Development of Potential Offsets Related to Implementation of Precision Farming Techniques

Introduction

This paper explores the potential to develop meaningful carbon offsets through the implementation of precision farming techniques. Precision farming is defined as an integrated information- and production-based farming system that is designed to increase long term, site-specific and whole farm production efficiency, productivity and profitability while minimizing unintended impacts on wildlife and the environment.

Current application of precision farming techniques coupled with numerous national and international studies have documented reductions in the application of synthetic (nitrogen based) fertilizers and pesticides while realizing large reductions in fuel usage over traditional farming methods. These results can lead to significant reductions in the emission of greenhouse gases. Based on results from current implementation of precision farming techniques in Washington State and data gathered through university studies, the Agricultural Sector Carbon Market Workgroup (ASCMW) believes there is significant potential for the development of carbon offsets and greenhouse gas emission reductions as a result of the application of precision farming techniques.

Basis for Selection

Precision farming methodologies increase yields, protect the environment, and minimize the costs associated with the application of fertilizers, pesticides, and water. These activities have been shown to have impacts associated with the reduction of emission of greenhouse gases (mainly N_2O). N_2O entering the atmosphere as a result of the volatilization of unabsorbed nitrogen fertilizer accounts for one-third of the worldwide greenhouse gases produced by agriculture (1). According the USDA reducing overlap in fertilizer and pesticide applications on the 250 million acres of cropland used to produce major crops, petroleum-based fertilizer and pesticide costs could be reduced up to $1 billion annually. A 1,000-acre farm can save up to $13 per acre by using precision agriculture techniques (2) (7).

Use of precision farming methods also results in decreased use of fuel by avoiding unnecessary passes of farm machinery over fields or orchards. Practitioners of precision farming methods have reported significant reductions in fuel usage resulting in reduced emissions from the burning of fossil fuels (3).

Synthetic Fertilizer Application

In evaluating the offset potential for reduced application of synthetic (nitrogen based) fertilizers the ASCMW has confined itself to those activities resulting from application only. The manufacturing aspect and the potential offsets realized through reduced production are left to the industrial/manufacturing sector for consideration.

Numerous studies conducted by regional universities indicate that reductions of nitrogen fertilizer of up to 40% can be realized through the adoption of precision farming techniques (4). Based on 2007 estimates of synthetic fertilizer used in Washington State (5) this can amount to 79,758,088 Kg N or .2273

$MMTCO_2e$ direct emissions and .0253 $MMTCO_2e$ indirect emissions. While it may not be prudent to assume a 40% reduction across the state it is reasonable to assume that a significant reduction (15 – 25%) is realistic.

The methodology employed to derive both direct and indirect emissions is uniformly used across the United States to account for the contribution of synthetic fertilizers to total emissions from the agricultural sector. It provides for a simple and accepted method to determine changes in N_2O emissions related to changes in total fertilizer application. As a result, the offset value for a proposed project can be readily determined using application records provided an acceptable baseline is established.

Since N_2O emissions from synthetic fertilizer applications are conducted based on a growing year, the ASCMW believes that initial offsets developed as a result of precision farming techniques utilize records of application at the beginning of the 2008 growing year as a baseline (suggest *tons applied/acre*). This will allow for implementation of projects while addressing the July 1, 2008 date specified under Section 4(g) of EESB 2815. Progress is measured on an annual basis by comparing current year records (*tons applied/acre*) with the baseline. Minimum levels of performance will be dictated by project level or aggregate contracts.

Fuel Use

In evaluating the offset potential for reduced fuel use resulting from precision farming, the ASCMW has confined itself to considering only use of "red diesel". Red diesel is used only for the operation of on-farm machinery and is not subject to federal or state taxes. This provides for a clean distinction between fuel usages attributable to agriculture from that attributed to the transportation sector.

Implementation of precision farming techniques have been shown to result in significant reductions in diesel usage as a result of reducing or eliminating overlap in the application of fertilizers and pesticides. Additional savings are realized in the reduction of over irrigation and costs associated with pumping water using on-farm energy generation (it should be noted that Power generation originating from off-farm systems cannot be considered for offsets, due to "double counting" within the energy sector). National and international studies of the effects of precision farming indicate anywhere from a 30 – 50% reduction in fuel use over that realized using conventional farming methods.

As an estimate of potential carbon offset due to the reduction of diesel use consider 1000 gallons burned in the course of conventional farming results in the emission of 2760 Kg of carbon [6]. Reducing the fuel use by 30% as a result of implementing precision farming techniques cuts the carbon emission by 825 Kg or 2973 Kg CO_2e. This reduction would be considered valid for the purposes of creating a carbon offset.

In order to establish a baseline for fuel use it is logical to employ the same timelines and conditions specified earlier for synthetic fertilizers. Offsets developed as a result of reduced "red diesel" use in conducting precision farming should be based on a growing year, the ASCMW believes that initial offsets developed as a result of precision farming techniques utilize records of application at the beginning of the 2008 growing year as a baseline (suggest *gallons/acre*). This will allow for

implementation of projects while addressing the July 1, 2008 date specified under Section 4(g) of EESB 2815. Progress is measured on an annual basis by comparing current year records (*gallons/acre*) with the baseline. Minimum levels of performance will be dictated by project level or aggregate contracts.

Pesticide Application

Implementation of precision farming techniques results in pesticide reduction of up to 45% (NRCS). Given the source of many currently used pesticides is petroleum, there appears to be a significant potential for GHG reductions as a result in decreased use. However, currently it is difficult to quantify an overall reduction for pesticides for either manufacturing, or potential volitization as a result of application.

Each specific pesticide will have its own emission value based on specific characteristics and method of application. While there appears to be a potential of offset development as a result of reduced use, the ASCMW feels that sufficient data does not exist to enable quantification of the emission expected as a result of pesticide application. However, because the potential does exist for future offset development, consideration should be given to further data collection in the hope of developing future offsets.

Case for Additionality

The movement from traditional agricultural practices to precision farming practices entails significant investment on the part of the land owner willing to implement the necessary changes required to achieve reductions in CO_2e as a result of reducing application of N_2O emitting fertilizers and/or reducing the burning of fossil fuels. The generation of marketable offsets as a result of moving from traditional framing practices to precision practices, incentivizes this activity on a farm by farm basis (project specific assessment). This action is beyond what would be termed "business as usual" and therefore additional beyond the norm for the sector. To address the question regarding "business as usual" the ASCMW recommends that only those projects begun during the 2008 (date to be discussed) growing year forward be considered additional. Without the implementation of precision framing practices, there would not be reductions in key GHG's easily measurable and verifiable on a project specific basis. As a result the ASCMW strongly believes that the additionality test is met through implementation of the recommendations stated below.

Recommendations

General

PF-1 ***It is unlikely that any single operation will generate sufficient offsets to be marketable in a regional system; therefore the ASCMW strongly recommends that an aggregation system be put into place. This recommendation is made here but applies to all subsequent recommendations within this paper.***

PF-2 ***Offset credits are owned and marketed by either land owners or operators who are ultimately responsible for financial benefits and/or risks associated with that land.***

Synthetic Fertilizer Use

PF-3 ***Reduction in the use of nitrogen based fertilizers using the beginning of the 2008 growing season as a baseline are eligible for marketable carbon offsets in a regional cap and trade system.***

PF-4 ***Carbon offsets resulting from a reduction of nitrogen based fertilizer application shall account for both direct and indirect N_2O emissions and should be calculated (using at a minimum) 2008 IPCC Guidelines for Greenhouse Gas Inventories.***

Pesticide Use

PF-5 ***At this, time there the ASCMW finds insufficient data available to recommend offset development from reductions in pesticide use. Therefore, the ASCMW recommends further study of this potential activity for offset inclusion***

Fuel Use

PF-6 ***Reduction in the use of fuel for the purposes of developing marketable carbon offsets in a regional cap and trade system, shall only apply to "red diesel" used in the course of implementing precision farming activities using the beginning of the 2008 growing season as a baseline.***

PF-7 ***Conversion from gallons of "red diesel" used to CO_2e shall be based on US EPA factors for most appropriate engine and operation conditions.***

References

(1) Stern Review Report on the Economics of Climate Change, 2006

(2) USDA-NRCS, *Conservation Resource Brief-Energy Management,* Number 0608, February 2006

(3) Soil Conservation Council of Canada, *Global Warming and Agriculture – Fossil Fuel Use,* Volume 1, Number 3, January 2001

(4) Kruger, Chad *Integrating Precision Conservation Technologies to Increase On-Farm Nitrogen Use Efficiency-Final Report,* WSU July 2008

(5) Washington State Department of Agriculture, 2007 Fertilizer Sales Records

(6) Lal, Rattan, *The Societal Value of Soil Carbon Sequestration,* Presentation Ohio State University, 2004

(7) USDA, *USDA Energy Commitment and Highlights-USDA Renewable Energy Investments in Rural America,* Fact Sheet No. 0535.05, March 3, 2006