

# **DELIVERABLE D54: TASK 5 – TERRESTRIAL FIELD VALIDATION TEST REGIONAL TECHNOLOGY IMPLEMENTATION PLAN**

Final Report

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## TABLE OF CONTENTS

LIST OF FIGURES .....	ii
LIST OF TABLES .....	ii
EXECUTIVE SUMMARY .....	iii
INTRODUCTION .....	1
CARBON TRADING .....	3
Carbon Offsets.....	3
Allowances .....	3
CARBON MARKETS.....	3
Market Participants .....	4
Voluntary Market Demand.....	5
Retail.....	6
Investment.....	6
Industrial .....	7
BUSINESS PROCESSES FOR TERRESTRIAL OFFSETS .....	7
Project Development .....	7
Project Design Document.....	7
Carbon Quantification and Estimation .....	9
Default Equations.....	11
Project Validation and Verification .....	11
Monitoring .....	12
Registries .....	13
Carbon Offset Standards.....	15
Project Capital .....	17
Aggregation.....	18
Program Marketing .....	18
Landowner Perspective .....	19
Conservation Easements .....	21
Best Management Practices .....	22
Carbon Offset Sales.....	24
Risk Management .....	24
Legal Instruments.....	25
Project and Credit Tracking .....	26
TERRESTRIAL OFFSET MARKET CHALLENGES .....	26
Preservation.....	26

Continued . . .

## **TABLE OF CONTENTS (continued)**

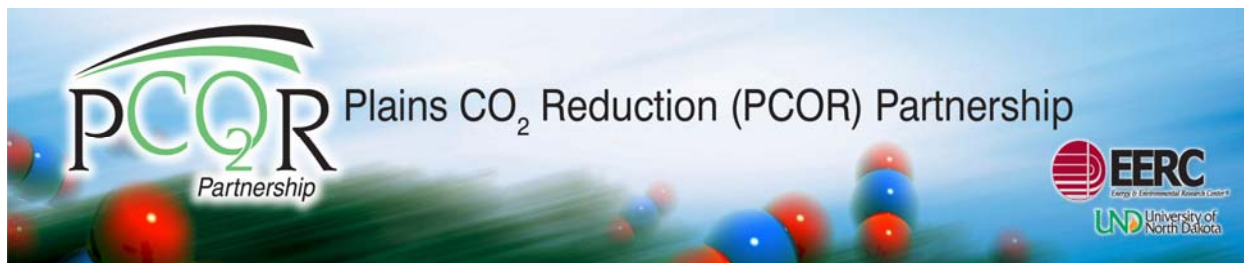
Avoided Grassland Loss Protocol in Development.....	26
CONCLUSION.....	27
REFERENCES .....	28
DETAILS OF THE U.S. DEPARTMENT OF ENERGY 1605B PROGRAM .....	Appendix A
CARBON LEGAL DOCUMENTS (EASEMENT, CONVEYANCE OF GHG RIGHTS, OPTION, AND ERPA) .....	Appendix B

## **LIST OF FIGURES**

1	The Prairie Pothole Region and regional project area for the PCOR Partnership Phase II Terrestrial Field Validation Test .....	2
2	Flowchart depicting the business processes to follow for implementing terrestrial carbon sequestration projects .....	8
3	Predicted percent change in the probability of transitioning from pasture/rangeland to cultivated crops between 2006 and 2011 .....	21
4	Ecoasset database with GIS front end developed by Ducks Unlimited for tracking carbon credit transactions and project .....	27

## **LIST OF TABLES**

1	Potential CO <sub>2</sub> Sequestration from Best Management Practices in the PCOR Partnership Region .....	23
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### **EXECUTIVE SUMMARY**

With increasing levels of greenhouse gases (GHGs) in the atmosphere and concerns over their effects on climate and weather, a momentous surge in interest in the various methods of carbon sequestration is occurring. Among them is terrestrial sequestration, the process of removing carbon dioxide (CO<sub>2</sub>) from the atmosphere by plants via photosynthesis and storing the carbon in biomass and soils. Terrestrial carbon sequestration projects offer an immediate and cost-effective strategy to reduce atmospheric emissions while other methods (i.e., geologic sequestration) are advanced. Secondly, land-use practices that enhance terrestrial sequestration generally also enhance soil, air, and water quality and improve wildlife habitat.

As part of the U.S. Department of Energy (DOE) Plains CO<sub>2</sub> Reduction (PCOR) Partnership Phase II Program, the Energy & Environmental Research Center; Ducks Unlimited, Inc.; the U.S. Geological Survey Northern Prairie Wildlife Research Center; and North Dakota State University have demonstrated optimal practices for terrestrially sequestering CO<sub>2</sub> at multiple sites located in the Prairie Pothole Region (PPR) of North America. A terrestrial field validation test was initiated to develop the technical capacity to systematically identify, develop, and apply alternate land-use management practices to the Prairie Pothole ecosystem (at both local and regional scale) that results in net GHG reductions and marketable carbon offsets. As part of this project, PCOR Partnership partners collected soil and gas samples from various age cohorts of restored grasslands, native prairie, cropland, and wetlands throughout Montana, North and South Dakota, Minnesota, and Iowa. In addition to carbon uptake and storage measurements, methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O) gas fluxes were also measured to estimate the net GHG flux of each management practice. These data have been instrumental in advancing terrestrial carbon credits from the PCOR Partnership region into the marketplace.



Terrestrial sequestration projects create carbon credits that can be transacted in voluntary or mandatory regional, national, or international carbon markets. Under a mandatory GHG reduction program, these credits provide entities with alternative compliance options, in addition to direct reductions, to reduce GHG emissions while new less carbon-intensive fuels and technologies are developed.

Many carbon market stakeholders are involved in bringing terrestrial offsets to end users, including those involved in financing, producing, generating, providing, aggregating, and/or marketing GHG emission reductions. The PCOR Partnership project results have supported the development of protocols for terrestrial carbon credit development and trading and are intended to serve as a model to promote and implement terrestrial sequestration across the PPR. The launch of the Ducks Unlimited Carbon Credit Program provides landowners with a revenue stream novel to the agricultural economy of the plains, sequestered carbon. Through this program, landowners sign perpetual grassland easements while, at the same time, they are conveying carbon rights to be bundled and sold on the open market. Results from this project have provided the science and business processes framework needed for project developers and investors to advance emission reduction targets as well as achieve financial returns in this rapidly emerging market.

This Regional Technology Implementation Plan (RTIP) outlines the framework developed for full-scale deployment of grassland-based terrestrial carbon sequestration methods in the PPR. The plan includes methodologies for project development, characterization, comprehensive monitoring, and modeling methods for verification; regulatory, permitting, and accounting frameworks; and public outreach and education strategies. Also included in the RTIP are legal documents for purchasing GHG and carbon rights and for carbon ownership transfer from private landowners to an aggregation entity and from the aggregation entity to the investor, as well as a site management plan that specifies best management practices for carbon sequestration and emission reduction in wetland and grassland complexes throughout the PPR. The RTIP also provides background information on voluntary and regulatory carbon markets in the United States and various GHG registries and programs.



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### **INTRODUCTION**

The Plains CO<sub>2</sub> Reduction (PCOR) Partnership region is home to a variety of land-use options that present an opportunity for carbon sequestration (Figure 1). Many of the region's important and highly productive ecosystems have been altered by agricultural and commercial development. Terrestrial carbon sequestration on these diminished lands can be enhanced by implementing practices such as introducing cover crops on fallow land, the conversion from conventional tillage to conservation tillage, and the restoration and/or preservation of grasslands and seasonal wetlands. Landowners adopting these practices can generate a new source of income while at the same time revitalizing a suite of ecosystem functions that were either nonexistent or greatly reduced.

The PCOR Partnership has identified cost-effective carbon dioxide (CO<sub>2</sub>) terrestrial sequestration solutions for the region and developed methods to facilitate and manage the demonstration and deployment of these technologies. In Phase II, PCOR Partnership partners characterized the technical, scientific, and administrative issues inherent to terrestrial offsets in the region. The Partnership also worked to enhance the public's understanding of CO<sub>2</sub> sequestration, identifying the most promising opportunities for sequestration in the region, demonstrating technologies, and detailing an action plan for the implementation of regional CO<sub>2</sub> sequestration projects.

This project focused on terrestrial sequestration opportunities in the grasslands and wetland catchments of the Prairie Pothole Region (PPR) portion of the PCOR Partnership region. The goal of this project was to monetize terrestrial carbon credits in these two areas. Through the Ducks Unlimited, Inc. (DU), carbon credit program, the monetization of carbon credits for grasslands has been realized. While credits for wetlands have not yet been realized, it is anticipated that with the results of this project, methodologies will be developed in the near





Figure 1. The Prairie Pothole Region and regional project area for the PCOR Partnership Phase II Terrestrial Field Validation Test.

future. Even though this report includes results from the wetland research, the methodologies presented focus on the implementation of grassland credits since they were monetized as part of this project. When wetland credits are monetized, the processes will be much the same.

Voluntary and regulatory legislative strategies to moderate global climate change focus on reducing greenhouse gas (GHG) emissions to the atmosphere, primarily the combustion of fossil fuels that release CO<sub>2</sub>. An approach to controlling GHG emissions combines market forces with regulation by setting an overall emission limit (cap) for a specific time period. Regulated entities are either allocated allowances or otherwise purchase and trade the allowances needed to meet their individual reduction targets. Entities able to reduce their emissions below their quota may sell unused permits to other entities unable to do so. One mechanism to reduce costs under a cap-and-trade program is the use of carbon offsets, emission reductions achieved by an unregulated source. Eligible offset projects vary by registry and/or state or regional cap-and-trade program, but some common project types include terrestrial or biological sequestration, agricultural and methane capture, and energy end-use efficiencies. Within the PCOR Partnership region, efforts to avoid the conversion of native prairie grassland ecosystems and the subsequent release of carbon into the atmosphere are compatible with carbon offset generation, under what is sometimes termed an “avoided loss” carbon accounting method. Similarly, some voluntary and regulatory programs have provisions for carbon offsets generated from avoided deforestation or reduced emissions from deforestation and degradation (REDD). Alternatively, carbon sequestration offsets can be generated by restoring vegetation. The restoration process, through photosynthesis, absorbs atmospheric CO<sub>2</sub>, transferring it to foliage, roots, stems, and associated soils.



Importantly, the accounting rules for certification of credits for different project types are still evolving and ultimately determine the financial viability and market acceptance of biological carbon projects and, subsequently, opportunities for landowners. In order for these investments in carbon offsets to become viable, by both industry and financial entities, a series of technical, scientific, and business-related processes must be applied. Results from the Terrestrial Field Validation Test have provided the data, technical, and market analysis and business frameworks for transacting grassland carbon offsets in the region. In addition, project results will likely enhance the development of methodologies for the transaction of wetland offsets in the near future.

## **CARBON TRADING**

### **Carbon Offsets**

The term “carbon offset” is often used generically to refer to a ton of CO<sub>2</sub> equivalent (CO<sub>2</sub>e). An offset negates the effects of carbon emitted in one place by avoiding the release of a ton of carbon elsewhere or absorbing/sequestering a ton of CO<sub>2</sub>e that would have otherwise remained in the atmosphere. As a unit of measurement, CO<sub>2</sub>e is used as the internationally recognized unit for GHG emissions, since CO<sub>2</sub> is the most abundant GHG. An equivalency measure creates a standard metric, allowing for the conversion of other GHGs, such as methane and hydrofluorocarbons, into a common unit. Emission reductions or GHG mitigation efforts achieved by an unregulated outside party that are transferred to an entity that purchases and/or reports the efforts are termed offsets. A ton of CO<sub>2</sub>e can be created, certified, or transacted in several different manners and, depending upon the combination of these factors, affect the terminology that a carbon offset credit may take on: Voluntary Carbon Unit (VCU), Climate Reserve Tonnes (CRT), Verified Emission Reduction (VER), Certified Emissions Reduction, Certified Financial Instrument, etc.

### **Allowances**

Under regulatory schemes, emitters are allocated a specified number of allowances, representing tons of CO<sub>2</sub>e they may legally emit. An entity that can reduce its annual emissions below the number of allowances received may bank the credits for future compliance, if allowed, or sell the credits/allowances to other entities whose emissions exceed annual allowances. Allowances may include emission reductions or offsets and are generally defined as acceptable emission units recognized by a registry. If the allowances are used toward entity compliance, they are retired and unavailable for trade.

## **CARBON MARKETS**

Several markets currently exist for the trading of carbon offsets either voluntarily or for achieving compliance with a GHG reduction program or policy. Within these markets there are varying rules and protocols that may or may not recognize offsets generated from terrestrial, grassland-based carbon projects. For example, the largest, multinational emission trading scheme

in the world is the Kyoto-driven European Union Emission Trading Scheme (EU ETS), as stipulated by the United Nations Framework Convention on Climate Change (UNFCCC). Terrestrial sequestration via afforestation and reforestation are UNFCCC-recognized sinks under the Land Use and Land Use Change and Forestry (LULUCF) sector and eligible for CDM VERs. The CDM is an arrangement under the Kyoto Protocol allowing industrialized countries with a GHG reduction commitment to invest in projects that reduce emissions in developing countries. However, the EU ETS does not recognize LULUCF CDM projects. Currently, the only market for CDM-verified LULUCF projects are Kyoto-compliant nations or voluntary buyers.

Access of carbon offsets derived from terrestrial sequestration projects in the Prairie Pothole Region to the international Kyoto market is further limited by the nonparticipation of the United States in the treaty. North American investors and politicians have instead demonstrated a strong desire to invest and act domestically, accommodating a much more robust portfolio of terrestrial sequestration strategies.

While there may be possible linkages to international markets in the future with the development of federal climate and energy legislation, the most immediate and greatest opportunity for U.S.-based private landowners is currently in the domestic voluntary market or mandatory state/regional GHG reduction programs. The advent of the voluntary carbon market is a relatively recent development, providing new income opportunities for terrestrial sequestration on private lands. The voluntary nature of the domestic market has produced many mixed price signals, with few comprehensive sources of carbon market activity available to date.

### **Market Participants**

An overview of market participants is useful for understanding the dynamics of the carbon market. Terrestrial carbon market participants include project sponsors, project developers, aggregators, brokers, verifiers, and buyers. Market supply is derived from project sponsors, project developers, and aggregators. Project sponsors are the owners of land or a business that undertake an activity or adopt a practice that sequesters carbon or reduces emissions. A project developer is responsible for all aspects of the delivery of the carbon offset, including the development of project methodologies, carbon baseline determinations, additional analysis, and monitoring plans. Aggregators may share similar functions while also bringing together smaller projects in marketable volumes to buyers, brokers, or exchanges. Project developers (also known as offset providers) may decide to enlist the services of a broker to market offsets and to act as an intermediary with potential buyers. Brokers sort through potential investment opportunities for buyers and create portfolios suitable to investor demand.

An integral process in the establishment of carbon offset quality and project integrity is independent verification of project offsets by a third-party agent. Verifiers may conduct field-based carbon measurements or perform remote audits of entity reports, verifying that registry or standard measurement protocols have been followed during the development of the project. The verification also guarantees that monitoring efforts are implemented and insures that reported emission reductions are real.

Primary buyer segments in the voluntary market include retail, socially conscious corporations, industrial precompliance, and investment. Ultimately, the majority of transacted offsets are reported to a GHG registry or exchange, where they are retired to mitigate an entity's GHG emissions.

### **Voluntary Market Demand**

The variation in carbon credit terminology does not adequately capture the variation in possible carbon credit attributes. Although carbon credits can be a homogeneous and commoditized good, they can have a suite of unique environmental and social attributes. The characteristic of each offset variety makes them attractive to different sectors of the market. Commoditized offsets guarantee that a basic level of offset permanence, additionality, and verification has occurred, providing a basic transferable unit of trade to accommodate GHG accounting and trading.

Results from the latest annual survey by the Ecosystem Marketplace, *State of the Voluntary Carbon Market 2009*, highlight many important motivations and trends in the voluntary market (Hamilton and others, 2009). This was the third year the survey was conducted. In 2008, buyer composition continued to be dominated by businesses, accounting for 66% of purchased offsets by volume, with only 2% purchased by individuals. Of this total volume, 39% of offset buyers were in the United States, with 52% coming from the regulated European Union. Consistent through each year of the survey, buyer motivations are most strongly influenced by corporate responsibility goals for sustainable reporting and public relation purposes, not regulatory concerns as is commonly assumed. Desirable offset attributes identified include social and environmental cobenefits, independent verification, quality of information provided by the seller, transparency of accounting, and provision of insurance measures. However, the most important offset attribute identified was additionality—demonstration that the emission reductions would not have occurred in a business-as-usual scenario. From the supply side, terrestrial offsets accounted for 11% of total over-the-counter (OTC) offsets sold in the voluntary carbon market in 2008, with 29% of total supply derived from North America.

Demand for commoditized offsets can be partially attributed to a compliance-driven market sector, predicated upon the expectation of future mandatory regulation. Conversely, a burgeoning voluntary “gourmet” sector, composed of philanthropic and environmentally motivated buyers, has emerged both in regulated Europe and in North America. Gourmet, or “charismatic,” carbon buyers demonstrate a preference for offsets with appealing social and environmental attributes (Bayon and others, 2007). The loosely defined criteria associated with gourmet offsets ensure that a vibrant, evolving market with access to small, creative projects will provide an opportunity for innovation in new GHG mitigation strategies. While the voluntary gourmet sector will provide an opportunity for innovation, standardized credits provide the fungibility needed for a credible carbon registry and market. The distinction in carbon grades also contrasts the three primary buyers active in the voluntary carbon market: retail, investment, and industrial. An overview of buyer motivations, market activity, and use of terrestrial offsets is provided below.

## ***Retail***

The most immediate opportunity for terrestrial offsets is in the voluntary retail market, made up primarily of online providers selling “carbon neutrality” products. Retail outlets operate by providing carbon calculators or generic offset packages representative of the “carbon footprint” for an individual, household, businesses, other institutions, or event. Emission-conscious consumers can then buy offsets to become carbon neutral. These retail operations include both for-profit and nonprofit operations and are based throughout the world. An independent review of this market analyzed 30 companies offering carbon neutrality products and ranked the programs based on transparency of projects and offset quantification and availability of educational materials (Clean Air – Cool Planet, 2006). Of the 30 providers, 15 offer terrestrial offsets, all reforestation, of which only one terrestrial provider earned the top-tier ranking, Climate Trust. At present, access of terrestrial offsets to this market is limited by low overall consumer demand. Offset providers occasionally solicit bids for new carbon projects, develop their own projects, or acquire offsets for resale. The volume of terrestrial offsets sold in this sector remains relatively small at 760,000 MTCO<sub>2</sub>e in 2008, or 2% of total OTC volume (Hamilton and others, 2009).

## ***Investment***

An expanding component of the voluntary market is the growth in investment demand by hedge funds, brokerage firms, private equity groups, and other members of the financial community. Forward-looking investors watching the growth of the European and global market see a preregulated U.S. carbon market as a great speculative opportunity, and for good reason. In 2006, the global carbon market was worth an estimated \$30 billion. The bulk of volume and value so far has come from the EU ETS, which has seen a 200-fold increase in the value of allowances traded through exchanges and brokers in 2006 from its inception in 2004 (Point Carbon, 2007). Encouraged by market growth and increasing demand pressure, carbon credit prices in North America are expected to follow a similar rate of growth. Projections by the Intergovernmental Panel on Climate Change (IPCC) estimate that by 2030, carbon credit prices will reach \$5–\$65 ton/CO<sub>2</sub>e (IPCC 2007a).

In addition to speculative demand, the investment industry has also created a vibrant secondary market, acquiring portfolios of carbon assets. Buyers find these products useful since they diversify risk and provide a low-cost alternative to acquiring the in-house experience needed to solicit carbon projects and assets. As carbon markets mature, a derivatives market based on the movement of carbon commodities will emerge, as is already occurring in Europe. Derivatives are financial instruments whose value is derived from the value of something else. They generally take the form of contracts under which the parties agree to payments between them based upon the value of an underlying asset or other data at a particular point in time. Many investors find carbon derivatives attractive because their performance is uncorrelated to traditional asset classes.

## ***Industrial***

A third component of the voluntary carbon market is derived from the demand by industrial actors, such as utilities, corporations, and other energy-intensive industries looking to reduce emission liabilities and to minimize future regulatory compliance costs. Participation in the early stages of the carbon market and the regulatory process provides opportunities to participate in protocol and registry formulation and enhance the recognition of already-acquired offsets for early action status under mandatory regulation. Other motivations for participation include corporate sustainability practices, public relations, GHG accounting and market experience, and gaining first-actor advantages. Domestically, industrial buyers have been a strong and consistent source of offset demand.

## **BUSINESS PROCESSES FOR TERRESTRIAL OFFSETS**

From beginning to end, many implementation steps must occur between carbon market participants in order to complete a terrestrial offset transaction. The basis of any scalable terrestrial project in the PCOR Partnership region is active participation by private landowners. As landowners weigh the benefits of enrolling in a carbon program, the returns of doing so will have to compete with other land uses and income opportunities. Aggregators and project developers play an important role as intermediaries between offset buyers and landowners, minimizing the risk of both parties as well as maximizing the benefits of a mutually beneficial carbon program. Among the services that aggregators and project developers provide are risk mitigation solutions that would be too great for landowners or buyers to assume on their own. Finally, and perhaps most importantly, several legal instruments must be prepared to ensure clear ownership of credits and transparency during the sales transaction.

An overview of the business processes required by carbon project developers and the role of landowners and aggregators is provided below (Figure 2).

### **Project Development**

#### ***Project Design Document***

The first step in a carbon project cycle is to assess the project methods and prepare documentation that will be used to evaluate whether it qualifies as an emission reduction activity within a particular GHG reduction program or standard. The project design document (PDD) is developed to address key components of the project methodology, including project location; technology used; project participants; cobenefits; monitoring plan; and additionality, leakage, and permanence characteristics. Once completed, the PDD is submitted to an approved third party for project validation.

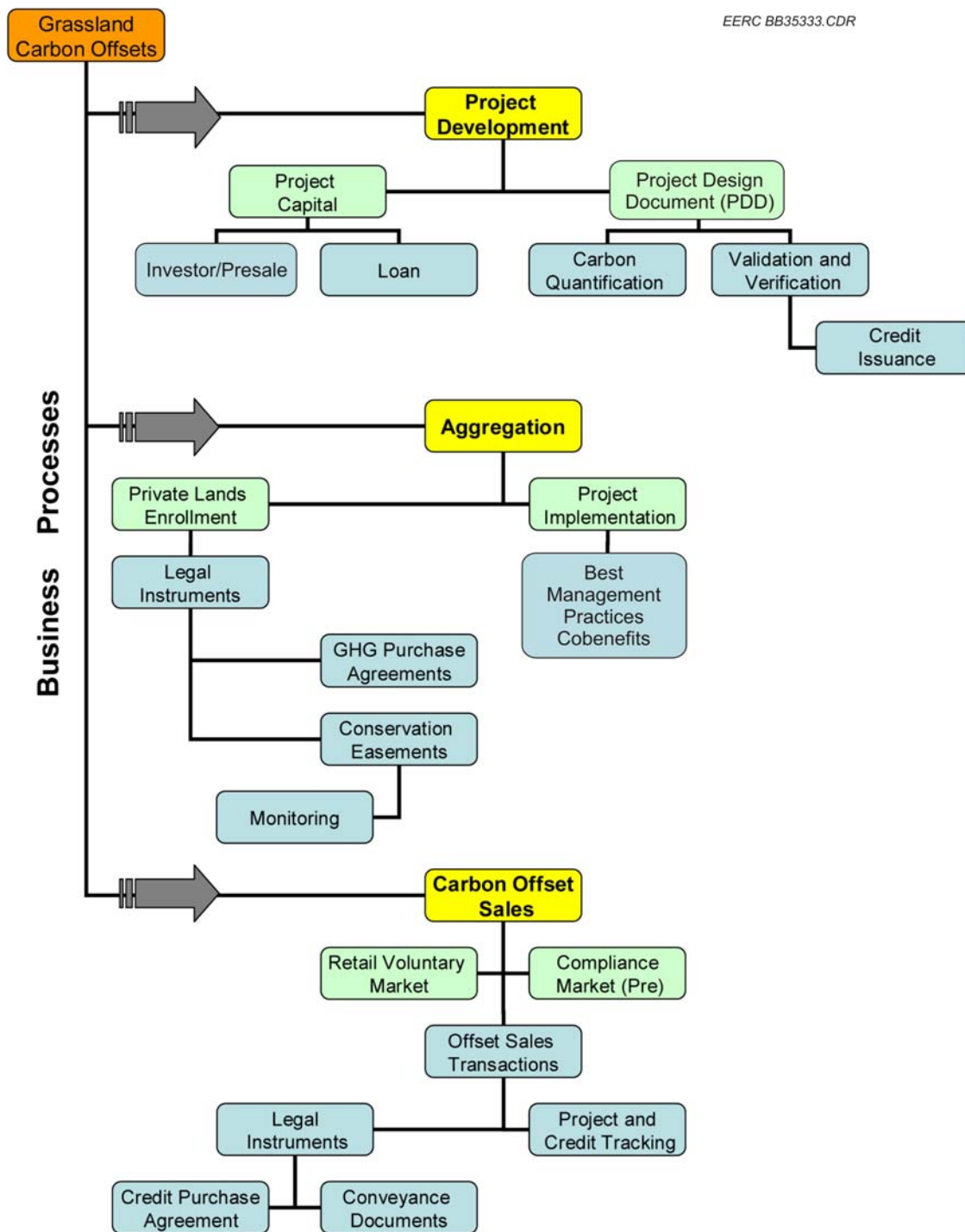


Figure 2. Flowchart depicting the business processes to follow for implementing terrestrial carbon sequestration projects.

## *Carbon Quantification and Estimation*

A calculation of emission reductions must be included in the PDD. This is calculated by first establishing the project baseline. The amount of carbon physically sequestered at any location is dependent upon a myriad of interactions between site-specific characteristics, land management, and weather events, leading to interannual and intra-annual variation in the rate at which carbon is sequestered and potentially even emitted. Like other biological systems, carbon pools and emission fluxes exhibit a wide range of variability within and across landscapes. The risk associated with variable annual sequestration rates can be addressed through frequent measurement and monitoring of terrestrial stocks or through conservative estimation of a regionally derived mean model.

Aboveground carbon stocks allow an easy approximation of these differences: aboveground vegetative mass can be measured and converted into estimated carbon stocks. However, across the majority of the PCOR Partnership region, strategies with the greatest potential to enhance carbon storage and sequestration are those that focus on enhancing belowground soil carbon stocks, such as grassland and wetland preservation and restoration, or conservation tillage. To improve the understanding of the carbon dynamics of these management practices and gauge the potential for these and other practices to enhance carbon sequestration, members of the PCOR Partnership have performed extensive soil and GHG flux sampling across the Missouri Coteau portion of the PCOR Partnership region. Soil samples were collected by North Dakota State University's soil science lab at seven study sites in Montana, North Dakota, South Dakota, Minnesota, and Iowa. Sampling was done in cropland, restored grassland, and native prairie. Results show positive sequestration gains from grassland restoration and protection, but substantial variability is evident.

The PCOR Partnership partners have also documented the ability of wetlands to store carbon and the potential for enhancing carbon sequestration when wetlands are restored. However, the net benefit of carbon sequestration in wetlands, in terms of a reduction in global warming forcing, has often been questioned because of potentially greater emissions of GHGs such as nitrous oxide ( $\text{N}_2\text{O}$ ) and methane ( $\text{CH}_4$ ). To better understand how restoration and land management practices may influence GHG flux, PCOR Partnership partners are comparing gas emissions ( $\text{N}_2\text{O}$ ,  $\text{CH}_4$ ,  $\text{CO}_2$ ) from replicate wetlands in each of the following land uses: 1) cropland and 2) restored grassland (idle, hayed) and native (idle, grazed).

To complement this effort, microbiologist Dr. Dingyi Ye of the Energy & Environmental Research Center performed laboratory-based and in situ microcosm studies on microbial cycling of  $\text{CO}_2$ ,  $\text{CH}_4$ , and  $\text{N}_2\text{O}$  in a wetland environment. The objectives of the laboratory microcosm study were 1) to verify and evaluate the potential of wetland restoration to sequester  $\text{CO}_2$ , 2) to clarify effects of the restoration on  $\text{CH}_4$  and  $\text{N}_2\text{O}$  emission, and 3) to examine the effects of wetland restoration on soil microbial community structure and population dynamics, especially those populations involved in the production and consumption of  $\text{CH}_4$  and  $\text{N}_2\text{O}$ . The in situ microcosm study was an effort to explore a methodology that may provide accurate estimation and prediction of changes in major GHG budgets by wetland restoration. This task consisted of two on-site column experiments: one to quantitate changes in  $\text{CO}_2$ ,  $\text{N}_2\text{O}$ , and  $\text{CH}_4$  fluxes from the investigated wetlands "before" and "after" restoration, while the other examined the in situ



effects of N-fertilizers on CO<sub>2</sub>, N<sub>2</sub>O, and CH<sub>4</sub> emission from terrestrial ecosystems. The results of these studies show that by restoring currently farmed wetlands, thereby cutting off N-fertilizer inputs, the following can be achieved: 1) a reduction of CO<sub>2</sub> flux and increased storage and 2) reduction of N<sub>2</sub>O and CH<sub>4</sub> emissions. Additionally, restoration activities do not promote a dramatic increase in population sizes of the microorganisms that produce N<sub>2</sub>O and CH<sub>4</sub>. These results demonstrate that wetland restoration will significantly reduce the overall global warming potential budget. Final results of the wetland, grassland, and arable land studies are included in the PCOR Partnership Terrestrial Field Validation Test Final Report. (Ye and others, 2009).

In developing the avoided grassland conversion carbon project, project partners relied upon soil carbon accounting methods recognized by the various registries and standards. Unfortunately, there are many limitations with the prevailing methods as applicable to many best management practices in the PCOR Partnership region. Accurate soil organic carbon (SOC) estimates typically require extensive direct sampling by extracting soil cores from the ground, then performing lab work to determine the carbon content of the soil. The number of samples required to obtain an estimate within a reasonable confidence interval depends upon the size of the project area and heterogeneity of the landscape sampled. For a small, relatively homogenous landscape, the number of required sample plots to detect soil carbon changes over time can be substantive and cost-intensive. If grassland sequestration offsets are to be accurately estimated and successfully verified in voluntary, regional, or federal GHG mitigation programs, greater certainty and cost-efficiency of soil carbon estimation is required. Strategic field sampling to validate soil carbon model estimates provides such a strategy.

Models are an ideal method for estimating SOC because they are capable of increasing estimate certainty while reducing measurement costs. Models validated through the peer review process and calibrated with local sampling and observations provide the optimal trade-off between efficiency and accuracy of soil carbon estimation. Recognized as the highest tier estimation method in various regional and national programs, models can account for the heterogeneity of landscape conditions, soil types, climatic variables, and management histories (see Appendix A for U.S. Department of Energy [DOE] Guidelines for Terrestrial Offset Determination).

Two primary model types, process-based and empirical or mechanistic models, are used to estimate soil carbon. A process-based model incorporates numerous processes, e.g., biological, climatic, chemical, or physical to provide an estimate of scenario outcomes given the dynamic interaction of the various processes. The benefit of process modeling is that experimentation of field conditions not easily observed or economically infeasible to monitor can be estimated. A drawback is that process models attempt to replicate what is actually happening, offering prescriptive estimates. A mechanistic or empirical model requires field samples sufficient to determine statistically significant relationships between management activities or other observed criteria with changes in soil carbon stock. As with all models, the outputs are only as good as the inputs. Fortunately, many of the climatic and soil condition variables are extensively tracked for various other reasons and support either a process-based or mechanistic model.

## Default Equations

Equations with national or regional default values are another possible carbon quantification method.

### Case Study: Avoided Grassland Conversion

Using the IPCC methods from the IPCC 2006 guidelines, the loss of SOC from mineral soil was quantified. The method allows the calculation of carbon stocks after 20 years of cultivation; after this initial 20-year cultivation period, the IPCC 2006 guidelines assume that carbon stocks stabilize, reaching a new depleted equilibrium. The IPCC 2006 guidelines assume that the loss of SOC is linear over time (IPCC 2006). Only SOC loss from mineral soil is considered, because there are no organic soils on the project site.

Changes in carbon stocks due to liming were omitted in order to be conservative. SOC stocks on a per acre basis were calculated from the following equation (Equation 2.25 in Chapters 2 and 5, in IPCC 2006):

$$\text{SOC}_{20} = \text{SOC}_{\text{ref}} * F_{\text{LU}} * F_{\text{MG}} * F_{\text{I}}$$

where  $\text{SOC}_{20}$  is the carbon stock after 20 years of cultivation,  $\text{SOC}_{\text{ref}}$  is the quantity of SOC in an undisturbed grassland soil,  $F_{\text{LU}}$  is the scaling factor for the effect of land-use change over 20 years,  $F_{\text{MG}}$  is the scaling factor for the effect of management practices, and  $F_{\text{I}}$  is the scaling factor for the application of inputs over a period of 20 years.

The value of  $\text{SOC}_{\text{ref}}$  (cold temperate moist: 95 Mg/ha C and cold temperate dry: 50 Mg/ha C) was drawn from IPCC 2006 guidelines, Table 2.3. The values of  $F_{\text{LU}}$  (long-term cultivated, temperate, moist: 0.69, temperate, dry: 0.80),  $F_{\text{MG}}$  (full tillage: 1), and  $F_{\text{I}}$  (medium inputs: 1) were drawn from the IPCC 2006 guidelines, Table 5.5. The SOC content for cultivated soils after 20 years is thus equal to 65.5 Mg/ha C (97.2 Mg/ac  $\text{CO}_2$ ) in the cold temperate moist regions and 40.0 Mg/ha C (59.3 Mg/ac  $\text{CO}_2$ ) in the cold temperate dry regions.

## ***Project Validation and Verification***

A typical prerequisite for offset standard approval and registration is independent third-party validation of projects and verification of offsets. An independent audit provides the authenticity needed to ensure objective offset reporting and high-quality project implementation. Registries and standards typically have a list of approved verifiers familiar with the appropriate guidelines and measurement protocol particular to the registry/standard and terrestrial carbon stock. Attributes that verifiers seek to authenticate include the clear demonstration of project additionality, permanence, and accounting of leakage.

Additionality is the demonstration that the project would not have occurred under a business-as-usual scenario. Common barrier tests used to demonstrate additionality include financial barriers—i.e., implementing a project would not be feasible without private finance—or institutional barriers that already mandate the project to be implemented. In a project-by-project verification, determination requires a degree of auditor subjectivity. A sectoral approach of

predefined additional activities helps make the additionality determination more objective, yet increases the risk that a nonadditional project may be approved.

An attribute of particular importance to terrestrial offsets is project permanence. Terrestrially sequestered carbon stocks can be considered permanent with a high degree of certainty if human and natural disturbances are managed properly. In order for carbon offsets to have a tangible impact on GHG reductions, it is imperative that offset reductions are permanently removed from the atmosphere and provisions are in place that address any risk of reversal (insurance, buffer reserves, etc.). Offset buyers also need confidence that the offsets they purchase represent real reductions and will not pose future liabilities. Human disturbances of terrestrial carbon stocks can be minimized with the placement of a perpetual conservation easement on the project site, prohibiting landowners and others from conducting land-use or land management practices that release terrestrial carbon stocks. Natural disturbances may be less predictable than human disturbances but can still be sufficiently minimized with proper land management practices that reduce the risk of fire, flood, or pest damage to terrestrial carbon stocks. Project monitoring ensures that easement terms are adhered to, and legal repercussions to enforce easement terms further encourage landowner compliance.

Leakage occurs when an offset project's actions increase or reduce emissions (positive leakage) outside of the project boundary both geographically and temporally. A common cause for leakage in terrestrial sequestration projects occurs when additional land is brought into production to compensate for land retired or yield reduced to achieve an emission benefit. Accounting for leakage provides the true net benefit of a carbon offset project.

Project validation is a combination of desk review and site visit, and it is critical in ensuring that the project will be able to deliver as described in the PDD. Once the project is operational, it is starting to reduce emissions. However, the emission reductions only acquire value with their verification. Verification is the ex post facto determination of the reductions in emissions, as determined by an entity independent of both the project developer and the purchaser of the emission reductions. The project developer monitors the project as specified in the PDD. On an annual basis, a monitoring report is prepared, which estimates the emission reductions generated by the project during the year. This report is submitted for detailed review by the independent entity, which then certifies the amount of emission reductions.

Offsets, once created, can be verified, certified, registered, retired, transacted, and traded in a number of different manners. Under emission reduction programs, registries serve as the place of record of entity annual emissions. Such registries, i.e., the DOE 1605b, EPA Climate Leaders, and the California Climate Action Registry, develop protocols for participating entities to quantify and report their GHG emissions. If a trading or offset component exists within the registry, protocols developed for entity emission quantification can also be used to validate offset projects, or separate offset-specific protocols may be used.

### ***Monitoring***

Monitoring requirements depend upon the requirements of the targeted GHG program or registry and are typically related to verification. In most cases, terrestrial carbon offsets can only

be reported and registered as they are measured and verified, therefore monitoring reflects the frequency of reporting by the end user of the offsets. Annual monitoring of conservation easement sites is also required to ensure the terms of the easement are being followed and generally become part of the verification report. A detailed monitoring plan is generally a required component of the PDD.

### ***Registries***

#### **DOE 1605b Voluntary Reporting of Greenhouse Gases Program**

The DOE 1605b program is a voluntary emission reduction program, cataloging entity emission reductions. Initiated in 1994, efforts were undertaken in 2002 to improve registry measurement accuracy, verification, and reliability in support of the Federal Climate Change Initiative. A key objective of the Initiative, and the Registry, is to voluntarily reduce 2002 domestic emission intensity levels 18% by 2012. Since the program is voluntary, the guidelines are intended to be flexible so as to encourage the greatest amount of participation.

In an effort to encourage wider participation, the Registry distinguishes between large emitters (10,000 MTCO<sub>2</sub>e/year or more) and small emitters and between the registration and reporting of offsets. These distinctions are intended to make participation easier for small emitters and either large or small entities wishing to report reductions, while allowing for more stringent entitywide requirements for large emitters intending to register emission reductions. The Technical Guidelines provide calculation methods for common emission reduction activities. Small emitters may elect to report on a single activity and register emission reductions, whereas a large emitter has to conduct an entitywide emission inventory if reductions are to be registered. Offsets, termed “transferred emission reductions” in 1605b terminology, can be acquired from another entity.

#### **Regional Greenhouse Gas Initiative**

The Regional Greenhouse Gas Initiative (RGGI), the first mandatory cap-and-trade program in the United States, was implemented January 1, 2009. A collaboration of ten northeastern and mid-Atlantic states, RGGI assists member states toward the achievement of state-specific emission reduction targets. In the initial phase of the registry, only electric producers generating 25 megawatts or greater that also burn greater than 50% fossil fuel a year are to be regulated. Offset projects from outside the RGGI region are eligible for registration if a cooperating regulatory agency in the state in which the project occurs has a memorandum of understanding with the RGGI regulatory body. To facilitate the expansion of eligible RGGI-linked states, a task force has been established to pursue memorandums of understanding with other states. Currently, only forestry projects are recognizable as a form of terrestrial sequestration under RGGI. Linkages between RGGI and other regional GHG reduction programs through the Climate Registry may afford future opportunities to propose the grassland/soil carbon offset project method developed during Phase II of the PCOR Partnership into the RGGI program.

#### **California Climate Action Registry**

The California Climate Action Registry (CCAR) is a nonprofit registry created to provide businesses and organizations operating in the state of California with detailed guidance on conducting and reporting entitywide emission inventories. The registry has been strengthened by

the passage of Assembly Bill 32, or the California Global Warming Solution Act of 2006, mandating annual GHG reporting by significant sources and statewide reductions in absolute emission levels by 2020 to 1990 levels. Accounting for emission activity is governed by the General Reporting Protocol and four industry-specific protocols, including a forest sector protocol.

The Climate Action Reserve (CAR) is a national program of the CCAR that develops offset protocol and methodologies and also registers and tracks offsets. It establishes regulatory-quality standards for the development, quantification and verification of GHG emission reduction projects in North America through a public and transparent process. CAR issued carbon offset credits known as CRT generated from such projects and tracked the transaction of credits over time in a transparent, publicly accessible system.

#### The Climate Registry

The Climate Registry was launched in 2007 to provide comprehensive entity emission inventory support and verification. Membership currently comprises 39 U.S. states, 13 Canadian provinces/territories, six Mexican states, and three Native Sovereign Nations. The Climate Registry incorporates the CCAR, the Western Regional Air Partnership, the Eastern Climate Registry, and the Lake Michigan Air Directors Consortium. PCOR Partnership members participating in the Climate Registry include the states of Iowa, Minnesota, Missouri, Montana, Wisconsin, and Wyoming and the Canadian provinces of Alberta, Manitoba, and Saskatchewan. A primary objective of the Climate Registry is to develop a standardized registry that harmonizes the different state and regional registries and that is stringent enough to meet the standards of international registries. The registry has indicated that the World Resources Institute/World Business Council for Sustainable Development Protocol (WRI/WBCSD) GHG Protocol Corporate Standard, ISO 14064-3, the California Climate Action Registry, and the Eastern Climate Registry (RGGI) all serve as high-quality models in the Climate Registry's effort to establish minimum data quantification standards. Incorporation of the minimum data quantification standards into any future mandatory programs has also been indicated as an important motivation for the registry. The Registry is policy-neutral, allowing states to adopt the Registry in either a voluntary or mandatory context. An important aspect is that the registry will provide for entitywide GHG reporting, mandating independent third-party verification for a mandatory program and strongly recommending verification for a voluntary program. Offsets may be reported as an addendum to an entity's annual emissions, and protocols may be developed in the future. Citing strong constituent interest, a rigorous accounting framework for terrestrial sinks will be included in the future.

#### Alberta GHG Program

As of July 1, 2007, the Alberta GHG program requires facilities with annual GHG emissions greater than 100,000 tons CO<sub>2</sub>e per year to reduce annual emission intensity by 12% a year below a 2003–2005 baseline. Regulated entities can achieve compliance through making improvements to their operations, purchasing Alberta GHG program-certified offset credits, contributing to the Climate Change and Emissions Management Fund, or purchasing emission performance credits. Alberta GHG program-approved offset protocols for terrestrial offsets include afforestation and tillage. Protocols for wetlands management, reduced summer fallow, conversion to perennial forages, soil amendment, rangeland management, and pasture

management are also under consideration. In 2008, 2.75 MTCO<sub>2</sub>e offset credits were verified within the Alberta offset program.<sup>1</sup>

### Other Registries

A handful of carbon credit exchanges and registries also exist to track credit transactions. The American Carbon Registry, formerly the Environmental Resource Trust, and the Chicago Climate Exchange (CCX) each employ proprietary protocols to develop and verify offsets. Others such as APX Inc., Caisse des Depots, NYMEX, Bank of New York Mellon, TZ1, and others function as registries for offsets verified against other standards or programs such as RGGI or the Voluntary Carbon Standard (VCS).

For terrestrial projects in the PCOR Partnership region, the National Farmer's Union CCX aggregation program has been the most active. As of August 2008, nearly 1000 North Dakota farmers and ranchers enrolled offsets from no-till, improved range management, and grassland restoration generating over \$2.6 million in payments (North Dakota Farmer's Union, 2008). The CCX is North America's first active voluntary trading platform. Participation comprises private companies, cities, universities, states, and nongovernmental organizations (NGOs) that have made a voluntary but legally binding agreement to reduce absolute entity emissions 6% by 2010, relative to a 1998–2001 base period. Participants exceeding their emission targets, or aggregators bringing offsets to the CCX, are then allowed to auction their offsets to members unable to meet their reduction obligations. The unit of trade on the exchange is a carbon financial instrument equivalent to 100 MTCO<sub>2</sub>e, which is demarcated by vintages ranging from 2003 to 2010. Prices have historically fluctuated from \$1 to \$7 per MTCO<sub>2</sub>e. The CCX recently entered its second phase in 2007, which will continue through 2010. Other aggregators of terrestrial projects in the PCOR Partnership region active in the CCX include the Iowa Farmers Bureau and the Delta Institute.

### ***Carbon Offset Standards***

Concerns about the quality of offsets in the voluntary market, the general lack of transparency, and the large variation of offset types and quality have motivated efforts to create offset quality standards. In the voluntary market, distinct standards have developed their own project protocols against which projects can be validated and offsets verified. Examples include the Voluntary Carbon Standard (VCS), the Gold Standard, and the Climate Action Reserve. Offsets verified against these standards can be transacted in the OTC market between two or more parties or through a registry or exchange.

A carbon offset verified against a recognized standard promotes credibility among registries and projects, enhancing investor confidence and ensuring environmental integrity. Within a standard there are numerous types: process-based, carbon accounting, and project validation. Process-based guidelines for entities or registry protocols (WRI, ISO 14064) do not directly certify offsets or projects but rather provide the standards for the development of GHG accounting guidelines. Carbon accounting standards ensure emission reductions are additional, permanent, and real.

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<sup>1</sup> <http://environment.alberta.ca/3468.html>.

Validation of a project's management plan, projected emission reductions, and capacity of the offset developer provide assurances that the project will endure and is eligible to generate offsets. Depending upon the quality of the standard, a standard-verified offset also carries a price premium over unverified offsets. Other standards with limited potential application to the PCOR Partnership region include Plan Vivo and Social Carbon. Although Plan Vivo is designed for forestry projects, both standards are targeted towards identifying social and community benefits of offset projects in least developed countries.

An influential process-based standard is the WRI/WBCSD. The WRI/WBCSD protocol was created to provide a harmonized accounting protocol for future emission exchanges, registries, and other emission reduction initiatives. To accomplish this task, two protocols were developed: the "Corporate Accounting and Reporting Standards" and a "Project Accounting and Reporting Standard." In 2006, a supplement to the "Project" was released: "The Land Use, Land-Use Change, and Forestry (LULUCF) Guidance for GHG Project Accounting," providing further guidance for quantifying and reporting GHG reductions from terrestrial sequestration projects (WRI, 2006). The guidelines can be applied to all LULUCF project activities but focuses on reforestation and forest management. It can also be used for avoided deforestation, although this is not specifically addressed in the guidelines. The WRI/WBCSD Business Standard is employed by the CCX, CAR, EU ETS, and the U.S. Environmental Protection Agency (EPA) Climate Leaders Program, among others ([www.ghgprotocol.org](http://www.ghgprotocol.org)).

Another commonly cited process-based standard used in the development of registry protocols is the International Organization for Standardization (ISO) 14064-2 and 14064-3. The ISO 14064 is somewhat of a hybrid, functioning as a process-based guideline with emission and project certification. The 14064-2 protocol provides project-level guidance for quantification, monitoring, etc., while 14064-3 is devoted to providing guidance on validation and verification of GHG assertions. The creation of the ISO 14064 came from the same realization that the WRI/WBCSD had observed—that governments, businesses, and other institutions and emission reduction initiatives were all employing different approaches to account for entitywide and project-based emissions. ISO 14064 organizational-level protocol is consistent with the WRI/WBCSD Corporate Protocol (Kook Weng and Boehmer, 2006). As a supplement to 14064-2 and 14064-3, 14065 was created to provide a protocol for the validation of accreditation or certification bodies.

A common framework for most offset and project certification guidelines is the Kyoto CDM standards, used for Kyoto-recognized certified emission reductions. Eligible terrestrial projects under the CDM are afforestation and reforestation, with CDM standard certification limited to projects undertaken in developing (Kyoto non-Annex B) nations. However, the creation of supplemental CDM standards to recognize and promote high-quality projects that have ancillary community, socioeconomic, or biological impacts beyond emission reductions can also be adopted for voluntary projects. Three of the most prolific of these voluntary standards are the CDM Gold Standard and the Climate Community and Biodiversity Standard (CCBS). Although the Gold Standard is considered the standard of excellence for the certification of renewable energy and energy efficiency projects, it does not certify land-based projects.



Specific to terrestrial projects, the CCBS is a voluntary set of standards intended to supplement CDM standards for terrestrial projects and also serves as a stand-alone project validation standard for the voluntary market. The standard was developed by the Climate, Community and Biodiversity Alliance—a partnership between leading companies, NGOs, and research institutes seeking to promote integrated solutions to land management. The CCBS was created after a lengthy stakeholder process; includes members from academia, business, environmental groups, and developers; and conducts field trials on four continents ([www.climate-standards.org](http://www.climate-standards.org)). There are 15 core requirements under the categories of general, community, climate, and biodiversity that a project must satisfy in order to achieve CCBS certification, as verifiable by an independent auditor. Additionally, projects that surpass minimum validation requirements are eligible for silver and gold-level ratings. The PCOR Partnership partners were successful in obtaining validation under the CCBS at the Gold level for the grassland carbon credit program referred to in this document. This was the first approved project by the Climate, Community, and Biodiversity Alliance in North America.

Unlike the previously discussed standards, the VCS is explicitly designed to verify non-CDM voluntary projects and offsets for the voluntary carbon market. The VCS was created by the International Emissions Trading Association, the Climate Group, and the World Economic Forum and is distinguishable by its intentions to function as a more general standard, providing a minimal threshold of offset quality to produce a globally standardized unit of trade. A set of terrestrial projects, termed Afforestation, Forestry and Other Land Use, are eligible under the following standards: REDD; Afforestation, Reforestation, and Revegetation; Improved Forestry Management; tillage management; range management; fertilizer management, and grassland restoration. Additional project types may be proposed and approved by the VCS technical committee pending a double approval process by two independent auditors. Projects satisfying the VCS are certified as VCUs and are eligible for registration with approved VCU registries. The VCS guidelines are available at [www.v-c-s.org](http://www.v-c-s.org).

Going forward into a GHG-regulated economy, federal oversight of offset quality and markets will become necessary. In voluntary schemes, opaque trading practices and products have led the Federal Trade Commission to hold hearings on offset business practices and the possibility of covering offsets under the commission's Green Guides. Passage of federal climate legislation will also most likely entail national offset protocols for use in a cap-and-trade system. In this vein, the U.S. Forest Service created the Office of Ecosystem Services and Markets (OESM) in December of 2008 to provide technical and administrative assistance in the development of protocols and guidelines to assist in the development of ecosystem markets, chief among them carbon sequestration. It remains uncertain whether the protocols developed by OESM will be recognized in a federal cap-and-trade program or if separate protocols will be developed by the EPA or other agency.

### **Project Capital**

High-quality terrestrial offsets have characteristics of permanence and cobenefits that are best achieved through the legal protection of conservation easements. This requires significant up-front capital for implementation, even though the emission reductions will occur many years

into the future. This creates a financial challenge for terrestrial offsets because today's carbon market focuses on sales of GHG emission reductions generated up to the end of 2012.

Two important criteria for carbon project development are the potential for generating GHG emission reductions over a specific time frame and a project's capacity to mobilize needed capital investment. A project developer should consider and balance the time taken to develop a project against the potential revenues and other benefits that may ensue. Other factors, such as the time needed to implement the project and the duration of the purchase period for emission reductions (and hence revenues), should also be carefully weighed.

### **Aggregation**

The aggregator of terrestrial offsets has a symbiotic relationship with landowners and buyers, providing numerous services that become economically feasible when conducted at a scale much larger than any landowner or group of landowners can conduct on their own. These services include risk management, offset marketing, outreach, restoration guidance, legal support, offset tracking, monitoring and verification of offsets, and the ensuring of administrative compliance. From an industrial buyer or investor's perspective, aggregators are essential for transacting terrestrial offsets on private lands. Industrial offset demand is typically in the magnitude of hundreds of thousands, if not millions, of tons of CO<sub>2</sub> while the most productive terrestrial projects only produce a few hundred offsets per acre over a 100-year time span.

Despite what appear to be market deterrents, demand for terrestrial offsets remains high for several reasons. Terrestrial carbon sequestration is one of many ecological services provided by habitat restoration, producing a suite of environmental and economic cobenefits to the region. Financially, terrestrial offsets are desirable since the cost of producing a terrestrial offset is currently less than geologic or technology-based offsets. While cleaner technologies are being advanced, terrestrial offsets will remain a cost-efficient emission reduction strategy. Aggregators for terrestrial offsets will be required in order for land-based sequestration projects to achieve scales that result in viable GHG reductions.

### **Program Marketing**

In the case of grassland offset projects in the PCOR Partnership region, several forms of marketing are necessary for the success of the program. Marketing the conceptual carbon program to potential investors is a necessary first step to secure needed capital for implementation. An alternative is to market the program to landowners who are offered an "option" for enrolling their properties into a carbon aggregation project (see Appendix B). The aggregated properties are then marketed to an investor or a potential buyer of offsets. If a buyer or investor is found, then the options are exercised with the landowners. If project capital is sourced internally by the project developer, then the project is implemented according to the PDD, and the verified credits are marketed directly to voluntary buyers or those who may be regulated under a cap.

Included in marketing activities are education and outreach for both the landowners and the end buyers of the credits. These can be in the form of workshops, brochures, Web content,

etc., and should provide transparent information on program guidelines for landowners and credit characteristics for buyers.

### **Landowner Perspective**

Landowners in the PPR are increasingly aware of possible income opportunities from terrestrial carbon sequestration projects. However, the success of any terrestrial carbon program will depend on the willingness of private landowners to adopt land-use and management practices that sequester carbon or reduce GHG emissions and the economic returns of these practices relative to alternative land uses, namely crop agricultural production. In economic theory, landowners are assumed to convert land to the use that maximizes the present discounted value of an infinite stream of net return less conversion costs. Assuming that landowners base their expectations of future net returns on current or historical returns, the landowner's decision rule is to choose the use with the highest expected one-period net return.

This project focused on wetland ecosystems, riparian areas, and associated grasslands to evaluate terrestrial carbon sequestration opportunities in the northern Great Plains. Wetland and grassland ecosystems are inherently heterogeneous, meaning that land management and land-use decisions are dependent upon the influences of site-specific attributes. Recently, participation in government programs, such as the Conservation Reserve Program and Wetland Reserve Program and others, has resulted in the conversion of marginal croplands to perennial grasses. However, the enthusiasm for participation in long-term cropland retirement has diminished as economic returns from those programs have not kept pace with economic returns from traditional crop production. To spatially identify land classes, land uses, and the necessary financial incentives needed to spur adoption, a spatial econometric model of land-use change in the PPR was developed as part of Phase II PCOR Partnership activities. Results will be used to identify land-use conversion rates for the Avoided Grassland Conversion project and in the targeting of program activities.

Future economic returns, usually represented by an annual value, can be discounted and summed to produce net present values. A net present value approach provides considerable flexibility to place different revenue streams into a common metric for direct comparison.

While the net present value approach allows for comparison of nonuniform economic returns over time among various activities, it is problematic for policymakers to expect wholesale land-use changes based on potentially small differences in net present values. There are likely to be a range of economic returns over which landowners will be indifferent to alternative activities. The extent that future economic returns need to exceed current returns for an alternative action to be acceptable is difficult to predict and subject to individual landowner and producer preferences, behavior, and perceptions. Regardless of those caveats, comparisons of net present value of various alternatives (e.g., retaining current land use versus implementing grassland and/or wetland restoration) provide a valuable benchmark to begin evaluating the economic viability of terrestrial carbon sequestration activities.

The PPR of the United States was divided into 16 subregions. Those subregions were created to represent areas with similar overall crop rotations, soil productivity, and production

characteristics. Crop rotations in each subregion were estimated based on crop acreage from 2006 through 2008. Seven years of revenues and expenses were compiled for the predominate crops in eight regions of North Dakota and Minnesota. Because of data limitations, a 3-year average of returns was developed for crop-producing regions in South Dakota and Iowa. In North Dakota and Minnesota, an Olympic average of crop returns was generated. The Olympic average for crop returns was then combined with crop rotation percentages to generate composite-acre values. Average composite-acre returns were then differentiated into three levels of producer profitability. The three levels of producer profitability represent the starting points for examining the economics of alternative wetland management. The premise is that widespread changes in land management and land use will require economic returns to be roughly equivalent or exceed those of existing activities.

Revenues are likely to be a function of net gain in carbon sequestration rates (i.e., those greater than what might exist with current land use and management), anticipated carbon prices, payments for ecosystem services, hunting leases, easement payments, grazing and/or forage revenues. Costs could include grass establishment, tree plantings, weed control, haying and forage collection expenses, and expenses related to changes in water conveyance (e.g., plugging tiles, altering ditches). Assuming a standard set of parameters (e.g., regional values for sequestration, carbon price sets, forage values) for the proposed activity, net present value of the two alternatives can be compared. Changes in some parameters allow various “what if” questions to be examined. As an example, if the net benefits from the wetland restoration are substantially below current economic returns, the activities are not likely to be implemented. If the difference is slight, perhaps changes in project design or enhancement might provide sufficient economic return to entice greater landowner participation. In other cases, projects may not be attractive to landowners until carbon prices exceed a certain threshold. Additionally, some activities in some regions may not be economically feasible over any reasonable range of carbon prices or forage values. The key variable in the analysis is the economic benchmark for existing land use, which provides the necessary starting point to examine the likelihood of widespread landowner participation in a host of wetland and grassland restoration projects.

Previous studies have found that carbon prices will have to reach \$10/ton C (\$2.73/MTCO<sub>2</sub>e) for conservation tillage and \$25/ton C (\$6.83/MTCO<sub>2</sub>e) for afforestation to become economically attractive to landowners in the Great Plains region (Lewandarski and others, 2004). As carbon prices rise, terrestrial sequestration practices will face competition among each other, with afforestation providing the greatest per acre carbon benefit and highest potential return at higher carbon prices.

Recently, interest in corn-based ethanol as a fuel alternative has put strong upward pressure on agricultural land prices, expanding corn production into historically unprofitable areas. However, not all agricultural activities preclude long-term terrestrial sequestration. In much of the PCOR Partnership area, grass-based economies dominate the landscape with activities such as haying and grazing to support livestock production. Research has shown that haying and grazing activities can continue without detrimentally impacting soil carbon sequestration rates or storage (Liebig and others, 2005).

The model developed by Dr. Ben Rashford at the University of Wyoming allows for predictive land-use changes given changing land-use returns in response to rising crop returns or carbon incentives, providing for prescriptive analysis of land-use change (Figure 3). Results have found the probability of grassland conversion highest in areas of higher soil quality; therefore, there is a higher opportunity cost of remaining in grassland. Probability conversion risk displays a high degree of spatial variability, but with higher probabilities generally found in the Minnesota and Iowa portions of the PPR. In absolute acres converted per county, the number of acres initially in a grassland use can lead to large conversions even for relatively low conversion probabilities. Final results of this modeling effort are presented in the final report.

## Conservation Easements

Terrestrial grassland carbon projects in the PCOR Partnership region are implemented using perpetual conservation easements to insure the carbon stocks are permanently protected. Activities permitted under perpetual conservation easements restrict activities that could disturb the SOC and release it into the atmosphere (Appendix B). In the case of the DU Avoided Grassland Conversion Carbon Project, threatened native grasslands are encumbered with perpetual conservation easements in order to prohibit conversion to crop-based agriculture, thereby protecting biodiversity and wildlife habitat, ensuring permanent storage of SOC, and providing a revenue source to landowners other than cropping. Easements can be held by a nonprofit organization or transferred to a public agency, such as the U.S. Fish and Wildlife Service, depending on the rules of the state.

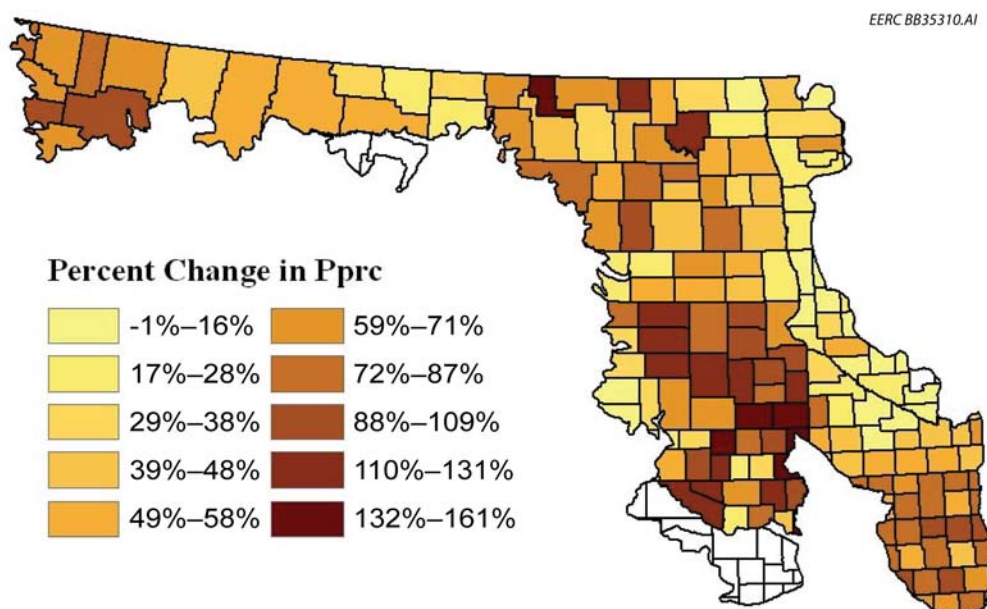


Figure 3. Predicted percent change in the probability of transitioning from pasture/rangeland to cultivated crops between 2006 and 2011.

## **Best Management Practices (BMPs)**

To achieve maximum sequestration results, it is important that BMPs are implemented and stipulated in management plans incorporated into a conservation easement. The most effective management strategies focus on increasing sequestration rates and storage capacity (carbon inputs) and minimizing carbon loss from disturbances (Paustian and others, 2000). Successful management plans require shifting land uses from those with low or negative sequestering capabilities to those with greater sequestering and storage capabilities (e.g., grassland protection and restoration, wetland restoration and enhancement, or afforestation), as shown in Table 1. However, a portfolio of more incremental management practices (e.g., conservation tillage) is available that, when aggregated over the hundreds of millions of private hectares in the PCOR Partnership region, has significant carbon-sequestering potential.

Croplands can be maintained as net carbon sinks by minimizing soil disturbances and improving the efficiency of soil water and nutrient use. An effective means to reduce soil disturbances on annual croplands is the adoption of conservation tillage, also known as no-till, partial-till, or mulch-till. Conservation tillage minimizes soil disturbance and provides a shield of crop residue that prevents loss of soil moisture and inhibits the breakdown of SOC (West and Marland, 2002). When SOC breaks down, CO<sub>2</sub> is rereleased to the atmosphere. Conservation tillage is most effective when used in conjunction with crop rotation with no, or limited, fallow periods. Historically, seasonal fallow periods have been used to conserve water and mineral content for future crops. This is typically accomplished with the application of herbicides or repeated cultivation. The repeated tillage of crop residue into the soil enhances the release of CO<sub>2</sub> into the atmosphere, thereby reducing the amount of carbon stored in the soil. The desired soil quality benefits of a seasonal fallow period can be achieved by rotating crops and implementing conservation tillage practices, which will enhance the ability of the soil to store carbon (DU Canada and Conservation Production Systems Limited, 2002).

The focus of any grazing land management plan is forage: the edible portion of plants that provide feed for grazing animals. Effective measures to increase carbon sequestration on grazing lands (rangeland and pastures) are those that increase forage availability. Forage production can be enhanced with additional but efficient applications of manure or the introduction of earthworms to the soil. Planted pastures should be seeded as a mixture of perennial grasses and legumes (alfalfa) rather than as a single seed planting to enhance carbon sequestration. A forage mixture better utilizes soil moisture and nutrients and is more resistant to insect and disease infestations. When possible, grazing is preferable to mowing since more organic material (excreta and plant material) is returned to the soil (Schuman and others, 2001).

The most effective practices for terrestrial carbon storage on Great Plains rangelands include grazing management strategies that minimize the risk of soil erosion and stress on perennial grasses. While most Great Plains rangelands have reached their carbon saturation limit, meaning that they have sequestered all of the CO<sub>2</sub> that they can; they continue to be valuable carbon sinks. In fact, a 1% loss of SOC from the surface 10 cm of private U.S. rangelands equals the entire amount of carbon lost annually from all U.S. croplands because of tillage (Lal, 2001). The most likely cause of carbon loss on rangelands is through soil erosion by overgrazing. Overgrazing causes a myriad of negative effects on the composition of plant communities,

**Table 1. Potential CO<sub>2</sub> Sequestration from Best Management Practices in the PCOR Partnership Region<sup>2</sup>**

<b>Activity</b>	<b>Sequestration MTCO<sub>2</sub>e/ha/year</b>	<b>Years of Sequestration until New Equilibrium Reached</b>	<b>Accumulation Potential per Hectare, MTCO<sub>2</sub>e/ha/year</b>	<b>Source</b>
Annual Conventional Tillage Wheat/Fallow	-3.40			3
Conservation Tillage (no-till) from Continuous Cropping	1.17	20		16
Improved Grazing Management	1.06			12
Grazing Land Management– Interseeding Legumes	1.21–5.71			12
Restore Grassland on Cultivated Lands	0.29–6.59	20		12
Wetland Restoration	10.98		36.60	17
Afforestation with Elm/Ash/Cottonwood	7.47	125	935.50	18
One-Time Loss from Conversion of Native Prairie to Cropland	-75.54			12
One-Time Loss of Conversion of Wetland to Cropland	-36.60			17
Average Annual U.S. Passenger Car Emissions (12,500 miles)	-5.19			19

<sup>2</sup> Taken from PCOR Partnership, 2008.

plant regrowth in current and subsequent growing seasons, ground canopy cover, and soil temperature. Damage to rangelands can be reduced by monitoring the frequency, duration, and intensity of grazing. Attempts to measure the impact of light grazing on soil carbon have yielded contradictory results and are likely codependent upon several factors, such as soil type, site management history, plant species, and climate (Schuman and others, 2001). For the mixed-grass prairies of the PCOR Partnership region, improved stocking rates and grazing management will likely increase SOC (Liebig and others, 2005).

Validated and verified offsets largely require that participating landowners enter some form of contract stipulating eligible land uses and BMPs to be implemented and maintained. A perpetual conservation easement or other deed restriction containing a management plan achieves this objective, while also ensuring participating landowners understand their management obligations. The degree to which a project's BMP is implemented will influence the amount of GHGs sequestered/avoided, and offsets produced.



## **Carbon Offset Sales**

### ***Risk Management***

Terrestrial carbon project delivery risk can be managed through the project design by employing conservative emission reduction/avoidance rates and/or using discounts on project emissions benefit to compensate for uncertainties. Carbon offset project insurance can also cover offset delivery default. Carbon insurance products can protect investors not only from project delivery risks but also verification eligibility under regulatory/voluntary schemes and pricing fluctuations with new, more expansive insurance tools yet to develop (Capoor and Ambrosi, 2007).

Terrestrial sequestration projects are subject to a number of risk factors, as previously mentioned, that can be managed with proper project design, management, and suitable legal and financial structures in place. Project delivery risk is ultimately realized in how and when a project's offsets are purchased. The most risk-adverse strategy from a buyer's perspective is a pay-as-you-go scheme with an ex post facto accounting where offsets are only verified after the emission reduction/avoidance has occurred and been independently verified. Under this scheme, offset providers are only liable for offsets already produced. Buyers find this delivery mechanism appealing because payment is for services rendered with no risk of delivery default. Terrestrial sequestration projects are typically poorly suited for this type of payment arrangement, as most project costs are upfront whereas the carbon benefit is realized over many years or decades.

An alternative to the pay-as-you-go agreement is a forward sale or upfront payment option based on an ex ante accounting method. A forward sale payment structure is characterized by full or partial payment for expected offsets to be delivered at a later date. Front-end transactions are desirable to some buyers as they provide access to a steady stream of offsets and hedge risk against future price increases. Financial risk from a front-end payment structure can be managed by discounting future carbon benefits. Project default associated with front-end payment can be successfully managed in several ways. One form of risk management is to have the project developer cash-flow the project by assuming all or part of initial project expenses, thereby inheriting a portion of the default risk. Full payment is then conferred after the project has been implemented, verifiable by the establishment of the terrestrial ecosystem and recording of a property easement.

Another popular risk strategy is a stepwise payment and delivery structure, where total offset delivery is distributed into phases, which can also be arranged as a forward sale if the price is agreed upon before delivery. Payment for offsets are made prior to project implementation, but only for the offsets produced from that phase. After offsets have been secured from the initial phase, payment is conferred to undertake additional rounds of offset production. Project default can also be addressed legally if delivery contracts contain stipulations that project developers replace offsets not produced or are accountable to provide the buyer financial compensation for shortfalls.

## **Legal Instruments**

The development of the voluntary carbon market has created a demand for new legal instruments used for carbon transactions. The abstract nature of GHG as a property right prohibits a single straightforward contract and requires several distinct agreements. Although a carbon transaction may appear as one transaction between an aggregator and a landowner, the clear conveyance of carbon rights and the perpetual protection of terrestrial stocks require several distinct agreements between the involved parties. At the front end of a transaction, a document is needed to convey the rights to the GHG offsets from the property owner to the project developer (see Appendix B for a conveyance example). The landowner conveyance agreement serves several purposes. First, it allows project developers to market and transact the offsets and removes any need for contact between the landowner and end buyer. Stipulations of the agreement also prohibit the landowner, or any other party, from registering the reductions on his/her own behalf or selling the offsets to another party, preventing the double counting of offsets. A second agreement needed between the landowner and the project developer is a permanent conservation easement, or deed restriction, perpetually restricting the property's land use to the specified terrestrial sequestration practice and allowable management practices (see Appendix B for an easement example). These practices can be included as part of a habitat management plan. The easement is recorded with the local city, county, or state courthouse so that the terms of the easement are transferred to future landowners. The distinction of carbon rights and permanent easement rights allows the transference of the easement to other entities such as conservation groups or government agencies, without implicating the entity in a carbon transaction. A perpetual conservation easement provides a legal guarantee that terrestrial carbon stocks will be protected perpetually and are a project requirement for most of the GHG registries and voluntary standards.

The interaction between project developers and end buyers requires a separate set of legal documents to convey the rights and to specify each party's obligations. A bill of sale, or conveyance document, provides the needed legal recognition of the end buyer's ownership and title to the GHG credits generated on project properties (see Appendix B for example). A bill of sale between the project developer and end buyer serves the same purpose as the landowner–project developer conveyance document: providing a traceable record of the offset creation and preventing the double counting of offsets. An executed carbon agreement is a separate contract between the project developer and the end buyer containing financial obligations, delivery schedules, monitoring requirements, legal repercussion for project noncompliance, etc. (see Appendix B for example).

Because of the fluid evolution of the market and the limited number of transactions performed to date, few legal firms have experience in providing adequate legal counsel and producing the needed agreements for landowners, developers, and buyers. For project developers and buyers, finding qualified legal counsel is a difficult process. However, the creation of the sulfur dioxide, or acid rain, trading program in the 1990s has provided some legal precedence.

## **Project and Credit Tracking**

Project developers should maintain a database of legal documentation and tracking of carbon credit transactions. This is critical for project accountability and for providing credit availability for buyers, aggregators, or audits. A geographic information system (GIS) can also be used for tracking offset project locations and carbon credits generated (Figure 4). Information management for carbon programs is integral to ensuring that credits are not double-issued and for providing accurate reports to buyers and investors.

## **TERRESTRIAL OFFSET MARKET CHALLENGES**

### **Preservation**

A common terrestrial sequestration strategy favored by the conservation community and others is the allowance of the preservation or conservation of existing terrestrial carbon stocks. Opponents of preservation argue that such measures do not contribute to additional GHG abatement, although approximately 25% of anthropogenic emissions are caused by land use and land-use change, primarily from deforestation (IPCC, 2007b). The preservation of threatened terrestrial stocks where the threat can be documented and quantified provides a viable GHG mitigation option. Opportunities and the need for grassland preservation in the PCOR Partnership region are particularly strong. An analysis of global biome risk found North American temperate grasslands to be the most threatened global biome out of 13 terrestrial biomes and 810 ecoregions (Hoesktra and others, 2005).

Forest preservation, or REDD, has gained more traction in the international community as an emission reduction strategy. Currently, CAR, VCS, and CCX each have protocols that provide detailed instruction on how forest preservation offsets are to be quantified. There are two primary avoided conversion accounting structures: immediate loss and land-use conversion trend. The immediate loss method assumes that the project site will be de-vegetated in the immediate future given a documented threat, e.g., a permit to develop. The land-use conversion method applies an annual land-use conversion trend for the surrounding area multiplied by the project area to estimate expected de-vegetation in the absence of the project. An example of a land-use conversion trend applied to grasslands is further outlined in the Final Report. A summary is provided below.

### ***Avoided Grassland Loss Protocol in Development***

Registry and/or verification protocols are guides to measure emissions or emission reductions accurately and consistently. When a new carbon offset protocol is being developed, a work group is typically formed to give input on the development, and the public is invited to review and comment. Ideally it is a transparent process striving to achieve the greatest level of integrity, effectiveness, and accuracy. As there is no current methodology or protocol for avoided grassland loss, PCOR Partnership partners developed a project methodology that was validated against the Climate, Community, and Biodiversity Standard. A complete copy of the

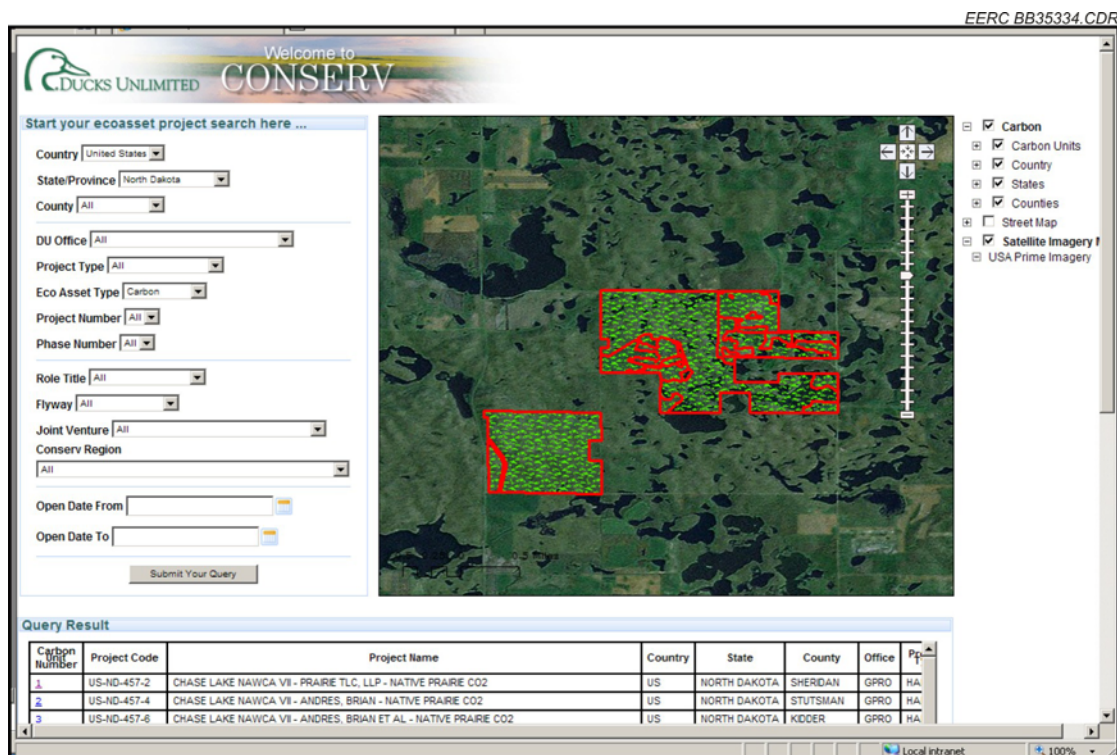


Figure 4. Ecoasset database with GIS front end developed by Ducks Unlimited for tracking carbon credit transactions and project.

methodology document can be found in the Final Report and also at [www.climatestandards.org/projects](http://www.climatestandards.org/projects).

The greatest impediment to advanced carbon sequestration model development is the lack of monitoring and understanding of terrestrial carbon cycling in various ecosystems. Because of the amount of research on forest-carbon dynamics, forestry offsets are the most commonly recognized terrestrial offset. If the carbon values of other ecosystems are to be fully recognized, greater amounts of research will have to be conducted. First among candidate ecosystems for the PCOR Partnership region are seasonal wetlands. Initial research conducted by the PCOR Partnership has found wetlands to be significant terrestrial sinks and a large potential source of emissions if exposed to cultivation (Gleason and others, 2005). PCOR Partnership partners continue to monitor prairie wetland carbon fluxes, but greater policy advocacy and dissemination of research results will be needed to alert policy makers of the GHG-mitigating potential of prairie wetlands.

## CONCLUSION

Terrestrial sequestration in the PCOR Partnership region has many opportunities to benefit from carbon market finance with the development of federal climate legislation that includes a robust offset program. Field measurements of grassland SOC and wetland GHG fluxes

performed during Phase II will continue to be instrumental in the future development of project methodologies and protocols to further advance terrestrial offsets in regulated and voluntary carbon markets, as they have been with the creation of the DU Carbon Credit Program. The development and validation of grassland-based carbon projects can produce market-ready offsets and provide a template that can be further replicated across the region in the future.

However, there are still challenges to address as these markets evolve, including refining the science and economic valuation of ecosystem services. Assigning values and metrics to carbon sequestration values in terrestrial ecosystems will be an integral part of the rule-making process for offsets under federal climate legislation. These rules ultimately affect the financial viability and competitiveness of grassland and other biological offset projects. Other questions yet to be answered about carbon project implementation in the PCOR Partnership region include uncertainties about tax implications for carbon revenue mechanisms for assigning risk or releasing liabilities among parties and the role of public incentive programs in climate mitigation and carbon sequestration.

Finally, considering possible climate change impacts on terrestrial carbon projects, it is important to establish projects and transactions with long-term monitoring or verification obligations (100+ years). Carbon market stakeholders and policymakers continue to research and explore options to address these challenges in ways that facilitate market development yet keep the interests of the various stakeholders in mind.

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## **APPENDIX A**

# **DETAILS OF THE U.S. DEPARTMENT OF ENERGY 1605B PROGRAM**



## **DETAILS OF THE U.S. DEPARTMENT OF ENERGY (DOE) 1605B PROGRAM**

### **Guidance for Aggregators**

The DOE 1605(b) Program can seem perplexing and intimidating to the uninitiated, but with some guidance, the participation process can be greatly simplified. The initial step in 1605b participation is the completion of a Start Year report, composed of an Entity Statement and Emissions Inventory provided in Form EIA-1605. The Start Year report provides the baseline to which future emission reductions will be compared and can be a single year or the average emissions of up to 4 years. Entities intending to report emissions can use a base period of no earlier than 1990 and those intending to register reductions no earlier than 2002. However, the final year of the chosen base period must immediately precede the year that emission reductions are to be reported or registered.

The DOE 1605(b) program differentiates between large and small emitters (those emitting more or less than 10,000 MTCO<sub>2</sub>e) and between registering reductions and less rigorously reporting them. The Simplified Emission Inventory Tool, or SEIT, can be used to determine an entity's large or small emitter status, but the more detailed emission inventory is still required (Schedule 1, Parts B and C of Form EIA 1605). Conducting the initial emission inventory is an onerous but potentially rewarding task of DOE 1605(b) registration. A full account of an entity's emissions provides opportunities to discover operational inefficiencies and provides a voluntary environment to gain emission accounting practice. The Technical Guidelines provide suggested estimation methods and tools for major emission sources and sinks, as well as demonstrative examples. Estimation methods are ranked on an A, B, C, and D scale, with a B average required for entities intending to register reductions.

Either small or large emitters may act as aggregators, registering or reporting offset reductions on the behalf of a nonparticipating third party. In recognition that a functioning carbon registry would require aggregators and that most aggregators would be small emitters, the guidelines give special treatment to small emitters that serve as aggregators. Aggregators may register third-party offset reductions without reporting on their own emissions or reductions, provided that they have already submitted an entity statement and an emission inventory demonstrating total emissions of less than 10,000 MTCO<sub>2</sub>e/year. However, an entity statement and emission inventory must still be filed on behalf of the third-party entity, and the third party must meet all of the requirements as if it were to report the reductions on its own behalf.

Additionally, an agreement with the third party allowing the aggregator to register/report emission reduction activities on the third-party's behalf is required. The DOE 1605(b) registry is not intended to function as an emission-trading platform but does accommodate the registration or reporting of offsets and reductions achieved by parties other than the reporting entity. Emission offsets may be acquired from a reporting entity, such as an aggregator, assuming that the offset provider includes these reductions in its annual report. The offsets can then be distributed to other reporting entities, as long as the relevant information is entered into Addendum B1–B16 and Column 3 of Schedule III of the acquiring entity's annual report.

1) An aggregator or project developer, such as Ducks Unlimited (DU) would be able to report the increased carbon stocks in the 1605(b) registry because its role in enforcing the administrative restrictions (i.e., easements) gives DU long-term control over the sequestration occurring on the land. DU would have to obtain an agreement with the landowner stating that DU may include the carbon sequestration in its 1605(b) report<sup>1</sup>. DU would then be able to distribute the increased carbon stocks (i.e., carbon credits) to another 1605(b) entity using the mechanism in Addendum B3, Part B of Form EIA-1605. Under this scenario, there are no emission-reporting or administrative requirements for or on the behalf of the landowner.

2) This is the offset provision (§300.7[d] and [e] of the General Guidelines) where any 1605(b) reporting entity could report the increased carbon stocks after completing a series of requirements. In addition to obtaining an agreement with the original landowner, the reporter must “include in its report all of the information on the other entity [*i.e., the original landowner*] including an entity statement, an emissions inventory (when required), and an assessment of emission reductions that would be required if the other entity were directly reporting to EIA.”

Option Two represents the administratively burdensome scenario DU and landowners have tried to avoid under DOE. Further, the entity acquiring the offsets would only be able to report, and not register the offsets in 1605b if Option Two is used.

### **DOE Guidelines for Terrestrial Offset Determination**

Terrestrial sequestration is a recognized form of emission reduction action in the Technical Guidelines of the DOE 1605(b) Program. Forest- and agriculture-specific sections detail eligible terrestrial sequestration practices, project requirements, and how offsets are to be quantified. In relation to terrestrial sequestration, the agricultural section is specific to grassland, pasture, and conservation tillage activities. The forestry guidelines are broader in application, referencing “terrestrial carbon stocks” and “native habitat” to describe certain management practices. For example, the preservation of existing terrestrial carbon *stocks* can be reported or registered as a forest management practice if restrictions are placed on the land to ensure that human-caused releases of carbon do not occur in the future. Options include permanent conservation easements and deed restrictions. Another section of the forestry guideline applicable to general terrestrial projects is the treatment of natural disturbances, i.e., insects, epidemics, drought, or wildfires.

Specifically, natural disturbance-induced carbon stock decreases may be excluded from registered emissions and reductions, provided that the entity cannot report gains in sequestration until the carbon stock has returned to the predisturbance level. As discussed in the risk management section, an issue with terrestrial offsets from restoration projects is the relatively long term over which carbon is sequestered. Terrestrial projects on private land have significant up-front costs for the acquisition of land or rights to the land, restoration costs, and carbon payments to landowners. The DOE guidelines accommodate these concerns by allowing for the accelerated registration of native habitat restoration activities. Under this stipulation, 50 years of expected carbon accumulation, discounted 50%, can be registered at project inception if native habitat is restored and administrative restrictions are placed on the land. Administrative restrictions can either be permanent conservation easements or deed restrictions that are

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<sup>1</sup> There is no guidance on the type of agreement, but an easement would be used that stipulates transfer of ownership of greenhouse gas rights to DU or a conveyance document.

registered with the county, state, or other government entity. The 50% discounting of the 50-year carbon stock increases closely approximates the present value of a 50-year stream of annual benefits discounted at a rate of 3% a year. However, no additional changes in the carbon stock attributable to these lands may be reported in the future.

The restoration of terrestrial ecosystems has a twofold impact on greenhouse gas mitigation: the sequestration and storage of carbon and the avoidance of emissions associated with agricultural production. Conventional agricultural production creates emissions from the usage of farm machinery and the application of nitrogen- and lime-based crop-enhancing amendments. Assuming that no on-site leakage occurs, the removal of land from agricultural production will lead to a reduction in overall emissions. Emission reductions from the decline in farm equipment use can be reported to the Registry but not registered since entity output cannot decline to register emission reductions with the Change in Absolute Emissions method. Farm equipment emissions can be calculated by Part D, Mobile Sources, Subsection 1.D.3.1.2 Off-Road Vehicles Including Diesel Locomotives of the Technical Guidelines. Nitrogen and lime application emissions, as well as the emissions of leguminous crops, can be estimated with an inference and activity-specific calculation method. An additional reporting requirement for recording emission reductions from the displacement of agricultural activity is that entity output, in terms of agricultural production, would have to be reported in both a reporting year and base period (U.S. DOE, 2006a).

### **Grassland Sequestration**

Grassland restoration, preservation, and enhanced management of existing stocks are all recognized forms of terrestrial sequestration under the DOE Technical Guidelines. The quantification of carbon sequestered via grassland restoration on croplands can be determined following the protocol under Section H Agricultural Emissions and Sequestration of the Technical Guidelines. Grassland restoration is assumed to take place on locations that have been under cultivation for at least several years prior to the base period. Soil carbon sequestered can be determined in three primary ways: default emission and sequestration figures, modeling (COMET-VR), and direct sampling.

Default sequestration figures for grassland restoration are an easy-to-use method but are a C ranking estimation method because of the large degree of uncertainty and site-to-site variations. Under this method, default sequestration rates are subtracted from default emission rates to provide the net CO<sub>2</sub> balance. Soil emissions are assumed to only occur in the first year of cultivation, accounting for approximately a 40% loss of soil carbon, with no emissions reported thereafter. Table 1.H.22 (DOE Technical Guidelines) provides soil and climate-specific emission estimates. Sequestration coefficients for soil carbon can only be used for 20 years, after which no annual changes in the soil carbon stock can be reported. The default sequestration rate for the establishment of natural vegetation on former cropland is 2800 kg/CO<sub>2</sub>/ha/year or 1.13 MTCO<sub>2</sub>e/ac/year (source: Table 1.H.23 Potential Rates of Carbon Sequestration, DOE Technical Guidelines [U.S. DOE, 2007]).

Model-based estimates of carbon sequestered, such as COMET-VR, are another easy-to-use and inexpensive quantification method. The Web-based program allows users to enter basic management and soil information, calculating an estimated carbon sequestration value. Based on

an uncertainty analysis of how well site soil and management characteristics match the model, COMET-VR-based estimates are either an A or B ranking method. More information and access to the model can be found at [www.cometvr.colostate.edu](http://www.cometvr.colostate.edu).

The most intensive, site-specific, and expensive estimation method for soil carbon is direct sampling, which is ranked as either an A or B estimation method. The specifics of a sampling plan are beyond the scope of this report, and references to appropriate textbooks or protocols can be located in the Technical Guidelines, Section 1.H.4.3.2.3. For reporting requirements, sampling should be conducted every 3 to 5 years. Estimation of soil carbon content from samples can only be conducted at certified laboratories, such as a local land grant university.

### **Forestry**

Although touched on briefly under the General Terrestrial Guidelines Section, the DOE 1605(b) program recognizes a robust portfolio of forest management practices. Eligible forestry projects include afforestation, reforestation, urban forestry, forest preservation, modified forest management, agroforestry, mine reclamation, short rotation biomass energy plantations, and timber product end-use management. The DOE 1605(b) guidelines are not discriminatory on forestry projects, as they are intended to serve as accounting guidelines for forestry owners, both private and commercial.

Unlike grassland and agricultural offsets that sequester the bulk of their carbon in belowground soil, forests sequester the majority of their carbon in aboveground biomass. Estimation methods suitable for forest project carbon estimation include the stock-change and net-flow approach. The stock-change entails an initial measure of carbon pools with successive measurements recommended every 5 years, since annual variations in certain carbon pools are not likely to be significant. A net-flow approach involves estimating the annual increase in carbon based on models or lookup tables. Estimation methods are detailed in Section 1.I.2.6 of the Technical Guidelines.

The U.S. Forest Service (USFS) assisted in the development of the Forestry Technical Guidelines, producing a set of lookup tables provided in Appendix I of the Technical Guidelines. The tables provide carbon stock measurements by carbon pool, age class, species composition, and geographic region. Lookup table estimates are ranked A, B, C, or D depending on how well management and site-specific conditions match those of the tables.

Models provide another user-friendly estimation method, provided they have undergone a scientific peer review, a quantitative comparison of model outputs to field results, and a sensitivity analysis. A model developed by the USFS and eligible for DOE 1605b reporting is the carbon online estimator (COLE). The COLE model is based on the lookup tables provided in the aforementioned appendix, calibrated to the county level and accounting for a greater variety of management conditions and forest species composition. The use of COLE with verified site data is considered an A ranking estimation method, whereas the general use of COLE is considered a B ranking estimation method. The most accurate method is direct measurement. Entities wishing to conduct a direct measurement need to develop a measurement plan by delineating forest area, determining the number of samples needed to provide an accurate estimate, and which carbon

pools are to be measured. It is oftentimes easier for entities to hire an outside party to perform these tasks.

Not all forests are subject to annual reporting of carbon stock changes. Forests placed under a sustainable forestry plan, as certified by the Sustainable Forestry Initiative, Forest Stewardship Council, American Tree Farm System, etc., are assumed to have no long-term declines in carbon stocks. The annual variation in a sustainably managed forest is, therefore, assumed to be de minimis and does not require further measurement.

## **REFERENCES**

U.S. DOE, 2006a

U.S. DOE, 2007

## **APPENDIX B**

### **CARBON LEGAL DOCUMENTS (EASEMENT, CONVEYANCE OF GHG RIGHTS, OPTION, AND ERPA)**

# APPENDIX I

## Carbon Legal Documents (Easement, Conveyance of GHG Rights, Option, ERPA)

North Dakota  
Grassland Easement  
(Revised June 1999)

### UNITED STATES DEPARTMENT OF THE INTERIOR U.S. FISH AND WILDLIFE SERVICE GRANT OF EASEMENT FOR WATERFOWL HABITAT PROTECTION

THIS INDENTURE, by and between \_\_\_\_\_ hereinafter referred to as Grantors, and the UNITED STATES OF AMERICA, hereinafter referred to as United States, acting by and through the Secretary of the Interior or his authorized representative.

#### WITNESSETH:

WHEREAS, the North American Wetlands Conservation Act, 16 U.S.C. 4401-4412; the Migratory Bird Conservation Act, 16 U.S.C. § § 715-715s, the Migratory Bird Hunting and Conservation Stamp Act, 16 U.S.C. § § 718-718j, the Fish and Wildlife Act of 1956, 16 U.S.C. § § 742a-742j, the Emergency Wetlands Resources Act of 1986, 16 U.S.C. § § 3901-3932, and the Land and Water Conservation Fund Act, 16 U.S.C. § 460/-4 to 460/-11, authorize the Secretary of the Interior to acquire lands and waters or interests therein for the development, advancement, management, conservation, and protection of fish and wildlife resources. The purpose of this easement is to protect the habitat quality of the lands described on Exhibit A and such lands shall be maintained to provide cover, especially nesting cover, and food for a varied array of aquatic, terrestrial, and avian wildlife, particularly waterfowl and threatened and endangered species. The lands described on Exhibit A are hereinafter referred to as a wildlife management area, and

WHEREAS, the lands described below contain habitat suitable for use as wildlife management areas.

NOW, THEREFORE, for and in consideration of the sum of \_\_\_\_\_ **and no/100\*\* Dollars (\$XX,XXX.00)**, the Grantors hereby grant to the United States, commencing with the acceptance of this indenture by the Secretary of the Interior or his authorized representative, an easement which includes a right of use for the maintenance of the lands described on Exhibit A, as wildlife management areas, in perpetuity, including the right of ingress to and egress on, over, across and through any and all lands of the Grantors, as described below, by authorized representatives of the United States. No rights herein are granted to the general public for access to or entry upon the land subject to this grant of easement for any purpose. The lands described on Exhibit A are located within, and the aforementioned right of ingress and egress extends on, over, across and through any and all lands within the following-described legal subdivision(s) in \_\_\_\_\_ County, State of \_\_\_\_\_, to-wit:

**T. N., R. W., 5th P.M.**  
Section ??, xxxxxxxxxxxxxxxx

SUBJECT, however, to all statutory rights-of-way and other valid existing rights-of-way for highways, roads, railroads, pipelines, canals, laterals, electrical transmission lines, telegraph and telephone lines, cable lines, and all mineral rights.

The conveyance hereunder shall be effective on the date of the execution of this Indenture by the Secretary of the Interior or his authorized representative; provided, however, that such acceptance must be made within **12** calendar months from date of the execution of this Indenture by the Grantors, or any subsequent date as may be mutually agreed upon in writing by the parties hereto prior to the expiration of such date; and provided further, however, that in the event such acceptance is not made by such date, this Indenture shall be null and void.

The Grantors, for themselves, and for their heirs, successors and assigns, lessees, and any other person claiming under them, covenant and agree that they will cooperate in the maintenance and protection of the habitat areas, delineated on the map(s) attached hereto as Exhibit A, as wildlife management areas for the protection of fish and wildlife resources and to maintain the quality of these lands to provide cover for wildlife, especially nesting cover, and food for a varied array of aquatic, terrestrial, and avian wildlife, particularly waterfowl, and threatened and endangered species. To that end and for the purpose of accomplishing the intent of this Indenture, the Grantors, for themselves or for their heirs, successors, and assigns, lessees, or any other person or person claiming under them covenant and agree as follows:

1. Grantors will cooperate in maintenance of the wildlife management area by maintaining permanent vegetative cover, consisting of grasses, forbs and low-growing shrubs, on said habitat areas, as follows: There shall be no haying or mowing or seed harvesting for any reason until after July 15 in any calendar year, no alteration of grassland, wildlife habitat or other natural features by digging, plowing, disking or otherwise destroying the vegetative cover, and no agricultural crop production upon the habitat areas delineated on Exhibit A, unless prior approval in writing is granted by the U.S. Fish and Wildlife Service; except that grazing the aforesaid lands is permitted at any time throughout the calendar year without approval in writing.
2. Grantors will pay taxes and assessments, if any, which may be levied against the land.
3. Noxious weed control and emergency control of pests necessary to protect the public good are allowed and will be the responsibility of the Grantors, subject to Federal and State Statutes and Regulations. However, mowing/haying noxious weed is prohibited in accordance with the easement terms stated above.
4. This easement and the covenants and agreements contained herein shall run with the land and shall be binding on all persons and entities who shall come into ownership or possession of the lands subject to this easement. The Grantors, successors and assigns shall notify the Regional Director, U.S. Fish and Wildlife Service in writing of any sale or transfer at least 30 days following the sale or transfer of any portion of the lands subject to this easement.

Copies of the above-referenced map(s), Exhibit A, are on file in the Office of the Regional Director, U.S. Fish and Wildlife Service.



It is understood that this Indenture imposes no other obligations or restrictions upon the Grantors and that neither they nor their successors, assigns, lessees, nor any other person or party claiming under them shall, in any way, be restricted from utilizing all of the subject lands in the customary manner for agricultural purposes except as provided herein.

It is further understood that the rights and interests granted to the United States herein shall become part of the National Wildlife Refuge System and shall be administered by the U.S. Fish and Wildlife Service, pursuant to the National Wildlife Refuge System Administration Act, 16 U.S.C. 668dd.

#### SPECIAL PROVISIONS

1. This indenture shall not be binding upon the United States until accepted on behalf of the United States by the Secretary of the Interior or his authorized representative, although this indenture is acknowledged by the Grantors to be presently binding upon them and to remain so until the expiration of said period for acceptance, as hereinabove described, by virtue of the payment to the Grantors, by the United States, of the sum of One Dollar, the receipt of which is hereby expressly acknowledged by Grantors.
2. Notice of acceptance of this Indenture shall be given the Grantors by certified mail addressed to \_\_\_\_\_ shall be effective upon the date of mailing, and such notice shall be binding upon all Grantors without sending a separate notice to each.
3. Payment of the consideration will be made by a United States Treasury check or a check from a private \_\_\_\_\_ conservation organization after acceptance of this indenture by the Secretary of the Interior or his \_\_\_\_\_ authorized representative and after the Attorney General, or in appropriate cases, the Solicitor of the \_\_\_\_\_ Department of the Interior shall have approved the easement interest thus vested in the United States.

IN WITNESS WHEREOF the Grantors have hereunto set their hands and seals on this \_\_\_\_\_ day of \_\_\_\_\_ in the year 20\_\_\_\_.

\_\_\_\_\_(L.S.)  
(L.S.)

\_\_\_\_\_(L.S.)  
(L.S.)

\_\_\_\_\_(L.S.)  
(L.S.)

#### ACKNOWLEDGMENT

STATE \_\_\_\_\_ )  
 )ss  
COUNTY \_\_\_\_\_ )

On this \_\_\_\_\_ day of \_\_\_\_\_ in the year 20\_\_\_\_ before me personally appeared \_\_\_\_\_ known to me to be the persons described in and who executed the foregoing instrument and acknowledged to me that they executed the same as their free act and deed.

Notary  
Public: \_\_\_\_\_

\_\_\_\_\_ My commission expires:

#### ACCEPTANCE

The Secretary of the Interior, acting by the through his authorized representative, has executed this agreement on behalf of the United States this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

THE UNITED STATES OF AMERICA

By: \_\_\_\_\_

Title: \_\_\_\_\_  
U.S. Fish and Wildlife Service

## **OPTION TO PURCHASE GREENHOUSE GAS RIGHTS AND CREDITS**

THIS OPTION TO PURCHASE GREENHOUSE GAS RIGHTS AND CREDITS (this "OPTION") is made and entered into the \_\_\_\_ day of \_\_\_\_\_, 20\_\_ by and between \_\_\_\_\_, husband and wife of \_\_\_\_\_, North Dakota, 58 \_\_\_, hereinafter referred to as "Grantor", and Ducks Unlimited, Inc., a non-profit corporation organized under the laws of the District of Columbia, with an address of One Waterfowl Way, Memphis, Tennessee 38120-2351, hereinafter referred to as "Grantee";

### Protection and Preservation of Greenhouse Gas Rights and Credits:

The Grantor has agreed to the terms and conditions contained in a United States Fish and Wildlife Service (USFWS) easement identified as a "Grant of Easement for Waterfowl Habitat Protection" (Grassland Easement). As part of the decision to sign this easement the Grantor recognizes there may be certain rights that may be marketable commodities. It is the intent of the Grantor that these rights be preserved so that they may potentially be sold in the current or in future markets. These rights are identified as the Greenhouse Gas Rights and Credits (GHG Rights and Credits).

### Severability of Cover-type Components of Grantor's Land:

The Grantor understands that the marketability of the aforesaid GHG Rights and Credits will depend on obtaining an ultimate buyer for these rights. Presently these rights are bought and sold under certain rules and standards that may change over time. These changes can affect the price at which the GHG Rights and Credits will be transferred. In addition, the Grantor recognizes that the current rules and standards favor some cover-types over others.

The four cover-types currently recognized in this option are: (1) native grass, (2) re-established grass, (3) other grass acres including Conservation Reserve Program, natives, and other tame grasses established prior to this option but excluding monotypic alfalfa fields, and (4) wetland acres.

The Grantor understands and agrees that the Grantee under this option will make diligent efforts to re-sell the GHG Rights and Credits associated with each of the above cover-types. The Grantor also understands that the Grantee may not be able to sell the GHG Rights and Credits associated with each of the cover-types identified above and associated with the Grantor's land. Finally, the Grantor understands and agrees that the Grantee may exercise the option on one or more of the cover-types but because of uncertainties in the ability to re-sell the GHG Rights and Credits, the Grantee is not under obligation to purchase the GHG Rights and Credits associated with any or all of the cover-types on the Grantor's land.

Grantor, along with all successors and assigns, hereby grants to Grantee, its successors and assigns, the exclusive right to purchase any or all of the Greenhouse Gas Rights and Credits associated with certain property containing \_\_\_\_\_ native grass acres, \_\_\_\_\_ re-established grass acres, and \_\_\_\_\_ other grass acres including Conservation Reserve Program, natives, and other tame grasses established prior to this option but excluding monotypic alfalfa fields, and \_\_\_\_\_ wetland acres situated in \_\_\_\_\_ County, North Dakota and more fully described on the Exhibit A attached hereto (the "Property");

OPTION PERIOD AND EXERCISING OF OPTION: The Grantor along with all successors and assigns, agrees that this OPTION will remain in effect for five (5) years after the date of execution of this agreement. If Grantee, its successors and assigns, decides to exercise this OPTION a NOTICE OF EXERCISE OF OPTION shall be posted by Certified Mail, Return Receipt Requested, or by overnight carrier such as FEDEX, to the Grantor at Grantor's principle address as shown in the first paragraph of this option.

PAYMENT FOR "OPTION TO PURCHASE GREENHOUSE GAS RIGHTS AND CREDITS": Grantee agrees to pay Grantor the sum of One Dollar (\$1.00) and other good and valuable consideration upon Grantor's signing of this OPTION. This payment binds Grantor to the terms and conditions of this OPTION. Grantor hereby acknowledges that this payment has been received.

Grantee also agrees to pay Grantor the additional sum of \$(One Dollar per acre) (\$1.00/acre) for all qualifying land, after the USFWS Grant of Easement for Waterfowl Habitat Protection (Grassland Easement) to the U.S. Fish and Wildlife Service ("USFWS") has been recorded in the \_\_\_\_\_ County Court House. This payment for the Option to Purchase Greenhouse Gas Rights and Credits will be provided within 21 days after the Grassland Easement recording.

PAYMENT FOR "GRANT AND CONVEYANCE OF GREENHOUSE GAS RIGHTS AND CREDITS": If the Grantee decides to exercise this option on ONE or MORE of the cover types optioned under this agreement, an additional payment of \$ \_\_\_\_\_/acre shall be made by the Grantee to the Grantor for each cover type conveyed in the GRANT AND CONVEYANCE OF GREENHOUSE GAS RIGHTS AND CREDITS. This payment will constitute a full and final payment for the "GRANT AND CONVEYANCE OF GREENHOUSE GAS RIGHTS AND CREDITS" and will be provided at closing.

CLOSING DATE AND DOCUMENTS FOR CLOSING: The closing for the "GRANT AND CONVEYANCE OF GREENHOUSE GAS RIGHTS AND CREDITS" will be within 21 days following the exercise of this OPTION. At closing, the Grantor, successors and assigns and the Grantee, successors and assigns, shall fully execute the "GRANT AND CONVEYANCE OF GREENHOUSE GAS RIGHTS AND CREDITS" document hereby attached and made part of this OPTION.

GRANTOR'S REPRESENTATIONS, WARRANTIES AND COVENANTS: Grantor hereby represents warranties, and covenants to and with Grantee, its successors and assigns, as follows, which representations, warranties and covenants shall be binding upon successor owners of the Property and run with the land:

(a) Notices. Except for the Grassland Easement, Grantor has not received any notice from any governmental authority with regard to condemnation of all or any portion of the Property, any work or improvements required or requested to be done on all or any portion of the Property, or any lien or other encumbrance on all or any portion of the Property. If Grantor receives any notice of any of the foregoing, Grantor shall promptly provide a copy thereof to Grantee.

(b) Transfer. Until payment of the balance of the purchase price hereunder, Grantor shall provide prior written notice to Grantee of any conveyance of all or any portion of, or interest in, the Property.

(c) Title. Grantor is the sole legal owner of the Property in fee simple, and the Property is not subject to any outstanding option or agreement of sale, easement, lien or other encumbrance, restriction, reservation or other condition that would affect the fee simple ownership interest in the Property, except as shown in the public real estate records for the County in which the Property is located. Grantor has not transferred or otherwise encumbered all or any portion of or interest in the GHG Rights and the Credits associated with soil organic carbon or below ground biomass.

(d) Compliance with Easement. Grantor agrees to comply with, and prevent any non-compliance with, the terms and conditions contained in the USFWS Grassland Easement. Grantor agrees that Grantee shall have the right to enforce the terms and conditions set forth in the Easement, and any deviation there from shall require the prior written approval of the U.S. Fish and Wildlife Service.

(e) No Brokers. There are no commissions, fees or obligations owed to any broker by Grantor in connection with this transaction.

(f) Additional Documentation. Grantor, at the request of Grantee and at no expense to Grantor, shall agree to reasonable future amendments, modifications or changes to this Conveyance, and/or execution of such additional documents as are necessary for the GHG Rights and/or Credits to qualify or otherwise become eligible for recognition as greenhouse gas abatement instruments pursuant to any greenhouse gas regulatory program and/or any non-governmental voluntary greenhouse gas program; provided, however, that such future amendments, modifications or changes shall result in no additional obligations upon Grantor.

ACCESS AND INSPECTION: From time to time before and after Grantee's execution of the acceptance of this Conveyance, but in each case upon at least five (5) days advance notice to Grantor, Grantee, its affiliates (including

transferees of the GHG Rights and/or Credits from Grantee) and their agents, may enter upon the Property at reasonable times for inspection, surveying, assessment (including assessment of greenhouse gas sequestration and reduction) and other appropriate purposes related to this transaction.

**REMEDIES:** In addition to any other remedy specifically set forth in this Option, the Grantee, its successors and assigns, has the right to enforce the provisions of this Option through an action for injunctive relief or damages or through other proceedings in law or equity. However, under no circumstances shall the Grantee be entitled to institute any such actions against the Grantor except for intentional or negligent violations of this Option on the part of the Grantor, its agents or employees. The election of any one remedy available under this Option shall not constitute a waiver of other available remedies.

**NOTICES:** All notices and other communications required or permitted hereunder shall be in writing and shall be duly given if delivered by Certified or Registered Mail, Return Receipt Requested, postage prepaid, as follows:

**Grantor:** \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Grantee:** Ducks Unlimited, Inc.  
**Great Plains Regional Office**  
2525 River Road  
Bismarck, North Dakota 58503-9011

**COMPLETE AGREEMENT, GOVERNING LAW:** This Option constitutes the sole and complete Option between the parties and no representations or promises not included in this Option shall be binding upon any party to this Option. This Option shall be governed by the laws of the state where the Property is located.

**EFFECTIVE DATE:** The Effective Date of this Option shall be the date of execution of the last party to sign this Option.

**SEVERABILITY:** If any term or covenant of this Option Agreement or the application thereof to any person or circumstance shall be invalid or unenforceable, the remainder of this Agreement shall be valid and enforceable to the fullest extent permitted by law. No waiver of the breach of any provision of this Agreement shall be construed to be a waiver of any subsequent breach of the same or of any other provision in this Agreement.

**COUNTERPARTS:** This Agreement may be executed in separate counterparts, all of which executed counterparts shall constitute one complete document.

**FIRST RIGHT OF REFUSAL – ASSIGNMENT OF OPTION:** Grantee has invested funds as part of the monies needed to purchase the USFWS GRANT OF EASEMENT FOR WATERFOWL HABITAT PROTECTION (Grassland Easement). It is this Grassland Easement that provides the necessary security and therefore additional value to the GHG Rights and Credits on this property. Grantee wishes to be fair to the landowner but at the same time protect its vested interest in the purchase of the Grassland Easement. Therefore, during the term of this Option, if any third party submits a formal, written offer to purchase the GHG Rights and Credits, from the undersigned landowner, successors or assigns, Grantee may at its discretion: (1) be granted a first right of refusal to match any third party formal, written offer made to the landowner, successors or assigns, to purchase the GHG Rights and Credits or (2) will assign this GHG option to any qualified third party interested in purchasing the GHG Rights and Credits from the undersigned landowner, successors or assigns, provided said third party agrees to fully reimburse Grantee for any and all monies Grantee has invested in the aforesaid Grassland Easement as well as any and all monies invested in this Option.

**GRANTOR AND GRANTEE ACKNOWLEDGEMENTS:** Both Grantor and Grantee hereby acknowledge that they have read, understand and agree to all of the terms and conditions contained in this “OPTION TO PURCHASE GREENHOUSE GAS RIGHTS AND CREDITS” as well as all of the terms and conditions contained in the attached “GRANT AND CONVEYANCE OF GREENHOUSE GAS RIGHTS AND CREDITS” document attached hereto.

IN WITNESS WHEREOF, the parties hereto have duly executed this Option.

**GRANTOR:**

\_\_\_\_\_  
(Landowners Name)

\_\_\_\_\_  
(Landowners Name)

STATE OF NORTH DAKOTA     )  
  )ss.  
COUNTY OF \_\_\_\_\_ )

On this \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, before me personally appeared \_\_\_\_\_,  
husband and wife, known to me to be the persons described in and who executed the within and foregoing  
instrument, and acknowledged that they executed the same.

\_\_\_\_\_  
Notary Public

**GRANTEE:**

**Ducks Unlimited, Inc.**

By: \_\_\_\_\_  
Its: **Director, Great Plains Regional Office**

STATE OF NORTH DAKOTA     )  
  )ss.  
COUNTY OF \_\_\_\_\_ )

On this \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_ before me personally appeared \_\_\_\_\_,  
known to me to be the Director, Great Plains Regional Office, described in and who executed the within and  
foregoing instrument and acknowledged to me that he executed the same on behalf of Ducks Unlimited, Inc.

\_\_\_\_\_  
Notary Public



## GRANT AND CONVEYANCE OF GREENHOUSE GAS RIGHTS AND CREDITS

THIS GRANT AND CONVEYANCE OF GREENHOUSE GAS RIGHTS AND CREDITS (this "Conveyance") is made and entered into the \_\_\_\_ day of \_\_\_\_\_, 20\_\_ by and between \_\_\_\_\_, husband and wife of \_\_\_\_\_, North Dakota, 58\_\_\_\_, hereinafter referred to as "Grantor", and Ducks Unlimited, Inc., a non-profit corporation organized under the laws of the District of Columbia, with an address of One Waterfowl Way, Memphis, Tennessee 38120-2351, hereinafter referred to as "Grantee";

WHEREAS, Grantors are the owner in fee simple of certain real property situated in \_\_\_\_\_ County, North Dakota, described on Exhibit A attached hereto (the "Property");

WHEREAS, Grantor has executed a Grant of Easement for Waterfowl Habitat Protection to the U.S. Fish and Wildlife Service ("USFWS"), a copy of which is attached hereto as Exhibit B (the "Easement"), to protect the habitat quality of the Property as described therein;

WHEREAS, Grantee exercised its option to purchase GHG Rights and Credits from Grantor under the OPTION TO PURCHASE GREENHOUSE GAS RIGHTS AND CREDITS ("Option") dated \_\_\_\_\_, \_\_\_\_\_.

WHEREAS, Grantor agrees to grant, sell, transfer and convey to Grantee all of the rights and interest (real, personal or otherwise) associated with \_\_\_\_\_ acres of \_\_\_\_\_ along with \_\_\_\_\_ acres of \_\_\_\_\_ as identified in the Option to any and all credits, allowances, permits or other tangible or intangible rights, benefits or interests, of, from or related to the Property, whether created through governmental program, regulation, voluntary actions or private contract now or in the future related to carbon dioxide and other greenhouse gases including without limitation the sequestration and reduction thereof (the "GHG Rights"), as well as any recognition, award or allocation of credits, allowances, permits or other tangible or intangible rights, benefits or interests, whether created through government program, regulation, voluntary actions or private contract now or in the future, associated with the GHG Rights for the Property (the "Credits"); and

WHEREAS, Grantee is a conservation organization whose primary purpose is conservation of waterfowl habitat, and that Grantee intends to re-sell the GHG Rights and Credits to help fund additional conservation activities.

NOW, THEREFORE, in consideration of the payment as agreed in the Option and other good and valuable consideration the receipt of which is hereby acknowledged, Grantor hereby permanently grants, sells, transfers and conveys to Grantee, pursuant to the following terms and conditions, any and all present and future GHG Rights and Credits for the Property, including but not limited to all rights to apply for, claim, use or sell all GHG Rights and Credits associated with the Property consistent with applicable laws of the United States and any other jurisdiction, domestic or foreign, including the right to sell or trade domestically or internationally by private or public transactions, and further including the right to count or claim any applicable reductions pursuant to the Department of Energy's Climate Challenge Program and to register all such reductions pursuant to § 1605 of the Energy Policy Act of 1992 and any other governmental program designed to encourage or reward the reduction of greenhouse gas emissions.

1. Payment. This Conveyance is for the Grantee to acquire the GHG Rights and Credits on a total of \_\_\_\_\_ acres. The consideration shall be the sum of \_\_\_\_\_ Dollars (\$\_\_\_\_\_). The Grantee shall make payment to the Grantor within 21 days after the Option is exercised by the Grantee.

Effective Date. The grant, sale, transfer and conveyance of GHG Rights and Credits hereunder shall be effective on the date of Grantor's execution of the Option.

3. Substitute Easement. In the event that the Easement is accepted by the USFWS and recorded, and thereafter the Easement is in whole or in part released or terminated, then Grantor agrees, at Grantee's request, promptly to enter into a grant of easement for waterfowl habitat protection to Grantee or, at Grantee's option, an affiliate of Grantee, imposing the same restrictions on the Property and granting the same rights to the grantee as are set forth in the Easement (the "Substitute Easement").



4. Access and Inspection. From time to time before and after Grantee's execution of the acceptance of this Conveyance, but in each case upon at least five (5) days advance notice to Grantor, Grantee, its affiliates (including transferees of the GHG Rights and/or Credits from Grantee) and their agents, may enter upon the Property at reasonable times for inspection, surveying, assessment (including assessment of greenhouse gas sequestration and reduction) and other appropriate purposes related to this transaction.

5. Grantor's Representations, Warranties and Covenants. Grantor hereby represents warrants, and covenants to and with Grantee, its successors and assigns, as follows, which representations, warranties and covenants shall be binding upon successor owners of the Property and run with the land:

(a) Notices. Except for the Easement, Grantor has not received any notice from any governmental authority with regard to condemnation of all or any portion of the Property, any work or improvements required or requested to be done on all or any portion of the Property, or any lien or other encumbrance on all or any portion of the Property. If Grantor receives any notice of any of the foregoing, Grantor shall promptly provide a copy thereof to Grantee.

(b) Transfer. Until payment of the balance of the purchase price hereunder, Grantor shall provide prior written notice to Grantee of any conveyance of all or any portion of, or interest in, the Property.

(c) Title. Grantor is the sole legal owner of the Property in fee simple, and the Property is not subject to any outstanding option or agreement of sale, easement, lien or other encumbrance, restriction, reservation or other condition that would affect the fee simple ownership interest in the Property, except as shown in the public real estate records for the County in which the Property is located. Grantor has not transferred or otherwise encumbered all or any portion of or interest in the GHG Rights and the Credits.

(d) Compliance with Easement. Grantor agrees to comply with, and prevent any non-compliance with, the terms and conditions contained in the Easement and the applicable easement management plan. Grantor agrees that Grantee shall have the right to enforce the terms and conditions set forth in the Easement and any deviation therefrom shall require the prior written approval of the U.S. Fish and Wildlife Service.

(e) No Brokers. There are no commissions, fees or obligations owed to any broker by Grantor in connection with this transaction.

(f) Additional Documentation. Grantor, at the request of Grantee and at no expense to Grantor, shall agree to reasonable future amendments, modifications or changes to this Conveyance, and/or execution of such additional documents as are necessary for the GHG Rights and/or Credits to qualify or otherwise become eligible for recognition as greenhouse gas abatement instruments pursuant to any greenhouse gas regulatory program and/or any non-governmental voluntary greenhouse gas program; provided, however, that such future amendments, modifications or changes shall result in no additional obligations upon Grantor.

6. Assignment. Either party may assign, in whole or in part, its or their rights, but not their obligations, in this Conveyance; provided, however, that a copy of the written assignment shall be promptly provided to the other party.

7. Remedies. In addition to any other remedy specifically set forth in this Conveyance, Grantor acknowledges that monetary damages may or may not provide a sufficient remedy and that Grantee (and its successors and assigns) has the right to enforce the provisions of this Conveyance through an action for injunctive relief or damages or through other proceedings at law or in equity. Grantor further acknowledges that it is aware that the election of any one remedy available under this Agreement shall not constitute a waiver of other available remedies. No waiver of the breach of any provision of this Conveyance shall be construed to be a waiver of any subsequent breach of the same or of any other provision in this Conveyance.

8. Notices. All notices and other communications required or permitted hereunder shall be in writing and shall be duly given if delivered by Certified or Registered Mail, Return Receipt Requested, postage prepaid, addressed to the party being notified at the addresses first noted above, or at such other address as the parties may designate by notice in writing from time to time.

Notary Public

ACCEPTANCE

IN WITNESS WHEREOF, this Conveyance has been duly executed as of this \_\_\_\_\_ day of \_\_\_\_\_, 200\_\_\_\_.

\_\_\_\_\_  
**Ducks Unlimited, Inc.**

By: \_\_\_\_\_

Its: **Director, Great Plains Regional Office**

STATE OF NORTH DAKOTA     )  
  )ss.  
COUNTY OF \_\_\_\_\_     )

On this \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_ before me personally appeared \_\_\_\_\_, known to me to be the Director, Great Plains Regional Office, described in and who executed the within and foregoing instrument and acknowledged to me that he executed the same on behalf of Ducks Unlimited, Inc.

\_\_\_\_\_  
Notary Public