Inc.](#), 2002.

<sup>2</sup> Marland G., and Schlamadinger, B. 1997. Forests for Carbon Sequestration or Fossil Fuel Substitution. A Sensitivity Analysis. *Biomass and Energy* 13 (6) 389-397. *Climate Change 2001 Mitigation*, IPCC.

<sup>3</sup> Personal communication, 2002. Aquiles Neuenschwander, Asesor Forestal, Fundación Para La Innovación Agraria (FIA), Chile