Recommendations for the Development of Agricultural Sector Carbon Offsets in Washington State

October 2008

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Glossary of Terms

ASCMW Agricultural Sector Carbon Market Workgroup – A committee composed of representatives from Washington State universities, state regulatory agencies, private land owners, agricultural organizations, and environmental organizations directed by the legislature to explore the potential for carbon offset development for the agricultural sector in a regional cap and trade system.

California Climate Action Registry A private non-profit organization originally formed by the State of California. The California Registry serves as a voluntary greenhouse gas (GHG) registry to protect and promote early actions to reduce GHG emissions by organizations.

Carbon Offset A term associated with mitigating carbon dioxide (CO_2) emission in one location by implementing an emissions reduction or carbon sequestration project (or practice) in another location. A carbon offset is the net reduction in CO_2 emissions resulting from the avoidance of a ton of CO_2.

Carbon Sequestration The net process of storing atmospheric carbon in a carbon sink. For example, terrestrial sequestration could result when carbon fixed in trees through aforestation, or plants and soil root masses, as a result of improved management practices that result in a net increase of carbon in the sink. (For example, carbon fixed through photosynthesis exceeding carbon dioxide release through plant respiration).

Co-Digestion The simultaneous digestion of a homogenous mixture of two or more substrates. The most common situation is when a major amount of a main basic substrate (for example, manure or sewage sludge) is mixed and digested together with minor amounts of a single, or a variety of, additional substrates such as food waste or the organic fraction of municipal solid waste (OFMSW). The expression co–digestion is applied independently to the ratio of the respective substrates used simultaneously.

CRP The Conservation Reserve Program – Provides technical and financial assistance to eligible farmers and ranchers to address soil, water, and related natural resource concerns on their lands in an environmentally beneficial and cost-effective manner. The program provides assistance to farmers and ranchers in complying with Federal, State, and tribal environmental laws, and encourages environmental enhancement.

CREP The Conservation Reserve Enhancement Program – A voluntary land retirement program that helps agricultural producers protect environmentally sensitive land, decrease erosion, restore wildlife habitat, and safeguard ground and surface water.

Dyed Diesel Fuel used in construction equipment and agricultural equipment only and prohibited for use on highways. The fuel is dyed so that regulatory agencies can easily enforce compliance to ensure that vehicles on the highway are not using the dyed fuel. Dyed fuel has no state and federal taxes imposed because vehicles using it do not use highways.

EQIP The Environmental Quality Incentives Program – Reauthorized in the Farm Security and Rural Investment Act of 2002 (Farm Bill) to provide a voluntary conservation program for farmers and ranchers that promotes agricultural production and environmental quality as compatible national goals. EQIP offers financial and technical help to assist eligible participants to install or implement structural and management practices.

ESSHB Engrossed Second Substitute House Bill

GHG Green House Gases – Temperature-regulating gases that form a blanket around the earth that traps heat from the sun within the earth's atmosphere, keeping the planet warm and habitable. "Global warming," or climate change, can occur when the concentration of atmospheric GHGs increases. Common green house gases include carbon dioxide (CO_2), Nitrous Oxide (N_2O) Chlorofluorocarbons (CFCs), and methane (CH4). The global warming potential of each of these gases differ significantly based on their radiative forcing properties. CO_2, the most common GHG, is assigned an index value = 1. Index values for CH_4 = 21; N_2O = 310.

MMV Abbreviation for the carbon contract administration processes known as Measurement, Monitoring and Verification. MMV can result in significant cost outlays to administer carbon contracts related to terrestrial sequestration (for example, no till, grazing/CRP, and reforestation/aforestation). MMV costs can exceed the market value of the carbon offsets, if sellers are forced to measure, monitor and verify actual field results of their management activity to create the offsets. For this reason, sellers of terrestrial-based carbon offsets have continued to support development and refinement of predictive modeling systems whose goals are to accurately duplicate the results that would be found from actual field measurements.

MTCO2e Metric Ton Carbon Dioxide Equivalent – Equates to 2204.62 pounds of CO2. This is a standard measure of amount of CO2 emissions reduced or sequestered. Carbon is not the same as carbon dioxide. Sequestering 3.67 tons of CO2 is equivalent to sequestering one ton of carbon.

N_2O Nitrous Oxide – A greenhouse gas produced by both natural and human-related sources. Primary human-related sources of N_2O are agricultural soil management, animal manure management, sewage treatment, mobile and stationary combustion of fossil fuel, adipic acid production, and nitric acid production.

OFMSW Organic Fraction Municipal Solid Waste – The portion of the municipal solid waste stream that may contain agricultural, food, yard waste, or paper in varying concentrations, sizes, and composition. It does not include non-organics, such as glass and metal.

Performance Based Contracts Carbon offset contracts that are based on actual performance achieved as measured by field testing or measurement models that determine actual amounts of carbon offsets accomplished through specific management practices that reduce emissions or sequester carbon. For example, farmers engaged in no till/Direct Seeding or Strip Till in highly productive farming regions with high rainfall and residue intensive crop rotations might sequester 1.0 Tons of CO2 per acre per year as a direct result of engaging in these cropping system practices. Whereas a farm in a low rainfall area with light, sandy soils, low organic matter, and limited viability of alternative rotation crops may only sequester 0.25 Tons of CO2 per acre per year from the same practices.

Executive Summary

In 2008, through ESSHB 2815, the Washington State Legislature directed the Department of Ecology to conduct an initial assessment of the potential for Washington Agriculture to develop and market carbon offsets or other credits as part of a regional greenhouse gas cap and trade system. To conduct that assessment the Agricultural Sector Carbon Market Workgroup (ASCMW), comprised of representatives from agribusiness, state agencies, universities, land owners, and environmental organizations evaluated four areas of interest: conservation lands, anaerobic digestion, precision agriculture, and soil carbon management on working lands.

The ASCMW *conservative* estimate is that Washington agriculture could provide 6.96 million metric tons of CO_2 equivalents annually as greenhouse gas emission offsets from the four areas under consideration. Currently offset development may occur as a result of greenhouse gas emission avoidance and terrestrial carbon sequestration through improved management of both working lands and set-aside conservation lands.

Agriculturally managed lands play a fundamental role in the global carbon flux – and currently represent a source of greenhouse gas emissions as well as a substantial *sink* of carbon (from both natural carbon pools and improvements due to prior management activities). Since agricultural production is essential to sustaining human population and subject to tremendous marketplace dynamics, and since greenhouse gas emissions from agriculture will continue to be unregulated unless it becomes an offset, improved agricultural carbon management must be *incentivized* in order to achieve wide-spread adoption of climate friendly practices. Incentivizing improved technologies and management practices is the most certain way to ensure additional reductions in agricultural greenhouse gas emissions as well as ensuring the permanence of the *existing sink* of carbon in agricultural lands which otherwise will continue to be or become new sources of GHG emissions. **In order to address this concern the ASCMW recommends that agriculture should be allowed to provide greenhouse gas emission reduction offsets into a regional cap and trade system.**

Three factors affect the extent to which offset projects may occur: (1) the rigor of offset project protocols and consequently the quality (hence marketability) of the offset projects, (2) the criteria by which offset projects must demonstrate additionality beyond business as usual, and (3) the degree to which the market incentive (carbon credit) ultimately enables producers to manage the risk associated with adopting improved practices and technologies. In order to address these factors, the ASCMW developed six guiding principles that are applied to all of the recommended potential offsets as specified in Section II of this document. In this set of recommendations, the ASCMW focused on the first two factors, by providing guidance and side-boards for how market protocols and public policy mechanisms could treat potential agriculture offset projects. The third factor is beyond the influence of the Workgroup and will

largely depend on the successful implementation of a mandatory, functional cap and trade system that allows offset projects.

In the following sections, the ASCMW has provided recommendations for how to enable Washington's producers to provide real, verifiable carbon emissions reduction offset projects into the marketplace in a way that will maintain the competitiveness of Washington State agriculture and will not put Washington's producers at a disadvantage. These recommendations maintain a balance between ensuring scientific validity and reasonable expectations for compliance that the ASCMW believes coincide with the intent of ESSHB 2815. Each focus area provides (1) an assessment of the rationale for emissions reductions, (2) criteria for establishing baselines for offsets, (3) criteria for measurement, monitoring and verification, (4) criteria for how to determine the additionality beyond business as usual for an offset project, and (5) a specific set of ASCMW recommendations. All recommendations achieved consensus agreement by the ASCMW with the exception of inclusion of dyed diesel for offset consideration (see Section III). Members and co-leads are listed on the inside front cover of this document.

> *While all Workgroup members have confirmed support for the recommendations contained here, Climate Solutions retained specific cautions and concerns, some of which are reflected as minority opinions throughout this document identified by italics and blocked paragraphs. Some workgroup members are primarily concerned about the role of offsets in proposed cap and trade systems, and the effect of offsets either to improve compliance cost and efficiency or to retard technology development for emission reductions by capped entities. The Workgroup therefore emphasizes that it is making recommendations to support bringing high quality agriculture sector offsets to the market, whereas it is making no statement about the* ***quantity*** *of offsets considered desirable in a cap-and-trade system.*

Overall, the ASCMW recommends:

- Agriculture should be allowed to provide greenhouse gas emissions reduction offsets into a regional cap and trade system in order to incentivize widespread use of climate friendly agricultural management practices.

- Additionality and baselines should be determined and established in ways that reflect the inherent variability and diversity of Washington agriculture.

- Reasonable expectations for measurement, monitoring, and verification should be established.

Due to the short time allotted for this process, the work of the ASCMW focused on areas perceived as having a high likelihood of potential to be offered as offsets into a cap and trade system. The ASCMW recognizes the need for critical discussions around additional policy options for carbon sequestration and GHG emissions reduction in the Ag sector, and encourages those discussions to occur whether by continuation of this workgroup or within another forum.

I. Setting the Stage – Agricultural Sector Carbon Market Workgroup

The agricultural sector in Washington State is identified, along with the forestry sector, as having the potential to provide carbon offsets or other credits within a state or regional cap and trade system. Offsets or other credits may be long or short term in duration depending on their acceptability within a regional carbon market. Given the proposed reductions for greenhouse emissions adopted by the Washington Legislature in ESSHB 2815 and/or those proposed by the Western Climate Initiative, the opportunity exists for a portion of that demand to be met with high quality carbon offsets or other credits generated through agriculturally focused projects.

In acknowledgement of this fact, the Washington State Legislature directed an analysis of the potential for these credits to be developed for voluntary participation in a cap and trade program. The recommendations were developed to ensure that the baseline does not disadvantage Washington State in relation to another state or states that may be part of the cap and trade program. These offsets or credits may be used by entities covered by the cap and trade program to meet their emission limits.

Methods used to generate offsets or other credits within the agricultural sector generally have co-benefits to the environment. Studies conducted by the federal government and universities focused on modifications to agricultural practices such as no-till, direct seeding, and conservation set-a-sides have been shown to result in an increase of stored carbon stocks in both soil and biomass. Precision farming and anaerobic digestion of animal manure or co-digestion of manure with the organic fraction of municipal solid waste have demonstrated the ability to reduce greenhouse gases such as nitrous oxide and methane, not only by emission reduction, but through the generation of electrical power and organic fertilizers.

Several areas within the agricultural sector exist for carbon offset exploration while providing environmental co-benefits. Those areas that diverge from the business as usual paradigm and hold the most promise from an implementation and verification standpoint have been the subject of review by the Agricultural Sector Carbon Workgroup. Based on these considerations, the ASCMW has elected to focus efforts on four of the six areas identified in 2007 by the Agriculture Technical Work Group of the Climate Advisory Team. They are:

- Management of Agricultural Lands Using Precision Management Techniques
- Agricultural Lands Set Aside or Managed for Conservation
- Development of Digester Systems to Manage Livestock and Agricultural Bi-Products
- Management of Agricultural Lands to Promote Carbon Sequestration

In evaluating each of these areas, the ASCMW has attempted to address as many existing concerns regarding offsets developed within a biological system as possible. As is the case with most biological systems, it is not always easy to directly measure inputs and outputs. In consideration of this fact, potential actions that may result in the generation of a carbon offset or credit must consider the ability for direct measurement of GHG's, or when it is necessary to rely on the application of models or other indirect methods that remove a sufficient amount of the uncertainty such that confidence is achieved within acceptable statistical limits.

The ASCMW has provided a series of consensus recommendations and one majority recommendation regarding not only the potential for offset development within the agricultural sector (subject to the conditions of the Washington State Legislature), but also the outline for protocols, by which development of carbon offsets or other credits within the agricultural sector may begin. Included in the products delivered by the ASCMW are recommendations for policy development or modifications that may be necessary to facilitate offset development while achieving a higher level of environmental protection and increasing the profitability of the agricultural sector with the intent to continue to build and develop practices that result in a reduction of greenhouse gases in all sectors within Washington State.

II. Guiding Principles for Development of Recommendations and Complementary Policy Statement

The following principles developed by the Agricultural Sector Carbon Market Workgroup are considered foundational and guided the development of all recommendations originating from the group and delivered to the Washington State Department of Ecology. These principles were deemed critical by the Workgroup in order to proceed with recommendations that are in conformance with ESSHB 2815, which requires that:

Recommendations developed for voluntary participation of agricultural lands and practices in an offset or other credit program in the regional multi-sector market-based system must ensure that the baseline does not disadvantage this state in relation to another state or states, and that the recommendations shall address agricultural products, including accounting for fossil intensive substitutes; agricultural land and practices; and agricultural lands set aside or managed for conservation as of, or after, the effective date of ESSHB 2815.

Guiding Principle One

The carbon market generated as a result of a regional multi-sector market based system will allow offset projects focused on reductions in N_2O, CH_4, CO_2 or other GHG emissions or increasing storage of carbon in soils.[1]

Guiding Principle Two

Offset projects that impact the emissions of more than one greenhouse gas will need to account for consequent changes (both positive and negative) in the emission of each gas. Negative changes (also known as leakage) should be considered within the context of an offset contract and discounted.

Guiding Principle Three

In all projects that may result in offset generation within the agricultural sector, additionality must be achieved by the implementation of management activities that result in a measurable increase in soil carbon content or a measurable reduction in GHG emissions beyond a project specific baseline. Reliance solely on changes in management practices without accounting for actual changes in soil carbon, or GHG emissions is not recommended.

[1] All emissions would be presented on a CO_2 equivalent basis.

Guiding Principle Four

Each potential offset derived from the agricultural activities specified under ESSHB 2815 must accept some level of uncertainty. The Workgroup acknowledges the critical nature for verification and measurability in striving to reduce uncertainty; however it believes that in order to promote offsets within a cap and trade system, initial projects must, to the greatest extent allowable, include a tolerance for uncertainty that will be reduced over time.

Guiding Principle Five

Potential offsets generated as a result of an agricultural sector project must have reasonable and valid requirements for measurement and verification. This should include reasonable and valid establishment of a baseline or baselines initially using project-specific assessment and moving toward a hybrid assessment approach. Such approaches will likely include the use of soil/crop process models. These baselines must not disadvantage the State of Washington. Measurement and verification in turn, ensure the recommended offsets are both real and enforceable.

Guiding Principle Six

The ASCMW recognizes that "permanence" for all potential Ag sector offsets is an issue that needs to be addressed. The ASCMW believes that it is more of a legal/policy determination than a technical determination, and that the best mechanism for addressing permanence is by assigning liability within the terms of the offset contract. Permanence can be addressed by requiring that GHG offset purchase contracts assign liability for sequestration reversals during the term of the contract to the seller, and that at the end of the contract the compliance buyer is responsible and liable for replacing the sequestration-based GHG offsets.

Complementary Policy Statement

A primary issue related to the development of offsets within major areas of the agricultural sector is its nonpoint source characteristic and the potential vast amounts of data currently required for validity and measurability. The amount of carbon sequestered in a field or region requires field measurement and monitoring, which potentially may exceed the financial benefits of an offset to a land owner. However, verification and measurability are necessary for any policies based on environmental performance.

In order to address the problematic nature of nonpoint offsets, there will be a need to utilize modeling approaches that can be applied in varied environmental and management conditions. Initially, depending on the extent to which the market will require validation and measurability, this model or models will need calibration that will entail the development of a database of site-specific soil carbon values. A discussion of relevant data development needs is contained at the end of each focus area.

In order to advance the availability of offsets within a cap and trade system, a complementary policy must be developed that addresses the short term need for offsets with a reasonable, cost-effective approach to achieving validation and measurability for projects. In view of this position the Agricultural Sector Carbon Market Workgroup recommends the following:

1) **Offset credits for projects using specific assessment methodologies to establish baselines and document progress shall be preferred. Site specific measurement of soil carbon will establish baselines and allow for documentation of subsequent soil carbon changes to quantify CO_2 equivalents units marketable for offsets.**

2) **Initial projects may use of regional default-based quantifications and a standardized approach to establish baselines and monitor progress. Projects utilizing default-based quantifications may be governed by a limited term and/or a discount factor applied to those initial credits (a discussion of the potential for confidence level tiers based on site-specific data quality is contained in the Ag Carbon section). During the term of the initial contract, emphasis should be placed on development of project specific data.**

3) **A carbon offset market for the agricultural sector in Washington State should move toward a hybrid approach to establish project baselines and measure progress as confidence is built in modeling capabilities and statewide data is collected through the development of project-specific assessments.**

III. Development of Potential Offsets Related to Implementation of Precision Farming Techniques

Introduction

This section 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.

Pilot 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. Practical application needs to emphasize a sound program of soil science (i.e. soil testing, and analysis) to determine what is optimal for specific situations and economics. This technology, field mapping, variable rate technology, precision placement, etc. being in its infancy stage has significant room for advancement and therefore increasing the value in reducing greenhouse gases in the future. These results can lead to significant reductions in the emission of greenhouse gases. Based on results from recent pilot implementation of precision farming techniques in Washington State and data gathered through university studies, the Agricultural Sector Carbon Market Workgroup 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 in emissions of greenhouse gases (mainly N_2O). N_2O entering the atmosphere as a result of the nitrification/denitrification of excess nitrogen fertilizer accounts for one-third of the worldwide greenhouse gases produced by agriculture.[1] According to the United States Department of Agriculture (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 US$1 billion annually. A 1,000-acre farm can save up to US$13 per acre by using precision agriculture techniques.[2]

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]

Implementation Approach and Mechanisms

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 significant reductions of nitrogen fertilizer application could be realized through the adoption of precision farming techniques.[4] Based on 2007 estimates of synthetic fertilizer used in Washington State, this can amount to 79,758,088 Kg N or .2526 $MMTCO_2e$ emissions.[5] 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.

Establishment of Baselines

As N_2O emissions from synthetic fertilizer applications are most commonly based on a growing year, the ASCMW believes that initial offsets developed as a result of precision farming techniques utilize records of application for the most applicable growing season as a baseline (suggest *tons applied/acre*) for potential projects.

Verification, Measurement, and Monitoring

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 dyed diesel. Dyed 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 those 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 excess 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.[2]

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 2.76 metric tons of carbon dioxide.[6] Reducing the fuel use by 30% as a result of implementing precision farming techniques cuts the carbon emission by 0.825 metric tons or 2.97 metric tons CO_2e. This reduction should be considered sufficient for the purposes of creating a carbon offset.

Establishment of Baselines

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 dyed 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 beginning with the most applicable growing season as a baseline (suggest *gallons/acre*).

Verification, Measurement, and Monitoring

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.

In making recommendations associated with the use of dyed diesel, the ASCMW is fully aware of the position of the WCI in regards to point of regulation. In respect to transportation fuel combustion, the September 23, 2008 WCI Design Recommendations Report states that point of regulation is determined to be where fuels enter commerce. Fuels, including dyed diesel, are scheduled to enter the capped sector in 2015 under the recommendations of the WCI. At that time, allowing credit for reductions in fuel use by the agricultural sector will result in double counting and therefore, would be ineligible of offset credit to the agricultural sector. However, because the high likelihood that offset credit could provide the “tipping point” for rapid transformation to precision agriculture technology prior to 2015, the ASCMW recommends offsets be allowed until the point at which a cap is enacted for [transportation] fuels.

Member Concerns Regarding Inclusion of Dyed Diesel for Offset Consideration

> *Climate Solutions would like to present a differing opinion on this matter. CS has previously commented to the WCI that the transportation sector should not be eligible for offsets during the first compliance period. The transportation sector accounts for almost half of Washington's greenhouse gas emissions and should be included as a sector regulated by the cap and trade program as soon as is technically feasible, believed to be 2012 at the commencement of the program. CS believes that making the sector eligible for offset credits prior to the second compliance period (2015) holds the potential to enact barriers to the sector's inclusion at all. CS has further concerns that offering offset credits to recognize reduced fuel use in the agricultural sector could encourage all users to apply for offset credits for driving less, which would delay policies to reduce emissions from the transportation sector and threaten the integrity of the limit on greenhouse gas emissions.*

Pesticide Application

Implementation of precision farming techniques can result in significant pesticide use reductions .[2] 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, at the moment it is difficult to quantify an overall reduction for pesticides for either manufacturing, or potential volitization as a result of application.

Each pesticide would 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.

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 greenhouse gas emissions 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" (BAU) and therefore additional beyond the norm for the sector. Only the documented reductions in CO_2

emissions compared to the baseline (for either N_2O or CO_2), would be eligible for offset consideration. Subsequent offset credits would only be generated if additional emissions reductions (beyond the initial project) were verified.

Policy and Technical Recommendations

General

PF-1 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.

Baselines

PF-2 Reductions in the use of nitrogen based fertilizers or dyed diesel beyond an established project specific baseline, using the most applicable growing season, should be eligible for marketable carbon offsets in a regional cap and trade system.

PF-3 Offsets for reductions in dyed diesel should be allowed until such time as the fuel becomes part of the [transportation] capped sector. See Climate Solutions' exception above.

Verification, Measurement, and Monitoring

PF-4 Carbon offsets generated by reducing nitrogen based fertilizer application shall account for reductions in N2O emissions and should be calculated (using at a minimum) 2006 IPCC Guidelines for Greenhouse Gas Inventories.[8]

PF-5 US Environmental Protection Agency (EPA) factors for most appropriate engine and operating conditions should be used to convert dyed diesel emissions to CO_2e.

Data Development Needs

The ASCMW finds that data quantification issues need to be addressed before recommending offset development from reductions in pesticide use. The ASCMW recommends further study of this potential activity for offset inclusion, and agrees that offsets should be offered where these issues can be overcome and meet standards.

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, C. and D. Huggins. Integrating Precision Conservation Technologies to Increase On-Farm Nitrogen Use Efficiency-Final Report to USDA NRCS, 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

(8) De Klein, Cecile, Novoa, Rafael S.A. et al, Chapter 11 N2O Emission from Managed Soils, and CO2 Emissions from Line and Urea Application, 2006 IPCC Guidelines for National Greenhouse Gas Inventories

IV. Development of Potential Offsets Related to Conservation and Grazing Lands

Introduction

This section explores the potential to develop carbon offset projects from voluntary landowner conservation programs. Historically, landowner conservation programs administered through federal, state, or private agencies such as the Conservation Reserve Program (CRP) and the Conservation Reserve Enhancement Program (CREP) have compensated landowners for establishing forests or grasslands on marginally productive agricultural lands or environmentally sensitive areas. The implementation of effective land management practices, especially through public or private stewardship programs, can in addition to enhancing water quality, wildlife habit, and landscape aesthetics, result in increased carbon sequestration.

Basis for Selection

In Washington, significant acreage is preserved and protected through enrollment in conservation contracts, leases, agreements or other similar mechanisms. In 2007, 1,539,250 acres of land were enrolled in CRP, 11,045 riparian acres were restored under the CREP, and considerable acreage was set aside for other public and private conservation programs and actions. Washington's Department of Natural Resources (DNR) leases approximately 1 million acres of grazing lands in Washington. Other publicly held and privately held grazing lands add several million additional acres.[1]

The carbon sequestration and greenhouse gas emissions reduction potential for Washington state lands enrolled in conservation programs varies by climate and soil type. Published sequestration potential ranges from a high of 0.5 tons/acre to a low of 0.1 tons/acre.[2,3]

Table 1: Published Ranges for Carbon Storage for Conservation/Grazing Lands

Conservation Activity	Published Sequestration Range	Source
CRP/Grassland Conversion	.397 Tons C/acre/yr .13 to .31 T C/acre/yr .1 to .5 T C/acre/yr	Consortium for Agricultural Mitigation of GHG Lal et al., 1999 USDA-NRCS, 2005
Rangeland Management	.13 to .22 T C/acre/yr .3 T/C/acre/yr .02 to .5 T C/arce/yr .3 to .7 T C/acre/yr	National Carbon Offset Coalition, Inc. USDA-ARS Dec 2001 Follet at al. 2001 Mayeux, Herman J. et al
CREP/EQUIP Lands	.1 to .3 T C/acre/yr	USDA / USEPA , Lal et al, 1999

The Washington State Department of Agriculture (WSDA) estimates 0.32 MMT of carbon or 1.13 $MMTCO_2e$ is sequestered yearly as a result of CRP, EQUIP, and CREP lands. It is estimated that through the implementation of progressive grazing management practices 0.3 to 0.7 tons/ac/yr C can be sequestered in soils.[4] Using only grazing lands leased through the Department of Natural Resources, 2.29 $MMTCO_2e$ potentially may be sequestered annually.

Washington State is entering a period when many of the terms of current agreements will be expiring at a time when global demand for agricultural production is increasing, and the landowners are expected to return to managing these lands for crop production. Contracts on approximately 40% of Washington's conservation lands will expire by 2010. As a result, there is a strong potential for carbon historically stored in these lands to be released – effectively establishing a new "business as usual" relative to carbon management. This release represents not only a reduction in the potential amount of carbon stored, but also in a new source of GHG emissions. Put into context, returning 15% of lands currently under CRP contract to active production could result in an emission release of 0.12 MMT CO_2e per year.

Implementation Approach and Mechanisms

Establishment of Baselines

In considering conservation lands and managed grazing lands as sources for potential carbon offsets, significant questions arise regarding baseline establishment. The establishment of a baseline from which to develop carbon offsets for nonpoint related activities within the agricultural sector has remained problematic. Generally, two types of mechanisms are considered when establishing these baselines: (1) those based on site-specific data collected for the purpose of establishing baselines for a project, as part of a survey, or for other purposes, or (2) those which involve use of regional data synthesized to arrive at an "average value" for soil carbon. The ASCMW considers baselines established which limit the level of uncertainty to be preferable to those based on regional averages. Baselines which utilize as detailed (and preferably quality assured) data as possible should be considered over those which are based on regional averages. Currently, there are two options available.

1) Initial baselines established using soil carbon data collected through comparative assessment of cropped acreage and conservation lands in near proximity to each other should be considered as the preference. This method provides a site based data set on which the changes in soil carbon can be measured, monitored, and verified.

2) The use of the Natural Resources Conservation Service (NRCS) Soil Survey Geographic (SSURGO) database can provide a data source from which to establish initial baselines for offsets derived from conservation lands. The range for soil organic matter contained in these data sets may serve as a baseline subject to the completion date of that

specific survey. There is a degree of uncertainty associated with use of this data given the fact that pertinent information is presented as a range, and depending on the completion data of the survey, that soil organic matter may be substantially outdated.

Verification, Measurement, and Monitoring

Verification, measurement, and monitoring of actual gains in soil and biomass carbon within conservation and managed grazing lands remains a subject of discussion among developers of cap and trade systems. Generally, the mechanisms used to address these subject areas through current voluntary programs are not sufficient for regulatory based systems which require reduced uncertainty for marketable offsets. These mechanisms rely on assumed soil carbon increased based on the adherence of specified practices.

However, more rigorous methods for reliably verifying, measuring and monitoring potential offsets derived from conservation lands do exist and have been implemented.[5] Future offset projects will benefit significantly through the use of site-specific data collection for both baseline establishment and soil carbon quantification, and will contribute to reliable models that are calibrated using data collected during initial projects. The goal is to move toward performance based contracts that rely on accurate modeling results instead of more costly paired plot (site-specific) sampling.

In the course of designing a VMM protocol it will be necessary to establish a statistical level of confidence for all data/modeling results. The ASCMW recommends a tiered approach that correlates confidence with percentage value of credits to incentivize the use of well-calibrated models. For example, full credit could be given for field/model results with greater than 90% confidence level, 75% credit for field/model results with greater than 75% confidence, and 50% for field/model results with less than 75% confidence level. Results with confidence levels below 50% would not be eligible for credit. To streamline the process for determining modeling confidence, a registry could be developed that approves various models with high, medium, or low level of confidence for zones with given soil, climate, and agronomic practices. [Further description of evaluating models is contained in section VI – Agricultural Carbon Management.]

Additionality

As stated in Part II, offsets developed as a result of developing conservation lands or implementing improved grazing practices must demonstrate an increase in soil carbon in order to be considered valid. This change must be beyond the determined baseline and must represent a change in business as usual (traditional farming and grazing practices). It is generally recognized that many agricultural activities, including establishment of conservation lands and enhanced grazing methodologies, do result in increased carbon sequestration both in above and below ground biomass/soil carbon. There is strong sentiment among members of the Agricultural Sector Carbon Market Workgroup that provided the guiding principles contained in Section II of this document are met and changes to business as usual management occurs. Offsets for conservation and grazing lands meet the additionality test.

Member Restatement for Emphases Regarding Additionality

> *Climate Solutions emphasize s that in order to meet the test of additionality, only that carbon sequestered that is beyond business as usual should be eligible for an offset credit. To preserve the integrity of the cap on greenhouse gas emissions, it is essential that any offset project is only credited for the surplus amount of carbon stored, that is, carbon stored beyond what would have happened in the absence of the offset project.*

Policy and Technical Recommendations

General

There exists a potential for the development of marketable carbon offsets resulting from conservation lands. There also exists a significant future potential for offsets to be generated from the implementation of progressive grazing practices. The co-benefits derived from conservation lands and potentially from grazing lands are significant in terms of environmental protection and habitat restoration. The fact that carbon sequestration also occurs as a result of this action should not preclude an affirmative determination of additionality. In consideration of the factors presented above, the ASCMW recommends the following:

CGL-1 Offsets should be developed for conservation lands. These lands must demonstrate continued increases in soil carbon levels to qualify for offset consideration. Future contracts must be revised to reflect carbon sequestration as a benefit.

CGL-2 Offsets should be developed for the voluntary conversion of actively worked agricultural lands to conservation lands as long as carbon sequestration is a recognized benefit and increases in soil carbon levels are demonstrated.

CGL-3 Current set aside lands that have more that five years left on the contract should be considered for offset development, provided that new commitments for carbon sequestration may be included as an amendment and increases in soil carbon levels are demonstrated.

CGL-4 Offsets should be developed for grazing lands provided scientifically defensible baselines can be established and increases in soil carbon levels can be demonstrated and verified.

Baselines

CGL-5 Baselines for offset projects related to conservation lands should use (in order of preference)

1) **Data collected as a result of a pair-plot approach**

2) **Data collected as a result of a NRCS SURRGO survey**

Verification, Measurement, and Monitoring

CGL-6 A minimum level of confidence associated with calibration and quantification methods should be established. The ASCMW recommends a tiered approach that may be employed to discount the value of the credit on the basis of the confidence level of the field sampling/modeling results.

CGL-8 Projects should be required to have third party verification to ensure that the appropriate contractual practices are performed.

Data Development Needs

1) Calibration/characterization of data relative to the impact of a given practice that can be used to calibrate a model. Initially intensive, site-specific data sampling is necessary to characterize the carbon dynamics for conservation lands compared to actively worked lands and lands under grazing management compared to both conservation and actively worked lands. To some extent, this data may exist via routine soil samplings that occur in large areas of the state (for example the Columbia Basin). Existing sources should be explored and aggregated into central database(s) to better establish baselines for both initial and subsequent projects.

2) Distributed or extensive initial soil carbon levels for agricultural lands that would be included in a carbon offset project. These could be sourced from generalized soil surveys, existing soil sample data, or could be collected with targeted sampling.

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V. Development of Potential Offsets Related to Anaerobic Digesters

Introduction

This section presents an assessment of the potential for meaningful carbon offsets from anaerobic digestion (AD) of dairy manure and co-digestion of dairy manure with other organic materials such as organic fraction municipal solid waste (OFMSW). AD is a biological process in which organic carbon materials are broken-down by anaerobic bacteria into a biogas consisting of methane, carbon dioxide (CO_2) and other trace gases. This carbon conversion at the commercial-scale leads to numerous advantages including odor, pathogen, and greenhouse gas emission reductions. AD operations present controlled, contained environments that support accurate measurement related to carbon emission offsets.

The US EPA estimates that approximately 3.5% of all US anthropogenic methane emissions results from dairy manure management. Methane emissions from dairy manure rose by approximately 50% between the years 1990 and 2005 primarily because of industry shifts towards more concentrated animal feeding operations that utilize manure handling systems. These systems are more susceptible to anaerobic conditions and methane release.[1] Numerous national and international studies of current AD technologies verify reductions in methane over conventional nutrient handling practices.[2,3,4,5] In addition to methane capture related to manure management, AD provides opportunities to:

- Capture methane related to co-digestion of OFMSW; and
- Displace CO_2 emissions through use of AD co-products, including generated electricity, pipeline-quality natural gas, transportation and boiler fuels, and conversion to other chemical forms (such as ammonia and methanol).

The Agricultural Sector Carbon Market Workgroup believes there is significant potential to develop permanent, real, additional, and verifiable GHG emission reductions from AD.

Basis for Selection

Because AD facilities are bio-refineries with the potential to produce diverse co-products, this section does not provide an exhaustive list of potential AD carbon offsets. Rather it examines those offset opportunities for which protocols exist and/or data is readily available. Since the following GHG reductions are beyond what would have happened in the absence of AD projects and are not required by regulation, the ASCMW believes they are additional and creditable.

Washington State has approximately 450 dairies consisting of 230,000 milking/dry cows, 74,000 heifers and 42,000 calves.[6] According to EPA, current AD technology is most effectively applied on dairies of 500 cows or more.[7] In Washington, 135 dairy facilities, comprising 166,757 cows and 50,088 heifers, have sufficient herd size to warrant immediate consideration.[8] Additional dairies could take advantage of AD technology through cooperation and clustering. Using the Intergovernmental Panel on Climate Change (IPCC) Tier 2 methodology for estimating methane emissions from liquid/slurry manure storage facilities, it is estimated that AD would reduce emissions by 2.75 MT CO_2e/cow/year.[9, 10] This translates into total avoided emissions of approximately 0.5 MMT CO_2e/year from Washington's 135 largest dairies.

Research at Washington State University (WSU) indicates that, compared to a manure-only AD baseline, co-digestion of OFMSW at an 18% volumetric flow rate increased biogas yield by 63%.[11] Additional research data indicate that this figure may be conservative since biogas production from co-digestion can increase substantially depending upon the type and volume ratio of OFMSW used as substrate. Assuming co-digestion diverts OFMSW from landfills, the baseline avoided emission rate is approximately 5.68 MT CO_2e/dry MT OFMSW digested.[12] This number, expanded for the 135 largest Washington dairies, yields an additional methane capture of 1.88 MMT CO_2e/year.[13] In addition to methane capture, co-digestion of OFMSW would remove approximately 0.33 MMT (dry) of waste from the landfills annually.

In Washington State, the current primary end-use of AD-captured methane is electricity production for the grid. AD-produced electricity avoids CO_2 emissions by displacing fossil fuel based electricity resources from the grid. The Northwest Combine Heat and Power Application Center's most conservative estimate for AD power production is 0.73 MWh/cow/year, yielding an energy production potential of 140,099 MWh/year from Washington's 135 largest dairies. Using the 2007 Climate Action Team (CAT) marginal emission rate of 0.5 MT CO_2e/MWh, AD on Washington dairies would provide a carbon offset of 0.07 MMT CO_2e/year from grid electricity displacement.[14] Assuming a 63% increase in biogas production from co-digestion with OFMSW, the carbon offset increases to approximately 0.1 MMT CO_2e/year.

Recovered nitrogen (N) and phosphorous (P) fertilizers are expected to be a primary co-product of AD projects. It is reasonable to assume that AD projects will extract 75% of phosphorus and ammonia nutrients from their effluent.[15] At this recovery rate, Washington's 135 largest dairies would be capable of recovering 4,128 MT P/year.[16] AD-recovered phosphorus is expected to be substantially equivalent to triple superphosphate (TSP) and serve as a direct replacement in the marketplace. Since Washington farms applied 15,556 MT P fertilizer inputs in 2001, AD-recovered nutrients would satisfy approximately 27% of on-farm market demand for non-manure P fertilizer.[17] TSP fertilizer production emits 1.1 MT CO_2e/MT P_2O_5.[18] As a direct replacement for TSP, AD-recovered P on Washington dairies would offset an additional 4,541 MT CO_2e/year. At the expected recovery rate of 75%, Washington's 135 largest dairies may be capable of recovering 33,425 MT N/year.[19] AD-recovered ammonium sulfate is expected to serve as a direct replacement for granular N fertilizers in the marketplace. Since Washington farms applied 176,000 MT of synthetic N fertilizer inputs in 2001, AD-recovered N from the largest 135 dairies represents approximately 20% of on-farm market demand.[20] The most common form of dry N fertilizer is urea, the production of which emits approximately 4.0 MT CO_2e/MT N. As a direct replacement for urea, AD-recovered N on Washington dairies would offset more than 0.1 MMT CO_2e/year.[21]

In addition to methane capture, electricity production offsets, and nutrient recovery, AD projects may realize embedded GHG reductions from:

- Combined heat and power energy applications;
- Fiber co-products that offset GHG emissions from peat-mining/soil amendment production; and/or
- Methane used as transportation and boiler fuels that offset fossil fuel-based CO_2 emissions.

While not quantified here, it is expected that GHG reductions related to the wide variety of bio-refinery co-products may accrue to the AD project according to the offset protocols applied.

Table 2: Summary of Selected AD Offsets

AD Activity	Offset Basis	Offset Potential
Manure Digestion	Captured Methane	0.5 MMT CO_2e/year
OFMSW Co-digestion	Captured Methane	1.9 MMT CO_2e/year
Electrical Generation	Displaced fossil fuel-based CO_2 emissions	0.1 MMT CO_2e/year
Nutrient Recovery	Displaced fossil fuel-based CO_2 emissions	0.1 MMT CO_2e/year
TOTAL		**2.6 MMT CO_2e/year**

Implementation Approach and Mechanisms

Establishment of Baselines

The issues of additionality and baseline establishment are closely related. A project "baseline" consists of GHG emissions that would be expected to occur in the BAU scenario in the absence of project activity. The ASCMW believes that, like assessments of additionality, the most credible baseline estimates will come from methodologies that include project-specific considerations. Baseline proposals in this section can be divided into two groups:

1. Manure Management and OFMSW Co-digestion baselines: Directly avoided emissions through methane capture.
2. End-use Baselines: Emissions avoided through various end-uses of previously captured methane and/or AD bio-refinery co-products. Offsets related to these end uses are not redundant, but result from carbon-beneficial use of captured methane and AD co-products.

Manure Management Baseline

It is generally acknowledged that standardized manure emissions estimates that ignore site-specific factors introduce large uncertainties into offset baselines. In an effort to establish credible baselines for methane emissions from conventional manure handling practices, EPA developed a methodology that improves upon standardized estimates by considering site-specific conditions, including (1) volatile solids (VS) available in the manure, (2) ambient lagoon temperature effects on microbial conversion kinetics, (3) management and design factors such as course solids removal, and (4) VS carry over during long-term storage.[22] In addition, the EPA methodology quantifies broader project emissions such as:

- Methane (CH_4) and Nitrous Oxide (N_2O) generated by the baseline manure management system;
- CH_4 that is generated by the project but not combusted by the project;
- N_2O generated by the project manure management system; and
- CO_2, CH_4, and N_2O emitted during any manure management system electricity generation and fuel combustion (including transportation in the baseline systems and the project).

While the protocol can be improved through greater attention to site-specific conditions and/or further study of manure management emissions, it is sufficiently project-based to yield a very credible baseline emission estimate.

OFMSW Co-digestion Baseline

Although the California Climate Action Registry (CCAR) is expected to publish guidance on baseline development in early 2009, no detailed protocol exists for offset development related to co-digestion of OFMSW.[23] In the absence of useful methodologies, two approaches to emissions avoidance from OFMSW co-digestion are used:

1. Assume that OFMSW has no CO_2 emissions impact and provide no carbon offset credit.[24]
2. Assume that all OFMSW is destined for uncontrolled anaerobic storage (landfill) and provide an offset accordingly.[25]

Neither approach, by itself, is adequate to determine a meaningful offset baseline related to co-digestion of OFMSW. The first fails to credit well-documented environmental gains from diverting OFMSW from landfills or other methane emitting end uses.[26] The second incorrectly assumes that all OFMSW is destined for landfill and, therefore, all methane capture from co-digestion is additional. In the absence of rigorous protocols, the ASCMW supports development of a protocol that includes project-specific assessment of:

1. The initial use from which the OFMSW was diverted (e.g., landfill); and
2. The characteristics, including methane generation potential, of the co-digested OFMSW.

Where scientific literature fails to accurately reflect actual emissions profiles of various wastes and/or their uses, primary data should be collected to ensure credible baseline development. Such a protocol would use reliable emissions data for the wide range of wastes and uses in order to establish project-specific baselines for OFMSW co-digestions offsets.

<u>End-use Baseline</u>

In addition to the baseline considerations already mentioned, potential GHG offsets exist from end use of AD-captured methane and the wide variety of AD co-products.

EPA recently established a protocol for offset development from four distinct end uses of AD-captured methane:

1. Generation of hot water or steam from boilers (onsite and offsite)
2. Generation of electricity (displacing onsite fossil fuel use)
3. Delivery of captured methane into a pipeline system or simple conversion to Compressed Natural Gas (CNG) or Liquefied Natural Gas (LNG)
4. Other direct uses—retrofits only (e.g., furnaces, kilns, engines, space heaters)—for various commercial and industrial uses, greenhouses, onsite leachate evaporation systems, and cooling.

The EPA protocol is thorough in its emissions quantification for these offset opportunities and should be used for offset development. However, the protocol fails to address offsets related to grid electricity, recovered nutrient fertilizers, and other AD bio-refinery products.[27]

Grid electricity production by any AD project is metered and directly measurable, however numerous approaches exist for determining the emissions offset for electricity production. Chicago Climate Exchange (CCX), for example, calculates energy offsets at a rate of 0.4 MT CO_2e/MWh electricity generated based on a default offset rate of a typical gas combined cycle power plant.[28] CDM provides mechanisms to determine project-based, region-specific offset rates.[29] The Climate Action Team energy offset rate of 0.5 MT CO_2e/MWh takes regional grid resources into consideration.[30] However, according to the Northwest Power and Conservation Council, higher CO_2 emission costs will result in coal-fired resources being the marginal resource more hours of the year, which would yield a higher offset rate for marginal renewable resources in the Northwest.[31] In addition, certain biomass energy sources, such as AD, are not intermittent resources and may be appropriately classed as base load rather than marginal. As base load power, AD projects may displace standalone coal-based power at a rate of approximately 1 MT CO_2e /MWh.[32] The ASCMW believes that development of standardized offset rates without attention to actual, project-specific power resource displacement puts Washington State at a disadvantage to other states. Offset rates developed by CAT should be reviewed in light of:

1. Recent studies/data, to include consideration of the increasing presence of coal-fired resources in the marginal power mix; and
2. Designation of non-intermittent renewable power, such as AD, as base load power.

No protocols exist for developing carbon offsets related to the wide variety of AD bio-refinery co-products, including recovered nitrogen and phosphorus fertilizers that displace fossil fuel-based products, fiber co-products that displace peat-mining emissions, and methane transportation fuel that displaces petroleum fuels. Like grid electricity metering, many AD co-products are easily quantifiable because of the closed, controlled-conditions of AD facilities. Moreover, the carbon benefit from various co-product end uses is expected to be real and verifiable. The ASCMW acknowledges that offsets from some bio-refinery co-products may not be creditable, depending on the cap and trade framework adopted by Washington State. However, these co-products may represent permanent, real, additional, and verifiable carbon reductions. Wherever these products are creditable within the accepted cap and trade framework, protocols should be developed and/or expanded to address to include the climate benefit from these important opportunities.

Member Concerns Regarding End-Use Methane

> *Climate Solutions has concerns about providing offset credits for end-use of captured methane to displace fossil fuels for electricity and transportation. CS is very supportive of crediting the methane captured by the process outlined above, but Climate Solutions does not think it is necessary to credit the selling of methane into the market, since there is already a strong financial incentive to sell such a product. It is our understanding that a Renewable Energy Credit (REC) can be issued for such a product, which we are supportive of, but do not think usage of captured methane is an eligible offset project.*

Verification, Measurement, and Monitoring

Verification, measurement, and monitoring approaches depend on the baseline approach used, as discussed above.

Additionality

Tests for the additionality of any particular project range from broad eligibility rules to specific, project-based determinations.[33] Regional Greenhouse Gas Initiative (RGGI), for example, includes broad eligibility rules: AD projects located on farms with 4,000 or more cows in states with an AD market penetration rate of greater than 5% are declared to be "business as usual" and, therefore, non-additional.[34] In contrast to the RGGI approach, project-based approaches such as the Clean Development Mechanism (CDM), created by the Kyoto Protocol, recognize that BAU scenarios differ from region to region due to localized economic, technological and regulatory barriers to development.[35] Consequently, the CDM provides multiple pathways to additionality. First, the mechanism applies two preliminary tests:

1. *Investment Test*: Is the project economically feasible in the absence of offset credit revenue?
2. *Barrier Test*: Are any significant barriers to implementation (such as local resistance to new technologies and local obstacles to feedstock procurement) overcome by offset revenue?

If the project passes *either* initial test, CDM applies a "common practice" (or BAU) test as an ultimate credibility check. Typically, "common practice" tests compare the emissions performance of a new project to that associated with BAU technologies/activities: if a project does not achieve greater emission reductions than other technologies/activities, it is not considered additional. The CDM application of this test differs somewhat: the mechanism identifies other technologies/activities operating in the region that are similar to the new project's activity, and considers whether those activities faced barriers or enjoyed benefits that were not applicable to the new project in order to make an additionality determination. In this way, the CDM ensures credible assessment while recognizing that simplified BAU tests may exclude creditable projects from offset development. Acknowledging the importance of such project-specific considerations, the ASCMW believes broad eligibility rules may artificially constrain AD project development and project-specific approaches should be used. The ASCMW is not advocating a novel approach to additionality. Rather, it supports use of proven, project-based mechanisms.

Regulatory Uncertainty Related to AD and AD Co-digestion

Regulatory uncertainty creates barriers to project development and investment. Currently, how federal, state and local air quality, water quality, and solid waste regulations apply to AD lacks clarity. Depending on their application to livestock facilities, EPA air quality regulations may support or hinder AD development. Washington State agencies have overlapping and potentially conflicting responsibilities and regulations related to AD. And local health jurisdictions may apply state solid waste regulations dramatically different from county to county. Agencies are working together, beginning to describe regulatory approaches to AD and AD co-digestion of OFMSW. However, if Washington State is to realize offset opportunities related to AD in the near term, regulators and policy makers at all levels must provide regulatory clarity and consistency.

Policy and Technical Recommendations

General

AD-1 Regulatory programs related to AD carbon offset development should revise protocols whenever scientific advancements demonstrate that existing protocols are inadequate to establish AD baselines reliably.

AD-2 Carbon offsets from methane capture related to manure AD and OFMSW co-digestion should be creditable.

AD-3 Carbon offsets from certain AD co-products, including recovered nutrients, transportation fuels, (see above comment) and soil amendments should be creditable to AD projects, depending upon the cap and trade framework.

Baselines

AD-4 Baselines for offset projects related to manure management AD should be developed using EPA "Climate Leaders Greenhouse Gas Inventory Protocol Offset Project Methodology for Project Type: Management Manure with Biogas Recovery Systems."

AD-5 Baselines for offset projects related to AD co-digestion of OFMSW should include:

1) **Project-specific determinations of the initial use from which OFMSW was diverted in order to determine OFMSW offsets reasonably; and**
2) **The characterization of OFMSW materials and their expected methane production.**

AD-6 Baselines for offset projects related to certain AD-captured methane end use (not including grid electricity displacement) should be developed using EPA "Climate Leaders Greenhouse Gas Inventory Protocol Offset Project Methodology for Project Type: Captured Methane End Use."

AD-7 The State should review how the marginal emissions rates for renewable electricity are applied to AD electricity production for the grid:

1) **Increasing presence of coal-fired resources in marginal power mix; and**
2) **Designation of non-intermittent renewable power, such as AD, as base load power.**

Verification, Measurement, and Monitoring

AD-8 Protocol development should consider the full range of real, additional and verifiable carbon offsets available through AD application, including co-products such as recovered nutrients, transportation fuels and soil amendments.

Member Comment AD-8

Coal not increasing in WA or west coast states, AD power should get recognition but not offsets.

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VI. Development of Potential Offsets Related to Agricultural Carbon Management (ACM)

Introduction

This section explores the potential to develop meaningful carbon offsets in conjunction with voluntary agricultural carbon management practices that increase the stored pool of carbon in soils and vegetation. Historically, traditional soil management has "oxidized" native soil carbon, emitting it to the atmosphere as CO_2. Improved management approaches can reverse this trend and restore atmospheric carbon to soils.

Basis for Selection

Over 15 million acres of land is managed by Washington farmers and ranchers, more than half of which is dedicated to a crop production system (including fallow).[1] In aggregate, these lands represent a substantial potential "sink" for atmospheric carbon that could help the state achieve its statutory greenhouse gas emission reductions. In addition, the Department of Ecology's *Biomass Inventory*[2] estimates 16.9 million dry tons of under-utilized organic material in the state, an increased fraction of which could be applied to agricultural lands as a variety of products which can increase soil carbon levels.

The balance of soil organic matter (sequestered carbon) is a function of carbon inputs, residue management, and disturbance. Traditional agricultural management practices such as inversion tillage and residue burning/removal have reduced native soil carbon pools in many soils by at least 50%. Improved understanding of soil carbon dynamics and improved soil management practices/technologies make it possible to reduce losses of soil carbon to the atmosphere and increase the sequestration and storage of atmospheric carbon in soils and vegetation. These management approaches include "direct-seeding" (such as reduced tillage and no-till), improved cropping rotations, application of organic residuals (such as composts, biochar, and digested manure), improved residue management, and use of cover crops. The use of these types of agricultural carbon management strategies under the right conditions and in the right combination will increase the pool of carbon stored in soils/vegetation relative to conventional management approaches.

Using a *conservative* rate of 217.2 Kg C sequestered/acre/year for dryland, reduced tillage grain production from the low rainfall region of Washington,[3] use of improved carbon management practices on 1 million acres (<15% of cropped land) could result in sequestration of 0.69MMTCO_2e annually. Sequestration rates as high as noted in the following table have been reported, indicating substantially higher soil carbon storage potential than used for the ASCMW baseline.

Table 3: Reported Carbon Sequestration Rates

Crop/Zone	Sequestration Rate
Dryland, no-till grain production higher rainfall zones of Eastern Washington	257.2 Kg/acre[4]
Mustard green manure cover crop in an irrigated potato rotation in Central Washington	315.7 Kg/acre[5]
Irrigated switchgrass production in Central Washington	1065.5 Kg/acre[6].

Implementation Approach and Mechanisms

Establishment of Baselines

Washington's agricultural soils have tremendous variability due to numerous factors including parent material, agri-climatic zone, and management. Accurate initial soil carbon baselines for a site are critical for accurately estimating the potential soil carbon sequestration, regardless of the practice or management system of interest. Existing, generalized [state/region-wide] estimates /inventories of initial soil carbon levels do not provide accurate and reliable baselines for estimating soil carbon offset projects. For instance, soil organic matter levels in existing soil survey databases are usually reported as a range for a given soil type. The resulting estimate of potential soil carbon storage – assuming the same site, management practices and climatic conditions – can be positive [carbon stored] or negative [carbon lost] depending on whether the lower or higher initial value is used. For instance, a simulation using *C-Farm*[7] for a no-till winter wheat-based crop rotation in Colfax, Washington resulted in a gain of 304.4Kg/CO2eq/acre/year or a loss of 117.4 Kg/CO2eq/acre/year depending on whether the higher (3.43%) or lower (1.60%) soil organic matter level from the NRCS STATSGO database was used as the initial baseline value. While an "average" of the range may prove to be useful for the purpose of a state-wide inventory and/or estimate of soil carbon sequestration potential, it may seriously over or under-represent the actual results for a specific carbon-offset project.

More accurate baseline data does exist for several sites/cropping systems – generally associated with studies by Washington State University or United States Department of Agriculture scientists – and further efforts are being made to supplement the database.

Additionally, many producers have long-term soil data sampled from their own fields as part of their fertility management program [generally less than 1 ft depth] that may contain soil organic matter estimates – though this information is not in the public domain. As carbon market opportunities emerge, it is expected that an accurate baseline database for the state can be developed through a combination of public and private data sources. Having accurate, initial soil carbon levels is critical to documenting whether carbon is actually being stored in a given field, based on the set of practices being used. While generalized numbers can be useful for early carbon offset projects, the need for developing a robust database of initial carbon levels is essential for ensuring long-term viability of carbon offset projects.

The ASCMW also believes that an appropriate initial date needs to be established as a baseline date after which carbon offset projects can be marketed. Carbon stored after a baseline date should be eligible for credit providing existence of sufficient defensible and verifiable data that does not disadvantage Washington State in relation to another state or tribe.

Verification, Measurement, and Monitoring

The ability to affect [increase or decrease] carbon pools in the soil and vegetation is a well-documented phenomenon in the scientific community.[8, 9, 10, 11, 12] As the understanding of the specific impacts of management on carbon pools has evolved, sophisticated models have been developed to simulate and predict the effects of a management practice. Given a sufficient time horizon and accurate parameters (including initial soil carbon levels), models can provide accurate and useful estimates of the average changes that a given practice(s) will have on the soil carbon pool on an annual basis.[13] In fact, with sufficient available input parameters, models are far more accurate at predicting changes in the soil carbon pool for a specific site than using existing, regional carbon storage rate tables.

There are several approaches to verifying confidence in soil carbon model outputs. The conventional methodology for ensuring the accuracy of model outputs is to have sufficient long-term, site-specific data for calibration and corroboration (calibrated models compare a simulation to site-specific data). Model performance can be evaluated using sensitivity indicators, such as root mean square errors (RMSE), the ratio of RMSE to the observed mean (an indication of the relative magnitude of the error), and the Willmott index of agreement.[14] Each of these indicators provides a quantitative measurement of confidence that can be used to determine whether the model will reliably predict the management impacts of a project under similar conditions as the site-specific calibration data. The greater the availability of calibration data, the greater the confidence will be in the accuracy of modeled outputs. In the absence of site-specific calibration data, the use of two or more models to simulate the effects of management can improve the confidence in the modeled outputs.

The ASCMW recommends a tiered approach that correlates confidence with percentage value of credits to incentivize the use of well-calibrated models. For example, full credit could be given for field/model results with greater than 90% confidence level, 75% credit for field/model results with greater than 75% confidence, and 50% for field/model results with less than 75% confidence level. Results with confidence levels below 50% would not be eligible for credit. To streamline the process for determining modeling confidence, a registry could be developed that approves various models with high, medium, or low level of confidence for zones with given soil, climate, and agronomic practices.

Models can also be used to estimate the impact of applying organic residuals such as manure, composts, biochar, and biosolids, so long as sufficient data exists to characterize the material (such as decomposition and mineralization rates). Efforts to document the impact of several types of materials are underway or previously published.

Additionality

The ASCMW is aware that the issue of additionality related to agricultural carbon storage offset projects is highly controversial, and in spite of extensive efforts to define the theory it remains unsettled in practice in regional, national, and international policy discussions. In principal, a practice is considered to have "additionality" if it otherwise would not have happened under a "business as usual" case. However, determining additionality for agricultural carbon management practices can be difficult because:

1. The inherent variability of agricultural soils and enterprises between regions and within a region;
2. Most "climate-friendly" agricultural management approaches are used [or not not used] for many additional reasons beyond the potential for reducing GHG emissions or storing carbon; and
3. Changing a specific practice / technology is only one [necessary] factor in a set of conditions that lead to increasing soil carbon storage.

The goal of determining additionality *should be* to ensure that offset projects are resulting in *actual increases of carbon storage above and beyond business as usual*, and not simply the adoption of a prescribed technology or practice. Several methods for determining additionality for offset projects have been proposed and are described at length elsewhere.[15] Generically applying these universal tests to determine additionality for agricultural carbon management practices in Washington State, without giving due consideration to the particular conditions of the region [and within region] or context of the agricultural production system, could dramatically reduce the potentially available agricultural carbon offsets our farmers could provide into a regional carbon market mechanism, and may put Washington farmers and ranchers at a disadvantage to others.

The use of any improved carbon management approach is not regulated, and the decision to use a given management approach is often determined by evolving economic, technical or biophysical conditions (such as increased weed or disease pressure, cost or efficacy of chemical herbicides, and risk). The initial adoption and continuation of an improved carbon management practice represents a voluntary [and often substantial] risk assumed by the producer. While there may be many other benefits of a practice, the larger context of risk may dictate that the best management decision is to revert to conventional management in the absence of an incentive to continue the improved practice, consequently undoing the carbon offset benefit. For instance, organically managed orchard land (a practice that could have carbon implications due to the application of organic amendments such as compost) in the state has oscillated due to volatility in the market demand for organic apples. The goal of providing measurable, verifiable carbon offset credits is to help provide the incentive to the producer to continue the use of management that result in the actual storage of additional carbon over time in spite of the larger context of risk. Artificially determining additionality on the basis of the adoption of a practice or technology does not reflect the reality of the decision-making framework that a producer uses. Many of the improved carbon management practices of interest in our region have higher costs and risk due to technical, biological or market-based barriers.

A number of progressive Washington farmers have voluntarily accepted the risks of adopting improved carbon management practices, leading to early action that has resulted in increasing the stored pool of carbon in the soils they manage. Much like the conservation set aside lands described earlier in this ASCMW document, this represents a potential source of new emissions if these lands revert to business as usual management. Prohibiting these early actors from participating in future carbon offset projects through a “practice-based” determination of additionality would reduce the potential incentives that would avoid the release of carbon stored through early action. Determining additionality on the basis of actual carbon being stored incentivizes these producers to continue using management approaches that increase carbon storage, indirectly avoiding the release of previously stored carbon.

Technology and/or practices that are utilized to sequester carbon in soils or vegetation can have consequent impacts [positive and negative] on direct and indirect emissions of other GHG’s (ie. leakage). For instance, use of no-till technology is generally associated with a reduction of fossil fuel related emissions due to decreasing the number of passes across a field. Also, the use of no-till or organic management (or other carbon management technology) *may, in some cases,* actually lead to marginal increases in nitrous oxide emission due to the stimulation of greater soil microbial activity. To the extent possible, based on the state of the existing science, efforts should be made to add or discount the consequent impacts (leakage) of a carbon management practice to reflect an accurate picture of the change in full carbon accounting for a system.

Member Restatement for Emphases Regrading Additionality

> *Climate Solutions adds that in order to meet the test of additionality, only that carbon sequestered that is beyond business as usual should be eligible for an offset credit. To preserve the integrity of the cap on greenhouse gas emissions, it is essential that any offset project is only credited for the surplus amount of carbon stored, that is, carbon stored beyond what would have happened in the absence of the offset project. The state should look at developing other programs, outside of cap and trade, to reward farmers who have previously adopted carbon sequestering practices to fully reward and incentivize their continuation of these practices while still strictly preserving the environmental integrity of the cap on greenhouse gas emissions.*

Policy and Technical Recommendations

General

There is great potential for agricultural carbon management offset projects to contribute substantially to the state's goal for reducing greenhouse gas emissions.

ACM-1 **Ag Carbon offset projects should be allowable for any set of practices / technologies that lead to the actual storage of carbon in soils or long-term vegetation, given that they are additional, measurable and verifiable. Practices /technologies include, but are not limited to: "Direct-seeding" (no-till, reduced till, high-residue), use of cover crops and/or perennials, improved residue management (including residue end uses), and the application of organic residuals (such as compost, biosolids, manure, and biochar).**

Baselines

ACM-2 **Early carbon offset projects should be allowed to use either generalized and/or published initial soil carbon data in combination with site-specific initial soil carbon data to the extent possible for establishment of soil carbon offset projects.**

ACM-3 **Development of a state-wide database of initial soil carbon level data that utilizes both intensive research-based site studies as well as more extensive private-domain data should be encouraged to improve the accuracy of offset project estimates over time.**

Verification, Measurement, and Monitoring

ACM-4 **The use of soil/plant/agroecosystem models in combination with a reasonable expectation for site-specific soil sampling to validate/corroborate the model outputs (including baselines for initial soil carbon levels) should be considered a reasonable methodology for estimating and measuring soil carbon offset projects. A tiered system should be employed that discounts the value of the credit on the basis of the confidence level of the modeling results.**

ACM-5 **Efforts to develop primary data to calibrate models to document the carbon storage impacts of land-applied organic materials should be encouraged.**

ACM-6 **Projects should be required to have third party verification to ensure that the appropriate contractual practices are performed.**

Additionality

ACM-7 **The determination of additionality should focus on whether additional carbon is stored, not whether a particular practice / technology is adopted.**

ACM-8 **The determination of additionality should be applied on a project-specific basis to ensure accurate, equitable assessment of the individual characteristics of a project.**

ACM-9 **The determination of additionality should account for regional variability, as well as changes in the larger agricultural management context that drives on-farm decision-making, rather than artificial or universal determinations**

ACM-10 **The determination of additionality should incentivize all agricultural management that increases carbon storage in soils over a site-specific soil carbon baseline.**

ACM-11 **Consequent impacts on other agricultural greenhouse gas emissions (such as leakage) due to the implementation of an agricultural carbon storage project should be credited or debited to the project accordingly.**

Data Development Needs

There are two types of data development needs relative to agricultural carbon offset projects:

1) Calibration/characterization of data relative to the impact of a given practice that can be used to calibrate a model. For instance, intensive, site-specific data sampling is

necessary to characterize the carbon dynamics for a specific cropping system/practice/ organic amendment. Extensive sampling data exists for high-rainfall dryland cropping systems and to a lesser extent low-rainfall cropping systems, and the west side. Extensive sampling exists for some irrigated cropping systems. Additional sampling is targeted for improved pasture in low-rainfall conditions, improved irrigated cropping systems, and orchards. Efforts are underway to systematize the availability of existing calibration data.

2) Distributed or extensive initial soil carbon levels for agricultural lands that would be included in a carbon offset project. These could be sourced from generalized soil surveys, existing soil sample data, or could be collected with targeted sampling.

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