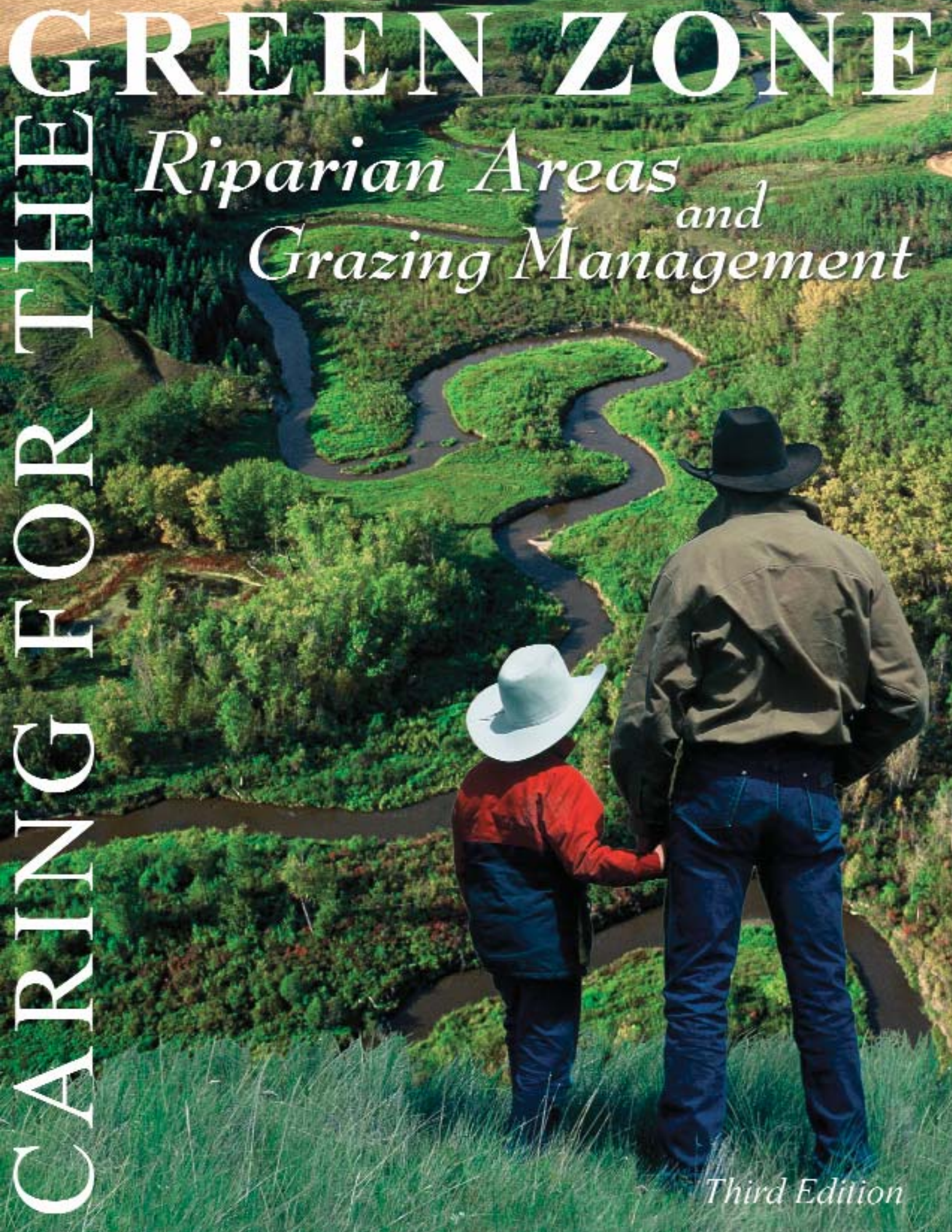
CARING FOR THE

GREEN ZONE

Riparian Areas and Grazing Management



Third Edition

Riparian Areas and Grazing Management

Third Edition

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What's in this Book?

In Riparian Areas and Grazing Management you'll find:

- Some help in understanding how riparian areas work and how to interpret your observations of these landscapes.
- A way to look at riparian areas from a different perspective-how they fit into a landscape and why they are valuable.
- Something to spark thinking about changes in livestock management (and other land uses) to improve riparian health.
- Encouragement to make the first steps toward improving and restoring the health of riparian areas.
- Tools and techniques, some in use by your neighbours, that you may need to solve a problem in your riparian area.
- Where to turn to find additional information, resources and advice.

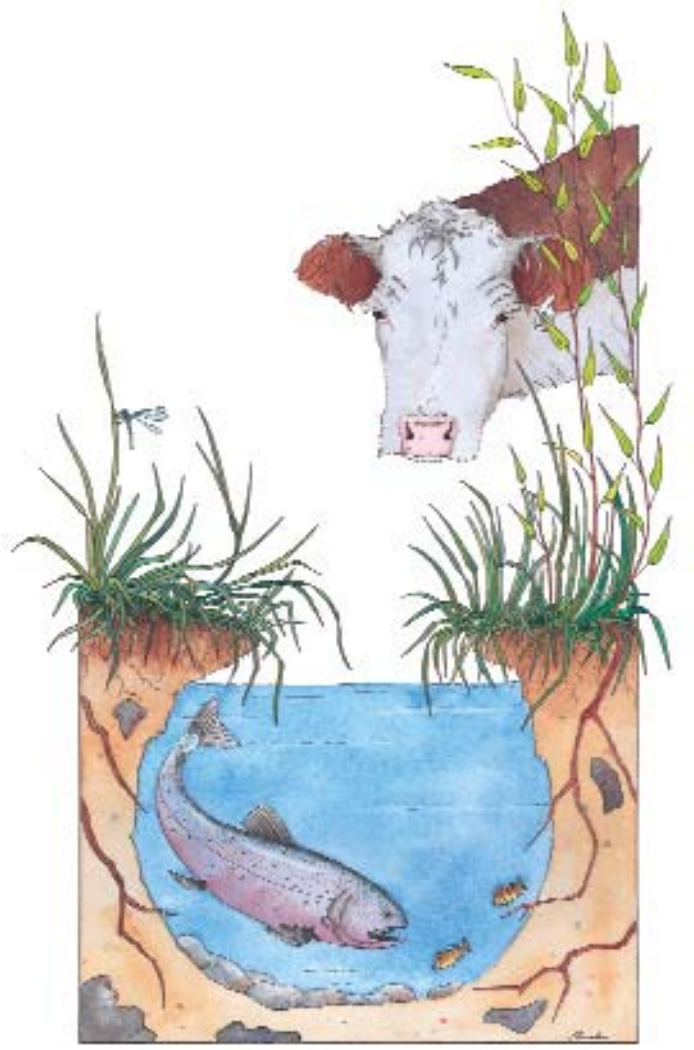

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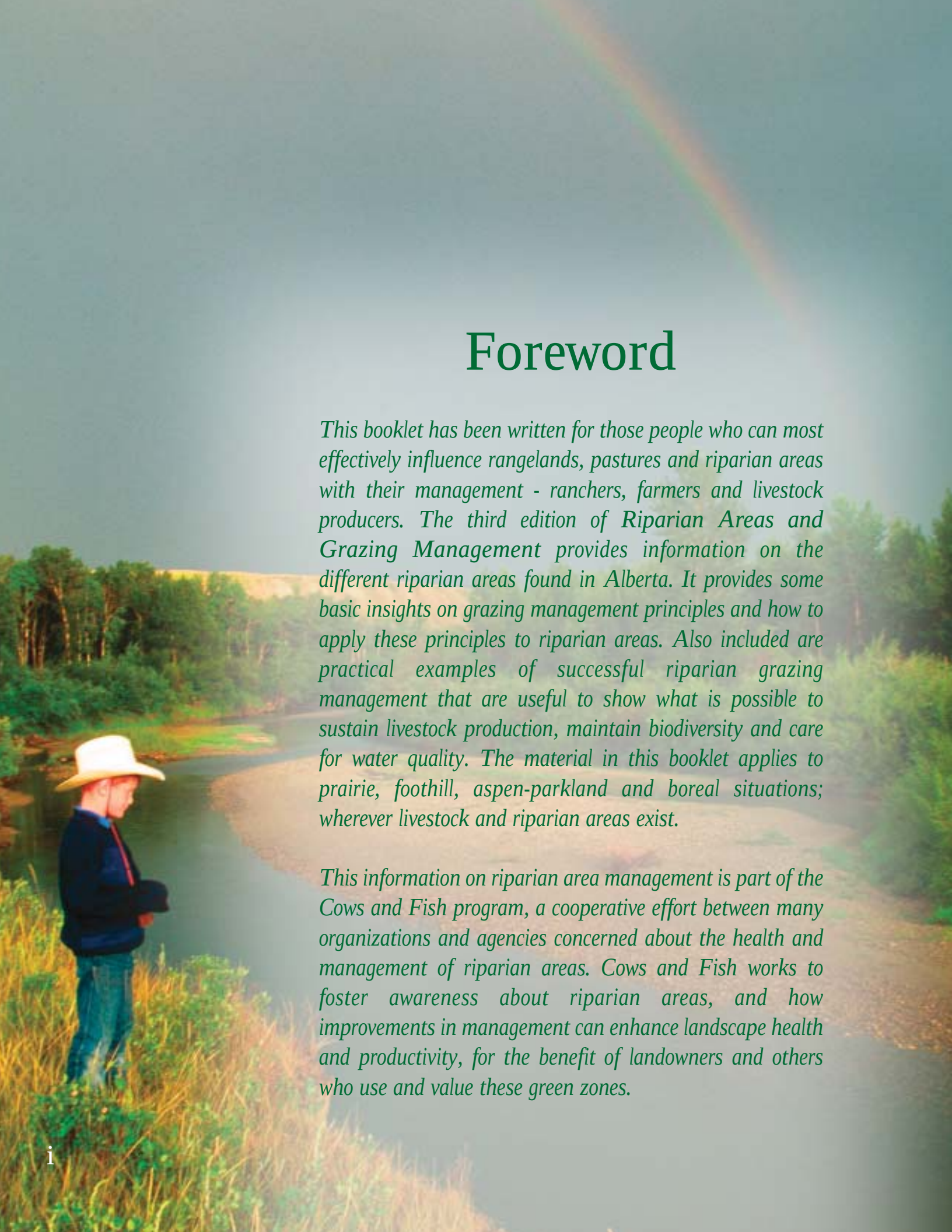
Table of Contents



Foreword

This booklet has been written for those people who can most effectively influence rangelands, pastures and riparian areas with their management - ranchers, farmers and livestock producers. The third edition of ***Riparian Areas and Grazing Management*** *provides information on the different riparian areas found in Alberta. It provides some basic insights on grazing management principles and how to apply these principles to riparian areas. Also included are practical examples of successful riparian grazing management that are useful to show what is possible to sustain livestock production, maintain biodiversity and care for water quality. The material in this booklet applies to prairie, foothill, aspen-parkland and boreal situations; wherever livestock and riparian areas exist.*

This information on riparian area management is part of the Cows and Fish program, a cooperative effort between many organizations and agencies concerned about the health and management of riparian areas. Cows and Fish works to foster awareness about riparian areas, and how improvements in management can enhance landscape health and productivity, for the benefit of landowners and others who use and value these green zones.

Introduction

This is the same riparian area, separated by a fence and a world of different management.

The overgrazed side represents a failure to treat riparian areas with care and thought. There are many reasons for this failure:

- past grazing management concentrated on upland areas, to determine levels of sustainable use and fix problems;
- it is easy to overlook riparian areas because of their relatively small size;
- riparian areas can seem to be hard to manage due to their small size and irregular configuration;
- even in drought and in an overgrazed situation they still appear green and lush, disguising problems; and
- without insight into their productive nature and how livestock are attracted to them, riparian areas can lose their value.

Riparian areas are too important, too productive and too valuable to go unrecognized and unmanaged.

Why Has the Use of Riparian Areas Become a Concern?

While there is no simple answer to this, we have to acknowledge there are more of us now than there have ever been and cumulatively we have a greater influence on riparian areas. It is also clear that the two to five percent of our rangelands and pastures, which are riparian areas, are disproportionately more important than their size would indicate. Nearly forty years of research by range managers, biologists and hydrologists has shown us the value of riparian areas for forage production, maintenance of fish and wildlife populations and providing water to sustain human communities. There is growing awareness of these values by livestock producers too. The key messages are: riparian areas have significant importance; they are different from uplands; and they need to be managed differently. Research results show us the difficulty of restoring the health and values of these areas, after years of inattention and damage. By comparison, careful, thoughtful management has been shown to maintain riparian areas and all their health and values.

What are the Benefits of Dealing with Riparian Management Now?

Ignoring or avoiding the problems won't serve us well in the long run and the problems will only get worse. Advice from other areas tells us the future of livestock grazing in riparian areas could well be determined by what changes are made now to maintain or restore those landscapes. Today, in Alberta, one of the forces of change to consider is society's growing awareness of the value and vulnerability of riparian areas. There are many good reasons for beginning to address riparian area management problems now:

- Healthy, productive riparian areas represent an opportunity to sustain your operation and maybe make more money, since abundant water, shelter and forage translate into cash.
- Well-managed riparian areas buffer the destructive impacts of floods and droughts, especially when your efforts are combined with those of your neighbours, on a watershed basis.
- Maintenance of productive riparian areas displays good stewardship of shared resources like water, fish and wildlife. Maintaining those products of riparian areas creates friends and allies for your agricultural operation.
- Voluntary efforts, to include riparian management in overall farm or ranch operations, may help temper legislation or regulation and may contribute to future incentives.
- A healthy, productive riparian area can be a powerful tool for you to persuade decision makers and the public that grazing is managed and is compatible with these riparian zones. That compatibility can't be shown only on selected ranches and farms. The practices need to be universally accepted and demonstrated.

Where to From Here?

As managers and livestock operators, the choice is ours. There are many examples in Alberta and from other areas where working together co-operatively with neighbours and resource managers has resulted in positive change and benefits. None of us are as smart as all of us are; tackling riparian management will require co-operation and maybe some outside help.

Riparian Areas and Grazing Management isn't a cookbook. It doesn't contain all the recipes for successful riparian management. Streams, rivers, wetlands and lakes are different, as are the landscapes they are part of and the farm and ranch operations that exist on them. Each has unique qualities and together are so variable that solutions need to be tailored to each situation.

Riparian Areas and Grazing Management is a guide book, on how to get started and directions on where your travels may take you. It is meant to be used with other Cows and Fish materials. Use it to ease your journey and to discover interesting tid-bits along the way.

What is Riparian?

Riparian areas are the green zones around lakes and wetlands, the emerald threads of vegetation that border rivers and streams and the lush fringe in valleys. When we look at the green zone and what makes it green, there are three clues that help to define "riparian". Although riparian areas are rarely uniform and show much variation, the common factor is the interaction of water, soil and vegetation.

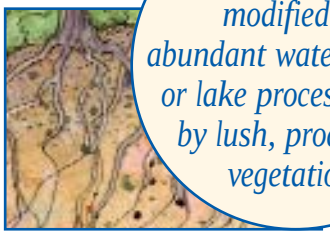
Clue 2

Vegetation is present that responds to, requires and survives in abundant water.

Clue 1

Lots of water is present, seasonally or regularly and that water is either on the surface or close to the surface.

Clue 3



Soils have been modified by abundant water, stream or lake processes and by lush, productive vegetation.

Riparian areas produce forage, shelter, fish, wildlife and water. These areas are a buffer, an insurance policy especially useful to have when drought or flood occurs. They are part of a healthy, functioning landscape and form part of an extensive watershed. Riparian areas sustain us, our lifestyles and our businesses. The importance and significance of riparian areas is far larger than their size suggest.

Riparian areas are a unique piece of the landscape. These are some examples of the 2 - 5% of the landscape called riparian.

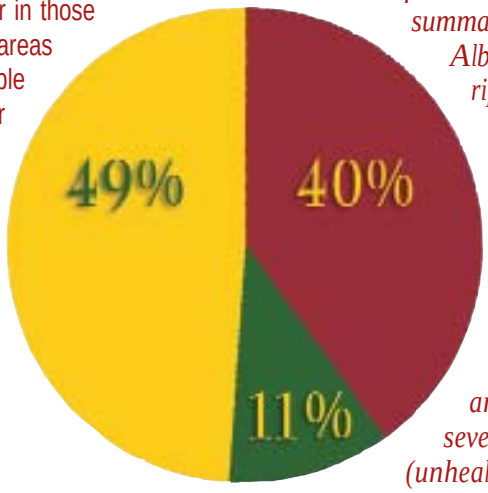
Alarming Issues

A Wake-up Call for Riparian Areas

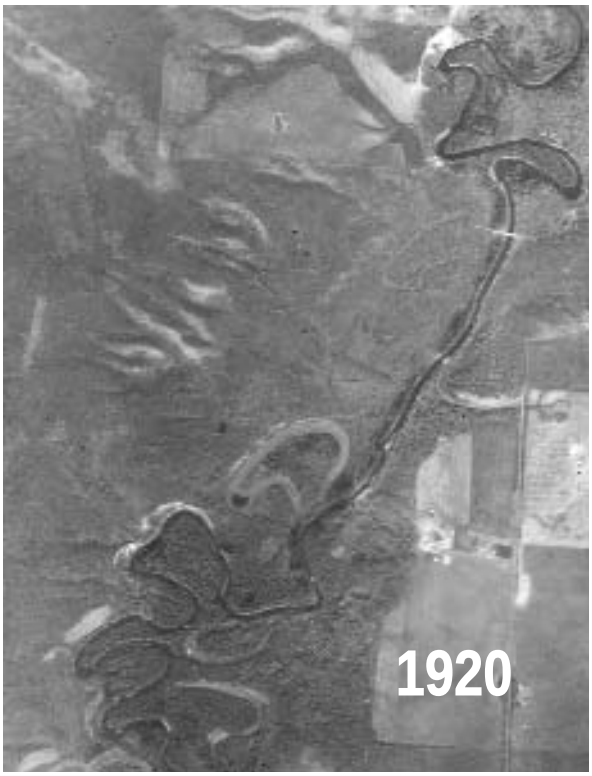
A mid–1940s view of a stream in the foothills of southwestern Alberta shows extensive willow growth in the riparian area, stable banks and a narrow channel with a willow canopy.

Fifty years later there are a few remnant willows and a wider channel with unstable streambanks.

We may tend to think of the products of riparian areas as forage for livestock and wildlife, shelter for livestock and ourselves and fish for angling, but the key element is water. Concerns about water will focus attention on the watersheds that produce this vital resource and on the uses that occur in those watersheds. Intact watersheds with healthy riparian areas will provide downstream water users with acceptable water quality. Those downstream users, including our urban neighbours, might also think about where their water comes from and how to help those that manage the watershed.



We face real issues based on a summary of riparian health for Alberta. Measurements of riparian health help us understand the proportion of reaches where all ecological functions are being performed (healthy), those with stress and some impairment (healthy, with problems) and the ones that are severely damaged (unhealthy). About 11% of Alberta's riparian areas are healthy, 49% are healthy, with problems and 40% are unhealthy.



In 1920, the riparian area of this river north of Edmonton was heavily wooded and the surrounding watershed shows few changes.

Eighty years later, clearing, settlement, drainage, channelization and roading have resulted in a significant loss of woody vegetation, extensive watershed change and loss of many riparian functions.

Livestock grazing in Alberta dates back over a hundred years. Livestock producers of today can look back on a wealth of experience gained through surviving drought periods, dealing with the problems of overgrazing, ever-changing weather and markets. Nothing is perfect though and sometimes we need to be reminded of that history to ensure we don't repeat the mistakes of the past. Some acknowledgement of today's riparian issues would help us all move towards solving the problems. The issues we face didn't just occur; they have developed quietly, have gone largely unnoticed but are now cumulative in their effect.

Many ranchers and livestock operators acknowledge that riparian landscapes require another look and are beginning to think seriously about how to modify grazing to improve the health of these areas. Some have already figured this out and provide us with examples of careful range management practices which we can all learn from.

How we face the issues surrounding riparian areas and the management decisions we make now will influence the future use, health and productivity of these green zones.

How Green is My Valley?

Riparian 101

Why do I need to know this stuff? Good question! An understanding of how riparian areas are formed and how they function is the first step in figuring out how to successfully maintain their productive nature for your farm or ranch. Think of this section as a shop manual for riparian areas.

Water Horsepower

Streams and rivers flowing through riparian areas have three common elements:

- the water in their channels has mass (or weight);
- the mass of water is dragged downhill under the influence of gravity; and
- the water flows at some speed (or velocity).

The stream's engine is the mass of water moving downhill. How much horsepower the stream's engine has depends on slope, amount of flow and resistance along the bank and channel. Horsepower, whether measured in a car, a tractor or a stream tells us how much work can be done.

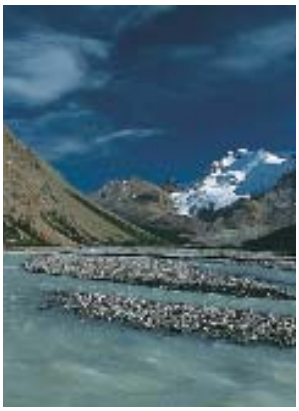
The work of a stream is to erode material from its banks or bed and then to transport that material downstream. Streams meander in order to balance the work they do with the energy they have and the material they carry.

If the engine idles, not much horsepower is generated; the stream isn't doing much work. However, when the engine races its horsepower is unleashed, allowing the stream to work harder at eroding and transporting.

A simple doubling of the speed of a stream's flow allows it to erode four times as much and to carry 64 times the amount of material. That's power! Too much power can translate into things like the loss of productive bottomland pastures to erosion.

Producers need to understand these simple physics, to avoid unleashing a problem, without knowing how it happened.

Streams erode the outside of meander bends and deposit material downstream on the inside of meanders.

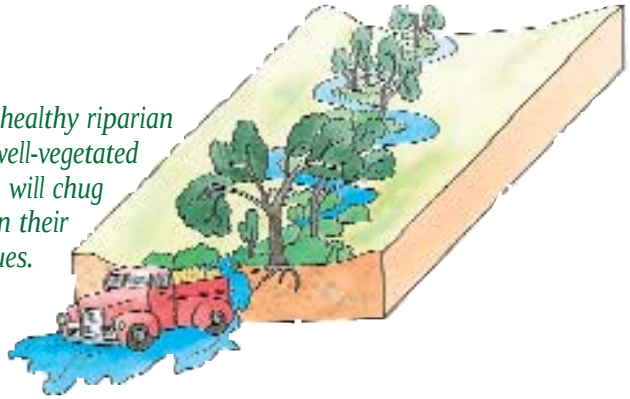


Eroded material is transported downstream either suspended in water or by rolling on the stream bottom.

Stream channels are seldom straight. Streams meander to balance water speed, valley slope and the amount of sediment to be transported.

Stream horsepower: don't let it get away on you!

Streams will respond to straightening and vegetation removal by racing. The chain reaction can reduce the productive nature of riparian areas.

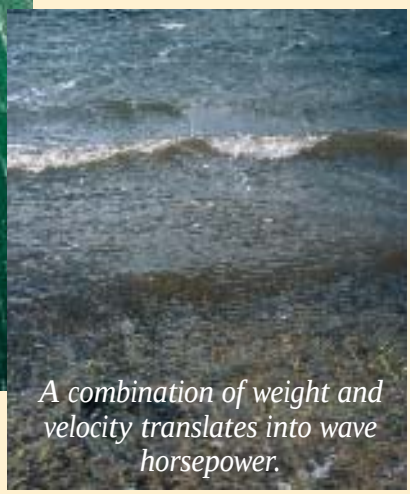


Streams with healthy riparian areas that are well-vegetated with meanders will chug along and maintain their function and values.

Shorelines - Water in Motion

Water in motion, in the form of waves on lakes and wetlands, has power. The amount of power relates to the weight of water, a relatively heavy substance (1000 kg/m^3), and how fast that water is moving (velocity). Waves are wind powered and the greater the expanse of water over which winds blow the greater the potential wave height, length and velocity. Water thrown up on shore by waves loosens unconsolidated materials, which are then transported by the undertow, the returning volume of water. Spring melt, accompanied by winds, drives ice onto shorelines. This is an annual occurrence and an additional source of water power.

Unlike streams, where the volume of flow is constantly replaced, lakes and wetlands are sinks, where the volume of stored water is exchanged very slowly. The exchange rate in wetlands and lakes can be years, to fully replace the stored volume with new water. That is why nutrient and sediment additions can be an issue, since once added they may linger for long periods of time.



A combination of weight and velocity translates into wave horsepower.

A shoreline composed of deep-rooted plants, especially trees and shrubs, resists the action of ice during spring breakup.

Understand the force!

Banks and Shores
Riparian Foundations

Banks and shores resistant to stream horsepower and wave action form the foundation of a stable riparian area.

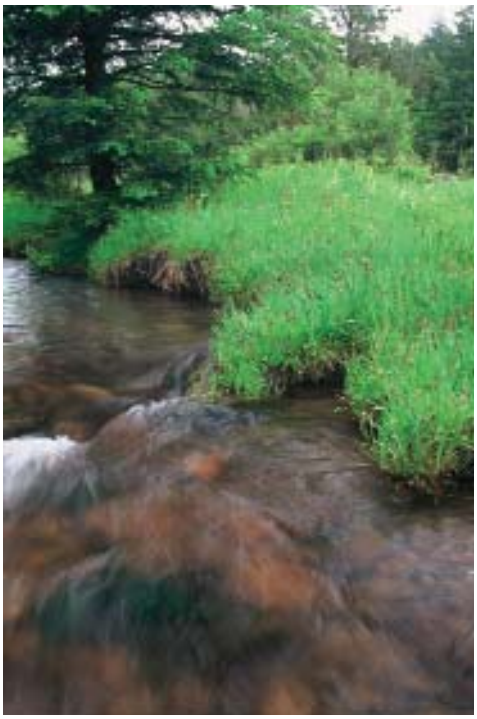
- Deeper, narrower streams flow through valleys where soils are finer in texture.
- Finer soils are more cohesive; they bind better than those composed of coarse gravel and rocks.
- Soil types and shoreline stability are linked to vegetation cover - its health, diversity and abundance. Continuous livestock use of banks and shores leads to a crumbling of the foundation.
- Shoreline trampling and streambank collapse occur with high livestock use of riparian areas.
- High livestock use can also alter, reduce or eliminate bank vegetation.

Stream channels and shorelines reflect the history and use of riparian areas.

- A wide, flat channel with low banks may not be what a stream wants to be; these features may represent our influence on the stream.

Changes in channel shape, to wider, shallower forms, can take years, decades and even generations to stabilize and evolve back to narrow, deep channels again.

- Healing takes revegetation, sediment deposition and bank rebuilding.



A good foundation is built with careful vegetation management.

Hoof power can't be underestimated. Cattle exert about 10 times the weight or pressure per unit area as a D9 cat with a blade. The foundation can't withstand this pressure for prolonged periods.

Banks and shores: build a good foundation for riparian areas and for your place.

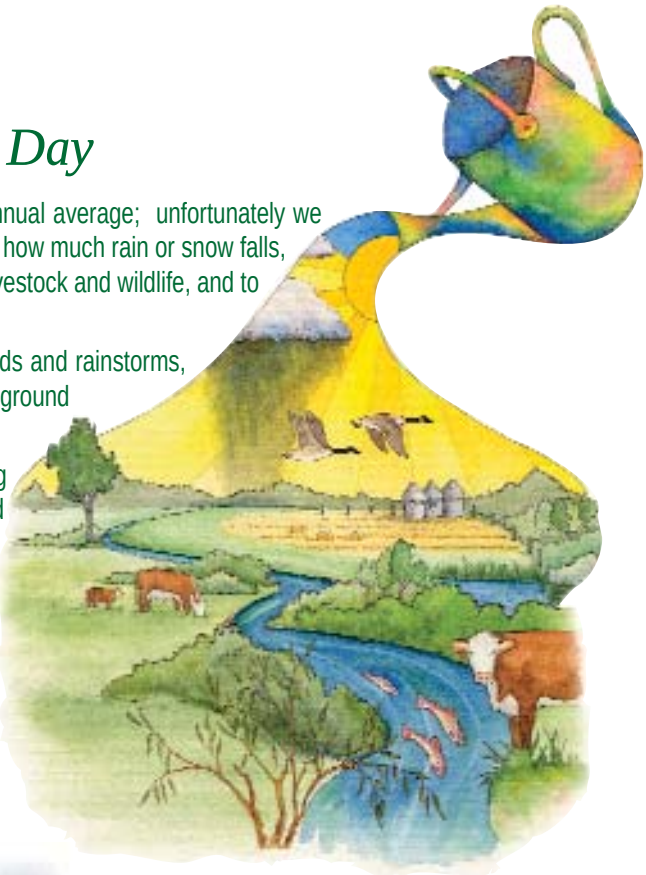
Water in the Bank

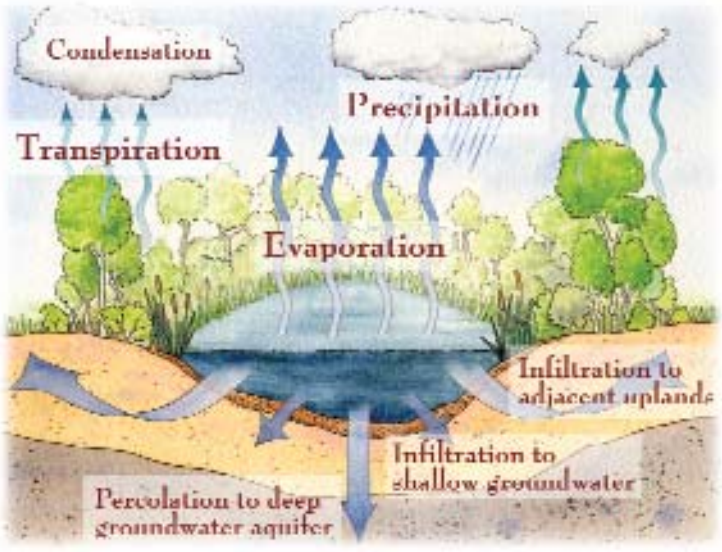
Putting Water Away on a Rainy Day

We live in a land where precipitation varies greatly around an annual average; unfortunately we can't count on the average every year. Although we can't change how much rain or snow falls, we can influence how much stays, to fuel plant growth, to water livestock and wildlife, and to provide flow in streams and water levels in lakes.

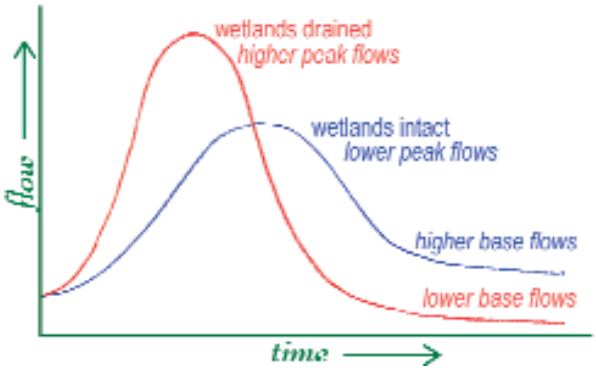
Stream valleys, wetlands and lake basins store water during floods and rainstorms, like a "sponge". How much they store and how quickly the underground reservoirs empty are affected by how we treat riparian areas.

Streams and rivers are the sum of many tributaries including dozens, sometimes hundreds of smaller streams, channels and drainages that collectively are known as the watershed. Watersheds also include wetlands and lakes. Even though these may not have surface drainage, water moves underground between wetlands, lakes, rivers and streams. Watersheds, in simple terms, shed water. They collect and deliver the water from rainfall or snowmelt. The physical characteristics of the watershed, the abundance, diversity and health of vegetation plus land uses, reflect the pattern of runoff.





Changing and removing vegetation cover combined with wetland drainage can cause runoff to occur more quickly as well as produce higher peak flows. That translates into more stream horsepower to do damage plus less retention time for water to soak into the soil and underlying substrate.



Draining wetlands has a direct effect on local stream flows. When wetlands are drained, higher peak flows (flooding) and lower base flows result. Where wetlands are intact, they store water and release it slowly. The net result is less flooding, increased base stream flows and groundwater replenishment.

	Maximum	Minimum	Average (mm)
Medicine Hat	642 (1927)	148 (2001)	340 (1911-2002)
Camrose	734 (1973)	236 (1929)	434 (1929-2002)
Rocky Mountain House	743 (1965)	335 (1950)	546 (1945-2002)
Lac La Biche	685 (1977)	216 (2002)	455 (1959-2002)
Fairview	606 (1973)	215 (1981)	386 (1944-2002)

"Average" precipitation is a theoretical figure, not something to be counted on every year. These are some average precipitation levels, plus the highs and the lows, for several Alberta locations.

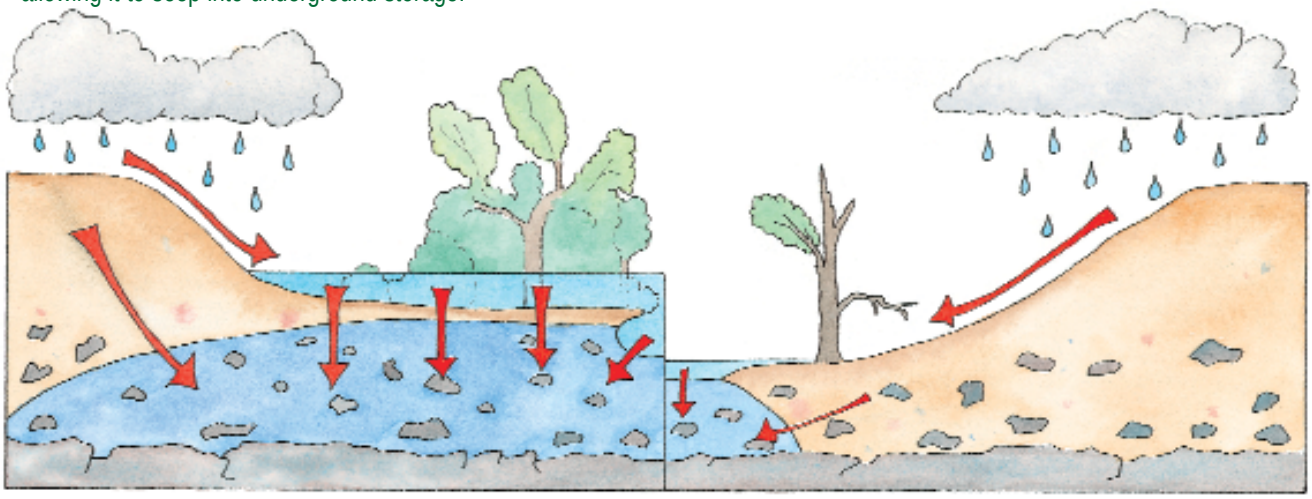
An understanding of how a watershed collects, stores and releases water may help us to save more water and benefit from it, especially during those years of below average precipitation.

Water Investments

Deposits

Flooding is one way of putting water in the bank, figuratively and literally; water saturates the floodplain and raises the water table. Most floods in Alberta occur during spring and early summer.

In years without flooding over banks and shores, water enters the floodplain through the bottom and sides of the channel or basin, adding to groundwater. Stream channel meanders, wetlands and a well-vegetated riparian area slow water down, allowing it to seep into underground storage.



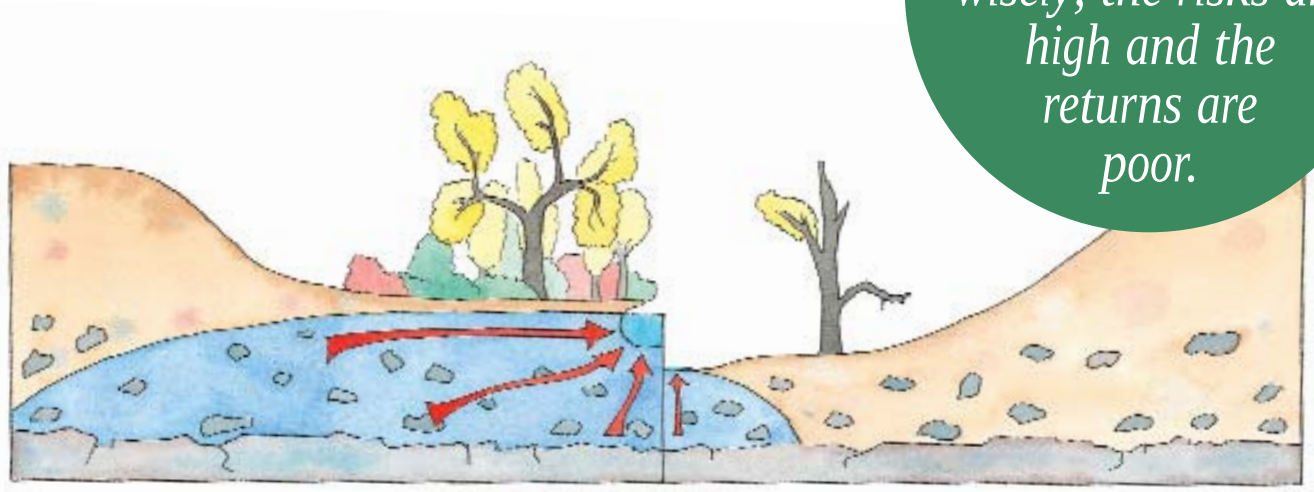
Healthy floodplains, which are well-vegetated, slow the flow of water, allow it to spread and soak in effectively.

Water speeds over floodplains with poor vegetation health, with channelized portions or cutoffs, and does not linger long enough to fill the underground "sponge".

Withdrawals

For most streams, flow for the late-summer, fall and winter months depends on groundwater storage, a withdrawal of the spring investment. The maintenance of water levels in wetlands and lakes also depends on that stored, spring water.

Water investments: if you don't plan wisely, the risks are high and the returns are poor.



In healthy, well-managed watersheds, stored groundwater is released back into the stream and riparian area.

Watersheds with poor groundwater storage capability may suffer low stream flows as the limited storage is exhausted. Streams may become intermittent in flow during crucial times and water may become unavailable for livestock, wildlife and fish.

Good Mud/Bad Mud

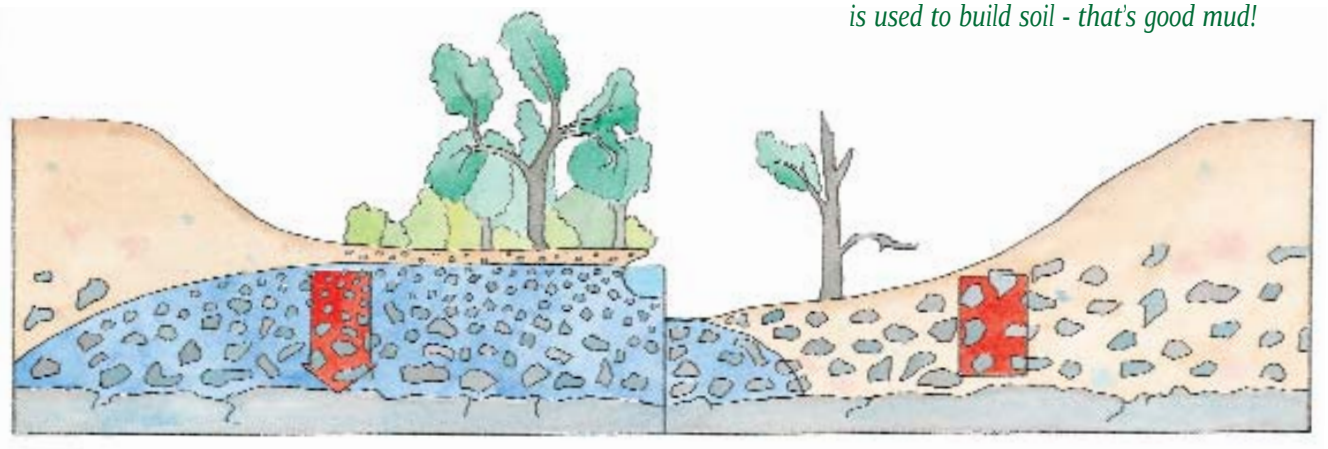
Sound planning for water investments starts before the water hits the stream or the lake. To maintain stream flow and lake levels throughout the year the riparian area must not only be recharged each year, it must be in a condition to first hold and then store water to be released later.

The type and volume of floodplain material - gravel, sand, silt or clay - determines the riparian areas' capability to hold, store and release water. Water moves more slowly through silt or clay than through sand or gravel.

During overbank flooding, areas that are well-vegetated catch more fine sediment than areas that are not. Sediment aids in the ability of soils to hold and store moisture by providing a base for plant growth. Plants return organic matter to the soil which increases the soil's water holding capacity. Organic material can hold nine times its own weight in water.

Nutrients, contaminants and pathogens attach themselves to sediment particles. Improving water quality starts with reducing erosion and sediment transport. Healthy riparian vegetation traps sediment before the load of problems is delivered to downstream water drinkers. Bad mud is transformed into good mud when it is trapped and stored in the riparian area, away from the water.

Plants bind soil in place and trap moving sediment - when sediment is captured and is used to build soil - that's good mud!



Sediments build more quickly on well-vegetated riparian areas. The cycle of flooding, sediment deposition and soil building increases the capability for water absorption and storage.

Where vegetation is lacking, less sediment is captured, the capability for water absorption and storage suffers and water quality can deteriorate.

Soil holds water and supports vegetation - give it a home on your riparian area.

Vegetation - The Roots of the Solution

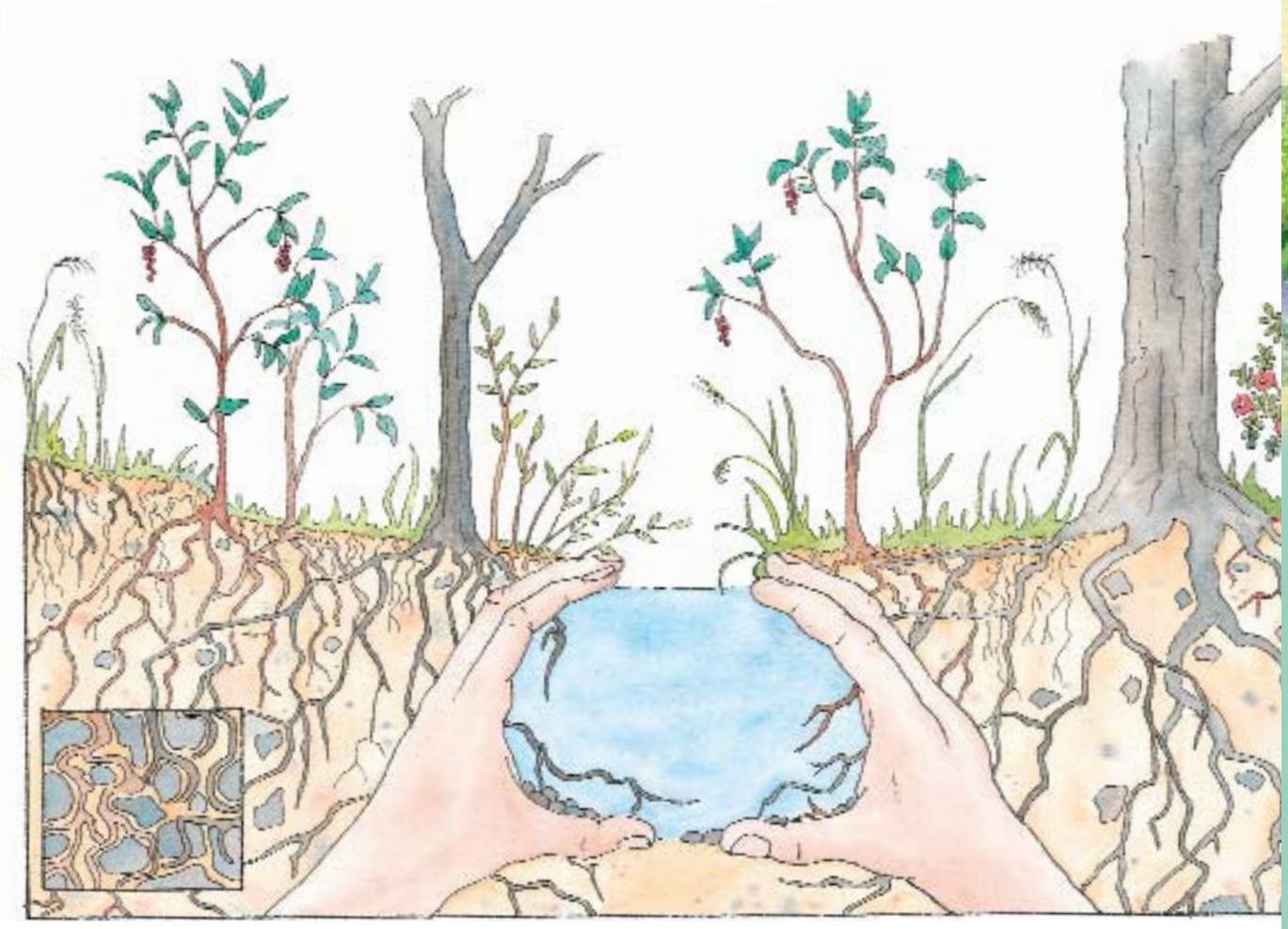
The riparian areas of streambanks and shorelines are glued together by a diversity of plants with strong, deep root systems, especially those of woody plants.

Riparian vegetation reduces horsepower by slowing water down through friction. A five centimeter deep rootmat resists erosion up to 20,000 times better than bare soil streambanks or shorelines.

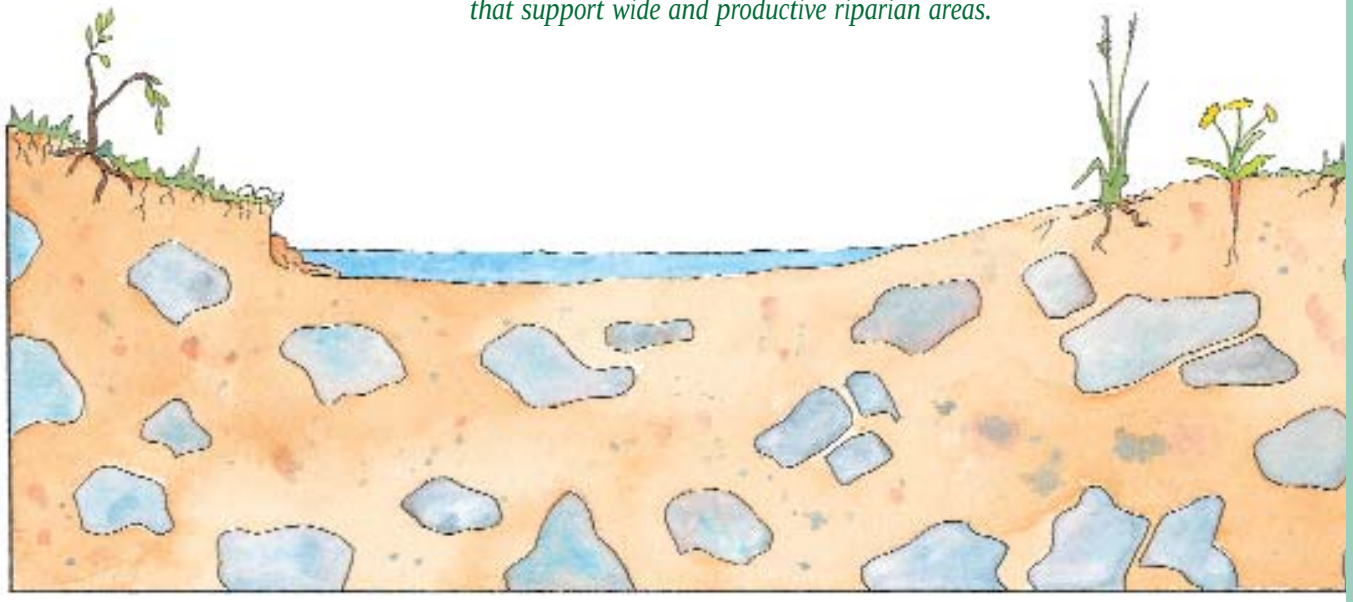
Deep rooted sedges glue together the riparian area of this small, low gradient stream.

For larger, higher gradient streams and rivers, shrubs and tree species are needed to stabilize streambanks.

As the percentage of roots in streambanks and shorelines increases, erosion decreases.



Well–vegetated streams tend to be narrow and deep due to the binding nature of plants and their root systems. They tend to be stable and have groundwater tables that support wide and productive riparian areas.



Where vegetation has been removed by heavy grazing, logging or other development, the cohesive nature of streambanks breaks down and streams become wide and shallow. These channels can be unstable, with lower water tables that shrink the size of the riparian area and its productive nature.

Diverse, healthy vegetation has a major influence on stream channel shape and on shoreline stability.

Big Wood - The Floodplain Builder

The roots of trees and shrubs stabilize streambanks and shorelines. Logs that fall into the stream channel assist in the development of broader floodplains which provide forage for livestock, habitat for wildlife and recreation sites. Flooding behind logs and other woody debris helps recharge the floodplain with water and nutrients.

"Big wood" dissipates stream horsepower and wave action, aids in channel development and forms important aquatic habitat.

When the deep, binding roots of shrubs and trees are absent, shallow-rooted grasses cannot withstand erosion forces....

but add a deep-rooted shrub like willow and the streambank starts to recover. Woody vegetation adds reinforcement to stream banks.

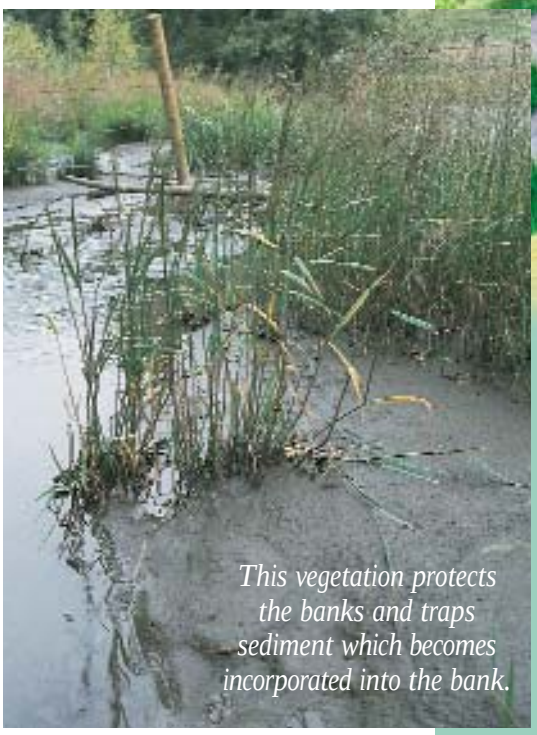
Wood is good!

As trees are incorporated into stream channels they modify slope and reduce stream horsepower.

Building a Riparian Area

Riparian areas slow water velocity, filter water passing through and hold water for later release.

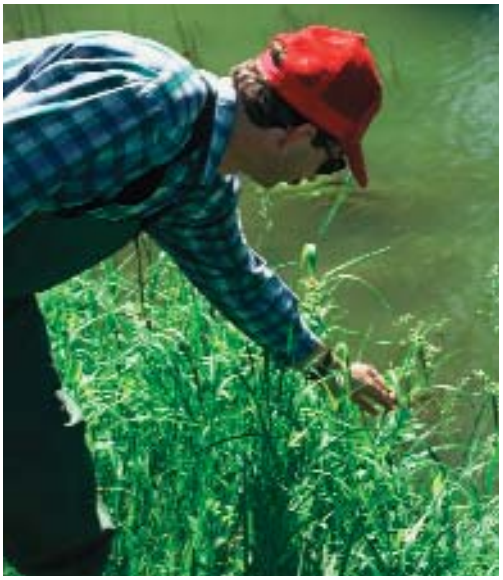
- When floods occur, flowing water is slowed by riparian vegetation and by the ability of the stream to access its floodplain; flood water is stored temporarily in wetlands, lakes and floodplains.
- Vegetation helps build and maintain streambanks, shorelines and riparian areas.
- Water quality is enhanced when sediment is trapped and incorporated in the riparian area.



This vegetation protects the banks and traps sediment which becomes incorporated into the bank.

Streambank vegetation "squeezes" stream flow upwards, slows it down, and allows more water to be added to groundwater and bank storage. The groundwater table moves upwards and sideways, increasing the size of the green zone.

- Nutrients are used by riparian plants, improving water quality.
- Vegetation helps keep streams flowing and water levels higher during low flow periods.
- Diverse types of vegetation are key to riparian area development because they add complexity, strength and reinforcement.



Many plants with high forage or habitat values respond to the higher water tables in well-managed, well-vegetated valleys.

Riparian vegetation "grabs" sediment, "holds" it and "sucks" up nutrients.

Vegetation: it's the root of the solution for riparian management.

Beavers - Riparian Managers

Beavers have been building and modifying riparian areas for thousands of years. Historically, most of our stream drainages contained beaver, and, under close examination, show some level of beaver modification today. Beaver "manage" riparian areas with their extensive dams and through their harvest of trees and shrubs. In the short term this management can sometimes conflict with our uses of riparian systems. Over long periods of time stream valleys evolve under beaver management.

Beavers modify riparian areas with dams that hold water and trap sediment.

Beaver modified valleys are fragile and need deep-rooted plants to resist downcutting through accumulated sediment.

Beaver modified valleys can produce a diversity of vegetation including large quantities of forage.

Even though beaver may be missing from the picture, their influence shows in sediment capture and wider, productive valleys. Each beaver dam can capture tons of sediment – that sediment builds deep soils and productive riparian areas.

Beaver dams reduce stream gradient (and horsepower) which allows sediment to accumulate. As sediments are trapped and slowly build behind dams the shape of a stream valley can change, often to a wider one, with gentle slopes. Beaver modified valleys represent productive, diverse and valuable portions of the landscape.

Beavers - another element in the understanding of riparian areas.

Riparian Actions that Create Problems

Often, because of our impatience with spring flooding we cut through bends to "speed" the water through, or straighten and channelize to protect buildings.

Straightening and widening stream channels increases stream horsepower and often the flooding or erosion is transferred to downstream neighbours.

Bridges are expensive, so culverts become the choice for many stream crossings.

Culverts increase stream velocity because friction between the water and the culvert material is reduced. If improperly sized or installed, culverts increase horsepower and downstream erosion is certain.

The "too soon, too long, too much and too often" type of grazing fails to protect riparian areas.

Excessive removal or alteration of vegetation by unmanaged grazing decreases friction on the banks and increases water horsepower. The defense against erosion is reduced.

Because we like to live beside water and establish our towns and cities there, we often develop the riparian area out of existence.

Drainage or removal of wetlands can increase flood risk, reduce water storage and negatively affect water quality.

Cultivation and logging, when undertaken without appropriate buffers, remove key elements of the riparian area.

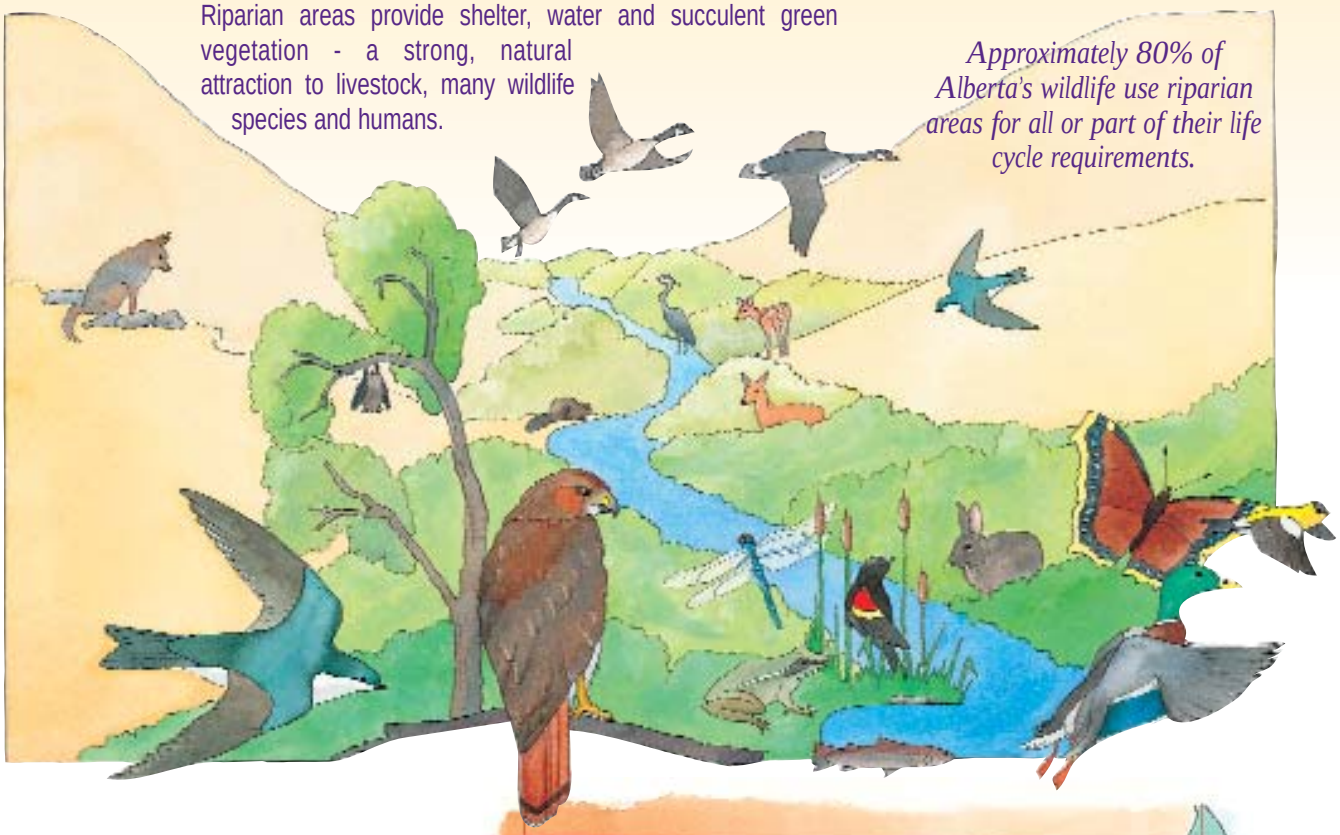
Stream horsepower is increased with the removal of the friction provided by streamside vegetation. The extra energy is used to increase erosion of the streambanks (lateral erosion) or stream bed (vertical erosion).

All of these actions can result in more pressure on the gas pedal, more speed, more energy and more erosion.

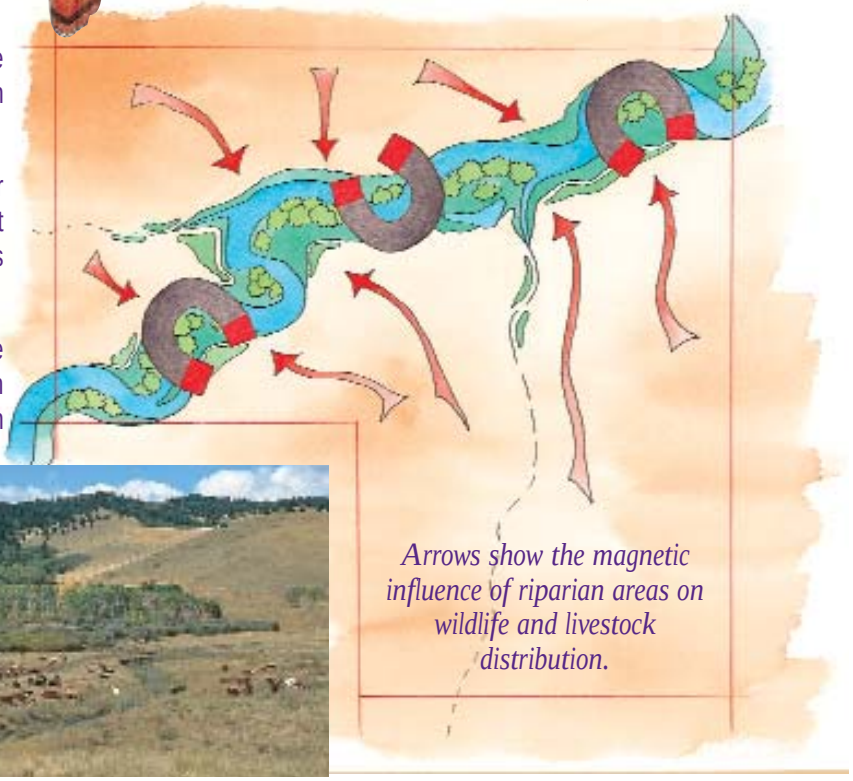
Riparian Areas
A Magnet for Livestock and Wildlife
Life in the Green Zone

Riparian areas provide shelter, water and succulent green vegetation - a strong, natural attraction to livestock, many wildlife species and humans.

Approximately 80% of Alberta's wildlife use riparian areas for all or part of their life cycle requirements.

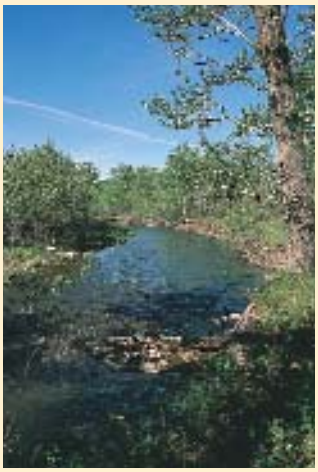


- During dry periods, the normal difference between upland forage and riparian vegetation is magnified even more.
- Riparian areas are attractive places for wildlife, humans and livestock; that attraction increases as upland areas become drier.
- Riparian areas are essential wildlife corridors, travel routes, connectors between different habitats and stop-overs on migration.

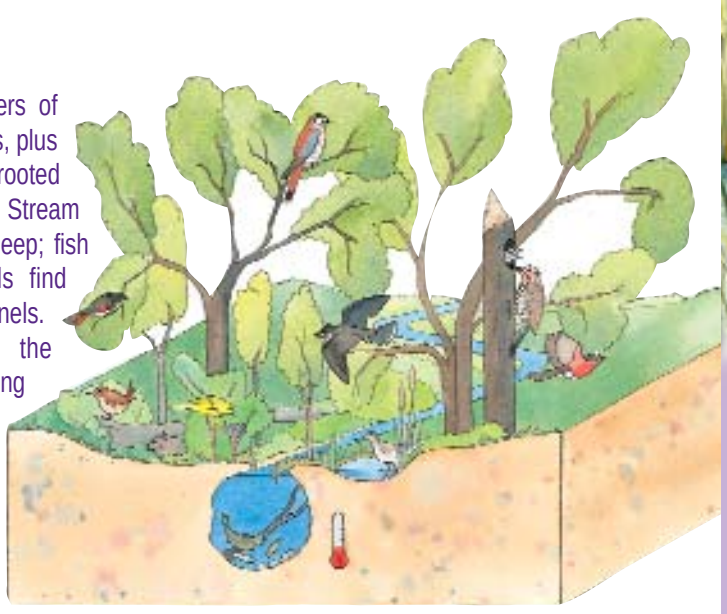


Arrows show the magnetic influence of riparian areas on wildlife and livestock distribution.

Well-managed Riparian Area:



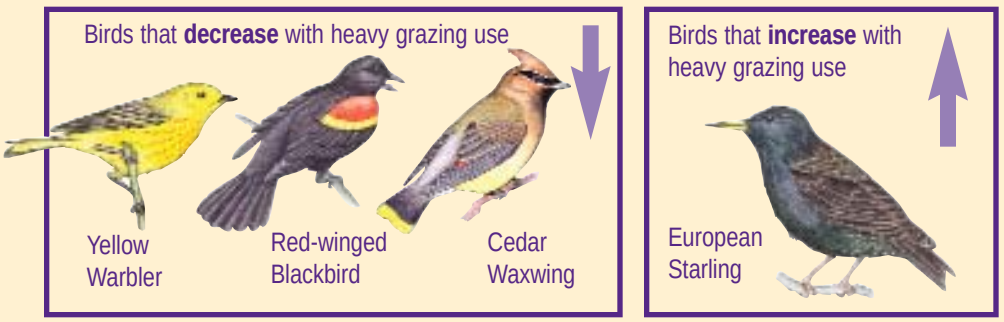
The riparian area has layers of shrubs and trees, of all ages, plus a dense growth of deep-rooted grasses, forbs and sedges. Stream channels are narrow and deep; fish and other aquatic animals find many homes in these channels. Wildlife is attracted to the diversity of habitats for nesting and foraging. Livestock find abundant forage, water and shelter.



Poorly-managed Riparian Area:

Too much use of the streamside or lakeshore alters or eliminates vegetation, the glue of riparian areas. Stream channels become wider and shallower, the water warmer and species like trout disappear. When the remaining mature trees die, few, if any, younger ones replace them. The site becomes drier, resembling upland areas. Wildlife find fewer places to live, and forage and shelter for livestock declines.

Heavy grazing, over many years, can remove the lower layers of vegetation, especially younger trees and the shrub component, which form key habitat for birds and other wildlife. That's why native bird populations are 2 - 3 times higher in healthy riparian areas compared to heavily grazed riparian pastures. Careful grazing management provides shelter for wildlife and livestock.



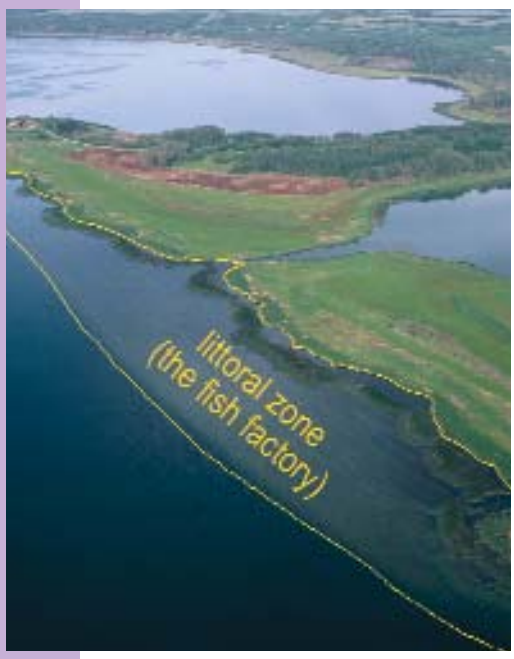
Response of some bird species to heavy grazing (from a summary of six Alberta and Saskatchewan studies).

Fish - Riparian Life of Another Type

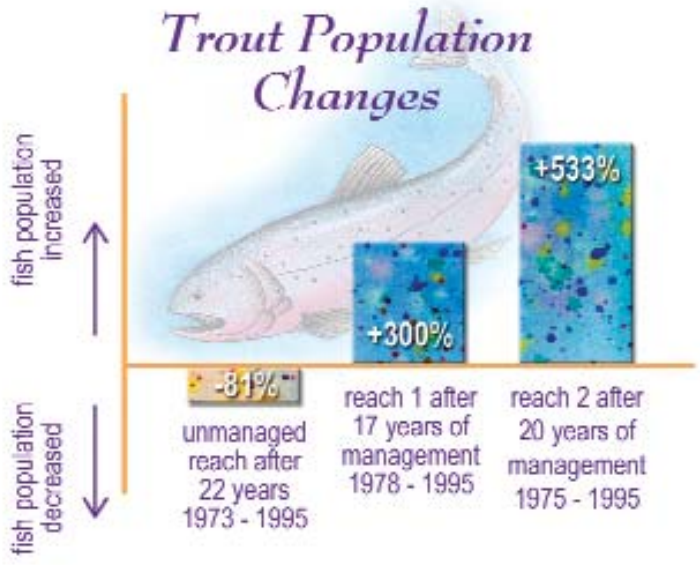
Fish and other aquatic creatures have a unique relationship with riparian areas. One of the reasons riparian zones are under a microscope is the effect that unmanaged livestock grazing and other land uses can have on fish habitat. Here are some useful things to know about the relationship between fish, other aquatic animals and the riparian area:

- Streambanks and shorelines provide habitat "edge" with high diversity. Fish live on the edge of streams and make more use of the edge than the middle of the channel. In lakes, the shallow water zone where sunlight can penetrate to the substrate is the area of highest productivity and the area used most by fish. In emergent and submerged vegetation fish find cover, food and places to spawn and rear. Instream cover, especially big wood, helps control water velocities so fish don't constantly fight the current.
- Fish habitat can include intermittent drainages that have water in the channel or over the shoreline for a short time during spring runoff. Some fish species use these riparian areas for spawning; the eggs incubate and hatch before water levels drop.
- The vegetation canopy on banks and over stream channels shades water in the summer and reduces the temperature. In winter the canopy insulates streams, reduces ice build-up and provides better overwinter survival of fish.
- Vegetation captures and binds sediment that otherwise would settle on food producing areas, fish spawning and rearing sites or in pools, reducing winter survival space. Riparian vegetation also traps nutrients which can be too much of a good thing. High nutrient loads lead to algae blooms which peak and quickly crash, using up dissolved oxygen. Fish kills often follow .
- A healthy riparian area collects, stores and releases water to maintain stream flow and lake levels. It's a simple formula; no water - no fish.
- Fish are indicators of the degree of health in their world and ours. Trout have the highest requirements for water temperature, dissolved oxygen and physical habitat. They have low tolerance for changes, especially in temperature and sediment. If trout are replaced by northern pike, or pike by white suckers, it suggests a dramatic change in habitat. If the trend continues, white suckers, one of the most tolerant fish of degraded habitat, will disappear. It may be very difficult to restore fish populations in some systems until we take a watershed approach to resolving issues around riparian health, water quality and water quantity.

Sediment is a normal product of erosion but many land uses greatly accelerate the amount of sediment delivered to the aquatic system. Healthy riparian areas can buffer the impacts of sediment on aquatic inhabitants.



The shallow water area where sunlight penetrates to the lake bottom, is called the "littoral" zone and is the "fish factory".



When riparian areas on the North Raven River were protected and managed, trout populations responded to habitat opportunities. Reaches of the stream that are not managed show substantial declines in fish populations from 1973 to 1995. Healthy riparian areas produce habitat for fish.

Riparian Areas and Grazing

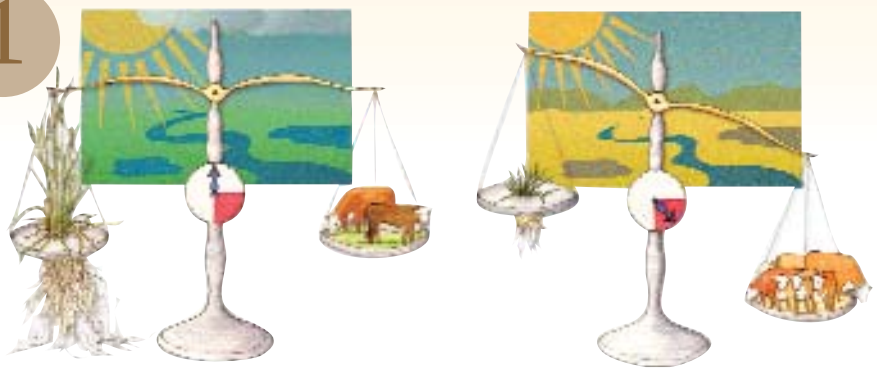
Range 101

Principles that Promote Healthy Riparian Vegetation

Healthy riparian areas are a foundation for your livestock operation. It begins with an understanding of the principles of range management and applying those principles to build and maintain the riparian foundation.

Good range management practices imitate the natural system and foster healthy native plant communities. The four key principles of good range management are:

1



Balance is the first principle to be achieved. Without it, a solid foundation for riparian and range management can't be built.

Balance animal demand with the available forage supply

- This means harvesting forage but leaving enough carryover or grass residue to protect plants and soil, conserve moisture, plus trap sediment.
- It's about understanding carrying capacity and setting annual stocking rates that don't exceed the available forage.

2

Distribute livestock evenly

- This means choosing from a long list of management tools to spread the grazing load over the landscape.
- It's about not allowing livestock to linger and overuse an area.

3

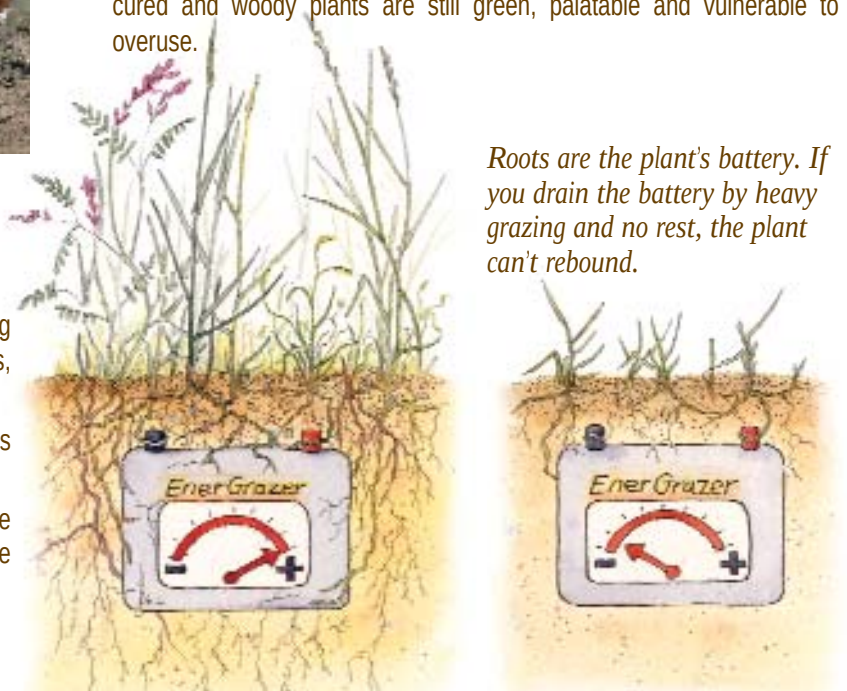
Avoid or minimize grazing the range or pasture during vulnerable times

- For riparian areas this may be when streambanks or shorelines are saturated with moisture and vulnerable to trampling.
- It could include times, like late summer or autumn when grasses have cured and woody plants are still green, palatable and vulnerable to overuse.

4

Provide effective rest after grazing

- Give plants time to rest when growing conditions are favourable to rebuild roots, energy supply and vigour.
- Energy stored in the roots of plants is needed to initiate growth in the spring.
- To be effective, rest has to occur during the growing season, not before or after the growth period.



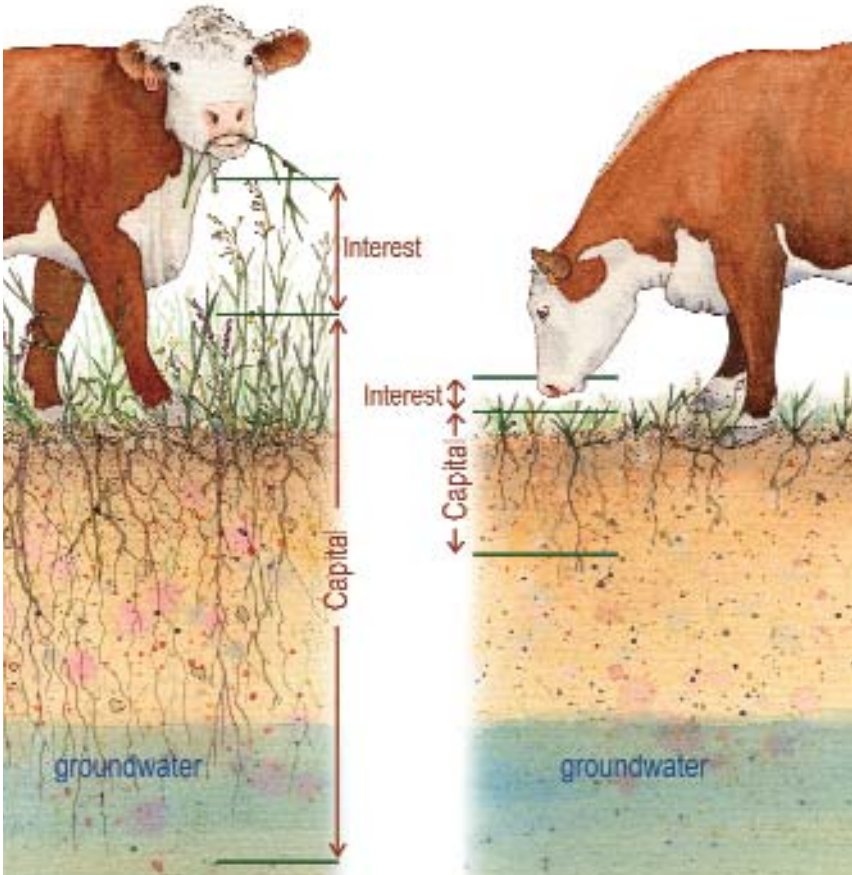
Roots are the plant's battery. If you drain the battery by heavy grazing and no rest, the plant can't rebound.

Maintain Your Range Capital - Live Off the Interest

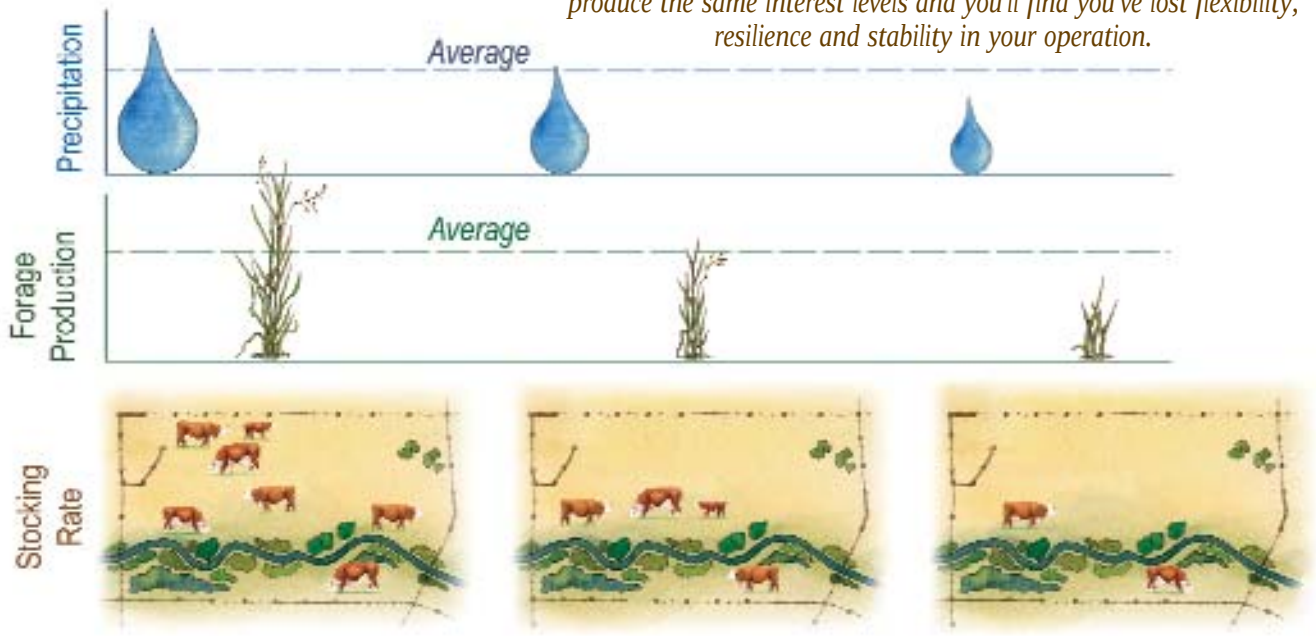
How do you know how many cows to graze on a pasture? To maintain your pasture and any riparian areas in that pasture you should be thinking about these things:

- how much forage is being produced?
- how much does a cow eat?
- when I do the math how many cattle can be safely grazed, and for how long?

Carrying capacity is the maximum amount of forage that can be grazed while still maintaining the plant community. It's like the red line on a tachometer. Running the engine consistently above the red line will shorten engine life and may cause it to break at an inopportune time. There is much wisdom in the old stockman's saying; "if you keep down the shoot, you'll kill the root". Grazing or browsing too much of the leafy material, the collector of solar energy, will wear the plant down and reduce its ability to store energy in its roots for regrowth in the next season. Heavy grazing, over long periods of time, results in shallow plant roots. This makes the plant dependent on surface moisture instead of tapping deeper, more abundant supplies of water. Pastures can become very vulnerable to drought conditions with a combination of shallow roots and no litter to conserve available moisture. A conservative level of grazing, which leaves forage as carryover helps retain moisture for additional growth. *"It takes grass to make grass."*



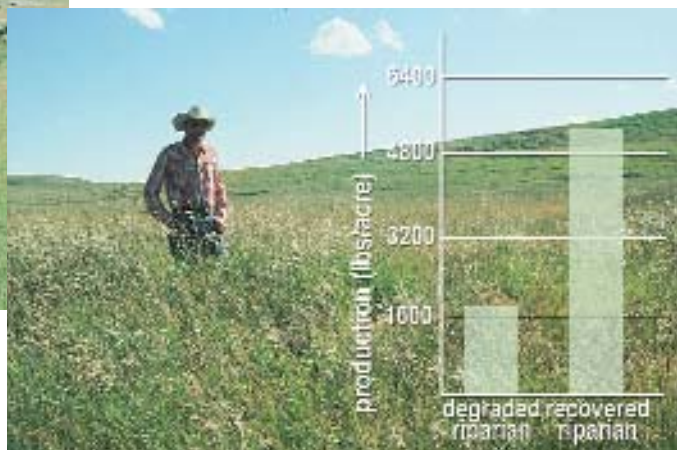
In your range or pasture bank account you have capital - the plants that sustain your operation. If that capital is maintained and managed well, with attention to carrying capacity and other range management principles, your investment will pay handsome dividends of grass interest on a sustainable basis. However, if you dip into the capital, it can't produce the same interest levels and you'll find you've lost flexibility, resilience and stability in your operation.



The primary limiting factor for plant growth is water. There is considerable variation in precipitation in Alberta, on an annual basis and variation between years. That variation causes forage quantity, and therefore the number of livestock that can be supported on a pasture, to vary. Planning your pasture use on the basis of average or high precipitation values could have you coming up short of forage in some years.

The Waldron Ranch - Making Change Pay Off

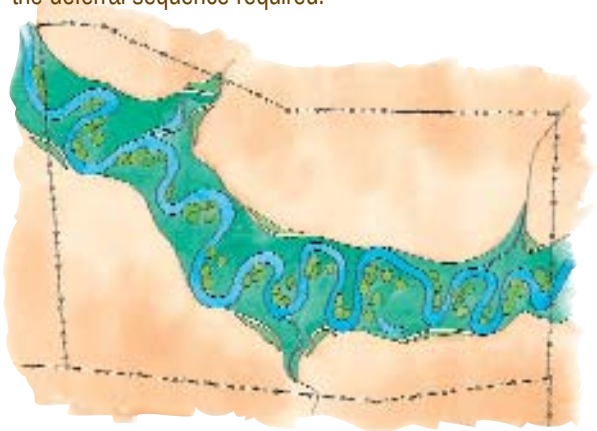
Callum Creek field under continuous grazing.



A change to rotational grazing, from a season-long, continuous style, produced a significant response in forage production. Forage production went from pounds/acre in 1988 to tons/acre in 1997.

The Waldron Ranch, a producer-owned and managed co-operative in southwestern Alberta, became concerned in the 1980s over bank trampling and erosion of Callum Creek, and serious declines in range condition and productivity of the floodplain pastures. It was determined that the problem was a combination of a season-long, continuous style of use, poor distribution in many fields (including overuse of riparian areas) and prolonged drought conditions. Changes were made that included a reduction in grazing period, more frequent moves of livestock, and deferral of grazing, to provide growing season rest to plants. The most important change was a greater attention to carrying capacity to build flexibility into the grazing system. Following these changes dramatic increases in forage yields (up to three times as much as before) occurred on the floodplains, providing a much more stable forage base over a range of moisture conditions. Increased forage yields are a reflection of improvements in plant species composition and plant vigour. The new grazing rotation did not require any new capital costs like watering sites or fencing. The big change was in animal management- moving livestock from field to field as grazing use and the deferral sequence required.

The recovery of Callum Creek has been accompanied by deep-rooted forage species, new willow growth and improved bank stability.

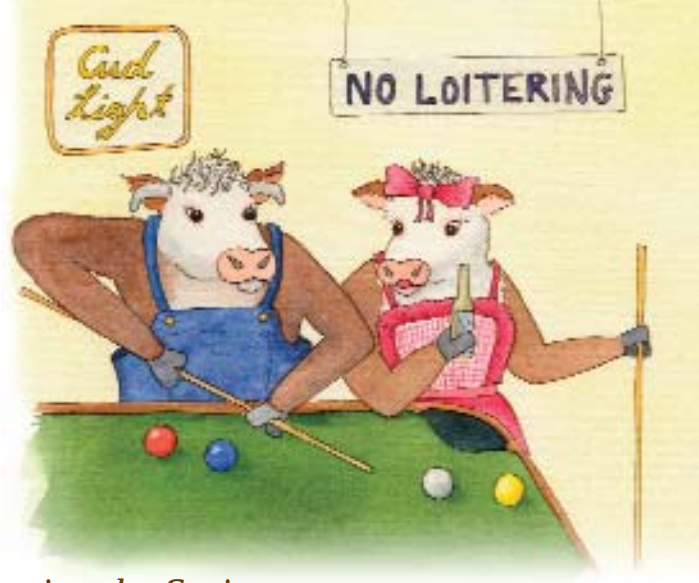


The riparian portion of this Waldron Ranch field makes up only 54% of the pasture, yet, in good range condition it can supply 82% of the forage. That's a big return for careful management of a small area.

Healthy riparian areas contribute substantially to forage yield in a pasture.

What Can We Learn from the Natural System?

The Canadian plains evolved with millions of grazing animals. Bison impacts on prairie, parkland and foothills ranges and riparian areas could, at times, be severe. However, these impacts were short-lived and riparian areas were maintained over thousands of years. The key feature of the natural system was that after there was grazing, there was rest and, often, long periods of rest.



Bison impacts on the prairie and foothills ranges were often severe, but after grazing there was rest. The yearly cycle of bison migration that incorporated summer use of the plains with winter use of the foothills and parkland provided effective rest for the riparian areas.

"They chased him (the Bison) and hunted him and blessed his beef and cursed his habit of filling every slough and water hole with mud and excreta."

"... they gagged when they drank the brackish water full of wigglers or nauseous with buffalo urine."

- experiences of the border surveyors from <u>Wolf Willow</u> by Wallace Stegner

Compressing the Spring

When grazing is too intense, or happens during vulnerable periods, or occurs without rest, or when distribution is poor, livestock can hold down the "spring" of riparian plant succession.

Releasing the Spring

When grazing management principles are carefully applied and in balance, riparian plant communities will "uncoil" and deep-rooted plants and woody species are released. Boing!

No Loitering Permitted!

Grazing, regrazing and trampling will damage vegetation and soil. In the natural system localized impacts were short-lived because animals did not loiter for long periods of time and use was followed by rest.

Early travellers often noted severe impacts to streams and wetlands from migrating herds of bison. Natural events such as floods, grazing from native ungulates, fire, drought, beavers and landslides did affect riparian condition and the results of these disturbances meant health could vary over time and from reach to reach. Because of the natural resilience of these systems and the long return intervals between use or disturbance, it is likely riparian areas healed quite quickly.

Long Grazing Periods Will Stress Riparian Areas

Long grazing periods allow cattle to graze where and when they choose to, not where and when we want them to. These long grazing periods fail riparian areas on all four range management principles.

Poor Distribution

- animals prefer to graze and loiter in riparian areas.
- they will stay there unless moved.

Vulnerable Period Use

- animals are present through all the vulnerable periods such as when banks are saturated and fragile or when woody species are susceptible to over-browsing.

No Rest

- favoured plants are grazed, then regrazed when they should be allowed to rest and recover.

Continuous, Heavy Grazing

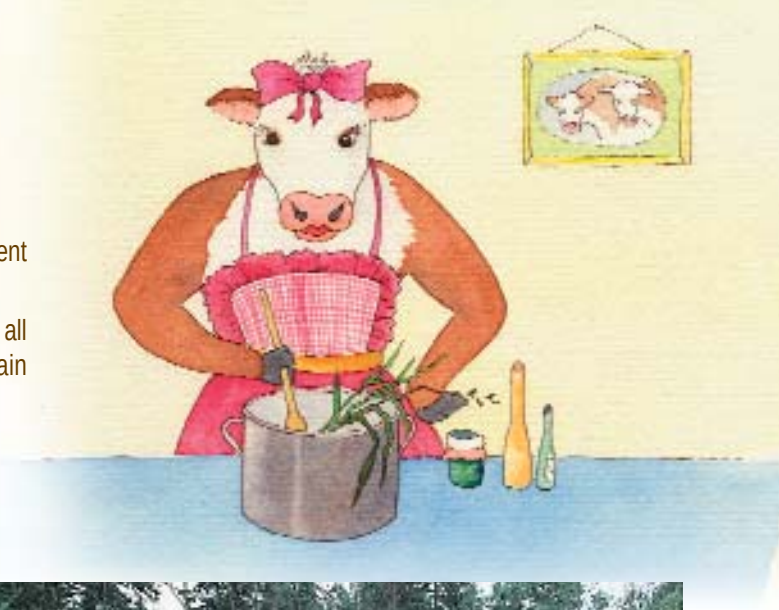
- animals loitering or making frequent visits for water will graze and regraze riparian vegetation to a short stubble, before grazing the uplands.
- insufficient carryover or grass residue is left to protect plants and soil.

When livestock are allowed to graze riparian areas for extended periods, especially under a season-long or continuous type of use, riparian areas will become degraded. Shortening the grazing period starts to fix the problem.

Ingredients for Success -
What is the "Right Stuff"?

By putting into practice the principles of good range management you can achieve a number of key conditions in riparian areas.

These conditions produce a common thread that runs through all successful riparian grazing strategies, ones that maintain productive riparian areas.



Healthy Vegetation

- rest and regrowth produce vigorous, productive riparian plants,
- energy stored in roots will sustain healthy riparian growth,
- healthy plants build strong streambanks and shorelines,
- healthy plants have deeper root systems, can tap deeper water and can withstand drought better,
- woody vegetation adds reinforcement,
- plant species diversity adds forage and shelter values.

Enough Vegetation During High Water

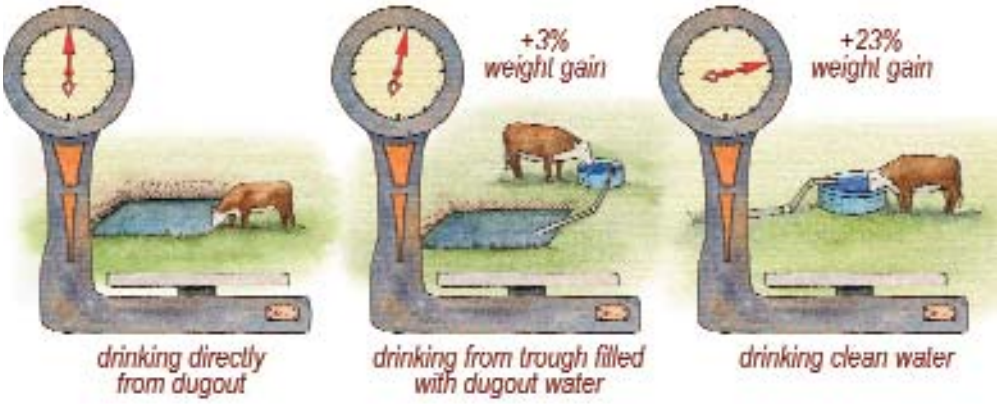
- dissipate stream and wave horsepower,
- trap sediments and build streambanks and shorelines,
- build ground water reserves,
- maintain stream channel shape.

Protection During Vulnerable Stages

- protect banks from trampling when fragile,
- protect brush species during periods of dormancy,
- maintain productive forage species.

A Word About Water

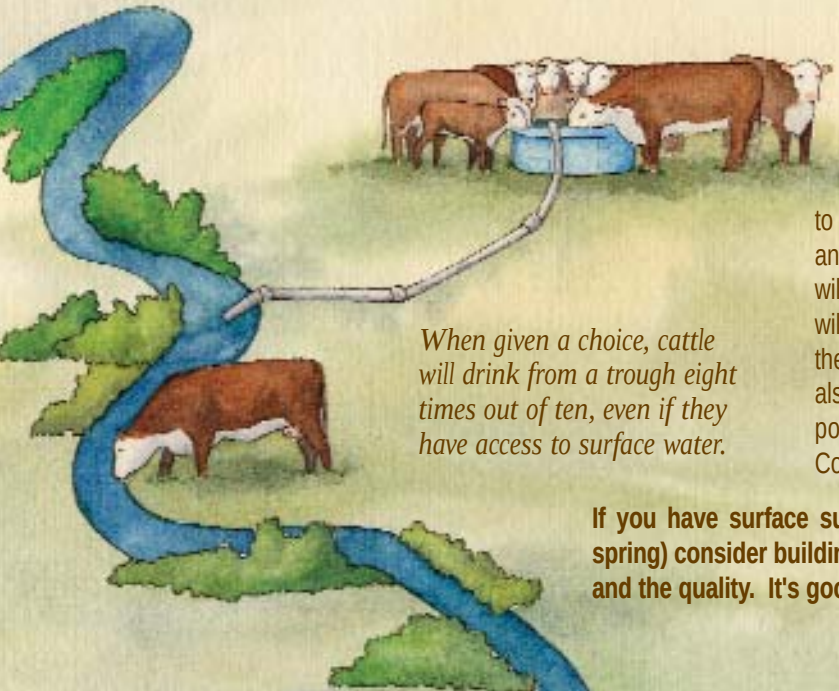
Water is important! It's not just grass that makes beef; it takes water to process food during digestion. Water is the most important nutrient and is often overlooked. Water shortage seriously affects the productivity of livestock. A cow eats about 12 kg of forage a day (measured as dry material) and requires 40 to 60 litres of water to digest that forage. Water quantity is one factor affecting livestock performance; water quality is also an important consideration. Livestock prefer to drink clean water. Cattle that drink clean water spend more time grazing and ingest more forage. Cattle gain more weight, when clean water is available to them, compared to watering directly from a pond or dugout. Research suggests water palatability, or taste, determines how much water cattle will drink and how long they will spend drinking, to meet their needs.



Clean water produced 23% greater weight gains for yearlings compared with direct access to dugouts or ponds. Pumping water to a trough from a dugout produced 3% greater weight gains (water quality does not change much). Livestock perform better with cleaner water!

When livestock have unrestricted access to surface water, they can contaminate that supply. While drinking, cattle will drop a load in that water about 25% of the time. Given a choice, cattle avoid water fouled by even small amounts of manure. Animal manure in water encourages algae growth. A kilogram of phosphorous, derived from animal manure, will spark the growth of 500 kg of algae. Coupled with other nutrient sources, lakes, ponds, dugouts and sometimes rivers and streams can experience large algae blooms. This strongly influences water palatability and some algae may be toxic to livestock.

How can we improve water quality, aid livestock distribution and increase livestock performance? Research suggests that choice can be provided to livestock, often without fencing, by piping or pumping water from surface sources to troughs. In the trials, livestock overwhelmingly selected troughs over surface water supply, even though no fences were present to restrict access. Often cattle would walk further to water at a trough than drink from a stream. Some of this must have to do with the difficulty of access to some surface water - wading through mud on the edge of a dugout or negotiating a steep streambank. It may also be related to animal security and comfort - the ability to see the surrounding area while drinking. Whatever the reason, it seems to work.



When given a choice, cattle will drink from a trough eight times out of ten, even if they have access to surface water.

Because off-site water changes livestock distribution, it reduces the risk of water contamination and better captures nutrients for plant growth in the pasture. About 65% of the manure produced will be deposited within 30 metres of bedding and loafing sites. These sites tend to be riparian areas, so moving water and providing shelter and shade away from streams, ponds, wetlands and lakes will improve water quality. Changing livestock distribution will improve the vegetation in the riparian fringe, which is the zone of critical filtering and buffering. Off-site water is also a way to extend the life of constructed dugouts and ponds, reducing cleaning and reexcavation costs. Conservation of water supply can be another benefit.

If you have surface supplies of water (a stream, river, lake, wetland, or spring) consider building an offsite watering system to maintain the supply and the quality. It's good for you, your cattle and downstream water users.

Tools and Techniques for Outsmarting a Cow

If left to themselves, livestock will graze where and when they choose. Successful riparian management requires modifying animal behaviour to control grazing patterns, timing and intensity.

1. Alter livestock distribution

- salt and mineral location,
- stock water development,
- drift or temporary fencing,
- animal placement/herding,
- alter species or class of livestock,
- alternative shade or shelter.

2. Control access to water

- provide off-stream, or off-site watering areas.
- provide ease of access through gravelled or hardened access points, that livestock will prefer to use.

3. Alter the timing of grazing when riparian areas are vulnerable

- avoid soft streambanks and shorelines or times that may be stressful to key plants such as tree seedlings and shrubs in autumn or winter.

4. Add more rest to the grazing cycle

- this enhances plant vigour, allows for bank building and allows tree seedlings to grow and reach a more grazing resistant stage.

5. Control grazing intensity

- intensity is a function of number of animals times duration of grazing.
- lower intensity results in better plant vigour and species composition.
- grazing intensity may also be regulated by providing supplemental feed.

6. Riparian pastures

- fence the riparian area into a separate pasture, with separate management objectives and strategies.
- riparian pastures increase your control over the grazing process (animal numbers, season grazed, length of grazing and rest periods).

7. Grazing systems

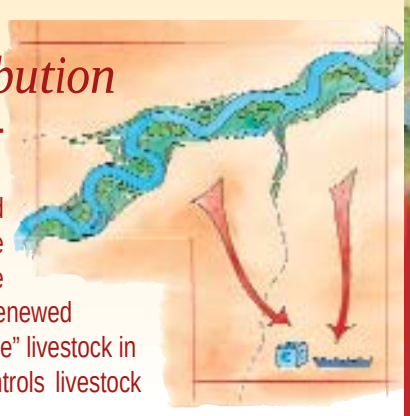
- a grazing system defines recurring periods and patterns of grazing and rest for two or more pastures. Grazing systems put range management principles and practices into effect.
- these grazing systems are a management tool to enhance livestock production and maintain or improve the plant community.
- when properly designed, a grazing system provides adequate rest and deferment periods to offset the impact of grazing and trampling during the grazing period.
- examples include deferred rotation, rest rotation and time controlled systems. Case studies of grazing systems are presented in the following section.

8. Corridor or exclusion fencing

- although not a favoured option for all situations, exclusion of livestock grazing may be the only option to deal with riparian grazing problems in high risk or chronic problem areas.

On The Range, Out in the Pasture
Successful Riparian Management

The First Step - Improving Livestock Distribution



A first step in any riparian grazing strategy is to improve livestock distribution - to better balance out the grazing load over the landscape.

There is no textbook approach to this. Good distribution requires imagination, trial and sometimes error. The most common option is to place attractants in the uplands away from the riparian areas. Things like salt, minerals, watering sites, oilers, rubbing posts and alternate choices for shade and shelter will help draw animals away from riparian areas. There is renewed interest in animal placement where the stockman employs special herding techniques to "settle" livestock in more lightly-used upland areas. Electric fencing is a low cost and effective tool that controls livestock movement and timing of use especially during high risk periods such as early spring.

Where is it Effective?

Animal attractants and herding are most effective where there is little variation in topography, elevation and vegetation types. Distribution tools will be less effective with grazing periods of one month or longer and with season-long, continuous use.

These tools are an incremental step towards tackling riparian management concerns. They are often best combined with other management actions.

Practices to Avoid!

Salt blocks (plus minerals, oilers and rubbing posts) placed by the water encourage livestock to camp there and don't provide an incentive for better distribution. Moving salt away from water supplies is one of the easiest and cheapest changes available to start managing riparian areas better.

Practices that Work!

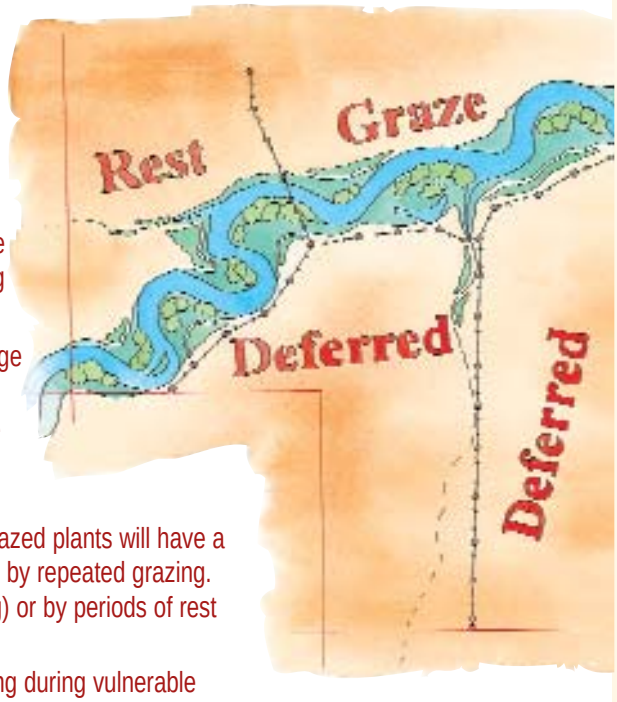
Roads and trails may funnel livestock to sensitive riparian areas. Drove trails that avoid riparian areas and link upland pastures are useful distribution tools. The Tulliby Lake Stockmen's Association uses a combination of drove trails, dugouts and salting to improve livestock distribution and riparian management on 17,000 acres of forest and riparian rangelands north of Marwayne.

Off-stream watering sites, permanent or portable, in the uplands, can draw livestock pressure away from riparian areas and achieve better use of upland pastures.

Providing feed and shelter away from riparian areas avoids heavy use and damage to woody vegetation, plus it reduces manure buildup and possible water contamination.

A forested buffer between upland pastures and shorelines, coupled with off-site water, can reduce pressure on wetlands and lakes.

Rotational Grazing



Rotational grazing involves a planned sequence of grazing and rest periods.

Rotational grazing normally requires subdividing the range into smaller pasture units. It is possible to implement a rotational grazing program with existing pasture units or even through herding practices.

A grazing rotation enables the manager to better apply the key principles of range management.

- Animal distribution will improve because animals will be forced to use the overall range landscape more evenly. Livestock grazing will be less selective, especially in riparian areas.
- More effective rest will be achieved by shortening the grazing period. Grazed plants will have a better chance to rest and regain vigour rather than being stressed further by repeated grazing. Rest may be provided either by periods of deferral (delayed early grazing) or by periods of rest after grazing.
- Season of use can be controlled to avoid or reduce the stresses of grazing during vulnerable periods such as during spring runoff when banks are fragile and easily trampled and fall when browsing can be excessive.
- Better overall carryover of litter is achieved. More uniform grazing will reduce grazing intensity in riparian areas and make more efficient use of upland forage.

Deferred Rotational Grazing at Beaverhill Lake

The Stauffer family (Milo, Bonnie, Scott, Darren and Julie) have a livestock operation that borders on Beaverhill Lake, near Tofield. Since 1983 they have developed an eight pasture rotation on about 980 acres of deeded and lease land. Four of the pastures are lakeshore ones; the remainder are upland ones. The rotation begins in late May on upland pastures, which defers use of riparian ones until July 15 in most years. Adjustments to drought conditions has meant supplemental feeding to allow deferral and to allow regrowth of riparian pastures. Grazing use in a typical season would be with 137 cow/calf pairs. Following use of each pasture, six weeks to two months of rest are provided, to allow regrowth, and then the grazing sequence is repeated. Since most of the pastures contain tame forages this sequence keeps the plants in a productive, vegetative state. Livestock are removed by September 30 and go onto stubble and hayland. Milo has reference areas in each of the eight pastures where he gauges utilization to meet a goal of 50% (take half-leave half). This provides good carryover of forage, to conserve moisture and to maximize regrowth. The sequence of pasture use changes from year to year based on pasture readiness.

Rotational grazing allows better control of livestock distribution and provides growing session rest for lakeshore pastures.

Dugouts are fenced, with water pumped to troughs, to conserve water and reduce maintenance costs.

Water developments facilitate this rotational system. Three fenced dugouts, with water pumped to troughs, are located so each supplies water to more than one pasture. This has increased water quality for livestock and has almost eliminated foot rot which was a chronic issue when livestock watered from the lake. Prior to 1983 and the development of cross-fencing, this was mostly one large pasture. It was very difficult to control livestock distribution and utilization; water supply was limited in the uplands and cattle parked on lakeshore areas. Investing in this grazing system has provided the Stauffer family with higher beef production, more control of livestock, drought proofing and a healthy lakeshore.

Rotational grazing on the Stony Hill Grazing Co-op

The Stony Hill Grazing Co-op is located on the south side of the Cypress Hills, in southeastern Alberta. Grazing occurs on lease land and the Co-op has worked for many years with Public Lands and PFRA on ways to improve range management. Initially one pasture was a four section field of mostly native rough fescue, with some smooth brome on old cultivation. In the early 1990s the practice of placing salt in the same locations within the field, at the top of drainages, was changed to moving salt to new locations every time a salt block was required. This change in salting, coupled with water development of an upland spring, in 1992, started to show benefits. Cattle distribution became more uniform and less use was made of riparian areas. The condition of woody plants began to improve in coulees, draws and along Grant Creek. In 1999 Co-op members and agency staff decided a cross fence would further improve the initial results. The one large field was divided in half with a fence that followed natural topographic boundaries. Grant Creek flows through both fields.

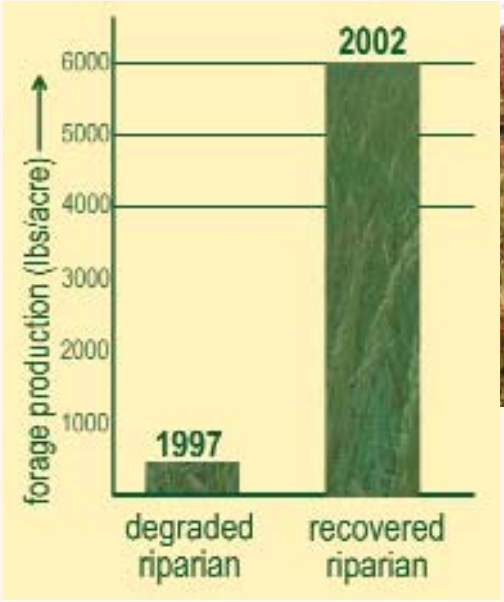
One of the benefits of rotational grazing has been better water storage in the riparian area and season long flows in Grant Creek.

before management change . . .

These fields are grazed with 268 cow/calf pairs and about eight bulls. The sequence of grazing starts about June 1 and the first field is grazed for a month. Cattle are then moved into field two where they stay for two months, until late August. This provides substantial growing season rest to field one, which is then regrazed for the month of September. Field two gets growing season rest both early and late, especially beneficial for woody plants which can suffer heavy browsing in spring and fall.

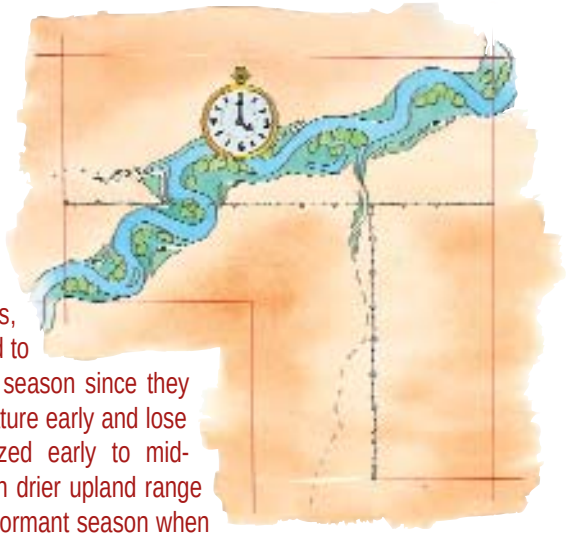
In this rotational system the sequence of pasture use changes every four to five years to facilitate maximum rest and regrowth of woody plants in the riparian areas of one field, then the other. When one field has had multiple years of growing season rest, in spring and fall, woody plants develop better resilience to grazing. This system of rest and planned use has allowed the recovery of woody plants in field two and the recovery of sedges in both fields, while maintaining the same amount of grazing that occurred before the changes.

The changes in Grant Creek are dramatic with the rotational system, and other management shifts. Forage production increased from about 600 lbs/acre to 6000 lbs/acre, a ten-fold improvement. That forage production is a reflection of the recovery of the riparian sponge that traps and holds moisture. Water flowed in Grant Creek, in the rotational pastures, throughout 2001, the driest on record for 130 years. Water quality is now higher; water is less turbid because the highly erodable soils are glued together with dense growth of sedges. These sedges have trapped substantial amounts of sediment; in places up to 10 cm in four years. Willows are reestablishing and their height and vigour are improving. With woody plant recovery, better snow trapping will occur and the watershed will store more water.



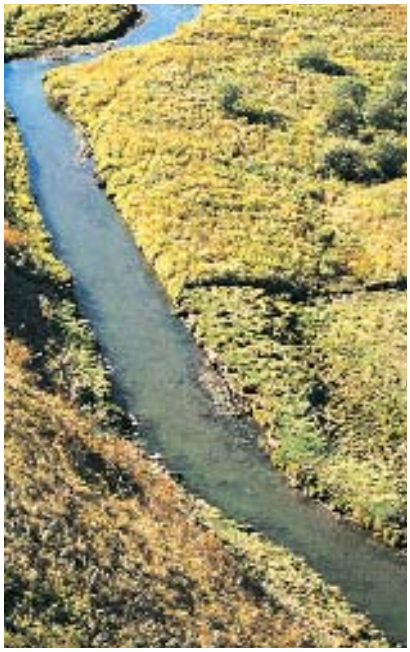
. . . after management change

Time-Controlled Grazing



A general trend in grazing management on many Alberta ranches is to shorten the grazing time, particularly during the phase of most active plant growth.

On many foothill ranches, riparian or lowland fields tend to be used during the growing season since they tend to have species that mature early and lose nutritional value if not grazed early to mid-season. Forage supplies on drier upland range tend to be "banked" for the dormant season when native bunch grasses can be used to best advantage. This practice may be very beneficial to riparian areas. Time-controlled systems minimize grazing of the regrowth that plants require for rebuilding roots and energy supplies. The actual sequence of use may not change much from year to year.



Fenceline contrasts show differences in livestock management and how streambanks respond. The healthy riparian area is a result of time-controlled grazing on the Bluebird Valley Ranch.

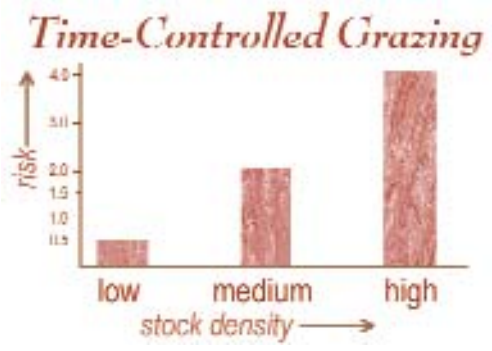
Bar S Ranch

The Bar S Ranch, owned and managed by Clay Chattaway and sons Scott, Christian and Morgan, sits at the head of the Mosquito Creek watershed. A 260 acre pasture that straddles Mosquito Creek was used as a holding field prior to 1925. The field was next to the ranch headquarters and, in earlier times, had become a "sacrifice" area. In later times the field was used for breeding, early in the grazing season. Management changes by the Chattaways in the 1980s have led to progressively shorter grazing periods. Now, the field is consistently used in the late-June to late-July period. It is rarely grazed for more than three weeks during this period, providing growing season rest both early and late. Another late season grazing may follow, but the bulk of the grazing use occurs in summer.

Adequate growing season rest, with time-controlled grazing, has allowed woody vegetation to establish and produce a healthy riparian area.

Risks of Time-Control

Time-control can be applied at light, moderate or heavy rates of stocking. There are places where heavy stocking for short periods can help you reach a resource management goal. However, there is increased risk with high livestock densities or stocking rates. Livestock become less selective in their grazing habits. If your goal is to restore woody plants, non-selective grazing may be very stressful to these species. Monitoring is the key. Be prepared to move animals if grazing impacts your riparian recovery goals.



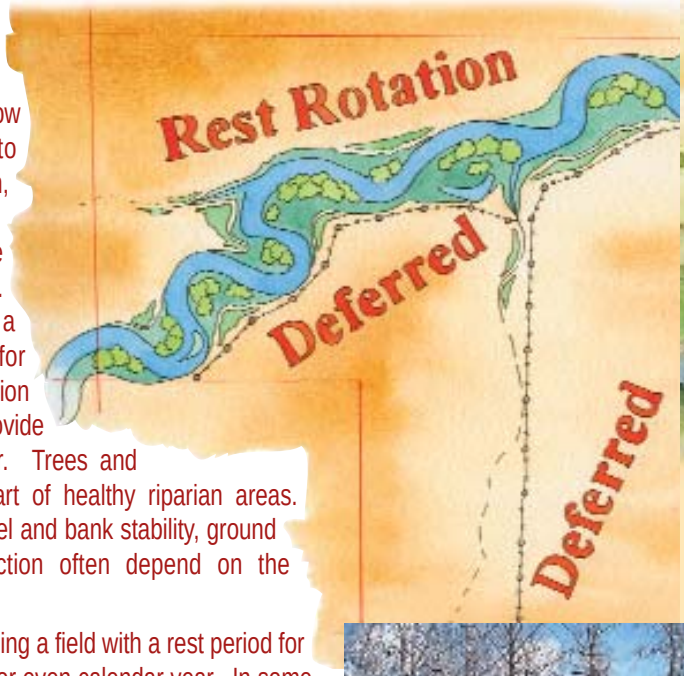
Careful monitoring will help you reduce the risk to your riparian areas.

Rest-Rotation Grazing

When it's critical to restore woody vegetation in riparian areas, a more conservative grazing strategy like rest-rotation grazing may be necessary.

Woody seedlings like this willow plant, will establish under deferred grazing, but may be grazed out during the dormant season. Rest-rotation helps to add this critical woody component to your riparian area.

A deferred rotation may allow new woody seedlings to establish in the short term, but without sufficient rest, the young plants may be grazed out by livestock. Rest-rotation grazing is a method to consider for maintenance or perpetuation of trees and shrubs that provide your livestock with shelter. Trees and shrubs are an integral part of healthy riparian areas. Riparian values like channel and bank stability, ground water and forage production often depend on the presence of "big wood".



Rest-rotation means providing a field with a rest period for the entire growing season or even calendar year. In some cases, rest may need to be applied for a series of years! For example, if riparian cottonwoods are unable to establish or get above the reach of cattle, there will be no recruitment of young trees to replace the old ones that eventually die and fall over. In these circumstances, a field may require many years of complete rest to allow new seedlings to establish and grow into forms that are more resistant to grazing. The amount and sequence of rest periods will depend on the species of trees and shrubs you have in your riparian area.

This riparian area shows no regeneration of woody plants and will require rest-rotation grazing to establish them. Livestock can be managed to allow plants to return and reach a grazing resistant stage.

These cottonwoods have reached a grazing resistant pole stage and the riparian area can absorb grazing pressure. Monitoring is key to ensure this vital component of the riparian area is maintained.

This cottonwood sapling has established itself but is not yet resistant to livestock use.

Tiny seedlings to tall trees grow - If we let them!

Bar U Ranch

The Bar U Ranch was established in 1882 on Pekisko Creek, south of Longview. The original headquarters, about 320 acres, is now a National Historic site managed by Parks Canada. The riparian bottomlands of Pekisko Creek have had very heavy use by livestock, through all seasons, for approximately 112 years. In 1994 it appeared all that was left on the site were cottonwoods between 80 and 100 years old with no other age classes or species of woody vegetation. Flooding in 1995 showed the weakness in the system without new woody vegetation to slow streambank erosion. Adequate rest for many riparian systems can be provided with seasonal rest periods and the pasture can still provide some forage. The Bar U contains a cottonwood forest that requires multiple years of total rest to allow tree and shrub seedlings time to establish and produce enough growth to make them resistant to grazing. The riparian area was fenced in 1997 to provide complete rest from grazing. The uplands continue to be grazed and provisions were made for livestock water from Pekisko Creek. New age classes of poplars appeared, as did other woody species. This showed that the natural capital of plant species was present as seed stock. The system just needed more rest to take the pressure off the "spring" that was held down by grazing. Careful grazing may be possible in the future as recovery levels are achieved.

Rest-rotation, using temporary electric fencing has allowed this fragile area to revegetate.

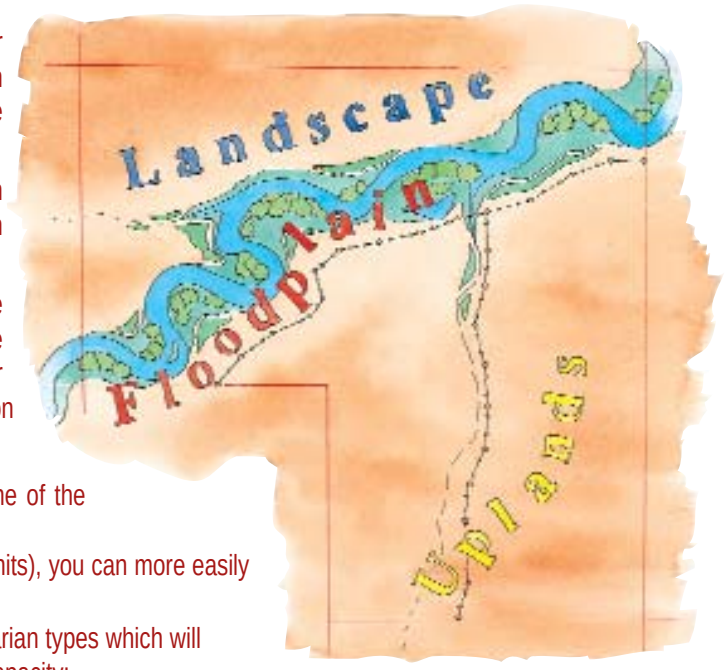
Butters Ranch

The Butters family ranch west of Cochrane, in the Ghost River watershed. Many years of livestock grazing coupled with beaver activity resulted in most of the woody vegetation, especially willows, to disappear from Robinson Creek. Robinson Creek has streambanks vulnerable to erosion, particularly without the roots of woody plants to hold them together. To allow woody plants to regenerate, Erik Butters has used temporary electric fencing to exclude cattle from the riparian area, while grazing the upland portion of the pasture. He has successfully used this, both for summer and winter grazing, to provide both growing season rest and to eliminate any browsing, trampling or rubbing during the dormant season. Single strand wire, supported with temporary posts and powered with a 12V battery has been effective for discouraging cattle from accessing the riparian area. The system is very portable, relatively inexpensive and is used elsewhere to provide better control and distribution of livestock in upland pastures. Erik has used portable electric fencing as a way to provide rest and allow woody plants to recover since 1998. Willow regeneration is occurring, but is not yet at the stage that grazing could resume.

Riparian Pastures - A Landscape Approach

Rotational grazing systems deal with recurring patterns or sequences of grazing and rest. The riparian pasture option takes us the next step to consider how we define and fence pasture units.

Moving to a riparian pasture system means defining fields in a manner that reduces the variation within a given field, such as fencing uplands separately from the floodplain.



Like rotational strategies, riparian pastures also will be grazed in a planned, purposeful sequence. However, the major difference between riparian pastures and other rotational strategies is the separation of range pasture units on a land type or landscape basis.

Often more fencing is required but a riparian pasture is one of the most successful options because:

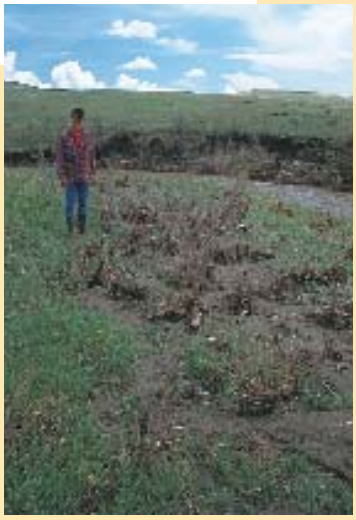
- when land is fenced "like-with-like" (in homogeneous units), you can more easily control livestock distribution;
- animal distribution is improved in both uplands and riparian types which will often allow you to increase your sustainable carrying capacity;
- providing effective control over livestock grazing during high risk periods allows for the most rapid recovery of riparian area health and productivity; and
- as a component of your riparian area goal, a riparian pasture will help you restore and maintain woody vegetation.

Vandervalk Ranch Riparian Pasture

Jack and Merry Vandervalk, of VXV Farms, have applied a riparian pasture strategy on their ranch on Lyndon Creek, west of Claresholm. One of their pastures has been fenced as a riparian pasture for 40 years. Grazing use in a typical season would involve 50 heifers for one month during the mid-March to mid-April time frame, followed by 140 yearlings for a week between April 15 and May 5. Yearlings are allowed to return in July to graze a certain amount of forage regrowth. Forage species here are well adapted to growing season use as long as grazing intensity is carefully regulated and an adequate rest period is provided. In this pasture, rest is provided from early-May to July, and then again after the regrazing period.

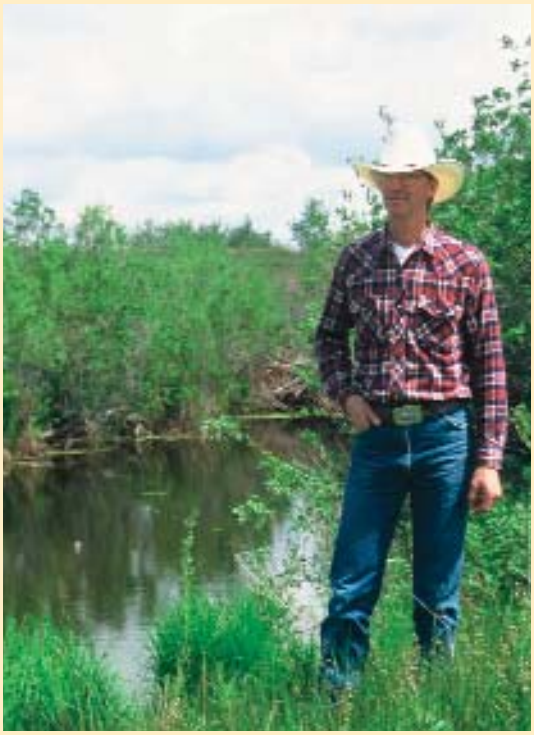
This field has been grazed as a riparian pasture for 40 years.

Over the years, Jack Vandervalk has learned to take his cues for managing riparian pastures from monitoring livestock use of woody species. He recognized early that prolonged, dormant season grazing will progressively set back the woody species that he needs to stabilize streambanks and provide shelter for his livestock. He has met those needs by shifting livestock use to upland, native pastures to avoid dormant season use in his riparian pasture.



Sediment trapped on Vandervalk's riparian pasture after spring floods shows riparian vegetation doing its job - building a productive riparian area.

Riparian Pasture - Graminae Red Angus Ranch



Lyle Voegtlin has applied a riparian pasture strategy on a portion of Amisk Creek, near Tofield, since 1985. About 120 acres are fenced on topographic boundaries forming a pasture composed of some upland, but mostly riparian bottomland. Animals are held on hayland early in the year, deferring use of the riparian pasture and providing growing season rest in May. The earliest cattle are put in the pasture is June 1 and the latest they are held is September 30, but the entry and exit dates are variable based on observations of pasture condition. If the spring is dry, livestock are held later on hayland. Pasture readiness is assessed based on moisture and growth. Multiple entry points are used to aid distribution and to ensure the sequence of pasture use changes from year to year. Utilization levels are monitored to ensure there will be litter reserves to conserve moisture and recycle nutrients. Animals are removed early enough to allow late season regrowth and to minimize browse use of woody plants.

There are several instructive things about management on this ranch:

- year to year variation in moisture and growing conditions is recognized;
- annual management is based on grass available rather than on average stocking rates;
- growing season rest is provided both early and late;
- the sequence of grazing use is based on moisture availability and pasture readiness;
- the riparian area is drier when grazing begins and there is less hoof damage and compaction; and
- there is a high degree of involvement in observing and assessing the pasture before, during and after grazing.

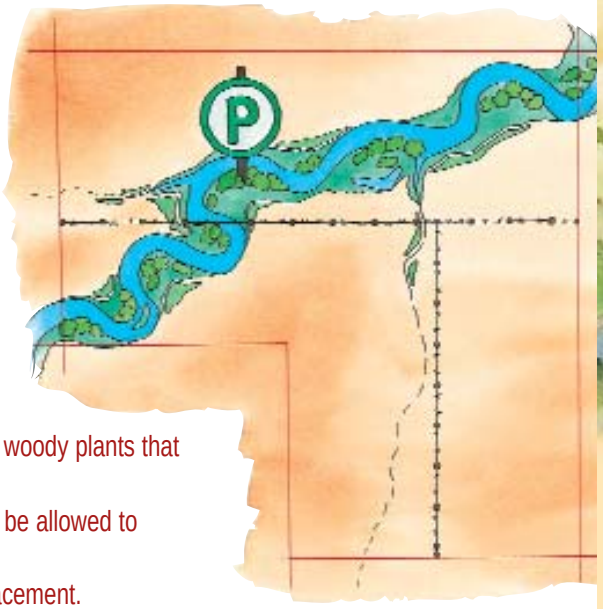
Riparian pasture management has produced a very healthy pasture and riparian area capable of sustaining livestock use. Cattle water from three preferred sites that have solid footing. Additional off-stream water development is planned to enhance livestock gain, improve better distribution and conserve water.

Riparian pastures provide effective control of grazing and allow riparian areas to maintain health and productivity

Holding Pastures

Holding pastures are those fields where livestock are held or "parked" for prolonged periods such as for winter feeding or calving, and where supplemental feeding is normally provided.

These fields may provide shelter through topography and/or wooded cover. Holding pastures may also describe fields where animals are gathered and held at high stocking densities for a relatively short period.



Problems Posed by Holding Pastures

- Holding pastures in riparian areas can experience very serious livestock impacts due to trampling of banks and intensive use of herbaceous and woody plants. Repeated, heavy use will threaten the woody plants that are so vital for livestock shelter and bank stability.
- Cattle browsing may damage woody seedlings and saplings that must be allowed to "release" and replace older trees or shrubs that age and die.
- In short, sustainable livestock shelter depends on tree and shrub replacement.

When can holding pastures work?

Holding pastures are hard to manage. The first step in successful management of these pastures is recognizing that livestock shelter and stable banks are the first priorities. Don't rely on the forage produced in these pastures.

In order for riparian areas to be maintained within holding pastures:

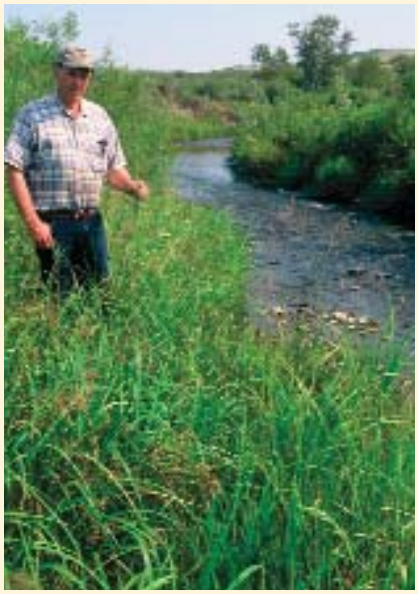
- Don't regard the vegetation in a holding pasture as forage. Provide adequate supplemental feed although sometimes livestock will still prefer native vegetation over supplemental feeds.
- Provide ease of access for livestock to water, or provide off-site watering locations.
- Direct herd pressure to the most resistant areas of the field through placement of supplements.
- Monitor livestock use of woody regrowth and forage. Provide more rest if tree replacement is suppressed, or provide alternative shelter.

McPherson Ranch

The McPherson Ranch maintains an example of a successful holding pasture on Pekisko Creek, west of High River. The 120 acre field is used as a feeding site for 130 heifer calves from November to February, followed by 50 to 70 two year old heifers from March to mid-May. The field may also shelter a few horses and sick cows year round. McPhersons maintain light grazing pressure on the riparian vegetation by providing adequate supplemental feed, by moving grazing pressure away from the cottonwood forest, and by providing off-stream water, in all seasons. Although livestock are present during vulnerable periods, this management combination has allowed regeneration of the woody plant community.

Careful grazing management on the McPherson Ranch allows regeneration of tree and shrub species.

The McPherson Ranch maintains a holding pasture in a riparian area dominated by cottonwood trees.



This holding field on the Mt. Sentinel Ranch is used and riparian health maintained with careful management.

6VU

Mount Sentinel Ranch

The Mt. Sentinel Ranch west of Nanton, owned and operated by Francis and Bonnie Gardner and family, maintains a holding field near the ranch headquarters. Stimson Creek flows through this field which has been operated as a holding pasture since the ranch was established in the late 1890s. The field is used periodically, throughout the year, with the primary uses being to winter bulls and to provide summer horse pasture. Riparian area health in this holding pasture has been maintained with supplemental feeding, moving grazing pressure onto the upland portions, and limiting access to the stream for livestock watering.

Supplemental feeding is key to successfully managing holding pastures.

Holding Pastures - Is One Horse Too Many?

Acreage life draws many people to the country where the desire may be to have a small livestock operation or provide pasture for a few horses. However, many acreage properties lack the forage resources and the land base to adequately sustain livestock. Too many animals grazing too small a parcel of land can lead to serious degradation of soil and vegetation, especially in riparian areas. Some properties may not have enough forage to support even one horse or cow.

How big must an acreage be to support livestock and not damage range and riparian areas? The following table provides an estimate of the forage supply or carrying capacity that land parcels of 3 to 40 acres would provide for horses or cow/calf pairs. The table values indicate the number of horses or cow/calf pairs that could be sustained for a five month grazing period, assuming that adequate supplemental feed would be provided for the balance of the year. For example, if you have a 10 acre property that consists mainly of a grassland vegetation type you may be able to graze up to 3 horses or cow/calf pairs for five months. The shaded portion of the table highlights those combinations of acreage size and pasture type where forage resources are inadequate to support livestock. For those acreages, the presence of grazing animals will lead to resource degradation, especially in riparian areas.

Calculate Your Grazing Potential by Acreage Size and Vegetation Type

	Parcel Size					
Vegetation Type	3 acre	5 acre	10 acre	20 acre	30 acre	40 acre
Grassland	0.9	1.5	3.0	6.0	9.0	12.0
Willow Forest	0.1	0.2	0.5	0.9	1.4	2.0
Poplar Forest	0.1	0.2	0.3	0.6	0.9	1.2
Coniferous Forest	0.05	0.1	0.2	0.3	0.5	0.6

Inside the shaded portion there isn't enough forage to support livestock; outside is an estimate is how many could be supported for up to five months.

Many other factors are also used to estimate livestock carrying capacity such as animal size, soil type of the pasture, the current condition of the pasture and the amount of moisture normally received for the area. Additional tools listed in ***Other Resources and Materials*** may be needed to fine tune the number of livestock that an acreage may sustain.

Corridor Fencing

Corridor or exclusion fencing involves eliminating livestock grazing on a narrow fringe of the riparian area.

Some riparian areas are too fragile and valuable for other reasons to be grazed by livestock. These areas are candidates for fencing, especially water sources like springs and seeps.

Corridor fencing can be a valuable first step to raise awareness about riparian area management by demonstrating the effect of rest on riparian vegetation. It is probably best applied in the following situations where fencing can be a feasible option:

- where topography and vegetation patterns are complex;
- where land holdings are small and fragmented;
- for banks or shorelines that are very fragile or severely degraded;
- on low gradient streams, that are laterally stable and not subject to severe flooding; and
- where other resource values such as water quality or fish are of a higher priority.

Generally, corridor fencing is considered a measure of last resort when other management options have failed to restore riparian health. Fencing livestock out of the stream or lakeshore corridor may fail to deal with grazing problems (or other land use issues) on all of the landscape units which make up a ranch. Corridor fencing is expensive, requires proportionately more fencing for area protected than any other option and maintenance costs may, over the long term, out-weigh those of construction.

The Elkhorn Ranch

Hilton and Alta Pharis from Lundbreck have co-operated with many of their neighbours in applying corridor fencing along Todd Creek to restore riparian condition. Corridor fencing has been a valuable tool in the community to demonstrate the value of management in restoring riparian vegetation and fish and wildlife habitat.

On the Pharis' Elkhorn Ranch, one field is used for the dual purpose of hay and pasture. Given the proximity of the site to the ranch headquarters and the fragile nature of the wooded drainage, corridor fencing was the favoured option. Access for livestock watering is provided through fenced access points.

After over ten years of recovery, there is some concern about the build up of vegetation in the riparian corridor. The Pharises are experimenting with some limited grazing using a few animals for a short period of time in the fall to reduce some of the buildup of old grass. This may have some additional beneficial effect on willow regeneration by reducing the competition between reed canary grass and willow shoots.

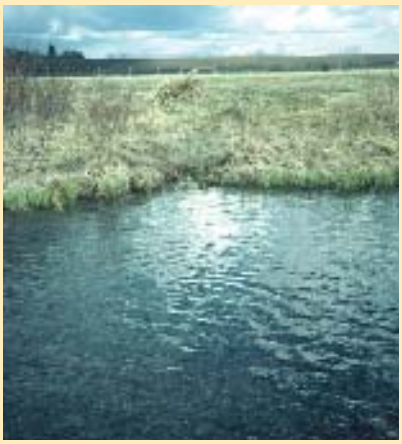
Corridor fencing was very effective for rapid riparian recovery within five years.

Limited fall grazing removes some of the grass buildup and may spark some additional willow growth.

The Raven and North Raven Watersheds

Since the 1970s, corridor fencing has been the favoured option for landowners along several spring-source streams near Caroline, such as the Raven and North Raven rivers. These streams have low gradients, and are stable, meandering systems with very high values for fisheries and water quality. Streambanks are composed of fine soils and without vegetation can be very erodable. With the assistance of provincial agencies and conservation groups many kilometres of these streams have been fenced, crossings installed and improved water sites developed. Although corridor fencing has meant loss of some riparian areas to agricultural production, this fencing has had other benefits. Stream fencing created many opportunities for rotational grazing, by dividing larger pastures into smaller units with less variation. This has helped deal with distribution problems, by giving livestock less choice, and allowing better control to effectively use upland areas of many pastures. Fencing, with improved water development, reduced veterinary costs, especially foot rot which is a problem with livestock use of wet soils in riparian areas. Many people have seen reduced livestock deaths from drowning, either young stock in spring high water, or animals falling through the ice.

1973 - before streambank fencing.



1986 - streambank fencing has allowed banks to revegetate, improving bank stability and water quality.

Streambank fencing provided valuable insight into the vegetation potential of many reaches and the extent of recovery possible with the removal of grazing pressure. The restoration of trout habitat and angling success has also translated into business opportunity for some landowners. Water quality improvements, based on less erosion, reduced sediment transport and better nutrient management, are important to downstream water users, including domestic water supplies for towns and cities.

Grazeable Corridors - An Alternative

Many corridor fences create a space too narrow to be effectively grazed. If the goal is to have some grazing use, a wider corridor could be fenced. Wider corridors would be cheaper to build and maintain with some grazing benefits. When reintroducing grazing into the corridor, these things need to be considered:

- grazing should be temporary and use may not happen every year;
- the corridor isn't a place to park livestock, so use should be short and not more than a few days;
- multiple entry and exit locations will help distribution in the narrow corridor; and
- avoid the vulnerable periods of spring and fall and use only after riparian recovery has occurred.

Building a wider corridor provides the potential of some grazing and a reduction in maintenance costs.

Looking At My Riparian Area

Do I Have a Problem?

Often, a riparian area will change so slowly and over such a prolonged period of time, that we may not notice what has happened to it. Here are some obvious signs to watch for that may indicate management problems in your riparian areas:

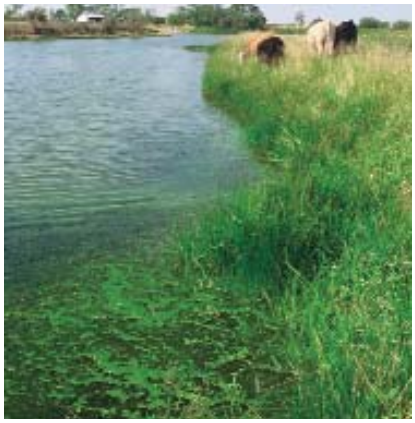
- ☐ *declining forage production*
- ☐ *change in plant species to drier, upland forms*

- ☐ *willows have mushroom appearance*
- ☐ *trees and shrubs hedged, severely browsed*
- ☐ *all trees and tall shrubs are old*
- ☐ *no young woody plants*
- ☐ *no trees or shrubs*

- ☐ *reduction in bank or shoreline vegetation*
- ☐ *many bare soil spots*
- ☐ *increased sediment on stream bottom*

- ☐ *undesirable or noxious weed invasion*
- ☐ *poor plant vigour, little or no litter carryover, few desirable forage plants*

- ☐ *streambank shear damage by hoof action*
- ☐ *active bank erosion from exposed soils*
- ☐ *bank caving*



- ☐ *water quality problems, algae blooms*
- ☐ *changes in water quantity, lower water tables, intermittent flow*

If you have a significant number of these signs in your riparian areas you might think about some management changes.

Where Do I Begin to Improve My Riparian Management?

You have already started by gaining an understanding of what riparian areas are and why they are valuable. Knowing how riparian areas work is key to managing them and to recognizing what might need fixing.

How do things look today?

You might find it useful to "tune your eye" with a riparian health evaluation. This will give you a sense of the current condition, or health, of your riparian area. Combine these measurements with a similar range health evaluation for your upland pastures, to get a feel for the overall condition of your farm or ranch.

Where should my efforts be focused?

Use aerial photographs or some other map base to highlight areas that are "healthy", "healthy but with problems" and "unhealthy". Identify those riparian areas that have the highest priority for improvement. Set management objectives that address soil, water and vegetation needs in both riparian areas and uplands. These objectives should be realistic, attainable and measurable.

What are my options for management change?

This booklet provides some practical examples and some additional sources to explore. Cows and Fish, many agencies and other livestock producers may be able to suggest ideas or share experiences to help you find the right option for your operation.

How do I know if it's working?

Successful management doesn't come from a cookbook. Improvement comes from involvement and learning by doing. Imagination, flexibility, observation, patience, trial and sometimes error are required. Monitoring progress with riparian health evaluations and photographs will help you see changes over time.

Choices

Does This Make Cents?

Are you left wondering if management changes are the right economic decision? Can it be profitable to invest in riparian management? Does it make sense to do so? Consider the following benefits, to help you make that decision. These are benefits many Alberta farmers and ranchers have already experienced with changes in riparian and pasture management.

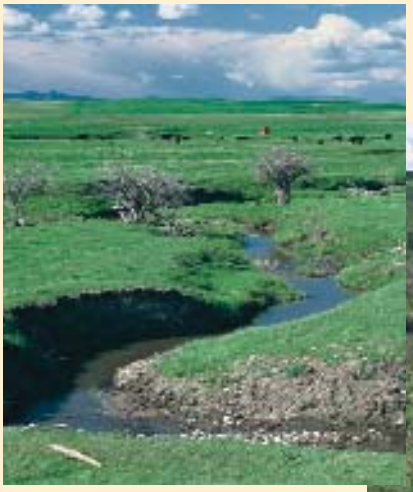
- **Animal performance increases with clean water.** This translates into greater weight gains and more return per animal.
- **Water conservation.** Better management of the water supply makes it go further and provides a measure of drought proofing.
- **Increased forage production.** Riparian areas can produce substantially more forage (tons/acre) than uplands if they are managed wisely.
- **Maintain or restore animal shelter.** The woody vegetation of riparian areas provides shelter for calving, protection from winter storms and shade if grazing management sustains the growth of trees and shrubs.
- **Reduced bank erosion.** Better management increases the stability of shorelines and prevents the loss of some of the most productive and valuable pastures because of lateral or vertical erosion.
- **Great stability and lower risk.** Moving to a sustainable stocking rate reduces risk, allows maintenance of a herd size through the highs and lows of moisture and forage, and provides long term stability and flexibility to your operation.
- **Better distribution and utilization.** With increased ability to manage livestock comes a reduced risk of overusing areas (especially riparian ones) and the opportunity to spread use over a pasture to better harvest forage.
- **Better nutrient management.** Better animal distribution reduces the risk of water contamination, nets higher returns in productivity of forage and reduces need for fertilizer.
- **Reduced maintenance costs.** Development of off-site and off-stream water supply increases the life span of dugouts and ponds, while reducing maintenance costs.
- **Reduced disease and death.** Better distribution practices and off-site water development can substantially cut veterinary costs for things like foot rot and reduce animal deaths by drowning.

Some of these benefits are immediate but most are long term ones. That's why, over the short term, the best economic return is often from season-long overgrazing, done year after year, with no grazing plan and investing nothing in management. However, it will catch up with you. The longer you "mine" the grass, the water and the shelter the sooner you lose flexibility, resilience and stability for your land and your operation.

Does riparian management require an investment? Yes! However, it may be less than you think. Your first investment is time and involvement. It could be thinking about the principles you've read here, looking at the examples of successful management and maybe evaluating riparian health for your pastures. Management changes don't have to be dramatic; they can be incremental. If you want to do it, it will get done. A good manager can make any system work; poor management will allow any system to fail. The key is involvement.

Choices to Make

If we continue to argue over the products of riparian areas and which one is more important- fish or cows, cows or water quality, water quality or agriculture- we may be missing the point. When we work toward restoring, or maintaining a healthy landscape these products, and more, can be part of the benefit package.



This riparian area has lost shelter, forage production, the ability to filter and buffer water and flow may disappear. It may not be the best choice for the future.

We can make other choices. The example to follow may be right across the fence. This kind of riparian area gives us all a future.

Where to Find
Additional Information & Resources

Cows & Fish Publications

The following are available from the Cows and Fish program:

Fact Sheets:

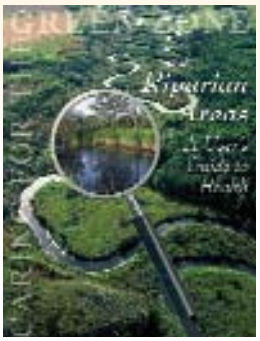
- Riparian Health Assessment and Inventory
- Riparian Health Training
- Invasive and Disturbance-caused Plants in Riparian Areas
- Invasive Weed and Disturbance-caused Undesirable Plant List
- Looking at my Lakeshore Riparian Health Checklist
- Looking at my Streambank Riparian Health Checklist
- Value of Wetlands
- Biodiversity and Riparian Areas-Life in the Green Zone
- Lakes and Wetlands
- Water Quality and Riparian Areas
- Economics of Riparian Areas
- Riparian Demonstration Sites - A guide to selection and development
- Riparian Profile and Reference Sites
- Crops, Creeks and Sloughs
- Tools for Riparian Management
- The Cows and Fish Process
- Facing the Issues

- Getting Past the Talk-Working with Communities
- Cows and Fish Brochure

Community Stories:

- Beaver Creek Watershed Group
- Municipal District of Ranchland
- Lower Mosquito Creek Water Users Association
- City of Camrose - A Forward and Upstream View

Awareness Documents



Riparian Areas:
A User's Guide to Health. 2003. Lorne Fitch and Norine Ambrose. Cows and Fish.

Literature Review: *Riparian health and water quality. Function, design, and management of riparian buffers*. 2001. Sandy Holmes. Cows and Fish Report No. 011.

Riparian Health & Classification Tools

Riparian Health Assessment for Streams and Small Rivers - *Field Workbook.*

Riparian Health Assessment for Lakes and Wetlands - *Field Workbook.*

Classification and Management of Riparian and Wetland Sites in Alberta. W. H. Thompson and P. L. Hansen.

Manuals & Forms

- Alberta Lotic Wetland Health Assessment for Streams and Small Rivers (Survey) User Manual and Form
- Alberta Lentic Wetland Assessment User Manual and Form
- Alberta Lotic Health Assessment for Large River Systems (Survey) User Manual and Form

Cows and Fish Resources

Cows and Fish provides presentations, workshops, training, extension material, riparian pasture walks and riparian health evaluations. We can also share management techniques, plus help create a pathway for your community to work on riparian management issues.

Other Resources and Materials

Publications & Videos

Along the Waters Edge (Video). Produced by Fisheries & Oceans Canada with input from Cows & Fish.

Caring for Shoreline Properties. P.Valastin. 1999. Alberta Conservation Association.

Cattle Wintering Sites. B.West. Available from Alberta Beef Producers, PFRA, or AAFRD.

Guide to Range Condition and Stocking Rates for Alberta Grasslands. 1988. R.Wroe, S.Smoliak , B.Adams, W.Willms and M.Anderson.

Northern Range Plants. 1999. C.Stone and D.Lawrence. AAFRD, Edmonton, Alberta.

Tips and References for Owners of Small Farms and Acreages. 1998. Municipal Districts of Rocky View, Pincher Creek and Foothills, AAFRD, PFRA, Cows & Fish, Alberta Environmentally Sustainable Agriculture Program.

The Stockman's Guide to Range Livestock Watering from Surface Water Sources. Prairie Agricultural Machinery Institute. Box 1060, 390 River Road, Portage la Prairie, Manitoba, R1N 3C5. Alberta Farm Machinery Research Centre, c/o Lethbridge Community College, Lethbridge, Alberta.

Effective Cattle Management In Riparian Zones. 1997. R.Ehrhart and P.Hansen. Montana BLM Riparian Technical Bulletin No. 3, Missoula, Montana.

Successful Strategies for Grazing Cattle in Riparian Zones. 1998. Montana BLM Riparian Technical Bulletin No. 4, Missoula, Montana.

Caring for Alberta's Rural Landscapes: Manure and Pasture Management for Horse Owners. 2003. L.Warren and C.Sweet. AAFRD, Edmonton.

Presentations and Courses

Cows, Fish, Cattledogs, and Kids! (Game Show and Game Board). A fun and educational interactive youth activity that helps young children learn about riparian areas, grazing and proper management. For ages 7-13.

Grazing/Pasture Schools. 1-2 day field courses offered throughout the province by local agricultural service boards, forage associations and other partners.

Grazing Management of Northern Rangelands (Home Study). 1999. G.Ehlert & D.Lawrence. AAFRD, Edmonton, AB.

Range Management by Distance Learning Initiative (Home Study). Western Prairie Range Management Course. Barry W. Adams. 2000. Public Lands Division, ASRD. Modules #1-15. Lethbridge Community Colleg**e,** Lethbridge, AB.

Stockman's Range Management Course Series. An applied field course offered to livestock producers throughout Alberta by Public Lands Division, ASRD and other partners.

Planning and Monitoring Tools

Basic Principles of Grass Growth and Management. 1988. Montana State University, Extension Service, Publication EB 35, Bozeman, MT.

Management of Prairie Rangeland. 1990. S.Smoliak, W.Willms & N.Holt. Agriculture Canada Publication 1589/E, Ottawa, ON, K1A 0C7.

Grazing Management of Native Grasses. 1992. W. Willms, B. Adams and J. Dormaar. Agriculture Canada Publication 1883/E, Ottawa, ON, K1A 0C7.

The Animal Unit-Adjusting for larger cows. 1990. Alberta Public Lands Division, Range Note 5.

Grazing Systems for Public Grazing Lands. 1991. B.Adams, G.Ehlert and A.Robertson. Alberta Public Lands, Range Note 10.

Livestock Distribution on Rangelands. 1991. A.Robertson, B.Adams and G.Ehlert. Alberta Public Lands, Range Note 12.

Managing Rangelands During Drought. 2003. Alberta Public Lands, Range Note No. 18.

Alberta Environmental Farm Plans 1-866-844-2337 www.albertaefp.com

Range Health & Management Tools

Range Health Assessment for Grassland, Forest and Tame Pasture. 2003. B.Adams, G.Ehlert, C.Stone, M Alexander, D.Lawrence, M.Willoughby, D.Moisey, C.Hincz, and A.Bogen. Public Lands Division, ASRD. Pub. No. T/044.

Grazing Notebook. Pocket notebook designed to keep grazing records for several grazing seasons. Public Lands Division, ASRD.

Range Plant Community Guides (see ASRD website: http://www3.gov.ab.ca/srd/land/publiclands/range.html)

Who Can Help With My Range Management?

Agricultural Service Boards and Rural Extension staff of your local municipality or county.

Alberta Fish and Game Association, Operation Grassland Community
http://www.afga.org/Conservation/ogc.htm

Alberta Watersheds http://www.albertawatersheds.org

Cows and Fish Supporters (see page 47).

Ducks Unlimited Canada, Edmonton office 780-489-2002 http://www.ducks.ca/contact/ab.html

Vincent Lake Working Group
www.healthyshorelines.com

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Cows and Fish Supporters

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Calgary, Alberta
Canada T2E 7H7
403-275-4400

Trout Unlimited Canada
P.O. Box 6270, Stn. D
Calgary, Alberta
Canada T2P 2C8
403-221-8360

Canadian Cattlemen's Association
215, 6715 - 8 St. N.E.
Calgary, Alberta
Canada T2E 7H7
403-275-8558

Alberta Environment
9820- 106 St., Main Floor
Edmonton , Alberta
T5K 2J6
780-427-6310

Alberta Agriculture, Food and Rural Development (AAFRD)
206, JG O'Donoghue Bldg.
7000 - 113 Street
Edmonton, Alberta
Canada T6H 5T6
780-427-3885

Producers and Community Groups

Alberta Sustainable Resource Development (ASRD)
Public Lands Division
Agriculture Centre
#100, 5401 - 1st Avenue South
Lethbridge, Alberta
Canada T1J 4V6
403-382-4298

Fish and Wildlife Division
2nd Floor, YPM Place, 530 - 8th Street South
Lethbridge, Alberta
Canada T1J 2J8
403-382-4358

Fisheries and Oceans Canada
7646 8th Street NE
Calgary, Alberta
Canada T2E 8X4
403-292-6549

Agriculture and Agri-Food Canada
Prairie Farm Rehabilitation Administration PFRA
600, 138 - 4 Avenue S.E.
Calgary, Alberta
Canada T2G 4Z6
403-292-5638

Alberta Conservation Association
P.O. Box 40027 Baker Centre Postal Outlet
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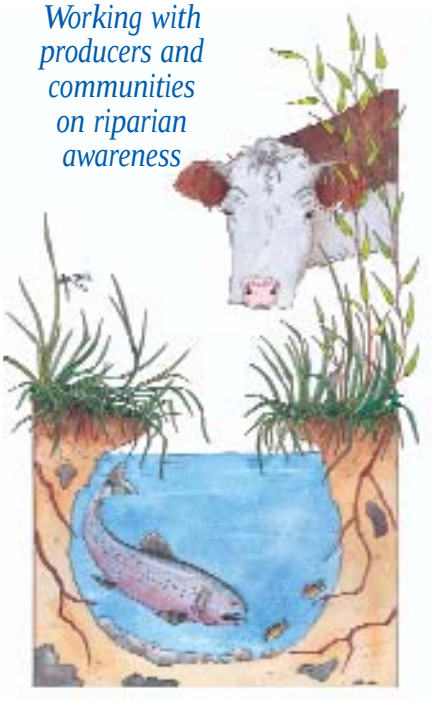
1-877-969-9091

Working with producers and communities on riparian awareness



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