Section 2
Grazing Management

Greenhouse Gas Benefit

According to *Beneficial Management Practices: Environmental Manual for Alberta Cow/Calf Producers*, grazing management is the care and use of range and pasture to obtain the highest sustainable yield of animal products without endangering forage plants, soil, water resources and other important land attributes. Accomplishing these goals require maintaining an adequate leaf area on desirable plants in order to intercept the sunlight on which photosynthesis depends. Animal grazing must also be controlled so that plant vigour is maintained, and water and nutrient cycles are enhanced. Grazing systems that control where and for how long the cattle graze, result in healthier pastures, higher productivity and potentially, a longer grazing season. Given the number of acres dedicated to livestock grazing in Alberta, improvements in grazing management could have a positive impact on provincial soil carbon sequestration while contributing to improved production and profitability.

Current Research

Significant gains in soil carbon may be achievable on grazing lands that are intensively managed (e.g. via nutrient amendment, irrigation, re-vegetation). But most grazing lands in Canada are subject to only minimal management (primarily through control of grazing intensity); while some opportunities for further carbon storage may exist, especially on degraded lands, the rates and amounts of carbon gain have not been established, widely and unambiguously, by analyses of rangeland soils.[14]

Increases in soil carbon are often associated with other benefits, notably preserved or enhanced productivity. Often these other benefits are sufficient to warrant the adoption of carbon-conserving practices, even apart from carbon sequestration benefits. Indeed, decisions to adopt carbon-conserving practices are often driven more by considerations other than sequestration.[15]

Credit: Duane McCartney

Improve your grazing management

Greenhouse Gas Benefit

A grazing system that shifts between use and recovery increases productivity and improves the quality of the forage. Healthy forage stands can increase the level of carbon sequestered in the soil. Although both rotational and intensive grazing systems require more management, labour and a potential increase in costs, subsequent increases in stocking rates, returns per animal, forage production, number of grazing days, net income and improved herd health are among the reported benefits.[16]

Generally speaking, most people that seek out grazing courses or consult with experienced graziers will make some changes to their management strategy. To see what these changes mean to pasture yield and species potential may take at least three years of improved grazing management to realize. Primary factors influencing that rate of change include moisture conditions and the extent of the management change that has been undertaken.

Alberta provides a wide range of training opportunities and print material that offer a greater understanding of grazing principles. For more information on the details of grazing, obtain a copy of *Beneficial Management Practices: Environmental Manual for Alberta Cow/Calf Producers* from Alberta Agriculture and Food, Ag-Info Centre: 310-FARM (310-3276) or Publications: 1-800-292-5697 (www.agric.gov.ab.ca). In addition, you can consult with an experienced grazier by contacting the Agriculture and Research Extension Council (780) 416-6046 (www.areca.ab.ca) and inquiring about the Grazing Mentor Program.

Current Research

There are a lot of misconceptions about what happens with carbon. Carbon is always in a state of flux. Sometimes it is being stored or sequestered and sometimes it is being released. Nature's goal is to reach an equilibrium – strike a balance to match the amount of carbon stored with the amount being released. That would be success…Carbon dioxide in the atmosphere is captured by plants and stored as carbon in plant tissue and in the soil…If there is a net carbon gain over a year the crop-soil continuum is a carbon sink. Healthy, vigorous growing forage stands, annual crops and land that is not cultivated have the greatest potential to store or sequester carbon. Overgrazed pastures, for example, and traditional summerfallow will release more carbon to the atmosphere than is saved and are known as sources of carbon. Several factors affect the amount of carbon returned to the atmosphere. Soil moisture, temperature, length of the dormant periods and health of the plant are all part of the equation…Field cultivation, pastures that are continually overgrazed or forage and crop stands under drought conditions are prime for net carbon respiration (i.e. carbon loss). Overgrazing and drought [create] conditions [under which] a forage stand has reduced ability to store carbon because photosynthesis is limited… Improved forage and grazing management often increases the equilibrium point for carbon storage or the amount held in the carbon account. Sequestration rates increase for a period of years until a steady state carbon-equilibrium is reached (the sink is full, based on prevalent conditions)… Small improvements to carbon sequestration rates over the large area of pasture and rangeland in western Canada could have a large impact.[17]

Reduce or eliminate cultivation on pasture lands

Greenhouse Gas Benefit

Many producers consider it necessary to break up a pasture thinking it has become "root bound" and therefore lost its productivity. However, whenever you cultivate you lose a portion of soil carbon. Historically cultivation has been employed to control weeds, prepare seedbeds and ultimately, to release nutrients stored in the soil organic matter. Over time, as the soil nutrients become exhausted, there comes a greater dependence on inorganic fertilizers to encourage plant growth. Under good pasture management perennial forages can be long lived at the same time maintaining or increasing soil carbon levels.[18] In the event that a stand has to be terminated, herbicide application may be considered rather than cultivation. The process of reestablishment provides an ideal opportunity to evaluate the makeup of the forage stand. Choosing the correct plant mix can make a significant difference in both productivity and sustainability. A large amount of carbon is stored in plant root systems and ultimately in the soil. Using a minimum disturbance seeding method will reduce the amount of carbon lost in the seeding process.[19]

Current Research

Breaking up and reseeding [perennial] forage [pastures] should be looked at as a last resort. Using tillage is expensive, leaves the soil prone to erosion and generally means losing one year of production.[20]

Planting adapted and improved species on tame pasture could increase the rate of carbon sequestration over pastures by 100 to 300 grams per square meter per year until a new equilibrium is reached.[21]

Credit: Gwen Doran

Incorporate legumes into tame pasture mixes

Greenhouse Gas Benefit

When considering a pasture mix, look to a grass/legume combination. Legumes provide grasses with nitrogen, creating a more balanced system. Adding legumes to pastures can actually improve animal performance by increasing feed intake, providing greater feed efficiency and by fostering a better use of forage nitrogen content. Grazing legumes improves feed efficiency and reduces methane emissions because they are more easily digested. This allows for quicker digestion and shifts the fermentation process towards lower methane production.

There are many greenhouse gas benefits in utilizing grass/legume forage mixes:

- the reduction in the amount of time it takes cattle to digest their feed results in decreased methane emissions
- soil carbon sequestration is increased as the amount of land in perennial forages increases
- legumes fix their own nitrogen from the atmosphere and do not require the addition of nitrogen fertilizer (In addition, grasses will utilize the nitrogen produced by the legumes reducing the possibility of nitrous oxide emissions.)

Current Research

Adding as little as 25 percent legume in the forage mix may result in significant drops in methane production because it greatly improves the efficiency of fermentation in the rumen. [22]

There are compounds, e.g. tannins, saponins and flavonoids, found in some animal feeds, particularly forages, that do reduce methane output…The challenge of research into these compounds is to find the level in the diets that might reduce methane output without having negative effects on the animal elsewhere. Some quite encouraging results are evident with tannins…Sainfoin is a tanniniferous legume of potential in Western Canada…It can be concluded that tanniniferous forages, such as sainfoin in western Canada or trefoil in eastern Canada, could be used to reduce methane output by grazing cattle. Unfortunately sainfoin many not have longevity or other attributes to make it adaptable in all regions of western Canada. It is too early to prescribe specifically how much tannin could be added to cattle feed to reduce methane output...[23]

Credit: Alberta Agriculture and Food

Maintain a litter cover

Greenhouse Gas Benefit

Litter, also known as mulch, is old grass residue left from previous plant production. It performs several important functions that contribute to the health of grazing lands while reducing and/or removing greenhouse gases:

- as the litter breaks down, plants use the available nutrients, increasing soil carbon content and reducing the need for the application of additional fertilizer
- litter conserves moisture by reducing evaporation thereby encouraging plant growth
- litter shades and cools the soil surface, traps snow, increases water infiltration and reduces raindrop impact

Litter cover and distribution is one of several factors taken into account in determining the overall health of grazing land. The *Rangeland Health and Assessment for Grassland, Forest and Tame Pasture Field Book* published by, and available through Public Lands Division – Alberta Sustainable Resource Development, is a comprehensive tool that one might use to assess the condition of specific grazing sites. To obtain a copy, contact Public Lands Division, Alberta Sustainable Resource Development. (On the Rite Line, dial: 310-0000).[24]

Note: The term "range health" refers to the ability of rangelands to perform certain key functions including net primary production, maintenance of soil/site stability, capture and beneficial release of water, nutrient and energy cycling and functional diversity of plant species.[25]

Credit: Kelly Montgomery

Extend your grazing season:

- **Stockpile perennial forage;**
- **Swath graze; or**
- **Seed annuals.**

Greenhouse Gas Benefit

Many livestock producers have determined that it is possible to extend their grazing season. Successfully doing so will see a decrease in financial costs and carbon dioxide emissions through the reduction or possible elimination of the fossil fuel required to put up and deliver forages to the livestock. Nitrous oxide and methane emissions may be reduced when the manure is directly deposited on carefully selected winter-feeding sites rather than stored in piles that may encourage anaerobic decomposition. Overall workload and fossil fuel use associated with hauling and spreading manure from confined areas will also decrease. Each strategy has both benefits and cautions. In all cases, remember to:

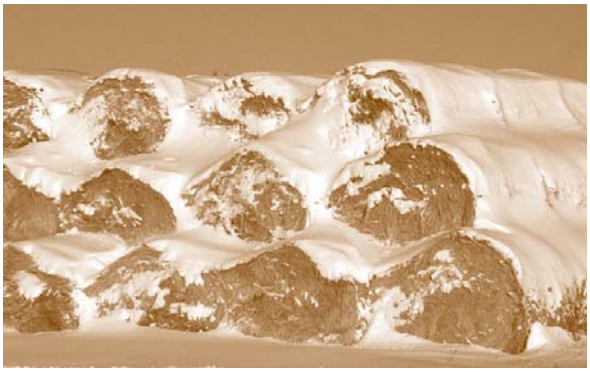
- determine sources of water and shelter
- recognize that snow conditions may hamper access to the feed
- consider the additional costs of checking cattle and developing and managing a fencing system
- be prepared for potential conflicts with wildlife

Stockpile Perennial Forage

To bank or stockpile pasture for use in the dormant season, plan a recovery period that is appropriate for the pasture type and growing conditions. In moist areas, cutting or grazing in early July followed by a pasture re-growth period for the remainder of the growing season may provide the best balance between quality and quantity. In drier areas, an entire year's growing season may be required. These strategies have the potential to result in an adequate quantity of high quality pasture for use in the fall or the following spring.[26] Species that are suitable for stockpiling must retain yield and feed value well enough to supply the cow's nutritional needs. When frost causes leaf loss or when rain and snow melt leach sugars out of frozen and dead plant cells, both yield loss and feed value loss can occur.[27] Dormant pasture may not contain an adequate quantity or balance of nutrients. Feed tests, monitoring animal condition and supplementing as required are necessary to maintain herd health and productivity.

Current Research

With a winter feeding period on the Canadian prairies that may last 200 days, winterfeed and feeding costs of beef cows are the largest costs in beef calf production. By stockpiling perennial forages, feed and feed costs may be reduced by 46 percent. This happens because baling, hauling, feeding and manure removal are eliminated from the traditional winterfeeding practice… The Alberta Agriculture Research Initiative funded a stockpiled perennial forage research project in Central Alberta. Scientists at Lacombe monitored yield and nutritive losses from the fall until spring of nine adapted forage species. This was repeated over three years from the fall of 1998 until spring of 2001. It was found that species choice is the first step in a successful stockpiled grazing program. The legume alfalfa lost leaves after frost and had more rapid yield and nutritive loss than all of the grass species. Grass species commonly found in permanent pastures, such as creeping red fescue and Kentucky bluegrass had the disadvantages of relatively low yields to begin winter. Quackgrass yielded well in years with average to above average rainfall and had below average yield loss due to weathering. Meadow bromegrass had stable and relatively high yields during all years of the study. What separated meadow bromegrass and creeping red fescue from the other species was their ability to resist the weathering process. In spite of frost, snow, snowmelt and rain, they retained their nutritive value longer than all other forage species. Their nutritional value maintained beef cows well into the winter months.[28]



Credit: Duane McCartney

Swath Graze

Swath grazing involves leaving swathed, late seeded annuals for cattle to graze during the dormant season. One additional consideration that needs to be taken into account with swath grazing involves the residue remaining in the field if the cattle have not made good utilization of the feed. Addressing this in the spring may require an increase in time, money and greenhouse gas emissions.

For more information on the details of swath grazing, obtain a copy of *An Introduction to Swath Grazing in Western Canada* Agdex 420/56-1 by contacting Alberta Agriculture and Food, Ag-Info Centre: 310-FARM (310-3276) or Publications 1-800-292-5697 (www.agric.gov.ab.ca).

Current Research

Plot research at Lacombe showed that there was potential for wintering cows on meadow brome and alfalfa regrowth. [During the winter of 2004/05], a research trial was established to evaluate cows grazing this type of perennial pasture. The meadow brome/alfalfa pastures were cut for hay in mid-July and the regrowth was then available for grazing during November, December and January. This growth was left standing for grazing through the snow. Winterkill was a major question and it was felt that trampling and smothering problems could occur if the perennial crop was swathed. By leaving the stockpiled forage standing, we also eliminated the swathing cost. The cows were strip grazed using an electric fence which was moved every two to three days depending on snow conditions…The forage was still green and the nutritional quality met the cows requirements…All cows performed well under these conditions. In fact they wintered in the same body condition as cows on oat swaths or fed a straw silage ration in the wintering facility. Cows appeared to be content during the winter grazing period. The cows on the meadow brome would graze the standing alfalfa stems first, (there were some alfalfa leaves remaining on the stems), followed by grazing the meadow bromegrass. The grass was flat to the ground. The cows would break through the snow and graze the meadow brome completely to the ground… We intentionally did not regraze the perennial fields in the early spring after calving as we were concerned about grazing the new growth too early in the spring before the plants had reached the three leaf stage. The alfalfa stand in the spring showed no visible signs of winterkill damage. The previous fall had been quite cold before the snowfall and the alfalfa plants had ample time to harden off prior to freeze up. This study continued for the winter of 2005/06.[29]

Current Research

Swath grazing of oats or barley can be used to pasture cows from mid-November to early spring depending on the calving season. Research at the Lacombe Research Centre has shown that swath grazing can reduce the traditional winter feeding and yardage costs by up to 50 percent with cows coming through the winter in the same body condition as those wintered on stored feed.[30]

Credit: Kelly Montgomery

Seed Annuals

In special circumstances when grazing options are limited, both spring and winter cereal crops can be used to provide productive annual pasture crops. Annual crops such as the ryegrasses can be utilized as well, although they do require a higher level of moisture to properly establish and be productive. Spring seeded oats and barley tend not to regrow as well as spring-seeded cereals such as fall rye, winter triticale and winter wheat. Winter cereals grow and stay green well into the fall for grazing. Fall rye and winter triticale are more productive at that time of year, whereas research has shown that winter wheat can be slightly more productive during the summer months.[31] Intercropping systems involving oats or barley interseeded with Italian ryegrass, fall rye, winter wheat or winter triticale have the potential to provide additional fall grazing as well as a silage crop. This system allows for dual use of your land base. However, to make this system functional, the crops need to be seeded as early as possible and cut for silage earlier than normal in order to provide enough growing days for the fall crop to grow.[32]

Current Research

Research out of Brooks has shown that if the spring cereals are clipped on a monthly basis, they are more productive than if they are clipped weekly or biweekly. This indicates that a rotation grazing system will increase production of the spring seeded winter cereals. Other research has shown that growing spring cereals and winter cereals in a mixture will increase the grazing days of the pasture. The early growth of spring cereals generally allows grazing seven to ten days earlier. In most instances, half a bushel of oats or barley mixed with a normal rate of winter cereals is a good mix... Winter cereals are a very effective source of pasture in the fall and provide a high quality productive pasture that can be used to extend the grazing season. Winter cereals have been shown to be a versatile crop that can be used for supplement pasture to reduce the overgrazing on perennial pastures.[33]

Credit: Vicky Spenst

Carefully manage riparian areas

Greenhouse Gas Benefit

Riparian areas are zones of vegetation along-side streams and around water bodies where the vegetation and soils are strongly influenced by the presence of water. In terms of greenhouse gas emissions, cattle managed improperly in these areas tend to overgraze the vegetation, negatively impacting soil carbon reserves and cause additional physical damage through soil compaction. The mismanagement of livestock can increase the amount of nitrous oxide emitted through the addition of manure to the system (Photo A). Riparian areas are recognized as having numerous important ecological functions (Photo B) that include:

- water filtration, which controls salinity and siltation
- water flow control, allowing for groundwater recharge
- flood regulation
- excellent source of clean water
- reliable source of pasture
- reduction and dissipation of stream energy
- maintenance of biodiversity[34]

Riparian area resources and functions are different from those of surrounding lands and require specific management techniques. Implementation of an appropriate grazing plan will take into account such specifics as controlling access, choosing alternate watering points, fencing, and utilization of distribution tools such as salt and mineral. Assessing riparian health can be achieved with the aid of *Caring For The Green Zone: Riparian Health Assessment for Streams & Small Rivers Field Workbook*, available through the Cows and Fish Program. To obtain a copy, visit their website at www.cowsandfish.org and follow the links to Community Tools and an online order form, or you can call the Cows and Fish Program Manager at (403) 381-5538.

Photo A Credit: Jeannette Austin

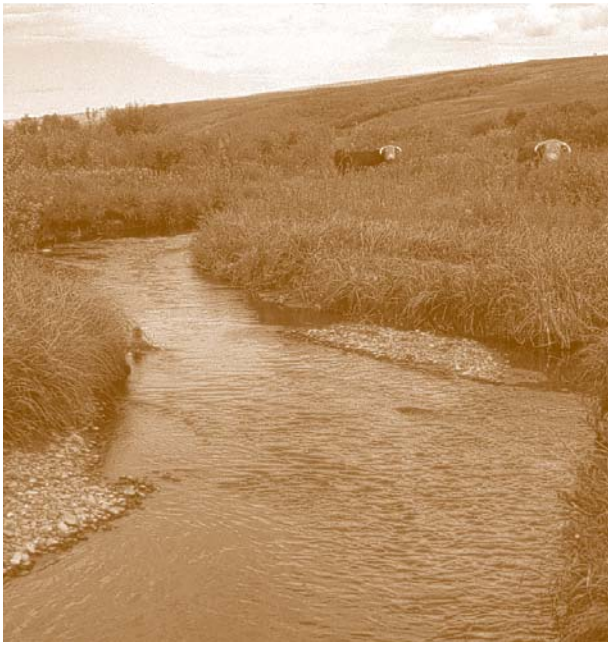


Photo B Credit: Cows and Fish