Climate Change Central

Tillage System Management - Alberta Protocol

Overview:

Carbon Offsets from Reduced Tillage in Alberta
This bulletin provides background and summarizes details of the Quantification Protocol for Tillage System Management in Alberta. An overview of Alberta's Regulatory Framework and Offset requirements are given in the Overview document.

Emission Reductions – Practices that Count:
The adoption of reduced tillage management results in slow rates of soil carbon gain through:

1. Reducing the rate of soil organic carbon decomposition by no longer incorporating crop residues into the soil and putting them in contact with soil microbes;
2. Improving residue management by retaining residues on the surface; and,
3. Improving crop yields over time through improved moisture content and increased fertility.

Further, fuel savings in reduced tillage systems result in less carbon dioxide ($CO_{2)}$ from combustion of diesel; and increased fertility rates through adopting reduced tillage usually result in less nitrous oxide (N_20) emissions from these systems. These are all accounted for in the Protocol – both for Reduced Tillage (RT) and for No Tillage (NT).

Because it's very difficult to confirm emission reductions for every combination of soils-climate-management and tillage system in the Prairies, pre-established coefficients of greenhouse gas (GHG) reductions per hectare for large regions have been established in the protocol. This greatly reduces the cost of entering the Offset System for farmers, and provides certainty for buyers and sellers in the marketplace**.**

Under the Alberta Offset System rules, Projects can claim credit back to 2002 onwards, if they meet the requirements of the system and protocols. There is no deadline for which to access these past tonnes. If a project developer/agriculture producer, wanted to wait a year to see how things evolve in the market, they could get involved a year from now and still gain credit back to 2002 if all requirements are met.

For reduced tillage projects under this protocol, the requirements are:

- Producing annual crops (non-irrigated)
- Confirmation of tillage practice on particular fields
- Affirmation by producers
- Farm records to show where tillage occurred

To claim offsets back to 2002, the above would need to be demonstrated in the Project documentation.

Coefficients of GHG gain:
Rates of carbon accumulation are also called factors, or, coefficients. **Default** coefficients for reduced tillage in Alberta are based on the scientific process used to develop Canada's National GHG Emissions Inventory Report (Environment Canada, 2006) for the Parkland and Dry Prairie regions. The default coefficients were calculated for Reduced Tillage (RT) and No Tillage (NT), relative to Full Tillage (FT) management (see link) for the Alberta system.

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A Flexibility Mechanism within the Protocol allows for the development of **customized** carbon coefficients for different soil zones in Alberta. These may be substituted for default coefficients if a series of rigorous, science-based requirements are met. Use of site specific factors that are 25% or greater more than the default factors will trigger a review by Alberta Environment.

Definitions

Reduced Till (RT)	Fall tillage limited to injection of manure or fertilizer with < 40%* soil disturbance, 1 to 2 cultivations on summerfallow.
No Till (NT)	Up to two passes with low-disturbance openers (up to 33%) or one pass with a slightly higher disturbance opener (up to 40%)*, discretionary tillage of up to 10%**, no cultivations on summerfallow, no fall tillage.

*Based on average opener width (below ground) divided by row or shank spacing of the implement.
**Up to 10% of the surface area of a single agricultural field may be cultivated to address specific management issues.

Default coefficients for reductions in N_2O emissions and energy use as a result of NT and RT relative to FT management were calculated similarly to the default carbon coefficient, as outlined in Haak et al. (2006).

Coefficient Adjustments:
A baseline coefficient adjustment takes into account the area of agricultural land that is currently under NT and RT management. An assurance factor is also included to account for the average risk of a field going back to tillage across all farms within each region. Default coefficients for the Parkland and Dry Prairie regions are listed below. When the total values are multiplied by market values of carbon dioxide equivalents (CO_2e), the value of the offset can be calculated on an area basis.

Table 1. **Default Coefficients to Multiply by Your number of Hectares or Acres**

Tillage Change	(Carbon sequestered	* Assurance factor ‡)	+ Nitrous oxide reduction §	+ Energy reduction ¶	= Total
			(T CO_2e per hectare per year)		
1) Parkland					
FT to NT	0.355	0.875	0.019	0.075	**0.405**
FT to RT	0.020	0.875	0.019	-0.010	**0.027**
2) Dry Prairie					
FT to NT	0.196	0.925	0.005	0.030	**0.217**
FT to RT	-0.018	0.900	0.005	-0.004	**-0.015**
			(T CO_2e per acre per year)		
1) Parkland					
FT to NT	0.144	0.875	0.008	0.030	**0.164**
FT to RT	0.008	0.875	0.008	-0.004	**0.011**
2) Dry Prairie					
FT to NT	0.079	0.925	0.002	0.012	**0.088**
FT to RT	-0.007	0.900	0.002	-0.002	**-0.006**

† Based on existing area of FT, RT and NT in Parkland and Dry Prairie areas (2001 Census), see Table A4 in protocol
‡ Accounts for risk of a field going back to tillage across all farms in a region (carbon only), see Table B1 in protocol
§ Account s for GHG reductions for reduced nitrous oxide emissions, see Table A4 in protocol
¶ Accounts for the GHG reductions for reduced fuel use, see Table A4 in protocol

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The Tillage Management Protocol differs in the credit duration period - the period of time for which the coefficients remain stable - from most other protocols in the Alberta system. The credit duration period for this protocol is set as 20 years due to the adjusted baseline approach. For these project types, the protocol of the day will be adopted every 10 years, and used for credit quantification over that associated period. If an approved protocol no longer exists at the end of any 10-year period, the last approved protocol will be used for the remainder of the credit duration period. This is not the same as a contracting period. The credit duration period simply gives the Project Developer some assurance as to how long the coefficients for quantification will apply. Most other protocols have an 8 year credit duration period, possibly renewable for another 5 years.

Some Practical Considerations:

Since emission reductions for tillage management on a per acre basis are small relative to the thousands of tonnes of CO_2e that buyers will be seeking, a large number of acres will most likely need to be bundled or aggregated for ease of management and reduced costs for offset sales. The specific acres for which emission reductions will be calculated must also be identified and registered. A number of private companies offer this service in Alberta (see www.carbonoffsetsolutions.ca).

Since Alberta's Climate Change Action initiative began in 2002, reduced tillage projects that have been in place since 2002 qualify as carbon offset projects. Offset projects that started before the current year are retroactive to 2002 and may be sold at any time. Producers may negotiate single or multiple years of carbon offset sales when signing an offset contract. Starting with small projects over a single year is a good way to learn about sales of carbon offsets in Alberta.

References:

Alberta Quantification Protocol for Tillage System Management and Guidance Document for Developing Custom Coefficients within the Quantification Protocol for Tillage System Management. 2007. at: http://www.carbonoffsetsolutions.ca

Environment Canada, 2006, National Inventory Report 1990 – 2004. Greenhouse Gas Sources and Sinks in Canada. Submission to the United Nations Framework Convention on Climate Change. 608 pp. at: http://www.ec.gc.ca/pdb/ghg/inventory_report/2004_report/toc_e.cfm

Haak, D. and Soil Management Technical Working Group for Canada's GHG Offset System. 2006. DRAFT of Tillage System Default Coefficient Protocol based on Canada's Offset System for Greenhouse Gases. Technical Background Document. 72 pp.