Saskatchewan Prairie Conservation Action Plan

Prairie's Got the Goods Week!

Adapting Grassland Grazing to Boost Carbon Sequestration

Monday March 16th, 2020 at 12:00pm MT (GMT-06)

Presenter: Mark S. Boyce, Professor of Ecology & Alberta Conservation Association Chair in Fisheries & Wildlife, Department of Biological Sciences, University of Alberta

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Presentation Summary:
Since the Pleistocene, grasslands grazed by bison have sequestered vast amounts of carbon into rich soils across Canada's Great Plains. Our research, supported by the Agricultural Greenhouse Gas Program, is designed to evaluate alternative grazing systems to develop recommendations on how livestock can be managed to maximize carbon sequestration and storage in grasslands. In particular we have designed a sampling procedure to evaluate the efficacy of adaptive multi-paddock (AMP) grazing for carbon sequestration, carbon retention, agricultural production, and biodiversity. AMP grazing involves having cattle at high density for hours or a few days before moving them on to the next paddock. Then for several weeks or months the paddock is allowed to rest without grazing to encourage plant growth without disturbance. AMP grazing is thought to simulate bison grazing where herds graze a site intensively for a short period before moving on to other sites, but with an extended period of weeks or months before revisiting a site.

Our study design involved first randomly selecting among AMP grazers across grasslands of Alberta, Saskatchewan, and Manitoba and then matching these properties with nearby ranches that use alternative grazing systems. Our evaluation required extracting thousands of 1-metre soil cores from which we measured soil organic carbon, inorganic carbon, nitrogen, salinity, bulk density, pH, and to monitor greenhouse gasses we measured CO2, N2O, and methane flux in the soil. In addition, we measured vegetation biomass and diversity, avian diversity and composition, water infiltration into the soil, albedo, and microbial metrics that help us to unravel the mechanisms of nutrient cycling. This research engages a number of investigators, graduate students, and postdocs to synthesize the results into management guidelines.

In soils from AMP ranches we have found reduced CO2 and N2O flux, and greater methane absorbed into the soil. Also, fungi:bacteria ratios are higher in the soil of AMP ranches, enhancing capacity of the soil to store carbon. Enzymes that facilitate carbon absorption by the soil are higher on AMP ranches. Dual-head nfiltrometer revealed better capacity of AMP soils to absorb water. Carbon balance and biodiversity are higher for native grasslands compared with tame pastures. Results continue to accumulate but overall our project supports several advantages associated with AMP grazing.

Recently a Canadian Grasslands protocol has been accepted by the California Action Reserve, a registry for carbon where carbon credits can be purchased by industry or government to support practices that sequester carbon. Grassland soils are highly secure places for carbon storage so long as the land is maintained in permanent grassland cover. Now that we have an accepted protocol, applications can be made for carbon investments allowing ranchers to receive monetary rewards for managing grazing to maximize carbon sequestration and storage.

Not only could this project have positive implications for beef producers in terms of monetary incentives, but it also could provide benefits for the Canadian beef industry as a whole in terms of improved public perception. If we can demonstrate the reduced carbon intensity of Canada's beef production by deploying AMP grazing practices, this could enhance public trust in Canada's beef system. Being able to more comprehensively put the socio-economics and science story together could further support and encourage a shift towards climate-friendly beef and restored grassland.

About Dr. Boyce:
Dr. Mark S. Boyce was recruited to the University of Alberta in 1999 to become the first Alberta Conservation Association Chair in Fisheries & Wildlife, and Professor of Ecology in the Department of Biological Sciences. He has been teaching and conducting research since 1976 on a wide variety of basic and applied topics related to wildlife management and conservation biology, and more recently, on the importance of grasslands in providing environmental goods and services such as carbon storage and the maintenance of biodiversity. Dr. Boyce is an elected Fellow of the Wildlife Society and the Royal Society of Canada and has been awarded the Miroslaw Romanowski Medal by RSC for using science to solve environmental problems.