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Alberta Government

Grassland Carbon Workshop

Summary and Roundtable Recommendations:
Needs, Gaps & Opportunities

January 15, 2016

The views and opinions expressed in this publication are those of the participants and do not necessarily reflect the official policy or position of the Ministry of Agriculture and Forestry nor the Government of Alberta.

Summary

On April 14, 2015, approximately 50 researchers, professionals, landowners and other invited stakeholders took part in a Grassland Carbon Workshop in Edmonton, Alberta. The workshop Agenda and Proceedings are available to view online or download, here. Organized by the Rangeland Research Institute and the Alberta ministry of Agriculture and Rural Development (now Alberta Agriculture and Forestry), the workshop aimed to update participants on the state of knowledge about carbon [C] storage in grasslands—and in other grazed ecosystems and agricultural lands—and familiarize them with how such information can be applied in economic and policy contexts. Participants were subsequently called on to identify needs, gaps and opportunities related to soil carbon valuation, and to articulate specific strategies to address these.

Morning Session: Research Update[1]

Workshop participants learned that although carbon storage in western Canadian grasslands has been studied extensively, important knowledge gaps still remain. Research has shown that soil C varies at multiple spatial and temporal scales, for example, based on region, landscape position, plant community composition, and climate (including temperature and precipitation, and interactions between these). Great Plains ecosystems have often been found to store C under 'normal' climatic conditions, but to be at risk of releasing C back to the atmosphere during drought years. Land management practices also affect C storage; conversion of grasslands to annual cropping systems results in a net loss of C, while inclusion of perennial species in crop rotations increases soil C. Effects of cattle stocking rate and grazing system on C storage remain mostly unclear, in part because many of the complex interactions influencing C cycling in grazed ecosystems, such as processes involving soil microorganisms, are still not well-understood. Additional data and scientific knowledge are required to make robust projections about changes in C storage in western Canadian grasslands. Remote sensing and modelling techniques can augment on-the-ground monitoring to significantly advance knowledge about grassland C, and to clarify how C storage may vary under different atmospheric and land use change scenarios. Meta-analyses of existing data can help to identify methods for quantifying grassland C storage that are most transparent, accurate, complete, comparable, and consistent. The application of such methods can facilitate greater collaboration and consensus among scientists studying terrestrial C storage. This is critical, since researchers still face financial and logistical challenges to conducting research at appropriate scales, and to integrating data from multiple studies in order to draw cohesive and robust conclusions about C storage in western Canada's grassland ecosystems.

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[1] Summary of key messages taken from presentations by Drs. Vern Baron, Angela Bedard-Haughn, Edward Bork, Cameron Carlyle, Miles Dyck, Larry Flanagan, John Gamon, Xiying Hao, Majid Iravani, Brian McConkey, Emma McGeough, and Walter Willms; copies of all presentations are available online at: http://rri.ualberta.ca/en/RanchersRangeUsers/CarbonWorkshop.aspx

Afternoon Session: Valuing Soil Carbon 101[2]

The value of C storage in western Canadian grasslands is not captured by current markets (i.e., it is a positive externality). To internalize the value of this ecosystem service, institutions would have to create demand for soil C storage, either through compliance or voluntary markets. The value assigned to C storage within such markets would theoretically depend on the societal demand for this and other closely related ecosystem services, plus direct costs to the landowner for implementing management practices that increase soil C, opportunity costs associated with adoption of the new practice(s), and transaction costs associated with verifying and contracting out the service. Market mechanisms to pay landowners for an ecosystem service like C storage generally require that the positive outcome (in this case, the amount of C being stored) be greater than it would if the landowner were taking a business-as-usual approach to management. However, if the normal trajectory for perennial grasslands in western Canada is to be converted to other land use types (e.g., annual cropland), maintenance of grassland could qualify as a departure from the status quo, or a 'new practice' to be rewarded. If a public policy were to reward landowners for storing C in grasslands, governments would look for scientific consensus regarding the capacity of different soils to store additional C, and would require the amount of C stored to be verifiable (through direct measurements, or review of management records, for example). Furthermore, the purpose for monetizing C storage would need to be clearly articulated, so that an appropriate policy mechanism could be designed, and a price set accordingly. Important considerations include whether C storage in terrestrial ecosystems is to be valued primarily as an offset to greenhouse gas emissions, or for example, as a proxy for ecosystem conservation. Knowledge needs will differ depending on how the case for rewarding C storage is articulated.

Roundtable

Q1. What is needed to advance soil carbon valuation, from the perspectives of science, economics and policy?

Workshop participants largely agreed that:

- scientific literature on C storage in grasslands needs to be collated and/or synthesized, so that standard approaches to measurement and knowledge gaps may be identified and communicated to all relevant stakeholders;
- more biophysical research must be conducted at spatial and temporal scales relevant to mechanisms underlying terrestrial C storage, and long-term monitoring programs should be implemented or maintained;
- a system for integrating C data from multiple sources in an ongoing way, while still retaining information on local and regional factors, is needed to facilitate appropriately-scaled analyses of terrestrial C storage;
- predicting the rate of change in soil C (over broad areas, and in response to different management approaches) should be a research priority;

[2] Summary of key messages taken from presentations by Tom Goddard, Anish Neupane, Sheilah Nolan, and Dr. Brent Swallow; copies of select presentations are available online at: http://rri.ualberta.ca/en/RanchersRangeUsers/CarbonWorkshop.aspx

- approaches to quantifying the amount of soil C in a given landscape that are both verifiable and cost effective must be developed and/or identified;
- public and private benefits of C storage, and likely responses to incentives or disincentives need to be better understood;
- the reason for internalizing the value of C storage, and the desired outcomes of implementing a new market mechanism, need to be articulated;
- the economic benefits of implementing a mechanism to reward C storage must be quantified, and weighed against potential transaction and monitoring costs;
- given the inherent flux in terrestrial C storage, the potential for market mechanisms to reward temporary vs. permanent storage should be explored;
- research funding needs to be linked to practical considerations (including appropriate timelines, the need for interdisciplinary collaboration, etc.); and,
- more communication is needed between researchers and policy-makers.

Many participants suggested that C storage ought to be considered alongside other ecosystem services from grasslands, and a case should be built for rewarding the provisioning of 'stacks' or 'bundles' of these services. If this approach were taken:

- key ecosystem values that society is willing to pay for should be identified;
- scientists, economists, and policy-makers should evaluate how the suite of key values from grasslands relate to C storage (including potential trade-offs between values); and,
- cost-effective ways of assessing the suite of ecosystem services (or the best proxy for all services) provided by a given landscape should be developed.

In contrast, if the intent of a new market mechanism is to reward C storage itself (e.g., for its role in mitigating the effects of climate change), some participants suggested:

- C storage in grasslands should be considered alongside storage in agroforestry and cropping systems (for which a market already exists), rather than in isolation;
- emissions and storage of other greenhouse gases in grasslands need to be studied along with C; and,
- consideration must be given to whether market mechanisms should be aimed at optimizing or maximizing C storage, and how the approaches to achieving each of these outcomes might differ.

There was no consensus among participants on whether the value of C storage would be best captured by a public policy or a private mechanism, but in addition to engaging with policy-makers, it was suggested that the economics of pursuing premiums for ecosystem services through value-added markets (e.g., C-friendly beef) needs to be explored.

Q2. What are the key gaps within and amongst these fields that inhibit soil carbon valuation?

Key gaps identified by workshop participants included:

- consensus on how baseline levels of C storage should be established, and relied upon during policy formulation;

- farm-/ranch-level information on C storage, including the landowner's experience (e.g., adaptive management actions, goals, motivating factors, etc.);
- articulation of the business-as-usual trajectory for western Canadian grasslands (and the C currently stored therein), and calculation of the opportunity costs to producers for not following said trajectory;
- societal awareness of the value of C storage and other ecosystem services from grasslands, and political will to internalize these values;
- understanding of society's willingness-to-pay for various ecosystem services, and the costs and benefits of paid ecosystem service programs (for landowners, and others);
- information on transaction costs associated with various potential market mechanisms that reward C storage and/or other ecosystem services;
- rationale for coupling the value of ecosystems with, or keeping them separate from, the food market; and,
- funding for research that bridges science, economics, and policy considerations about paid ecosystem service programs.

The lack of locally-appropriate best management practices (BMPs) to promote C storage (and/or overall reduction of greenhouse gas emissions from grasslands and other grazed ecosystems) was another key gap articulated by many participants. Others argued, however, that soil carbon valuation need not be tied to the formulation of BMPs, if the following gaps were addressed:

- existence of a dynamic model/tool to evaluate C storage across relevant areas in a unified way; and
- innovative policy options that account for our capacity to monitor C flux in real time (versus existing options that based on historical scientific approaches).

Q3. What synergies and opportunities stem from the needs and gaps that have been identified?

Workshop participants suggested that policies that reward C storage (or 'bundles' or 'stacks' of ecosystem services) could have multiple positive outcomes, including conserving soil, and thus improving on-farm efficiency, and improving producers' social license to operate by communicating the value of the many services working landscapes provide to the public.

Linkages to other programs or resources may also offer opportunities to reduce monitoring and transaction costs. Suggestions included mining the Government of Alberta's Rangeland Health Assessment dataset for indicators related to soil C and other ecosystem services, and linking environmental farm plan monitoring with ecosystem service monitoring.

Finally, technological developments allow for new approaches to measuring, reporting, verifying, and/or assigning value to C storage, such as using remote sensing of C flux to overcome the inherent spatial and temporal variability in C storage (e.g., by establishing a median level to serve as the baseline for a given area and time period); and tying prices to real-time fluxes in global C stocks.