Western Beef Resource Committee

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Cattle Producer's Handbook

Range and Pasture Section 515

Global Climate Change: Opportunities and Challenges for Rangeland Managers

Sheila Barry
Livestock/Natural Resource Adviser
University of California Cooperative Extension

Carbon dioxide (CO_2) is one of the major greenhouse gases contributing to global climate change. The burning of fossil fuels by is a primary source of CO_2. Methane and nitrous oxide are more potent greenhouse gases but occur in much smaller quantities. The current focus of reducing greenhouse gases on rangeland is on sequestering CO_2, because CO_2 from the atmosphere can be captured by plant photosynthesis and trapped in the soil. Rangelands can act as organic carbon soil sinks.

Research is beginning to shed light on management practices that may improve the carbon sequestering capacity of rangelands. This is becoming both economically and environmentally important. This fact sheet explores current economic opportunities as well as management challenges to consider in regards to storing CO_2 in rangeland soils.

Current economic opportunities allow rangeland owners to sell carbon offset credits in the commodity market. These offset credits are purchased by businesses, municipalities, or individuals that want to mitigate their "carbon footprint." The Chicago Climate Exchange (CCX) sets the contract specifications for the exchange program. The CCX is the world's first and North America's only active, voluntary, legally binding trading system to work toward reduction of greenhouse gas emissions. In addition to rangeland improvement projects, the CCX offers credits to the following projects: agricultural methane, landfill methane, coal mine methane, agricultural soil carbon, forestry, and renewable energy.

Basic CCX Specifications for Rangeland Soil Carbon Management

Offset credits can be issued to rangeland owners who commit to increased carbon sequestration through grazing land management in eligible geographic areas. Eligible geographic areas are defined according USDA Land Resource Regions and include only rangeland sites where long-term annual average precipitation is not less than 14 inches and not greater than 40 inches.

Eligible project types on rangeland include:

- Non-degraded rangeland managed to increase carbon sequestration through grazing land management that uses light to moderate stocking rates and sustainable livestock distribution.
- Restoration of previously degraded rangeland through adoption of sustainable stocking rates, rotational grazing, and seasonal use grazing practices initiated on or after Jan. 1, 1999.

Offsets are issued at standard rates depending on project type and location. Rates vary from 0.12 to 0.52 metric ton of CO_2 per acre per year. Fig. 1 maps out the USDA Land Resource Regions.

Offset projects involving less than 10,000 metric of CO_2 equivalent per year should be registered and sold through an Offset Aggregator. An Offset Aggregator is an entity that serves as the administrative representative, on behalf of offset project owners, of multiple offset-generating projects.

The following documentation is required to participate in the program: (1) map and photos of the property; (2) evidence of previously degraded status as defined by USDA NRCS, if applicable; (3) evidence of stocking rate (i.e., ranch records, grazing plan); and (4) Range Management Plan including project narrative, utilization, season of use, plant productivity, average grass height, dominant species, invasive species, precipitation, and drought mitigation. Offsets may be issued for each year that verifiable grazing practices have been implemented from 2003 to 2010.

Since January 2008 prices for carbon offset credits have ranged from $1 to over $7 per metric ton. For more information on the exchange visit www.chicagoclimatx.com.

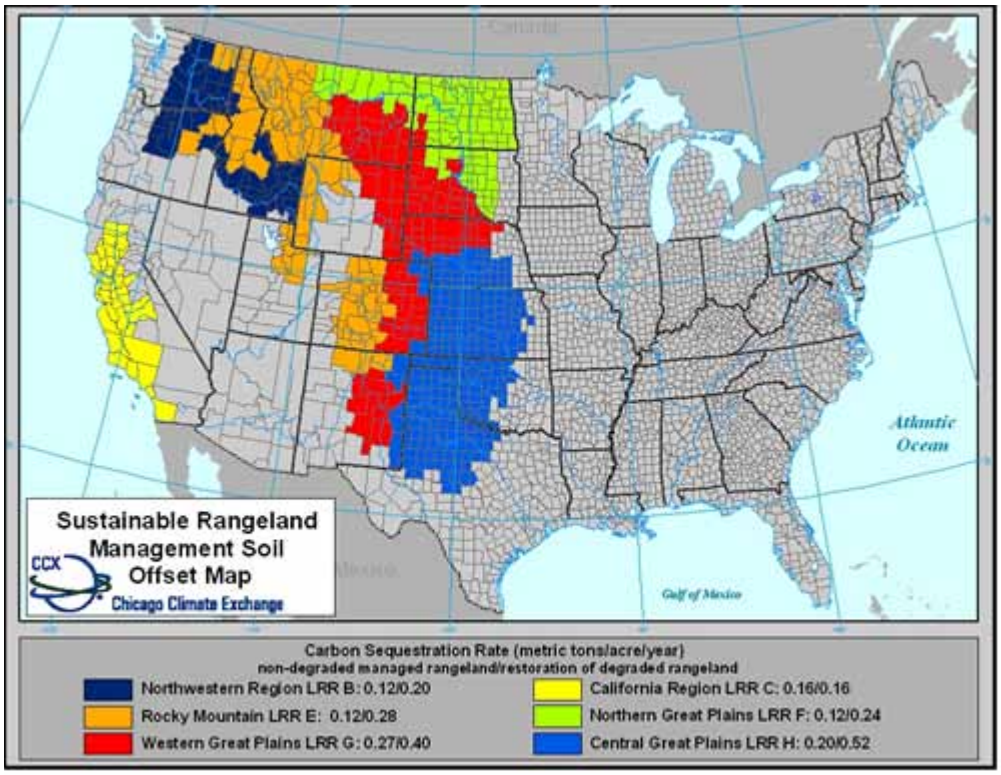

Fig. 1. Sustainable Rangeland Management Soil Offset Map.

The Climate Exchange Registries

In addition to the Chicago Climate Exchange, there are state (The California Climate Registry) and national (The Climate Registry) programs to track and register baseline carbon emissions and voluntary projects that reduce emissions. Although these programs provide no formal market framework for the exchange of credits, entities wishing to offset their carbon emissions may "shop" from a list of registered projects and negotiate with the carbon offsetter to financially support these projects. These programs provide standardize accounting systems for reporting greenhouse gas emissions and standardized protocols for gas reduction. Currently there are no protocols for carbon offset projects on rangelands.

Rangeland Management for Carbon Sequestration

A review of rangeland research has indicated that climatic variables, native vegetation, depth, time, and original soil C all affect rates of soil C change, but on average, management improvements and conversion into pasture lead to increased soil C content and to net soil C storage. Although range specialists are just beginning to understand the net impact of management practices on increasing soil C storage on rangelands, initial findings indicate that several range improvement techniques intended to increase forage production may potentially increase soil C. In particular, the following range improvement practices seem to have significant affect on soil C:

Sowing Grasses and Legumes

In addition to increasing forage production, sowing grasses and legumes often results in increased belowground production. This leads to increased belowground C inputs and can result in increased soil carbon. Furthermore, the introduction of legumes can increase soil nitrogen, resulting in superior soil fertility, further increasing aboveground and belowground production. It appears likely that sowing improved species, both grasses and legumes, increases total plant–soil system C, thus sequestering atmospheric carbon.

Grassland Fertilization

Grassland fertilization has been used for centuries to increase forage production. Fertilization results in increased belowground production as well as aboveground production, which can both lead to increased soil carbon.

Fertilization resulted in increased production, when it was measured, with increases ranging from 41 to 109 percent. Soil C increases were generally greater with higher levels of fertilization, though this is not always the case.

The addition of manure to soil can also lead to increased production, leading to increased sequestration of atmospheric carbon. However, the direct addition of manure makes it difficult to estimate atmospheric C sequestration since a portion of increased soil C is attributable directly to the addition of manure C to the soil.

Grazing Management

Moderate grazing has generally been shown to maximize forage productivity. With forage production maximized, producers can expect to see the highest potential for soil C.

Both prolonged rest and continued over utilization by livestock can result in significant decreases in forage production and shifts in plant composition, which may impact ability of rangelands to store C. The impact of managed grazing in increasing soil C is more significant in warm dry regions, especially those with high potential evapotranspiration.

Trade-offs from Emissions of Rangeland Management

Though current studies indicate that improved grassland management can sequester considerable amounts of atmospheric C, emission costs are associated with many types of grassland management. For example, nitrogen fertilizer applied to grasslands also contributes significantly to N_2O emissions. Carbon and nitrogen emission costs associated with improved management must be considered when estimating C sequestration potential of grassland soils with improved management.

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