PRINCIPLES AND PRACTICES

TYPES OF RIPARIAN AREAS

Before you assess risk and devise a plan, familiarize yourself with the different types of riparian pastures. Riparian areas are often categorized according to the water body they're directly connected to, such as a watercourse, a lake or a wetland. While these types seem obvious, it's helpful to know more specific characteristics of each one, like soil conditions, riparian vegetation, functions, and real-life examples from around Ontario.

Bear in mind too that many of these riparian types are connected. For example, wetlands, ponds and small creeks and streams feed ever-larger watercourses as water flows to its destination – a lake, in the illustration below.

The following illustrations and descriptions should help you get site-specific with your property as you select BMPs that best suit your circumstances and intentions.

Depicted above are common types of riparian areas and streamside pastures found in an agricultural watershed in southern Ontario. The drainage system moves from sources of the upper "reaches" of the watershed in the upper-right corner (wetlands, ponds, creeks) to the lower reaches that empty into a lake found in the lower left. Generally speaking, natural areas and extensive grazing practices are more common at the top of the watershed, whereas management intensive grazing practices are more common in the lower reaches.

The types of riparian areas found in the distinct components of this watershed are described over the next few pages.

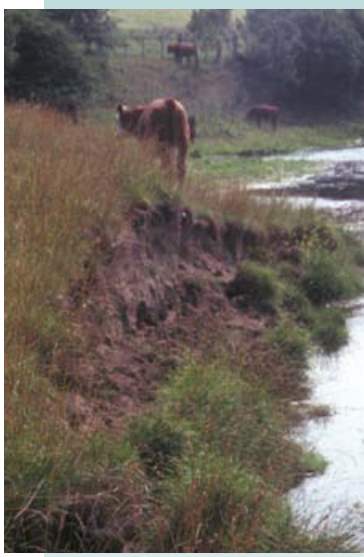
STREAMS AND CREEKS – NARROW CHANNELS

Streams and creeks in the upper reaches of watersheds often form narrow channels through level landscapes dominated by clay or sandy soils.

In the upper parts or reaches of many watersheds, you'll find natural watercourse riparian areas adjacent to streams or creeks in level landscapes. They're characterized by narrow, shallow valleys and deep channels (1–2 metres [3–6 ft] or deeper if in clays). Typical soil types range from fine sands to clays found in sand and clay plains.

Streamside pastures in these areas require prudent management to prevent long-term bank damage. Otherwise, exclusion – permanent or with management-intensive grazing systems and controlled access – is recommended.

Bank erosion and damage at access points on the upper reaches of rivers can be reduced with BMPs for controlled and restricted access.



STREAMS AND CREEKS – WIDE CHANNELS

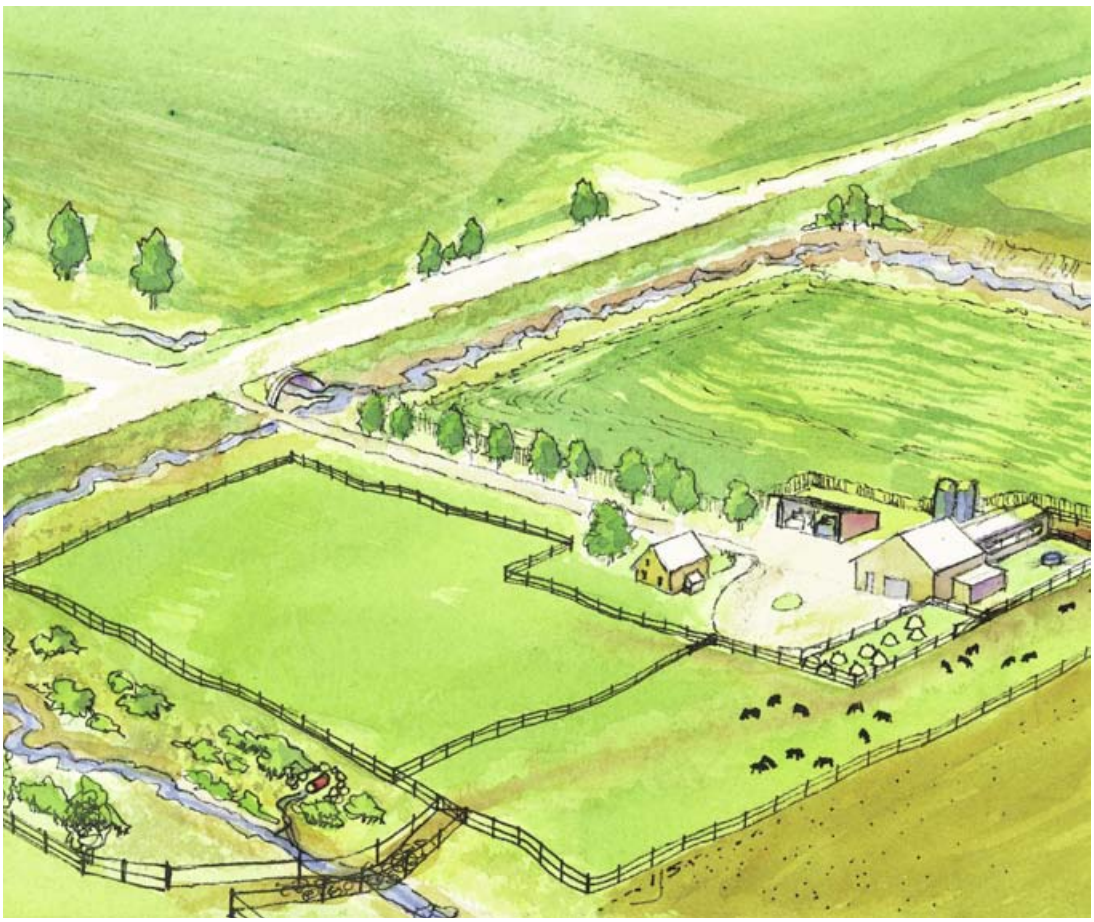
In the rolling topography of upper reaches, you'll find wide channels with cobbly or bedrock-controlled streambeds.

In extensively grazed shallow channels, it's the habitat functions that are most negatively affected. BMPs such as controlled access, delayed grazing and alternative water sources are effective in minimizing impacts on riparian habitat.

At the watershed level, upper parts or reaches are dominated by rolling landscapes, rivers with steeply sloping valleys, and medium-width (10–30 metre [30–90 ft]) shallow channels. Bank and bed materials are usually cobbly or bedrock-controlled. Typical soils are stony or gravelly sandy to loamy soils. In parts of northern Ontario and parts of central and eastern Ontario, these areas are often shallow to bedrock.

Livestock density is rarely high in these areas but can be a source of bank erosion where access is localized and concentrated.

CONSTRUCTED WATERCOURSES – DRAINS AND CHANNELIZED STREAMS



Constructed watercourses and open drains have been shaped to help convey surplus water safely from agricultural lands.

Constructed watercourses are open drains or channelized streams designed and constructed (or altered) to convey water from tile-drained lands, field surfaces and upstream surface waters.

Grazed livestock should be kept out of most constructed watercourses. Provide alternative water, salt and shade away from the watercourse.

STEEP RIVER VALLEYS AND EXTENSIVE FLOODPLAINS

Riparian areas in the middle-reach zone of rivers have steep valleys and broad floodplains.

Riparian areas in the middle-reach zone of rivers have steep valleys and broad floodplains. These valleys have slopes of over 10 per cent, i.e., 10-metre (30 ft) drops over 100-metre (300 ft) distances. Slopes are even steeper through clayey soils or bedrock faults (gorges).

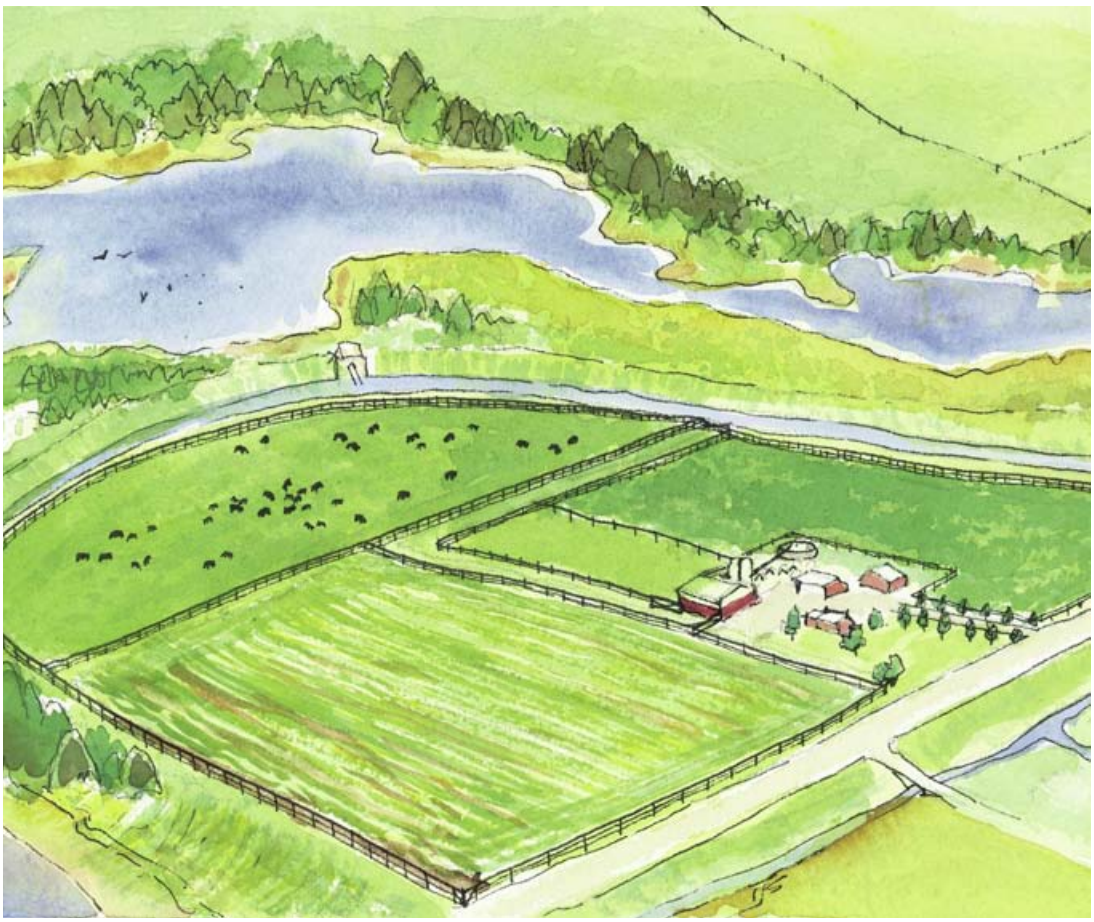
The floodplains are often wide (30–500 metres [90–1500 ft]) with shallow, meandering channels.

In both medium and wide floodplain areas, a combination of woody shrubs, grass and broadleaf vegetation is very important to counteract the sheer stress of floodwaters on the banks. Grass roots alone cannot do it.

These areas are prone to flooding and channelling.

On fragile, steep ravines, livestock exclusion with permanent or temporary fencing at the top of ravines is recommended. Ravine slopes can be planted to trees and shrubs. On less sensitive sites, ravines can be selectively grazed for short periods during the driest times in the summer grazing season.

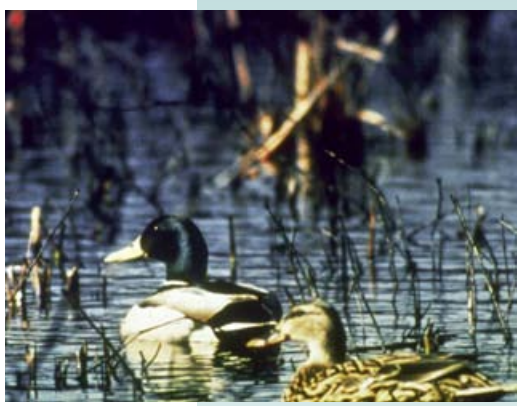
DELTAS AND BROAD FLOODPLAINS



Deltas are fragile areas found at the mouths of major rivers.

Riparian areas near the river mouth feature a mix of broad, deep and shallow valleys, a wide channel, broad floodplains, and as they approach the mouth, delta "islands" and braided streams.

Soils in the floodplain and deltas consist of silty and fine sand materials. Natural vegetation is most often grass and wetland species, with small pockets of ravine bottomland forest.



Delta areas are important habitat for fish, waterfowl and other wildlife.

LAKES – BEACHES, BLUFFS AND BEDROCK-CONTROLLED SHORELINES

The suitability of grazing near lakeshores is very site-specific. Beaches, bluffs and lakeside wetlands are not suitable. However, bedrock outcrops can withstand hooves' action when accessed.

Beaches are particularly prone to habitat destruction.

Lakes are also riparian areas. There are three main types.

Beaches, usually found in lake bays, consist of sandy, gravelly or stony materials. Riparian-area grazing near beaches is uncommon as these areas are at risk of habitat destruction and water quality problems.

Bluffs are shorelines with sizable elevation drops (5–50 metres [15–165 ft]) from the top to the water's edge. Some are formed from bedrock, like the lakes in the Canadian Shield or limestone bluffs in the Lake Ontario–St. Lawrence River Valley. Others, such as Lakes Erie, Ontario and Huron, are formed from silty and clayey materials. Clay bluffs are prone to severe shore and gully erosion.

Between bluffs, points and bays on lakes in the Canadian Shield, you'll find **bedrock-controlled shorelines**. In their natural condition, these riparian areas are dominated by forest cover in uplands and wetland vegetation in lower areas.

Low-density lakeside grazing has little impact on shorelines dominated by exposed bedrock outcrops.

WETLANDS AND NATURAL PONDS

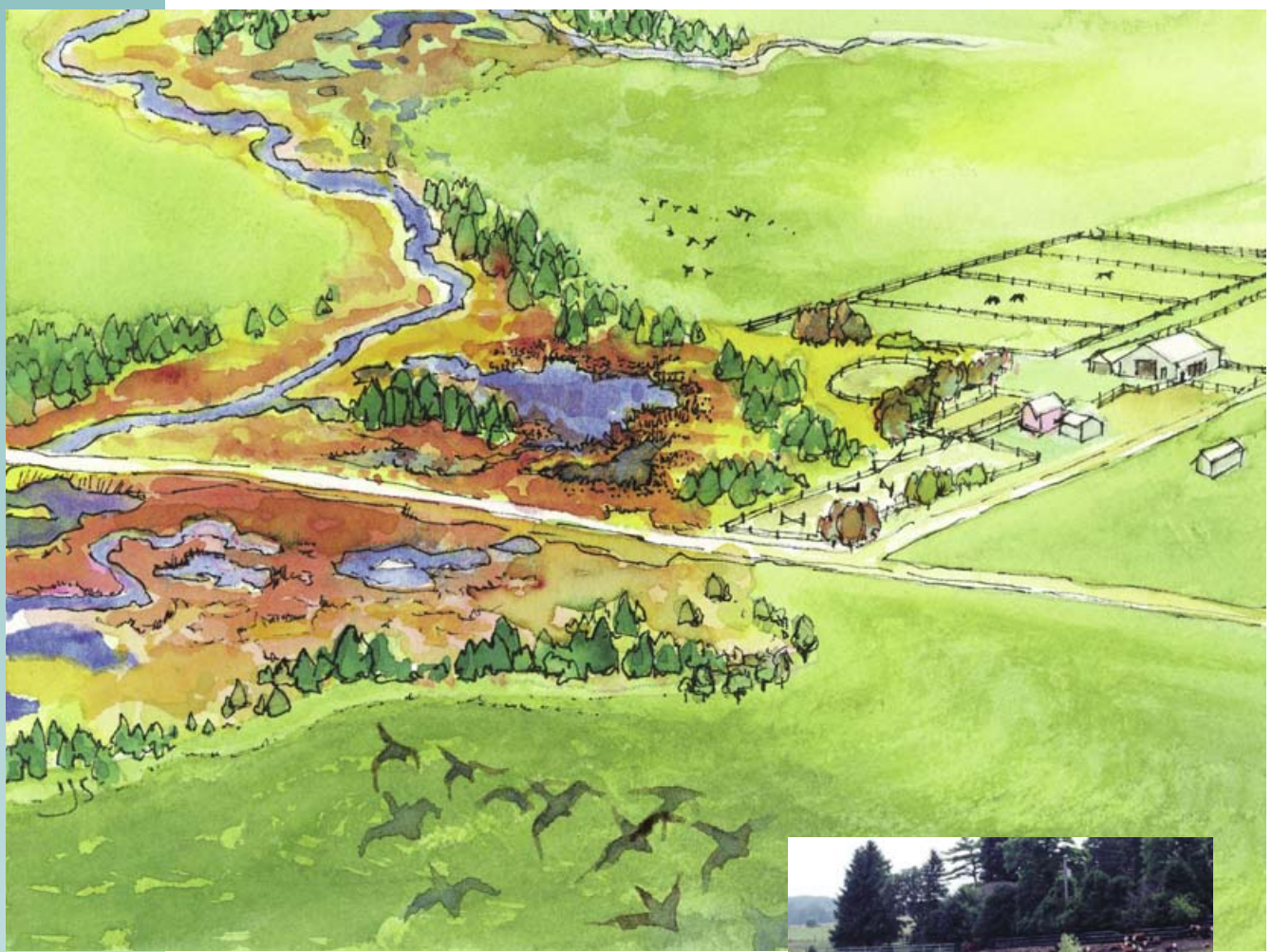
Wetlands are permanently or seasonally flooded areas with high water tables, saturated soils, and water-tolerant plants. In agricultural areas, wetlands can be found in depressional areas away from watercourses and lakes, or can be part of the riparian areas of watercourses and lakes. Wetlands include swamps, marshes, bogs and fens.

These wetlands are often associated with natural ponds.

Ponds are small bodies of non-flowing surface water – like miniature lakes. Ponds can be fed by discharging groundwater, overland flow or by flooding watercourses. Riparian vegetation around ponds closely matches nearby wetland vegetation.

Natural ponds and wetlands are important watershed resources. They provide:

- **water storage**
- **water purification**
- **recreational opportunities, and**
- **fish and wildlife habitat.**

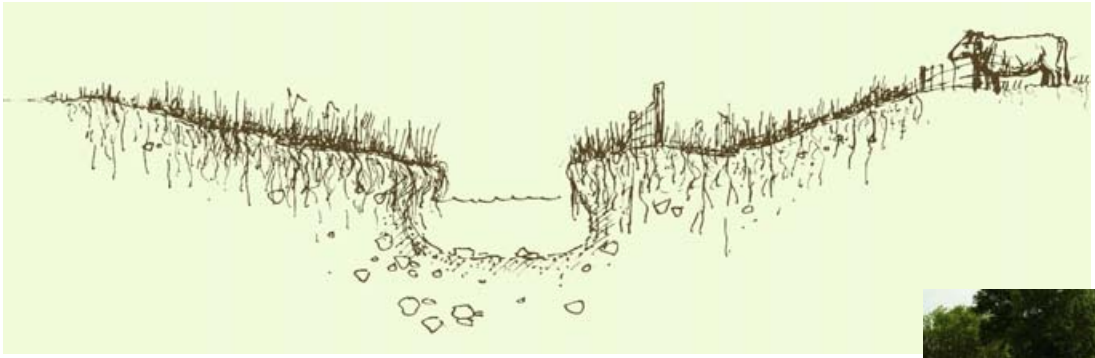


Wetlands are important for water quality, water supply, and habitat functions. Livestock should be excluded from grazing in wetlands.

Ponds are fragile ecosystems and are directly connected to the quality of the drinking water for both your family and your livestock. Livestock should be excluded from grazing around natural ponds.

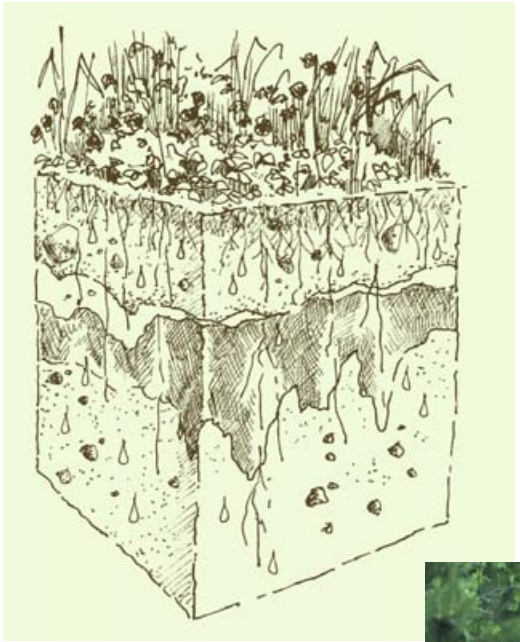
ENVIRONMENTAL IMPLICATIONS OF GRAZED RIPARIAN AREAS

FUNCTIONS



A well-managed grazed riparian area supports vegetation with rooting systems that hold bank soils in place, and help the channel to form a cup shape. Riparian pastures with these qualities have a greater capacity to store floodwaters.

Livestock performance can be significantly improved on a well-managed streamside pastures.



Properly managed grazed riparian buffers improve soil and maintain or protect water quality. Roots stabilize the soil. Plant materials add organic matter to the soil that improves its structure, chemistry and biological diversity. Streamside pastures act as vegetated buffers, helping entrap and filter out sediment and debris from floodwaters and runoff. Within the soil profile, nutrients are adsorbed to soil particles, absorbed by plants, and transformed into less harmful chemicals.

Riparian areas can serve as travel corridors for wildlife.

The red-sided dace is a Special Concern fish under the species-at-risk schedule, relying on properly functioning riparian areas for habitat protection.

Streamside pastures with treed buffers protect fish habitat. Tree roots hold soil in place. Trees provide shade and cool water temperatures. Fallen woody debris is used as cover for many aquatic species. Leaves from trees help to feed aquatic insects and other food sources for fish.

IMPACTS OF LIVESTOCK ACCESS

Livestock access can impair riparian functions. The extent of the impact increases with the sensitivity of the grazed riparian area, the intensity of access (i.e., number of livestock in a given space), and the duration of the access during sensitive times of the year.

Manure can be deposited directly or can reach surface water with storm runoff events. This is most commonly a problem with high-density stocking conditions like those found in yards and drylots (outdoor confinement areas).

Riparian soils and streambanks are prone to compaction when access is not managed.

Unmanaged access and high-density stocking levels lead to overgrazing, bank instability and increased runoff.

Livestock tend to congregate in the same spots. This can be prevented by diverting them away from these areas with shade, salt, feed, and alternative water.

POTENTIAL IMPACTS OF UNMANAGED GRAZING ON STREAMSIDE PASTURES

LIVESTOCK ACTIVITIES	CONDITIONS WHEN POTENTIAL RISK IS GREATEST	POTENTIAL RISKS	POTENTIAL IMPACTS
MANURE DEPOSITION*	• spring and early summer – when manure is deposited near streams • high-density livestock – manure is directly deposited in surface water during low-water conditions	• nutrient runoff • pathogen contamination • sediment loading	• lower oxygen levels for aquatic life • ammonia toxicity • degradation of spawning habitat • shift in aquatic species • decreased ability of fish to spawn and grow • treatment required for drinking water
SOIL COMPACTION	• saturated soil conditions • soils with high silt and clay content • high-density livestock or prolonged congregation	• soil degradation • sediment loading • decreased water infiltration	• increased risk of flooding • increased risk of erosion • degradation of aquatic habitat • increased cost of water filtration • loss of deep-rooted vegetation
OVERGRAZING	• early spring, late summer and early fall – when plant growth is slow or anytime that density exceeds capacity	• less water infiltration • increased runoff • lower diversity of vegetation	• reduced groundwater recharge • lower water table • increased risk of flooding • less shade and higher stream temperatures • less sediment trapping • decreased water infiltration • increased streambank erosion
DAMAGED STREAMBANK	• saturated soil conditions • insufficient vegetation cover • heat – livestock seek shade and cool water • no BMPs in place such as alternative water, shade, salt, feed	• severe streambank erosion	• fewer plant roots for bank stability • increased surface water turbidity • degradation of aquatic habitat • accelerated bank erosion and widening of stream channel • increased risk of flooding

* Manure is considered a deleterious substance under subsection 36(3) of the Fisheries Act.

A SYSTEMS APPROACH TO RIPARIAN GRAZING

Use the systems approach to double-check that the BMPs you've selected are effective, practical, and suit your operation.

Perhaps you've already adopted a "systems approach" to most of your operation. If not, consider putting it to work for you. A systems approach has:

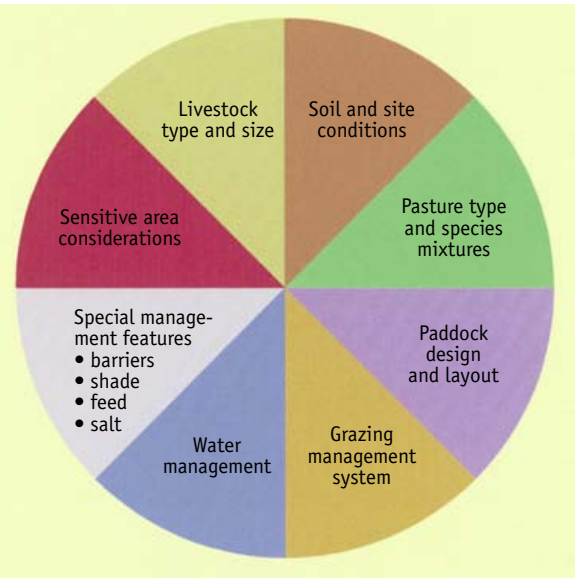
- integrated goals – including production, environmental and economic
- a management-intensive approach – changes are planned, monitored and adjusted
- flexibility – planned changes are adjusted to better suit seasonal weather changes and pasture requirements
- site-specific characteristics – production targets, management system, special features and protection practices relate to local site conditions.

In a systems approach, the key components of the production system are identified and described during the planning process. You act on the understanding that an important management change or change in local conditions will have impacts on other components – and adjust accordingly.

The components of a riparian grazing system include:

- livestock – type and size
- pasture type and species mixtures
- soil and site conditions
- sensitive area considerations
- water management
- grazing management system
- paddock design and layout
- special management features (placement of shade, salt, feed, barriers).

The key to streamside grazing is management. Streamside grazing without livestock exclusion will only work if there is a demonstrated commitment to intensive management.

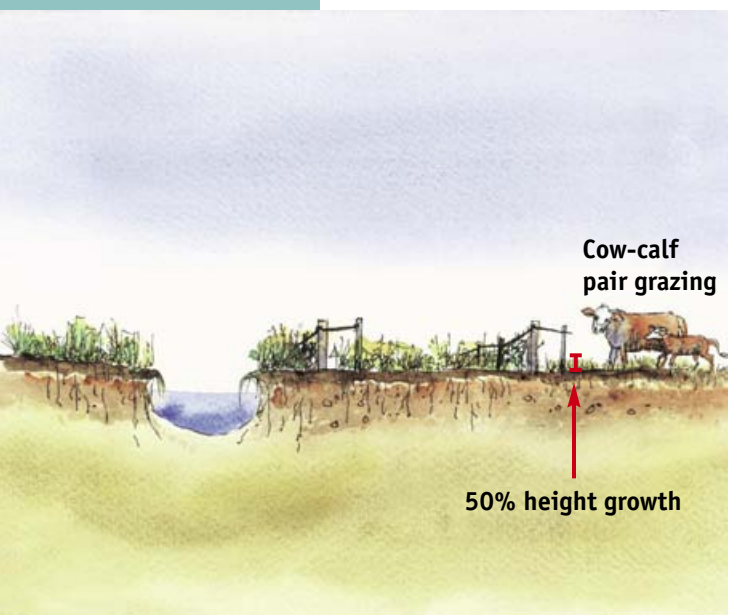


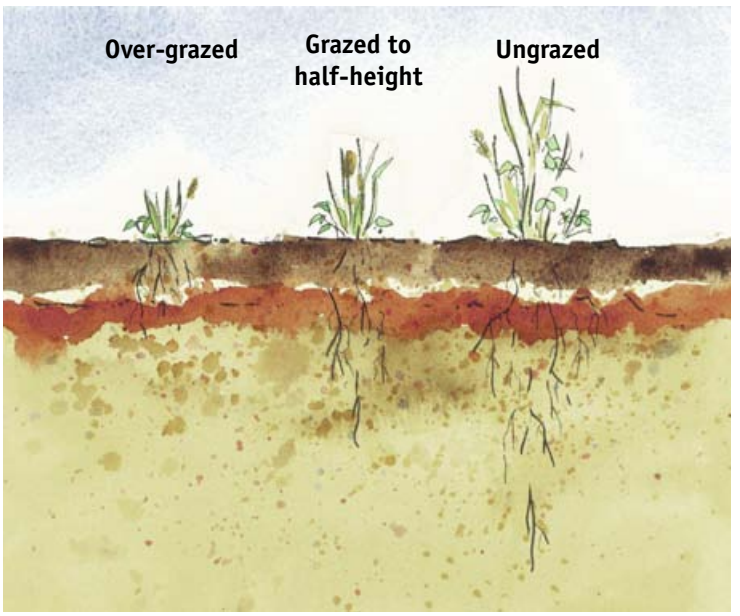
A systems approach to management ensures that the entire system is considered in a comprehensive way.

COMPARISON OF MANAGEMENT PRACTICES IN STREAMSIDE AREAS

MANAGEMENT PRACTICE	UNRESTRICTED ACCESS	MANAGED GRAZING
1. PLANNING AND MANAGEMENT	• not a planned system • no risk assessment • management methods focus on inputs and production outputs	• planned system to prevent problems • routine monitoring of paddocks • flexible management practices • management solutions address environmental and production goals
2. SITE-SPECIFIC PLANNING	• no restriction to streambanks or water • no protection for environmentally sensitive areas	• requires site-specific knowledge about soil and site conditions • livestock access to sensitive areas (e.g., banks and shores) is limited or restricted
3. PASTURE SHAPE AND LAYOUT	• large pastures – livestock move at will • congregation not discouraged	• paddocks designed to reduce wasted forage • watering areas, shade, and minerals are strategically located within paddocks • paddock design features encourage movement, not congregation
4. NUMBER OF PADDOCKS	• grazing area is one large paddock	• several small pastures or paddocks, sized according to planned needs, and delineated using temporary fences
5. ALTERNATIVE WATER AND OTHER INPUTS	• alternative water systems not provided • livestock use surface water for drinking water	• alternative water systems, feed, salt and shelter are located away from streambanks
6. PASTURE FORAGE REGROWTH	• pastures are not usually rested in an organized manner	• pastures rested and provided with sufficient time for forages to regrow before next rotation • forage height used to schedule rotation
7. GRAZING DURATION	• continuous, season-long grazing OR • grazing in same spot, same season, each year	• limited grazing time, then moved to another paddock • animals moved frequently and at least every 5 days
8. FORAGE USE MONITORING	• monitoring forage use is minimal • continuous, season-long grazing OR • grazing in same spot, same season, each year	• forage use monitored so that animals are moved after they've removed $^1/_2$ – $^2/_3$ of the forage growth

Intensive management requires regular monitoring of pasture conditions.





Constant grazing will not allow forages to maintain root growth or build up reserves. As a result, with repeated over-grazing, regrowth is progressively poorer and root systems weaker. On the other hand, if grazing is managed to remove only half of the height growth, regrowth can be maintained.

RIPARIAN PASTURE MANAGEMENT

Upland pasture management is a planned system of pasture production. It includes establishment and improvement as part of grazing management.

Riparian pastures or components of riparian pastures can be managed similarly. But components such as certain floodplains will require special precautions.

Ravine soils are prone to weed pressures normally associated with marginal lands.

Riparian areas are fragile – prone to flooding, compaction and erosion. Use BMPs that minimize disturbance when improving pasture conditions.

PRINCIPLES

Pastures are forage crops managed specifically for grazing. They are subject to the forces of natural succession, i.e., the shift of plant communities from grass/legumes to grasses to non-forage or undesirable pasture plants, shrubs and trees.

To combat this natural process, and to reduce the need for costly renovation, pastures need to be managed intensively. Intensively managed pastures are more efficient (for meat and milk production) and deter natural succession.

Intensive management can be particularly challenging in riparian areas because:

- floodplains are very productive and under naturalization pressures from all kinds of vegetation – natural and introduced, invasive and non-invasive, upland and lowland – and not all is desirable for grazing production or environmental production goals
- many adjacent ravine slopes are just the opposite: soils are often degraded and not productive, and exposed ravine soils are prone to weed pressures normally associated with marginal lands (e.g., carpet weed)
- management is also challenging: floodplains are fragile and inaccessible, and ravine areas are often sloping and in poor condition.

Pasture management goals should include the following:

- adequate soil fertility
- careful pasture crop species and mixture selection
- effective establishment and improvement techniques
- effective weed control
- sustained grazing, and
- protection of riparian areas.

Floodplains are very productive and are under intense weed pressure.

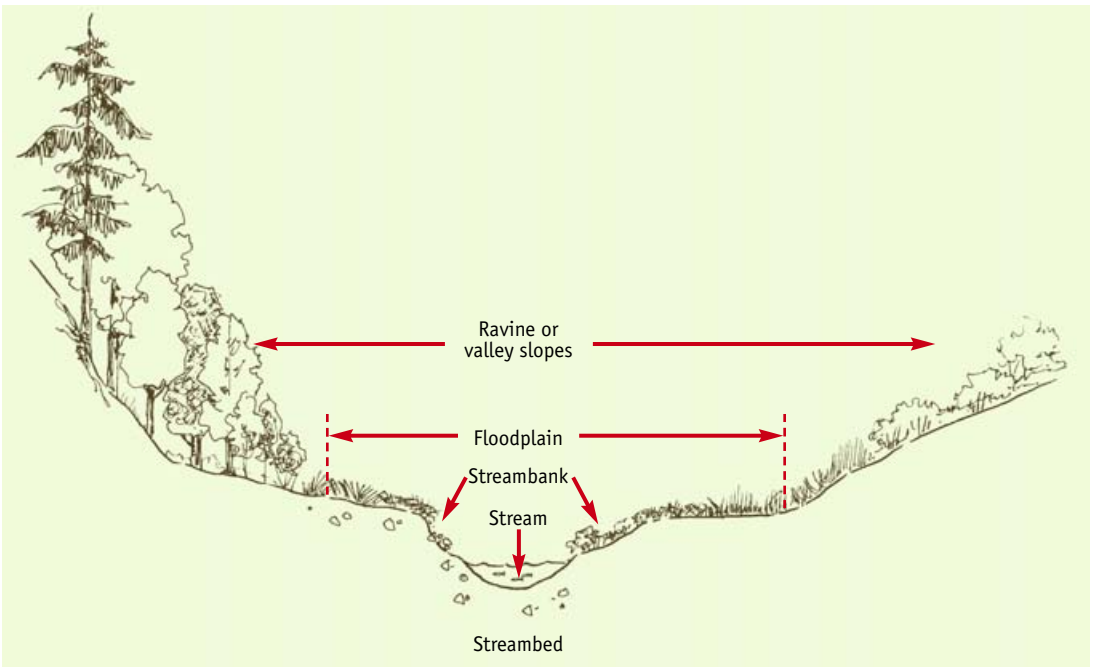
"Management Intensive Grazing or MIG has allowed me to achieve pasture production of over 600 pounds of beef produced per acre."

– Tim Prior, Brussels, Ontario

SITE-SPECIFIC RIPARIAN PASTURE MANAGEMENT

Riparian areas have several landscape components:

- banks or shores
- floodplains or bottomlands
- ravine slopes
- upland areas – usually above the ravine slope and more level (also known as table lands).



For many obvious reasons, banks and shoreline areas should not be considered part of a riparian pasture. Here the management strategy should be to eliminate or discourage access.

Floodplains and bottomlands come in all shapes and sizes, so always be sure to match pasture management to site conditions.

- **some are narrow and are indistinguishable from upland pastures**
  - this is common in landscapes with level topography and adjacent to narrow-channel streams, drains, and some wetlands and ponds
  - these areas can be managed like uplands, provided special considerations are taken for pasture establishment and the application of inputs

- **others are narrow and part of a ravine system**
  - these areas are often naturalizing or have wetland, woodland and natural meadow components
  - intensive pasture management options here pose higher environmental risk and should be left to grazing management decisions
- **some bottomlands – as found in rivers and larger streams – are wide enough to support a forage-pasture system**
  - besides some access challenges, management choices can be similar to upland areas – provided special considerations are taken for pasture establishment and the application of inputs
- **ravine slopes**
  - can be pastured or naturalizing, healthy or degraded
  - management options are limited for degraded or naturalizing ravines on slopes >10%
  - some moderate improvements, including weed and brush control, over-seeding (consider erosion control species mixtures), and nutrient management are recommended

For the most part, slope and erodibility are the most limiting pasture management features. This makes conventional site preparation a high-risk proposition, and maintenance of desirable forage species a critical management objective.

Upland or tableland pastures follow conventional pasture management principles.

Proper soil fertility – Forage grasses and legumes are competitive plants. But they need a continual supply of crop nutrients to out-compete weeds and provide sustained forage production. Fertile pastures are an environmentally friendly land use.

Crop selection – Pasture species and mixtures should be selected to meet your site conditions, animal requirements and management expectations. Mixes that are durable, nitrogen-efficient, and provide sustained yields are the best choices for pastures near riparian areas.

Narrow floodplains in level landscapes can be treated like upland pastures. However, special care must be taken when applying nutrients and herbicides during pasture renovation.

Pasture management on the wide floodplains of streams requires special attention to the risks of managing close to surface waters.

For a more detailed approach to pasture management, please refer to *Pasture Production* (OMAFRA Publication 19).

BEST MANAGEMENT PRACTICES

This section features tips for improving pastures, improving grazing management, and protecting the environment.

To improve a streamside pasture, you can choose between rejuvenating and renovating it. To decide which path to take, you should:

- ▶ assess pasture condition
- ▶ determine production goals, environmental limitations and timeframe
- ▶ determine conditions that limit improvement (soil depth, etc.)
- ▶ assess costs.

Rejuvenation is a quick way to improve undergrazed areas with low fertility. Test soil and improve fertility to increase survivorship and production of desired species. Develop and follow a GMP to sustain production.

Renovation means increasing productivity by introducing pasture species with or without disturbing the soil. Successful renovation depends on:

- ▶ proper pasture mix selection
- ▶ site preparation
- ▶ timing of seeding
- ▶ legume inoculation
- ▶ soil fertility and moisture levels during establishment, and
- ▶ weed control during establishment.

Extensive flooding can cause severe damage to recently established streamside pastures. Chain harrowing and cyclone seeding can be used to overseed flood-damaged areas where needed.

Special precautions are required to prevent erosion and runoff when working near water.

Test soils in riparian areas regularly.

Riparian Pasture Improvement – Stand Establishment

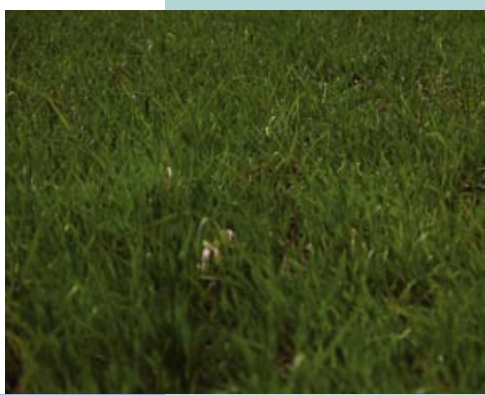
Manage fertility with care. Fertile pasture soils will help pasture crops become established, grow and compete with weeds.

- ✔ Test soils one year before establishment.
- ✔ Keep P and K levels high – forage/pasture species are big feeders.
- ✔ Sample unique areas separately, e.g., bottomlands and ravine slopes.
- ✔ Apply fertilizers carefully in riparian areas to maximize nutrient use efficiency and at times that will reduce loss from flooding and runoff.

Match seed mixture to goals.

- ✔ Select a mixture that meets your goals for site conditions, growth, gain targets, and use. Species that are durable, fast growing, and nitrogen- and water-efficient will help lower greenhouse gas emissions.
- ✔ For floodplains – choose moisture and flood-tolerant pasture mixes for these areas.
- ✔ For ravines and steep slopes – consider species mixtures normally used for erosion control.
- ✔ For uplands – consider pasture-forage mixes that are suitable for both pasture and hay crops.

Choose flood-tolerant forage species and mixtures for floodplains.



Seed with care.

- ✔ Plant seeds 6–12 mm ($^1/_4$ – $^1/_2$ in.) on clay and loam soils and 12–18 mm ($^1/_2$ – $^3/_4$ in.) on sandy soils.
- ✔ Use companion crops such as spring cereals only in areas prone to erosion.
- ✔ Consider using no-till after a cover crop is killed prior to establishment – soil is disturbed less.

Get an early jump on weeds.

- ✔ Get an early jump on weeds. Kill perennial weeds prior to establishment
- ✔ Clip weeds during early establishment and in pastures left for longer rest or rehabilitation periods.

Choose erosion-control mixtures for degraded areas.

Riparian Pasture Quality Assessment

Riparian pasture condition is a key indicator of pasture and grazing management practices. Having a good fix on it is an essential step in building a successful grazing system.

Pasture condition is highly variable within and among riparian pastures, and closely related to management and land use history, productivity and sensitivity. However, over time, you should be able to identify the direction in which the pasture condition is moving.

The following chart is meant to help you:

- ▶ assess condition within and between pastures
- ▶ determine where and what kind of improvement is required, and
- ▶ evaluate results of management decisions.

"We value pasture as our most important crop. We have built good laneways to the fields and fenced the cattle onto the lanes and out of all wetland areas. They have access to water at a low-level crossing and at alternative gravity-flow troughs beside the waterways. These lanes and our alternative watering allow us to use five- to seven-acre fields to manage the grazing throughout the season as well as different breeding groups of cattle.

"We have also fenced small fields along the streams, where we can graze cattle for short periods of time when the ground is dry so that little damage is done to the streambank or area. These practices have not only let us increase beef production but have improved herd health and prevented leg and feet injuries while better managing our stream and wetland areas."

– James & Joan McKinlay, Ravenna, Ontario

PASTURE CONDITION SURVEY

	FIELD	PADDOCK/ PASTURE AREA A	PADDOCK/ PASTURE AREA B	PADDOCK/ PASTURE AREA C	PADDOCK/ PASTURE AREA D	PADDOCK/ PASTURE AREA E
	ACRES					
	MONTH & YEAR	M____/Y____	M____/Y____	M____/Y____	M____/Y____	M____/Y____
CATEGORY	SCORE	SCORE	SCORE	SCORE	SCORE	SCORE
SPECIES COMPOSITION	Undesirable 0 1 2 3 Desirable 4					
PLANT DIVERSITY	Narrow 0 1 2 3 Broad 4					
STAND DENSITY	Sparse 0 1 2 3 Dense 4					
PLANT VIGOUR	Weak 0 1 2 3 Strong 4					
LEGUMES IN STAND	<10% 0 1 2 3 >50% 4					
PLANT RESIDUE	Deficient 0 1 2 3 Excess 4					
BROWSE UNIFORMITY	Concentrated 0 1 2 3 Uniform 4					
SEVERITY OF USE	Heavy 0 1 2 3 Light 4					
WOODY PLANTS	>40% 0 1 2 3 <10% 4					
SOIL EROSION	Severe 0 1 Moderate 2 3 Slight 4					

The source for this chart is the *Grazing Systems Planning Guide,* written by K. Blanchet, J. DeJong-Hughes and H. Moechnig, and published by the University of Minnesota Extension Service, item 07606, revised 2003.

Pasture condition is a good indicator of pasture production, quality, and environmental impact.

The best management practice for low-density streamside pastures is to exclude where needed.

RIPARIAN GRAZING SYSTEMS

Quite simply, the best management practice for low-density streamside pastures is to:

✔ exclude where evidence warrants, according to the results of your risk assessment.

Otherwise, the strategy for low-density grazing near riparian areas should be to:

✔ mimic exclusion by using a suite of BMPs

✔ use the risk assessment and GMP to pinpoint where access-related problems exist and which BMPs would be best to address them

✔ complement these measures with a well-planned grazing system, high quality pasture, a suitable fencing system, and non-fencing approaches such as alternative water sources.

LIVESTOCK AS STREAMSIDE GRAZERS

Each species has unique grazing habits, but here are some general habits across species:

▸ livestock graze 7–12 hours/day
▸ quantity grazed is related to bite size and grazing rates
▸ larger bites are taken when forage is in good supply
▸ livestock will be more selective if forage quality is high and access is unrestricted
▸ sheep and goats are the most selective followed by horses and cattle
▸ grazing animals have height and species preferences.

GRAZING HABITS, BY SPECIES

LIVESTOCK	GRAZING METHOD	GRAZING PREFERENCES	GRAZING PATTERNS
CATTLE	• use tongues to pull plants into mouths	• ideal plant height range is 10–25 cm (4–10 in.) • prefer fine grasses • prefer to roam or move	• rotational or strip grazing are suitable methods • will congregate in areas of preference – species or local conditions • move milking cattle every 2 days; heifers and drys every 5 days • move beef every 5 days
HORSES	• selective grazers • bite close to ground	• need space to run • small paddocks are not suitable	• graze one area close to ground and leave less preferred area for manure
SHEEP	• use lips and tongues to graze selectively	• forbs>grasses>sedges>shrubs • prefer short-height material	• uniform grazers • will not access flowing water
GOATS	• use lips and tongues to graze selectively • prefer to browse	• not as particular • milking goats require high quality forages	• very adaptable • will graze small trees and shrubs

Cattle prefer to roam when grazing but will adjust well to small paddocks.

Goats are very adaptable grazers.

Sheep are uniform grazers and will not access flowing waters.

Horses are not suited to small paddocks.

PRINCIPLES OF GRAZING NEAR RIPARIAN AREAS

This section explores a number of grazing management practices applicable to riparian areas. Selecting a grazing management practice or a combination of practices depends on several factors including:

- ▶ available grazing-land resources
- ▶ opportunities for improvement
- ▶ farm/ranch goals and finances.

Grazing management alone can reduce much of the impact of livestock on most environmentally sensitive areas and improve productivity. But it's most effective when used with other BMPs for pastures near riparian areas. Understanding the principles is the key to identifying which grazing management system will work in your operation.

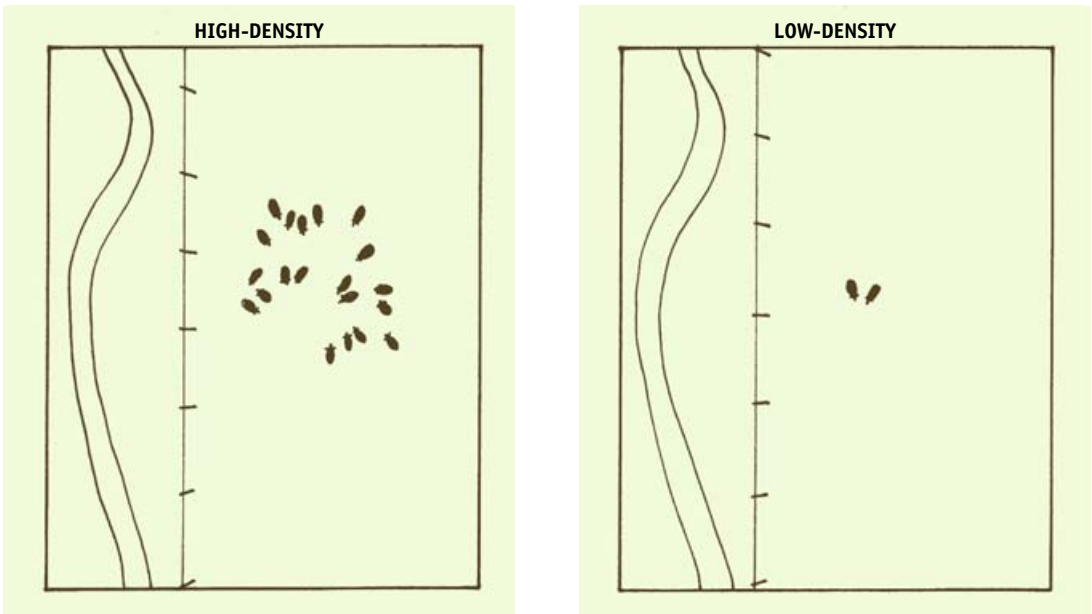
Grazing Capacity and Stocking Rates

Grazing capacity

Grazing capacity is the **average** stocking rate that a pasture can sustain (or carry) over time without the need to provide additional feeds and without causing excessive damage to the riparian area. Grazing capacity depends on local climate, and soil and site conditions. Knowing the grazing capacity of your riparian area is important for medium- and long-term planning. Stocking rates are influenced by such factors as riparian health and the current season's growing conditions.

Stocking rates

Each acre of pasture has the capacity to sustain a certain number of livestock over the grazing season – beyond which the pasture can't recover quickly enough or site damage is severe (e.g., compaction). Stocking rate is influenced by site type (floodplain vs. upland), soil type and quality, and weather conditions. By managing for stocking rates, graziers can maintain production and minimize impact.



Stocking rate is considered the most significant factor in streamside grazing management. Overgrazing in high-density pastures leads to poor pasture condition and environmental damage.

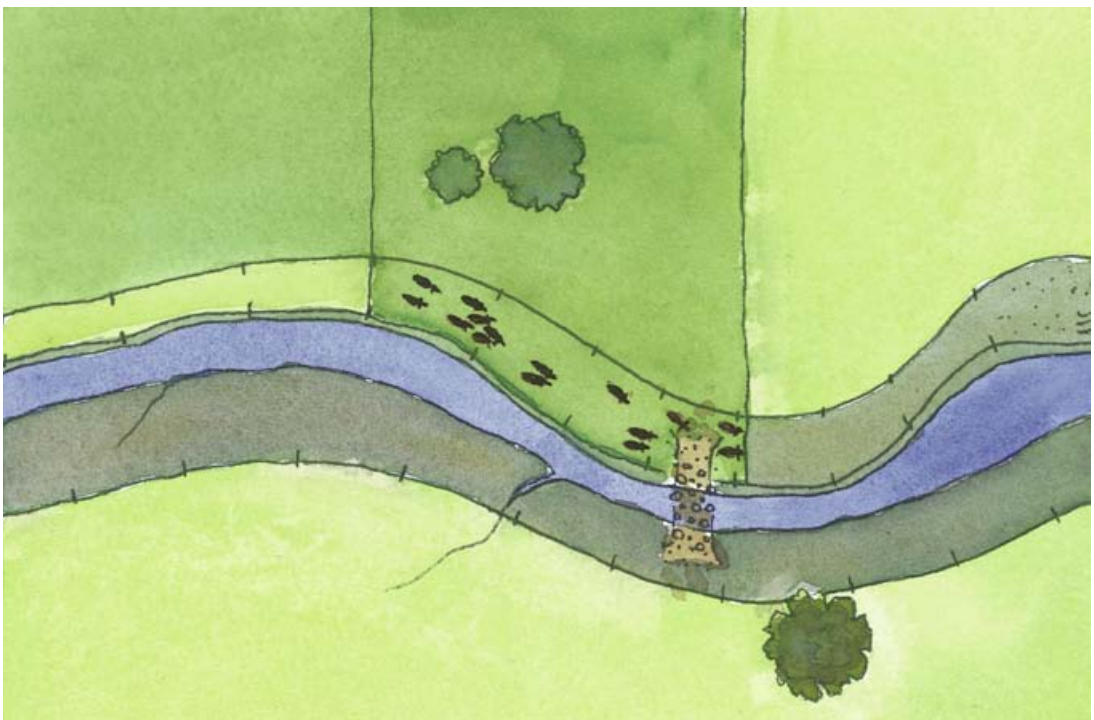
The highest stocking rate for most low-density grazed riparian areas is 2.5 cow-calf pair/ha/yr (1 cow-calf pair/ac/yr) or equivalent. Stocking rates that exceed this level are considered high-density.

Remember that:

- ▶ stocking rates can affect animal production and the health of riparian and upland areas
- ▶ the safest and most profitable stocking rate usually lies between the rate that achieves the highest individual gain and the rate that achieves the maximum per acre animal gain – moderate stocking rates are recommended
- ▶ moderately stocked grazing land often withstands drought better than overstocked land.

Regardless of the grazing system employed, overstocking will negatively affect the health and productivity of riparian areas and uplands.

Site Features and Conditions



Grazing in riparian areas can be site-specific. Here, the narrow floodplain is fenced off, but accessed for a short duration with high-density stocking to control weeds in late summer – when conditions are dry.

Even at lower densities, grazing in a fragile riparian area can be harmful. Small streams, ponds and wetlands that are saturated most of the time may not be able to withstand much grazing pressure without being damaged.

The situation is considerably different in large, broad floodplains of the middle and upper reaches of rivers. These sites can withstand higher livestock densities for very short periods if grazing is delayed until conditions are drier. On the other hand, eroded or fragile ravine slopes have the lowest grazing capacity. In most cases, the upland portion of a riparian pasture area has the highest carrying capacity.

Soil type or texture may have a limiting effect on stocking density. Some soil types (e.g., soils with a high silt and clay content) are prone to compaction. Other soil types – those that are shallow to bedrock, or have high sand and gravel contents – are prone to leaching. Still other riparian areas – those with high clay contents or past compaction – are more prone to runoff. All of these situations will limit stocking rates.

In addition, riparian areas with steeply sloping ravine or valley slopes are more prone to runoff and erosion.

Riparian areas with high natural water tables are at a higher risk for groundwater contamination as stocking density increases.

Residual Vegetation

The quality of riparian vegetation is key to sustained production targets and environmental goals. To meet these goals, a critical amount of "residue" – meaning the growing forage vegetation post-grazing – must remain after each grazing period.

Pasture residue is important for regrowth, plant reserves for over-wintering or periods of drought, maintaining cover, and for effective nutrient cycling. The amount of residue required will vary with the type of riparian vegetation, number and intensity of flooding cycles, grazing system, and season of grazing.

Specific recommendations for residue condition for pasture species in riparian areas are not known. However, the general guidelines are as follows:

- an average stubble height of 15–20 cm (6–8 in.) is recommended for grasses and legumes with intermediate light, e.g., timothy
- 20–25 cm (8–10 in.) would be required for taller species, such as orchardgrass
- adequate stubble height of herbaceous plants will ensure reduced pressures on browse species. In areas with multiple flooding cycles, an average stubble height of 30 cm (12 in.) would be desirable.

The recommended amount of residue will also depend on the growing season. Less residue can be left if the season is ideal for forage production. More should be left during poor conditions such as a drought.

Careful planning and monitoring of livestock habits will help manage paddock residue requirements on a site-specific basis.

Leaving sufficient cover after pasture will result in greater forage growth the following season.

Poor cover is an indicator of poor site conditions or poor management.

MINIMUM HEIGHT FOR PASTURE SPECIES AT BEGINNING AND END OF GRAZING SEASON

SPECIES	BEGIN GRAZING: INITIAL GRAZING HEIGHT IN EARLY SPRING* (INCHES)	BEGIN GRAZING: MINIMUM AND OPTIMUM GRAZING HEIGHTS (INCHES)	END GRAZING: MINIMUM STUBBLE HEIGHT (INCHES)**	END GRAZING: MINIMUM REGROWTH BEFORE KILLING FROST (INCHES)
ALFALFA***	–	Bud stage	–	6 ****
KENTUCKY BLUEGRASS	2	4–6	2	4
ORCHARDGRASS	3–4	6–10	3	6
PERENNIAL RYEGRASS	3–4	5–7	3	4*****
REED CANARYGRASS	4–5	8–8	4	6
BROME	4	8–14	4	6
TALL FESCUE	4	6–10	3	6
TALL WHEATGRASS	4–5	8–14	4	6
TIMOTHY	4	6–10	4	5
		WARM-SEASON GRASSES		
BIG BLUESTEM		10–14	6	6
INDIAN BLUESTEM		10–14	6	6
LITTLE BLUESTEM		5–7	3	4
SWITCHGRASS		12–20	8	10

This chart was adapted from *Grazing Systems Planning Guide*, University of Minnesota Extension Service. (see pg. 31).

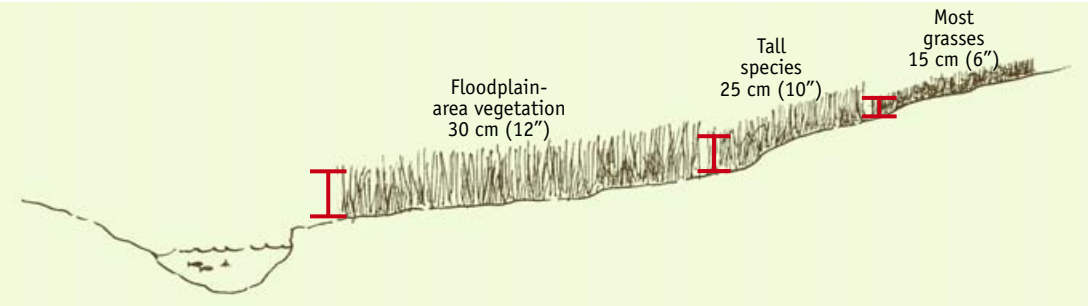
* This applies only to the initial grazing in the spring. The livestock must be moved rapidly through paddocks to prevent overgrazing and compaction.

** Minimum stubble height must be observed to maintain growth throughout the grazing season. This minimum critical height applies to the entire season.

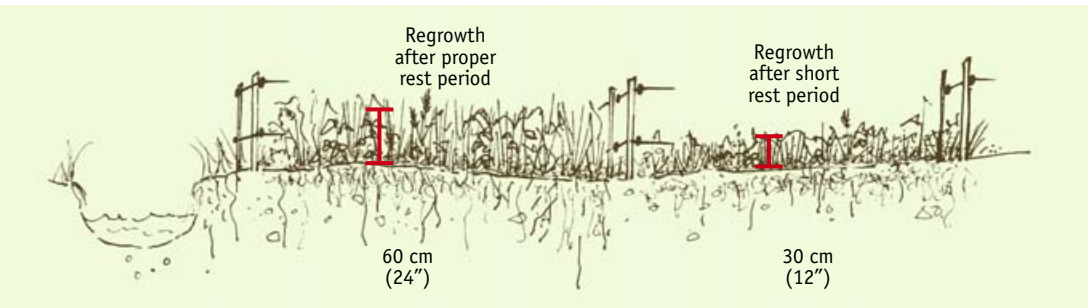
*** There is a greater risk of bloat on stands with more than 50% alfalfa, especially before full flower.

**** Alfalfa should not be grazed or harvested later than 35–45 days before the first date of freeze-up.

***** Regrowth should be grazed to 5 cm (2 in.) after dormancy and prior to snow cover.



Pasture residue or the amount of growing forage that remains after grazing is critical for regrowth and survival through winter and during droughts.



Pastures require proper rest periods for regrowth and forage survival. One indicator of short rest periods is the invasion of weeds.

Frequency and Duration of Grazing and Rest Periods

Pasture and riparian species require rest periods for regrowth. Otherwise, they can be grazed out and replaced by weeds, or even bare soils. With management-intensive grazing practices, graziers monitor regrowth patterns and manage grazing frequency to maintain production. This is of particular importance in riparian areas.

Frequency of grazing and the length of rest period can be manipulated to improve or maintain the health of riparian areas.

In general, only one short grazing pass (3–4 days or less) is recommended per season for floodplain and other sensitive areas, such as near wetlands, ponds and riparian meadows. If more than one grazing pass is employed, adequate rest period between grazing passes is essential, and total grazing time should not exceed 2–3 weeks.

Rest allows plants to recover from grazing and helps maintain plant roots and vigour. Rest also allows soil to recover from compaction. Rest periods are normally 25–60+ days depending on plant growth.

Short grazing periods will minimize the potential for grazing regrowth before plants recover fully.

As grazing pressure increases, the amount of rest required increases. The longer the grazing period, the longer the rest period required. The greater the green plant material remaining after grazing, the less rest required.

Long-term rest (one or more growing seasons) may be employed in problem areas where riparian health is at risk or in areas set aside for long-term recovery. Newly established vegetation such as trees, shrubs, and pasture species mixes benefit from being undisturbed as well.

Also, years of above-average precipitation offer an opportunity to rest one or more paddocks for a full season.

Complete exclusion of animals from riparian areas is not the only option but should be considered or identified in risk assessment – except in environmentally sensitive areas, where exclusion may be your only option.

Consider exclusion as a BMP when protecting environmentally sensitive areas such as wetlands or riparian meadows.

Use long-term rest to restore highly degraded streamside areas.

In severely damaged areas, livestock exclusion may be necessary to start the recovery process. The duration of the rest period depends on the severity of the degradation and local site conditions. Ultimately, the goal of providing rest is to allow the recovery of vegetation and streambanks, and survival of recently established plants.

Areas that are badly degraded or have been abused for many years will take a long time to recover. Similarly, riparian areas in more fragile environments, such as chronic low-water watersheds or areas with long winters, will take a longer time to recover than areas with more moderate climates or more humid conditions.

The rest period should also allow for the establishment of sufficient vegetation to stabilize the streambank, filter sediments, and allow nutrient recycling. Management practices that favour riparian area revegetation are listed below.

Long-term rest may be a suitable BMP when you're establishing trees or trying to rehabilitate highly degraded areas.

- ✔ Control weeds, especially if invasive or noxious weeds are present. In less degraded areas, grazing once or twice in the late summer can control weeds.
- ✔ Improve pasture – including fertility, pH and species composition.
- ✔ Stabilize streambanks with rip-rap, bio-engineering structures or fast-growing plants before revegetating other portions of the riparian area.
- ✔ Allow new plants such as shade trees or barrier trees and shrubs to become well-established before allowing livestock to graze in the revegetated area. This establishment period may last several years, especially in dry sites or severely degraded areas.

Control of Animal Distribution

Control of livestock distribution often determines the success of a grazing management plan for riparian areas. We know that livestock prefer the lush forage, shade and water availability found in riparian areas. This is more noticeable in drought years, when there's more to eat in the riparian zone.

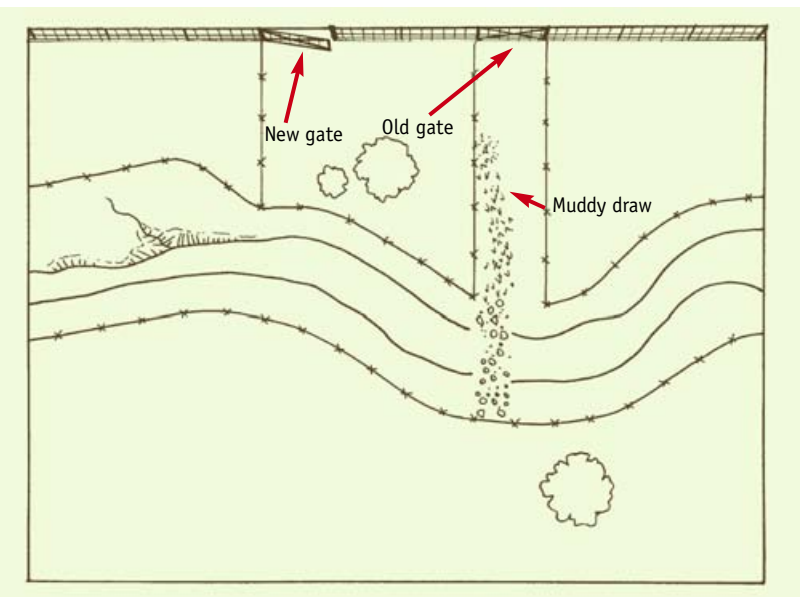
Practise riparian-friendly, management intensive grazing strategies to limit the season and duration of access. To encourage greater use of the uplands and less use of riparian areas, consider the following practices.

- ✔ Develop alternative water sources in uplands away from streams and water bodies, if possible.
- ✔ Establish shade/shelter facilities in uplands.
- ✔ Provide feed and supplements away from riparian areas.
- ✔ Place salt blocks away from riparian areas.
- ✔ Herd livestock into less preferred areas of the paddock.
- ✔ Switch paddocks. Livestock preference for riparian areas may be stronger in some paddocks than in others.
- ✔ Change season or timing or sequence of streamside paddock grazing. Manipulate the grazing season as livestock preference for riparian areas may vary with season.

In some streamside pastures, impact can be reduced by moving feed and other items away from the banks.

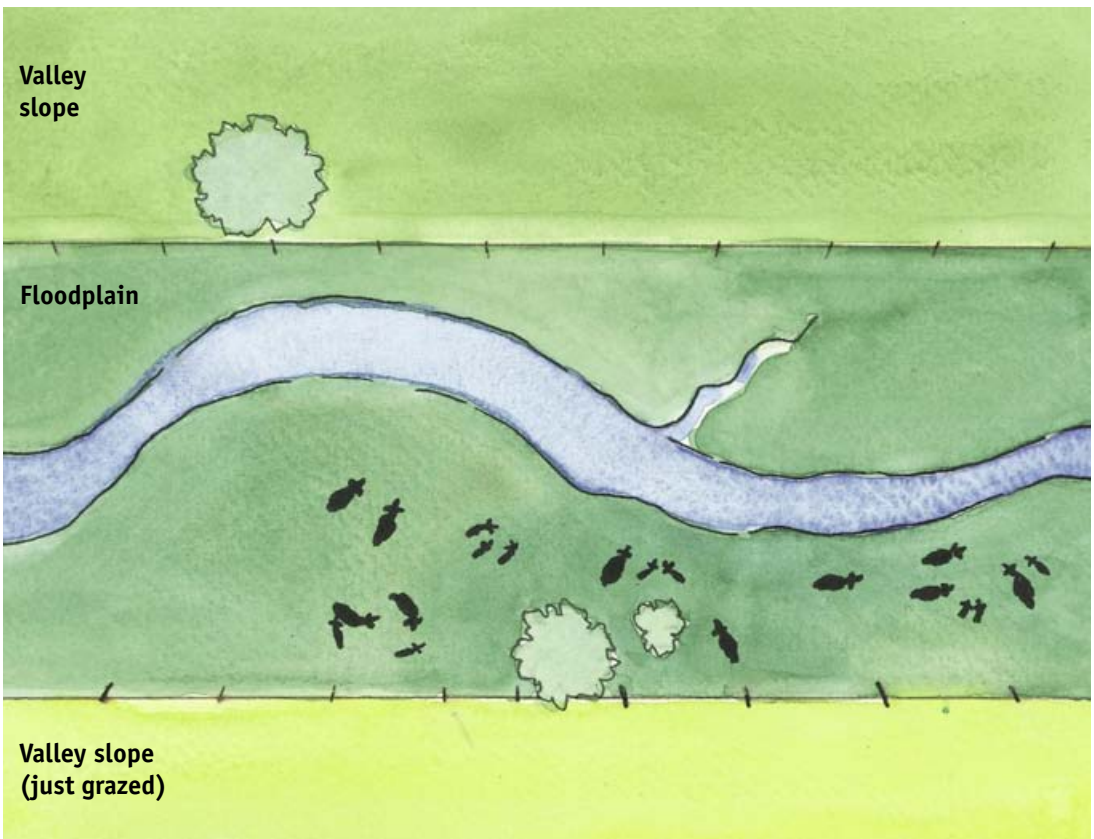
Move salt licks and feeding stations away from the streamside area.

Impacts from the grazing of riparian areas may be delayed or reduced if livestock enter the paddock from a point away from the riparian area.



✔ Change the location of the pasture entrance. Impacts from the grazing of riparian areas may be delayed or reduced if livestock enter the paddock from a point away from the riparian area.

✔ Consider fencing if less costly practices are not effective. Permanent or movable, the most suitable type depends on management goals, area size, topography, and location of shelter, water, salt, and other resources.



Temporary fences are an efficient way to control distribution. With the delayed grazing method, livestock can be fenced away from the stream until conditions are drier.

Seasonality of Rotational Grazing Practices in Healthy Riparian Areas

Managing when livestock are allowed access to riparian areas is also critical to maintaining and restoring riparian health. Riparian soil and water quality problems can be prevented with seasonal grazing.

Factors that determine the appropriate time to graze animals in riparian areas include:

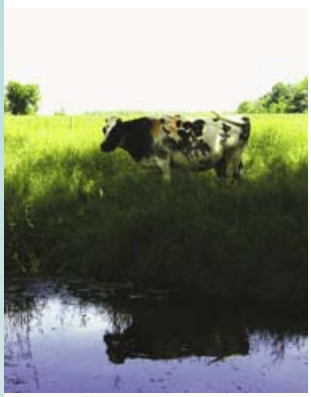
- ▸ soil moisture following snowmelt, rainfall, and heavy streamflows
- ▸ the type of riparian vegetation and its periods of peak growth and dormancy
- ▸ freeze and thaw cycles, as well as snow cover patterns, during the winter.

To prevent compaction:

- ✔ don't graze wet riparian areas
- ✔ exclude animals from riparian areas during late fall, late winter and early spring
- ✔ move livestock out of floodplain areas for most of the fall season in areas with heavy late-season rains.

To prevent erosion:

- ✔ consider fall grazing in some areas, particularly on ravine and valley slopes, if it can be carefully monitored – leaving enough vegetation at the end of the season to protect against spring runoff and erosion
- ✔ consider midsummer grazing or early fall in floodplain areas – leaving sufficient time for forage regrowth before winter.



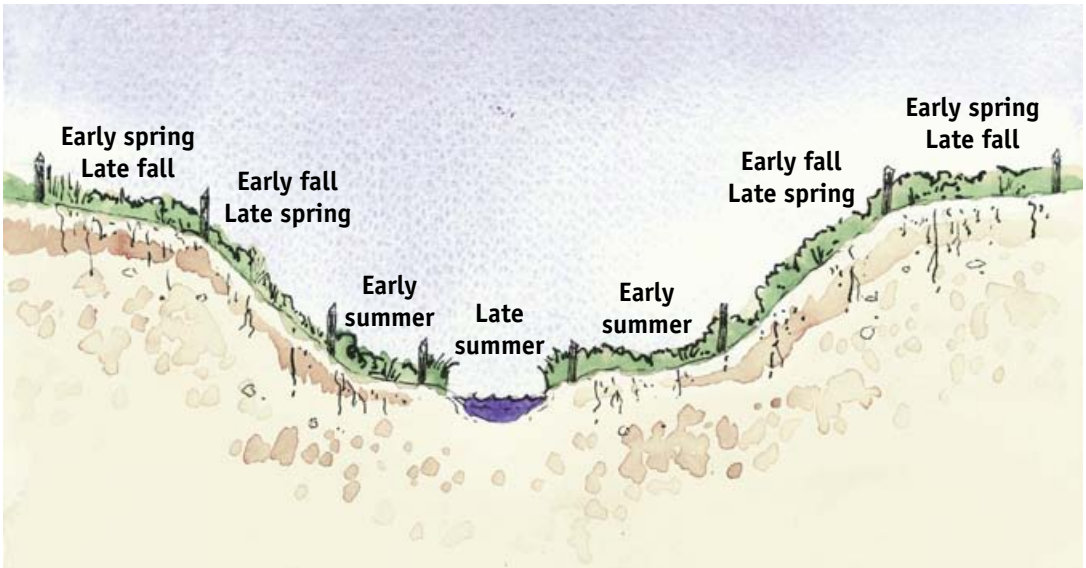
Timed grazing can also be used to protect healthy vegetative growth in riparian areas. Periodic grazing can be used to remove the top portions of grasses and sedges. This promotes vegetative reproduction by stimulating the sprouting of additional stalks or tillers.

Allowing access for grazing livestock during early spring can put them at risk of flooding and injury. In the photo above, the tree bears a high-water mark from an Easter Weekend flood.

GRAZING SEASON SELECTION

GRAZING SEASON	WHERE SUITABLE	ADVANTAGES	DISADVANTAGES
SPRING TO EARLY SUMMER	• upland areas and ravine slopes can be suitable for only a short period (3 weeks or less) • during droughts and if floodplain soils are dry so that the risk of compaction is low	• time for re-growth during the remainder of the growing season	• increased risk of floodplain compaction and bank damage in wet areas • grazing occurs during the active growth stage of plants and the risk of overgrazing may be high
MID TO LATE SUMMER	• most floodplains for short periods with management-intensive grazing practices • where salt, shade and alternative water are used to attract livestock away from the floodplain area • where full-season rest techniques are routinely used	• conditions are more resilient to impact • lush growth of streamside vegetation is more palatable and nutritious when the upland plants are declining	• reduced time for recovering from defoliation before onset of the dormant season – repeated annual grazing in riparian areas in midsummer eventually reduces plant vigour and productivity, thereby promoting invasion of undesirable species • cattle and horses will access water if no temporary fencing system is used
FALL	• most ravine slopes and upland components of riparian areas without young planted trees and shrubs • streamside grazing when salt, minerals, feed, herding and/or drinking water are placed away from the water	• reduced potential for overgrazing • soils are often drier in early fall and less susceptible to damage • reduced impact on fish and wildlife habitat needs	• potential damage to trees and shrubs due to excessive browsing • livestock may choose to linger in the riparian area unless provided with incentives to move into the uplands • higher risk of compaction and bank damage as soil water content increases

Access in early fall causes minimal damage when conditions are dry.



When managing grazing near riparian areas, not all seasons are equal.

- **Spring – In most cases, try to avoid access in spring. High soil moisture contents lead to compaction and bank damage.**
- **Summer – Without other BMPs in place, summer grazing can be the most damaging time for streamside vegetation. The grazed area doesn't have sufficient recovery time before winter.**
- **Late summer and early fall – These are usually the preferred seasons for access. Plants are mature, root reserves are up, and winter hardiness should not be affected. Moreover, low soil moisture content at this time reduces the risk of compaction and bank damage.**

Winter grazing is site-specific. Grazing grassy buffers in open winters will have similar minimal impacts to fall grazing. However, grazing treed or forested riparian areas can be devastating to vegetation. The risk of manure runoff during the winter months and early spring also increases.

GRAZING SYSTEMS

Grazing management systems vary according to the following characteristics:

- ▸ site types, quality and condition – riparian grazing systems should be site-specific
- ▸ livestock type – the needs and behaviours of grazing livestock
- ▸ pasture quality and sensitive areas – production is optimized and damage is minimized
- ▸ stocking rates and density – some systems accommodate density levels that exceed the carrying capacity of fragile riparian areas
- ▸ frequency and duration – length of time livestock can spend in a paddock will vary depending on environmental conditions, grazing system, season of use, and growth rate of vegetation
- ▸ season of access – some grazing systems allow you to alternate the season of use, thus minimizing the potential adverse effects of repeated grazing during a particular season

► paddock layout – the greater the number of paddocks, the shorter the amount of time livestock spend in each paddock, and the lower the potential for re-grazing plants before they fully recover from previous grazing events.

SUITABILITY RATINGS FOR RIPARIAN GRAZING SYSTEMS

GRAZING SYSTEM	POTENTIAL FOR IMPROVING ANIMAL DISTRIBUTION	POTENTIAL FOR MAINTAINING BANK STABILITY	POTENTIAL TO REDUCE DAMAGE TO STREAMSIDE SOIL
SEASON-LONG	Very low	Low	Low
SHORT DURATION – HIGH INTENSITY	Very high	Moderate	Low
 **Short-duration systems are well-suited to floodplains that dry out during the summer.**			
DEFERRED – NO ROTATION	High	Low	Moderate
DEFERRED WITH ROTATION	High	Moderate	High
REST–ROTATION	High	High	High
 **In rest-rotation systems, a selected paddock is left at rest for an entire season.**			
STREAMSIDE PASTURE[1]	Very high	High	High
 **Riparian pasture is established to control timing and intensity of grazing.**			
CORRIDOR FENCING[2]	Not applicable	Very high	High

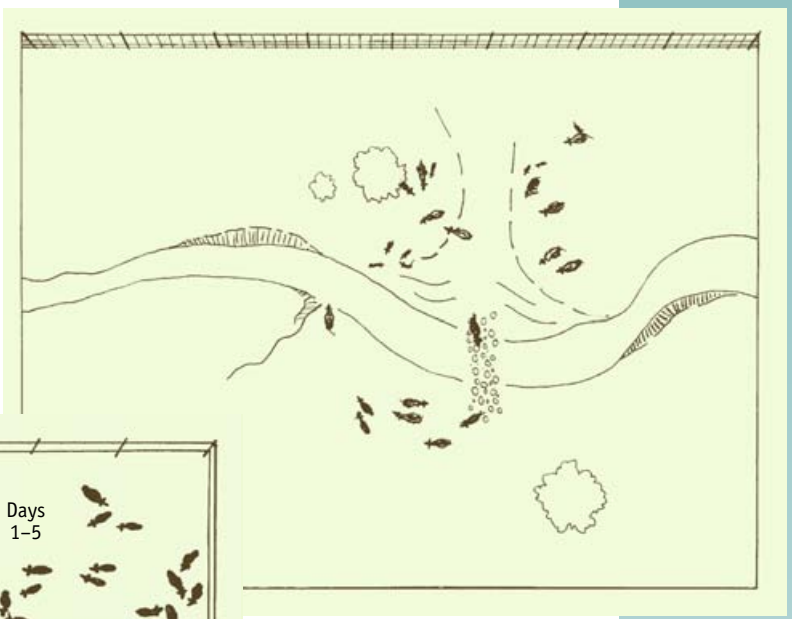
[1] A paddock is established consisting exclusively of the streamside area to control timing of grazing and level of utilization.
[2] Streamside area is fenced-off and no grazing is allowed.

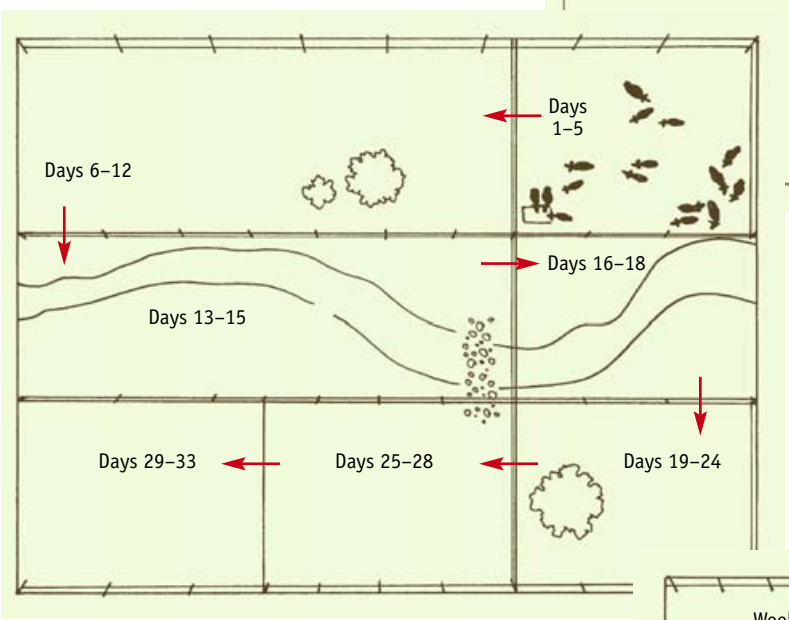
STREAMSIDE GRAZING MANAGEMENT SYSTEMS

GRAZING SYSTEM	DESCRIPTION	WHEN AND WHERE SUITABLE	BEST MANAGEMENT PRACTICES	COMMENTS AND CONCERNS
SEASON-LONG	• season-long stocking • livestock can be very selective regarding forages **Severely degraded areas usually require fencing and exclusion as part of a suitable management system.**	• bedrock-controlled shores and wide-channel streams where stocking rates are very low and minimal impact is observed • livestock behaviour follows forage growth	• requires management features such as salt, feed, shade, water and barriers to encourage livestock away from sensitive areas	• forage species can be over-grazed – seasonal damage isn't prevented • unsuitable for pastures near wetlands and ponds • may work with corridor-fencing where livestock are excluded with this system, particularly if near narrow-channel watercourses and drainage ditches
TIME-CONTROLLED GRAZING (OR SHORT-DURATION)	• livestock are rotated through several paddocks over short intervals on a recurring basis • high stocking rates for short periods of time – with rest periods for recovery	• suitable for grassy streamside pastures with fenced paddocks • useful for dairy and other high-production livestock operations	• move livestock to next paddock when 10–15 cm (4–6 in.) of forages remain • note that rate of rotation varies with the rate of plant growth • use specialized timing and intensity of grazing to control weed growth	• rest periods must be long enough for suitable recovery • grazing times must be short enough to prevent rapid regrazing • there's a higher risk of damage in spring
SEASONAL ROTATION (OR DEFERRED ROTATION)	• grazing is delayed until forage plants have reached desired growth stage and when soil conditions are less prone to damage	• suited for low-density stocking near wide-channel streams, middle-reach rivers and riparian areas to avoid damage in spring and plant stress in mid-summer	• use short grazing periods – not managed as intensively as time-controlled grazing • works best with alternative watering systems and other practices that encourage animals to congregate away from streambanks	• riparian areas should be in healthy condition prior to using this system • helps newly planted buffer areas get established

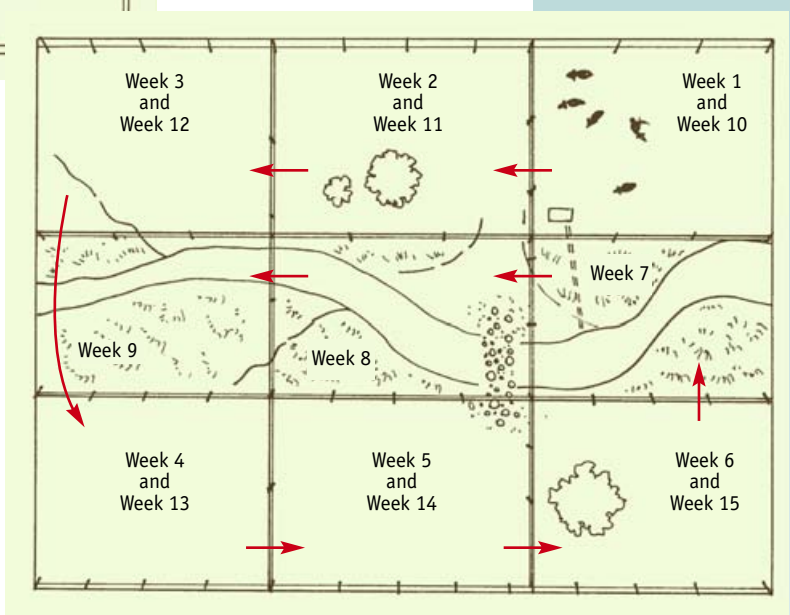
Chart continues on pg. 48

Season-long grazing is most suited when stocking rates are very low and when feed, water or shelter has been moved away from banks.





Short-duration systems can work well on well-established forages and productive soils when rest periods are adjusted to soil moisture conditions.

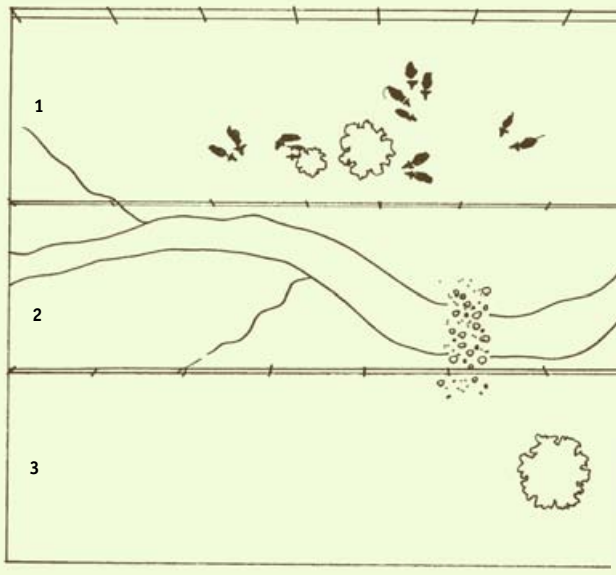


With seasonal rotation, grazing is delayed until pasture species growth (maturity) and conditions are more suitable.

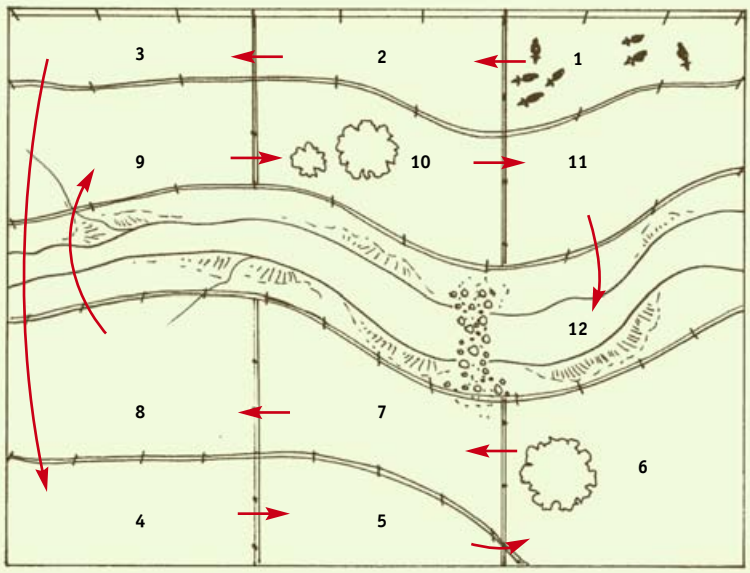
STREAMSIDE GRAZING MANAGEMENT SYSTEMS (cont'd.)

GRAZING SYSTEM	DESCRIPTION	WHEN AND WHERE SUITABLE	BEST MANAGEMENT PRACTICES	COMMENTS AND CONCERNS
THREE-PASTURE REST–ROTATION SYSTEM	• only 2 paddocks of 3 grazed each year • rotation schedule for pastures: ◦ year 1: spring grazing ◦ year 2: late summer and fall grazing ◦ year 3: complete rest	• ideally suited for streamside grazing – floodplains can be favoured to allow for restoration or improved pastures to become established • unsuitable for areas recently planted to woody species	• monitor carefully to protect against streambank degradation in spring and forage depletion in the fall • requires management features such as salt, feed, shade, water and barriers to encourage livestock away from sensitive areas	• if used in woody riparian areas, restrict grazing time during the late-summer rotation to limit livestock feeding on woody plants • adding more pastures will increase the amount of time land is rested and will further protect woody species • allows for grazing restored areas during prolonged droughts
SITE-SPECIFIC MANAGEMENT	• paddocks are designed to maximize grazing and minimize risk – using pasture species, growing season and site position as factors	• in riparian areas where site differences are distinct (e.g., wet floodplain and degraded ravine slopes)	• graze drier sites early and for short durations • defer grazing on wetter sites and graze for short intervals	• acceptable low-density grazing in grassed ravines, floodplains and adjacent to wetland areas, where access can be controlled/restricted to the preferred (drier) season, and for very short periods to control weedy vegetation

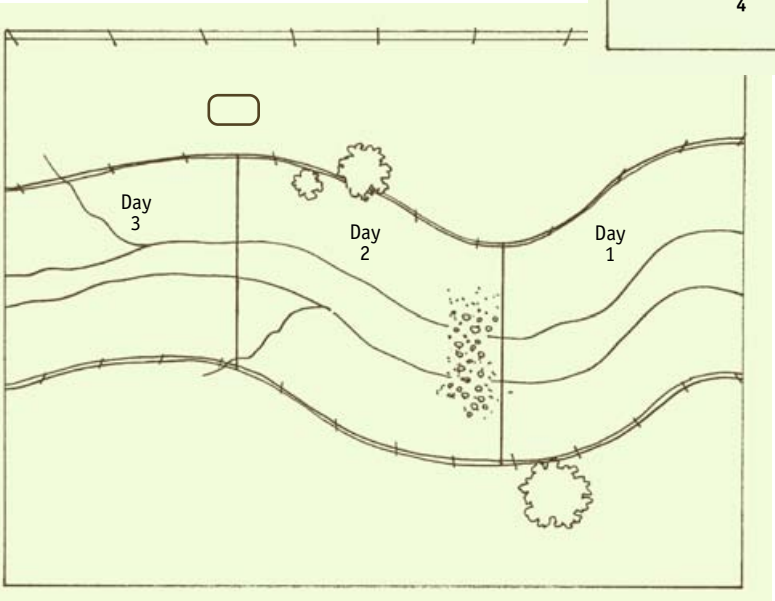
Degraded ravine slopes can be managed separately from the floodplain and upland pastures to help forages re-establish.



With pasture-rest rotation, only two of the pastures are grazed each year. This system is suited to areas where access is needed but banks need time to rehabilitate.



A site-specific system involves the grouping of paddocks by soil and site properties (rather than just area-grazed). Dry areas can be rested thoroughly during droughts.

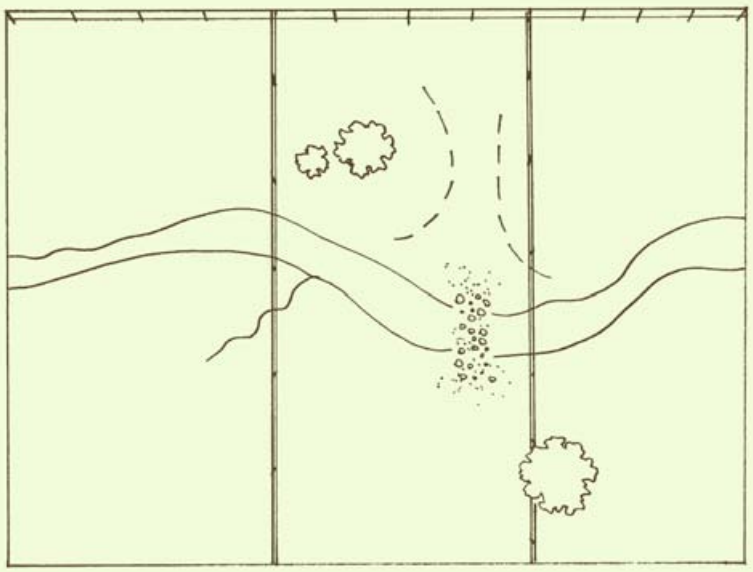


Cross-stream short-duration is a hybrid of short-duration and site-specific systems. It allows short-term access to control weed growth along streams. This system can be modified annually by changing the (temporary) fence design to a short-duration, seasonal or pasture-rest system.

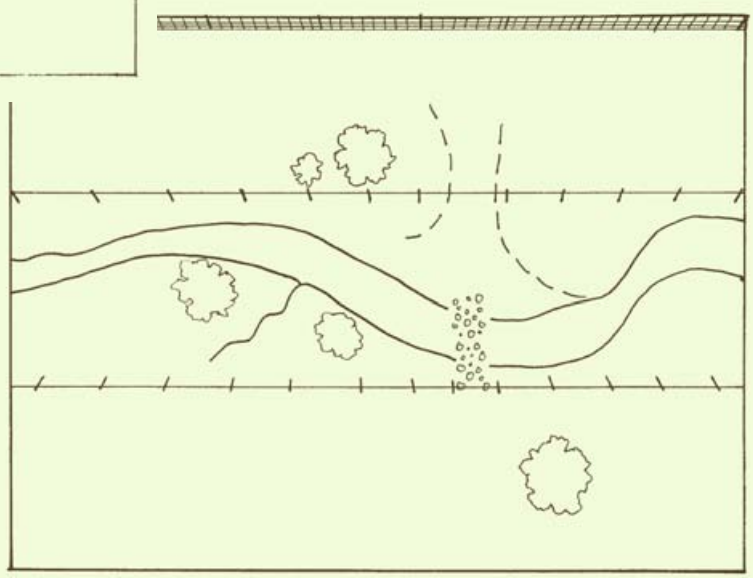
PASTURE LAYOUTS FOR SOME STREAMSIDE GRAZING MANAGEMENT SYSTEMS

PASTURE LAYOUT	DESCRIPTION OF PADDOCK LAYOUT	WHEN TO USE THIS PRACTICE	BEST MANAGEMENT PRACTICES	COMMENTS
RIPARIAN UPLAND PASTURE	• small paddocks containing both upland and floodplain vegetation	• smaller watersheds and riparian areas near short-sloped ravines in good condition • enough good quality forage available in upland areas so livestock don't depend on riparian vegetation for their foraging needs	• move livestock to non-riparian areas before upland vegetation becomes depleted	• use riparian-dominated paddocks for access in mid-summer or as late-season hay crop
RIPARIAN PASTURE	• streamside pastures separate from uplands	• when paddocks are relatively small so that impact can be monitored • when weed control is required • on sites where scheduling grazing doesn't depend on condition of upland vegetation	• monitor and manage to restore favourable riparian conditions • monitor impact on soil and vegetation • move to paddocks away from streamside area	• change season and duration to reduce annual impact
CORRIDOR FENCING	• permanent exclusion by fences	• where recovery of degraded riparian areas is required • permanent fences are costly and may not be suitable in ice-floe and flood-prone areas • electric or other non-permanent fences allow more management flexibility at a lower cost	• use cedar rail for shallow to bedrock • use electric fencing with flexible posts for ice-floes • use cement fenceposts in steel drums for high water table conditions • maintain with seasonal inspections • develop buffers on streamside	• unsuitable where impact is minimal and alternative water is too expensive • corridor fencing alone may not improve riparian grazing practices

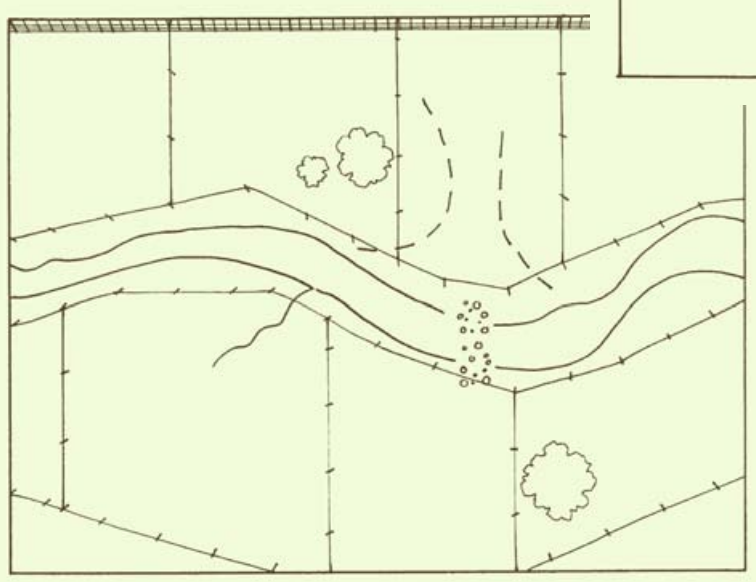
Corridor fencing with permanent fencing materials will provide streambank protection. Outside the corridor, you have season-long or intensive grazing management options.



Small paddocks consisting of both upland and floodplain sites are suitable for smaller-sized streamside pastures when conditions are good.



With corridor fencing, livestock are excluded from the stream area. Intensive grazing management practices are encouraged for the rest of the riparian and upland area.



Floodplain paddocks are managed separately from the upland and ravine slope paddocks.

If you have grazed riparian areas, you have two choices: manage or exclude!

FENCING SYSTEMS

FENCING FOR EXCLUSION

Fencing for exclusion means livestock have no access to a watercourse, pond, lake or wetland. Fencing doesn't have to be permanent and expensive – but it must be effective.

Exclusion fencing is the first step towards rehabilitation of riparian areas. There's less sediment disturbance and no direct manure deposition. Bank, bed, and local riparian erosion is also reduced. Water quality improves. Fish and wildlife habitat starts to come back.

Suitability

Permanent fencing is suitable for:

- holding areas adjacent to riparian areas
- intensively grazed riparian areas where the density exceeds 2.5 Nutrient Units (NU)/ ha/yr (1 NU per acre in a given year)
- extensively grazed riparian areas with severe problems or with moderate problems where fencing is the most suitable solution
- extensively grazed areas where fencing for exclusion is determined to be the only effective long-term solution.

Fencing with buffers is a suitable management option in riparian areas where damage is noticeable and ice-floes are not common.

Permanent fencing is not an option for areas prone to ice-floes.

If your watercourse is a municipal drain, you must confirm the appropriateness of your plans with the engineer's report for the municipal drain.

Permanent fencing is not suitable for:

- riparian areas prone to ice-floes
- riparian areas subject to frequent and extensive flooding.

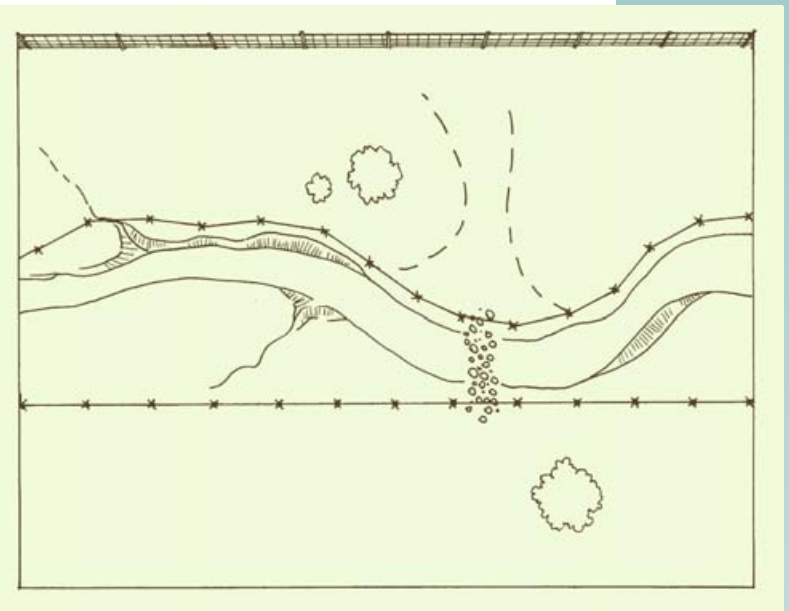
Design Considerations

As you plan, consider the following:

- ▸ size of area and length of fence
- ▸ 5-m (15-ft) minimum buffer (recommended) between fence and top of bank
- ▸ square-off for maintenance ease
- ▸ electric fencing with flexible posts for ice-floes
- ▸ cedar-rail designs for shallow to bedrock or excessively stony areas
- ▸ special fencing for high water table conditions – e.g., fencepost cemented in steel drum.

Maintenance Checklist

- ✔ inspect permanent fences seasonally for repair
- ✔ inspect posts regularly
- ✔ manage vegetation near electric fences



Some graziers prefer to square-off paddocks where there is considerable stream meandering.

Cedar-rail fences can be designed to work in pastures that are too wet or shallow to bedrock.

Permanent fencing can and should be complemented with any of the following:

- ▸ controlled access
- ▸ buffer strip and treed buffer establishment
- ▸ alternative source of drinking water
- ▸ relocating shade, salt and feeding
- ▸ temporary grazing of riparian areas.

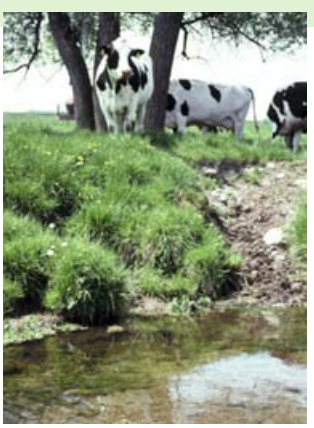
FENCE TYPES

TYPE	DESCRIPTION	ESTABLISHMENT TIPS	ADVANTAGES + / DISADVANTAGES –
RAIL 	permanent • traditional fencing method	• place a strand of electric or barbed wire along fence ○ some styles rest on top of ground, thus a good choice on shallow bedrock or high water table locations • allow space for drain maintenance • leave at least 5 m (15 ft) from top of bank/shore as buffer	+ permanent + minimal inspection and maintenance + moderate cost – construction can be time-consuming – not suitable for ice-floes and floods
PAGE WIRE 	permanent • page wire	• select fence height and wire spacing based on animal type to be excluded • fence must be adequately anchored • allow space for drain maintenance • leave at least 5 m (15 ft) from top of bank or shore as buffer	+ permanent + minimal inspection and maintenance – construction can be time-consuming – not suitable for ice-floes and floods – expensive
SUSPENSION 	permanent • high-tensile smooth wire	• has 3–8 strands of wire on posts set at 27 m (90 ft) centres • can be electrified, i.e., 1 or 2 strands 12.5 GA – smooth wire is most common • allow space for drain maintenance • leave at least 5 m (15 ft) from top of bank/shore as buffer	+ permanent + relatively quick and easy to install in floodplain areas + moderate cost – electrified fence requires some vegetation maintenance
ELECTRIC 	temporary or permanent • wire/polywire/ polytape	• can be installed quickly • space posts at 15 m (50 ft) • use tape, wire or combinations with easy-to-install posts • must be properly grounded • train livestock to use	+ easily installed and moved + suitable for flood-prone areas + low cost – requires power source – some maintenance/management requirement with vegetation – requires regular checking

Note: Never electrify barbed-wire fence.

If previous access provided drinking water for livestock, you must provide an alternative source. See pages 58–59 for suggestions.

If livestock are given a preferred location to access water, pressure may be greatly reduced along other portions of the watercourse – even to the extent of reducing the need for extensive fencing.



FENCING TO REDUCE ACCESS

Controlled access involves fencing with openings that permit livestock access to the water for drinking or crossing. It is not intended for high-density grazing areas.

Please note that allowing livestock access is not in full compliance with the Fisheries Act. However, it may be a necessary step where total exclusion is not possible.

Fencing to reduce access is suitable:

- for low-density riparian grazing areas where access is causing low to moderate problems
- for upper and middle reaches of watersheds, and some ponds
- where pasture length is long and/or the stream meanders, making it difficult to establish continuous fencing
- where there are pastures on both sides
- where creating a reliable water supply would be difficult and expensive
- where streambed materials are coarse enough (e.g., gravels, stones, cobbles) to reduce impact or to reduce appeal for livestock crossing

Management Tips

✔ Use permanent or temporary fence to reduce access.

✔ Leave at least a 5 metre (15-ft) setback from the top of bank.

✔ Determine approach to crossing:

- don't focus all livestock on one crossing in extensive pastures
- locate crossings to points that currently exist – this distributes the smaller impacts to several areas and allows for stream recovery between crossings (see pages 57–58 on crossings).

✔ Monitor livestock movement in the pasture to determine favoured access points:

- place planned crossings nearby, and use limited fencing to "funnel" livestock to the new crossing.

Advantages and Disadvantages

+ makes water available for drinking
+ reduces time that livestock are in water
+ stabilizes banks
– concentrates livestock in specific areas
– can increase impacts at focal points
– may require maintenance at entry points
– top of bank trailing can cause impact unless fence is set back from top of bank.

Controlled access – here as one-sided access – is suitable for certain low-density streamside pastures, particularly if salt, feed, shade or alternative water have been located away from the area.

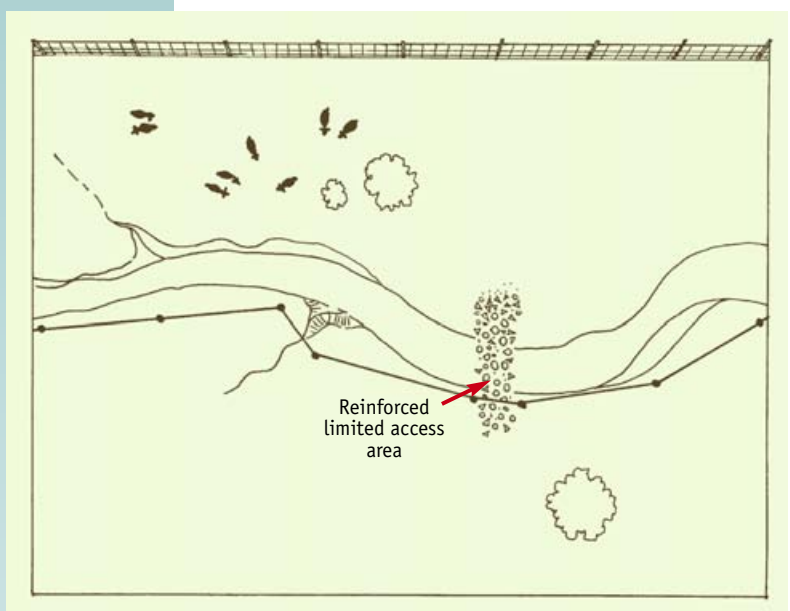
Monitor livestock to determine favoured access points before designing fencing systems to reduce access.

LIMITED ACCESS POINTS

Limited access allows livestock to reach water for drinking but does not permit crossing. Again, strictly speaking, access is not allowed under the Fisheries Act. However, it's better to do whatever possible to protect water quality than do nothing at all.

Limited access points are suitable for:

- riparian pastures under planned management intensive grazing system
- pasture systems where livestock pasture on only one side of a watercourse
- pastures where there's already a bridge or culvert crossing that can be used by livestock to get to other pastures
- areas where alternative watering isn't feasible
- upper-reach areas where ice damage or flooding hasn't been a concern.



One-sided pasture fencing can work well if it's part of an intensive grazing management system.

Management Tips

- ✔ Construct a permanent or temporary fence that extends from the shore into the water to depths of <46 cm (18 in.) and can be moved during high water periods.
- ✔ Make it large enough for several livestock to water at once.
- ✔ Protect with erosion-resistant materials.

Advantages and Disadvantages

+ low cost
+ livestock don't get complete access to water
+ concentrates livestock in only a few areas

– only access one side
– impact on sloped entry to water
– limited use for pastures on both sides
– susceptible to ice and floods
– requires fencing along entire access
– should also include stabilization work in area where livestock have access to drink (ramp, shore, upstream and downstream)

CROSSINGS

When pastures are located on either side of a watercourse, you may need to manage access while minimizing damage.

Closely monitor livestock movement in the pasture to determine the location of favoured watercourse access points. Establish crossings nearby, and consider using limited fencing to funnel livestock to preferred access sites.

Remember that structural features should be designed to reduce access, but should not cause damage to fish habitat or prevent others from using navigable waters. Poorly designed crossings can obstruct fish movement in flowing waters and limit navigation by small watercraft.

If there are no environmental concerns with a natural crossing between extensively grazed areas, then you may want to consider leaving well enough alone. Sometimes the siltation that could result from improvements can make things worse.

You must check with regulatory authorities to obtain approvals before creating any type of crossing structure. Start with your local Conservation Authority or Ministry of Natural Resources (MNR) office. Remember too that for work in and around water, you may require assistance from an engineer or other professional.

Bridge Crossings

▶ wood or steel bridge adequately designed as crossing
▶ suitable for upper-reach watercourses with excessive flooding or ice-floes
▶ should span from the top of the banks of both sides
▶ can be used by machinery
▶ expensive, requires permit and approvals – not suitable for drains

Mid-Level Crossings with Full-Flow Culverts

Culverts and concrete are used to construct these bridge-like crossings at mid-bank level.

▶ culverts are usually placed at bed-level (embedded to 10% of culvert diameter)
▶ may be suitable for narrow-channel streams and drains
▶ approvals are required from the various agencies for work in and around water
▶ relatively high cost
▶ can cause flooding upstream

Bed-Level Crossings

- crossing is established at watercourse bed-level
- materials used are concrete slats, coarse, angular stone and other prefabricated materials
- suitable for wide-channel streams and some drains
- approvals are required from various agencies for work in and around water
- no negative impact on water flow if built properly
- livestock still have impact while crossing

Leave Natural Crossings As They Are

- livestock use one or multiple natural (non-constructed) crossing areas
- bed is firm and contains >50% coarse materials (>2 mm [0.08 in.] in diameter)
- suitable for very low-density grazing systems with coarse-textured beds
- use other BMPs to alter grazing and traffic behaviour
- use rock or boulder deflectors or thorny shrubs to direct livestock to preferred crossing areas

ALTERNATIVE WATER SOURCES

Alternative water alone can dramatically reduce the amount of time livestock spend in and around water. Depending on the circumstances, livestock even show a preference for water troughs over streams. Alternative water may be drawn from streams, wells or groundwater springs.

Recent grazing management research indicates that, given the choice, livestock prefer alternative water sources. And when such sources are put in place, they will reduce access by 80% or more.

WATER FROM BARNS

If a barn is nearby, this is the simplest approach to accessing groundwater supplied through an existing well. Consider shading the trough to limit algal growth if this is a permanent site.

SOLAR-POWERED PUMPS

Recent designs of more efficient pumps and solar power panels result in a feasible, reliable source. Solar panels that are used to recharge deep-cycle marine batteries provide a continuous power source for the pump.

DUGOUT PONDS
Dugout ponds are excavated to collect surface runoff, groundwater and tile drainage as an alternative water source. Buffer areas around the pond and fencing should be considered to protect the quality of the water source. Have a soils investigation done prior to excavation to be sure water will stay in the pond. Otherwise you'll need artificial liners of bentonite clay or synthetic materials.

NOSE PUMPS
This diaphragm pump is mechanically activated by livestock. The pumping action draws water through an intake line and foot valve. Nose pumps aren't suitable for calves or sheep.

SEEPAGE TROUGHS
Seepage troughs intercept groundwater from seepage areas on hill slopes. If used year-round, place inlet and outlet pipes close together. This will increase surface turbulence and help keep them ice-free.

WINDMILLS
A windmill can be expensive, but is reliable and low maintenance. Old mills can be rebuilt to keep costs down. These work best if you provide a storage reservoir as backup to supply water during low wind periods.

RAM PUMPS
Ram pumps take advantage of falling or flowing water to drive the pumping mechanism. Get a supplier to help you determine the appropriate pump for your situation.

SHADE, SHELTER AND FEEDING

Dense plantings of trees and shrubs – especially with thorns – can deter access to surface waters.

In extensively grazed areas with moderate-to-minimal risks and observed problems, sometimes just a combination of a few BMPs can make all the difference.

For example, moving feed, salt and water away from the riparian area can be as effective as and less costly than permanent fencing. In areas of low risk, placing deflectors in areas of habitual access and adding alternative watering may be sufficient to reduce the risk of environmental impact.

Vegetative Barriers

✔ Use thorny shrubs or very dense evergreen trees to deter livestock from riparian areas.

✔ Use temporary fencing and some weed control practices to protect the trees until they're established, especially on floodplains.

✔ Use this BMP in combination with other non-fencing options to increase effectiveness.

In addition to those trees and shrubs that are already thriving, consider species such as: wild rose, black locust, wild apple, red pine, white spruce, white cedar and tamarack.

This approach is suitable for low-risk areas where livestock have access at several points.

Stone Deflectors and Barriers

✔ Place stones and other materials in the path leading to riparian areas. Livestock will gain access at a different place or go to an alternative watering facility.

✔ Use materials such as:

- ▸ large natural stone (cobbles or larger) on top of the bank – space them far enough apart to permit plants to grow
- ▸ permanent fence in segments – this keeps livestock completely out of sections to permit permanent plant cover, tree growth and root stabilization.

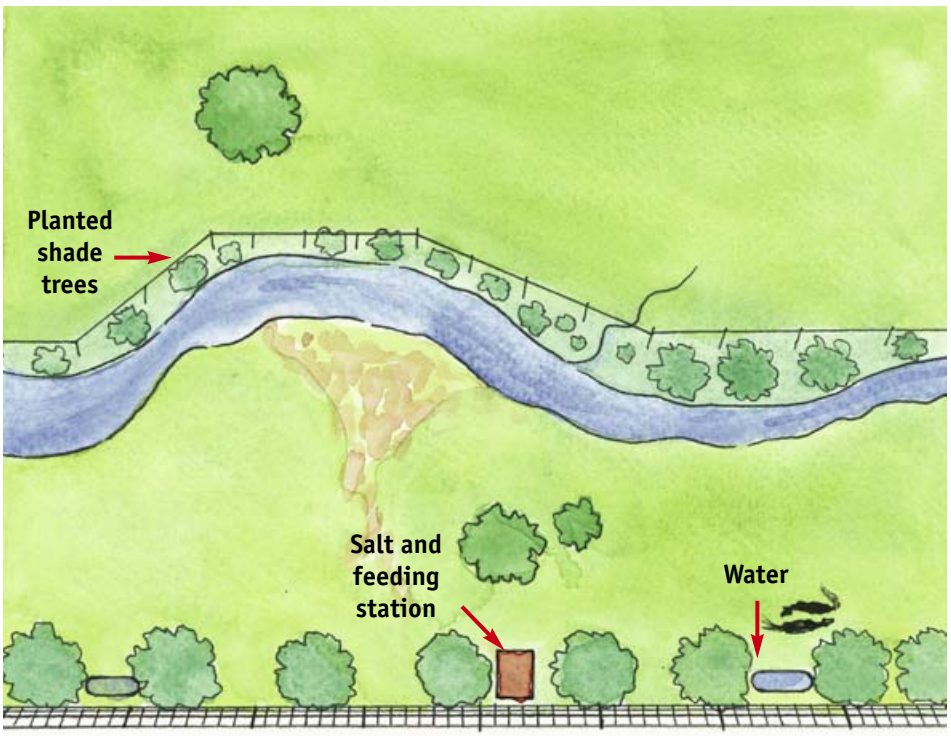
Placing stones and other physical barriers may deter livestock access when used in combination with other streamside grazing BMPs.

Relocating Shade, Salt and Feeding Areas

Livestock are attracted to shade, salt and feeding areas. Moving them away from riparian areas will reduce the risk of impact in moderate-to-low risk areas. Again, these BMPs work best if done in combination.

✔ Locate salt, feed and shelter(s) more than 50 metres (164 ft) from surface water (ponds, lakes, watercourses or wetlands) where there is no fencing.

BMPs FOR WATER QUALITY AND HABITAT



Shaded streams are better for fish habitat. Shade trees and shrubs should be planted on the south and west sides to improve the cooling effect as seen on the left side of the stream. Shade can also be used to attract away from riparian areas. It is more effective when alternative water, salt and feed stations are also located away from the streamside.

Trees planted in riparian areas where extensive fencing is not planned may eventually encourage access by livestock seeking shade.

Even well-managed riparian grazing areas cannot control erosion and runoff from cropland. Much of the risk of surface runoff and concentrated flow from cropland can and should be managed in the field by soil and water conservation structures and practices. Grazed riparian pastures are one part of this soil and water conservation system – to repeat, **they are the last line of defence**.

The BMPs illustrated below are practices and designed structures that will reduce cropland erosion and runoff.

CONTOUR STRIP CROPPING

Alternate strips of row crops, cereals and forages on the contour level slow surface flow and increases infiltration rates.

EROSION CONTROL STRUCTURES
Structures such as this grassed waterway are designed to control erosion and safely convey surface water to an adequate outlet. You should seek technical advice for design and construction. Common examples include grassed waterways, drop pipe structures, terraces, and water and sediment control basins.

ROCK RIP-RAP
Rock rip-rap is a hard erosion-control structure for banks. Angular rocks are strategically placed at 2-ft horizonal for every 1-ft vertical rise, or flatter to protect bank materials. Rock rip-rap is most suited to local spots of extreme erosion. It may not be suitable for sandy areas or areas with significant subsurface flow. In these areas, soil materials can be washed from beneath the rock, causing failure and severe erosion. These structures are best used in combination with plant bioengineering techniques.

LIVE STAKING
Live, rootable cuttings are planted along eroded banks of small streams to create a living root mass that will stabilize and bind the soil.

DROP PIPE INLETS
Placed at the edge of fields near ditches and other watercourses, drop pipe inlets drop concentrated flow and ponded waters safely to watercourses. Pipe designs can be steel or plastic.

WaSCoBS (WATER AND SEDIMENT CONTROL BASINS)
WaSCoBs are earthen berms constructed across a low draw in the field with the function of ponding runoff water. They prevent gully erosion by intercepting concentrated flow and creating temporary ponding conditions behind an earth dam or berm. Ponded water is slowly released through a drop inlet to a proper tile inlet. Water is ponded behind the berm for up to 24 hours.