Tuning Your Eye

Diagnosis for Riparian Health

Riparian health evaluations tune your eyes and allow you to see the components or pieces that contribute significantly to health or, when missing or degraded, impair ecological functions, the foundation of health.

Riparian Health Questions

What is measured? *These characteristics are evaluated to assess the health of riparian areas along streams and rivers or around lakes and wetlands:*

How much of the riparian area is covered by vegetation?

Vegetation reduces the erosive force of raindrops and the velocity of water moving over a floodplain, along a streambank or onto a lakeshore. Think of vegetation like a mesh umbrella that slows and blunts the force of moving water.

Vegetation cover:

- reduces erosion;
- traps sediment and stabilizes banks and shores;
- absorbs and recycles nutrients;
- allows water to infiltrate to refill and recharge aquifers;
- reduces the rate of evaporation; and
- provides shelter and forage values.

The amount and type of vegetation present determines how well these services are performed.

>95% cover

80% cover

<75% cover

runoff and sediment

runoff and sediment

As vegetation cover diminishes, the amount of runoff and sediment increases. That can affect water quality and quantity.

How much of the riparian area is covered by weeds (invasive plant species)?

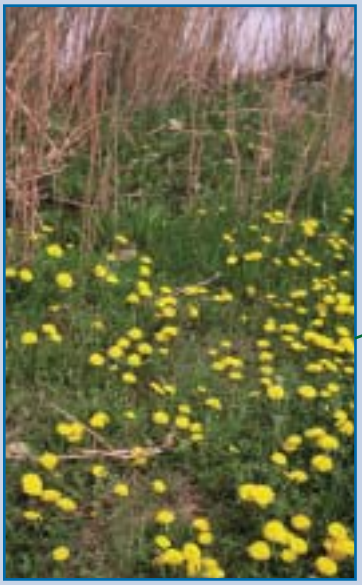
Weeds are alien species; they have been imported from elsewhere and their introduction causes both economic and environmental harm. Invasive plants include "noxious" or "restricted" weeds. Weeds invade riparian areas where disturbance has created bare soil. The presence of weeds can indicate a threat to health. No weeds indicate the riparian area is well vegetated, there is no bare soil and there is no seed source. Several weeds indicate space is available and there is a threat of quick invasion. Many weeds signal the system is degraded.

Invasive plants may contribute marginally to some riparian functions, but their negative impacts reduce overall health. They are not present in early spring to trap sediment or protect banks and shorelines from runoff. Their presence inhibits other important and beneficial species that contribute to bank and shore stability, biodiversity and primary productivity.

Examples of Invasive Weeds

- Nodding Thistle
- Canada Thistle
- Knapweed
- Hound's Tongue
- Leafy Spurge
- Toadflax

How much of the riparian area is covered by disturbance-caused vegetation?



Examples of Disturbance-caused plants

- Common Dandelion
- Foxtail Barley
- Timothy
- Stinkweed
- Kentucky Bluegrass
- Clovers
- Plantains

Disturbance-caused species are plants which are absent, or present in small amounts, in undisturbed areas, but invade reaches with high levels of use or disturbance. A large cover of these plants, either native or introduced, indicates an alteration of the normal plant community that would be expected to occur on the site. Like invasive plants, disturbance-caused species are well adapted to an environment of continual stress, where the competitive advantage of better riparian species has been diminished. These species have more value than invasive plants, but are usually;

- shallow-rooted and less productive;
- have limited value for bank binding and erosion prevention; and
- inhibit other preferred plants.

Is woody vegetation present and maintaining itself?

Most, but not all, riparian areas can support woody vegetation (trees and shrubs). Trees and shrubs have an important and key role in riparian condition. Their root systems generally are excellent bank and shoreline stabilizers and play a key role in the uptake of nutrients that could otherwise degrade water quality. The canopies formed by trees and shrubs protect soil from erosion, provide shelter to wildlife and livestock, and modify the riparian environment. Even when dead the trunks provide erosion protection and structural complexity which plays a role in modifying stream valleys. A good indicator of the ecological stability of a riparian reach is the presence of woody plants in all age classes, especially young age classes. Without signs of regeneration of preferred woody plants (those species that contribute most to riparian condition and stability) the long-term stability of the reach is compromised.

Some trees and shrubs just aren't the right stuff. They don't do as good a job of gluing banks and shores together, they reflect a history of disturbance (e.g. rose, snowberry) and some are exotic, aggressive species (e.g. Russian Olive, Tamarisk) we don't need or want in riparian areas.

These poplar seedlings and saplings represent new age classes of trees that will replace the older individuals in the background.

What will replace these trees in the next few years?

Examples of preferred Trees & Shrubs

Trees:
cottonwood, aspen, poplars, birches, conifers

Shrubs:
willows, dogwood, saskatoon, chokecherry, alders, hazelnut, pin cherry, cranberry, honeysuckle, raspberry

Is woody vegetation being used?

Beaver activity, for food and dam building, is an example of utilization of woody species.

Many animals browse woody plants, including domestic livestock.

Because woody species have such an important role to play in riparian health, measuring use helps us understand whether they will persist in the reach. Livestock will often browse woody plants, especially in late summer, fall and winter. Wildlife, including beaver, make use of woody plants year-round. Mowing, trimming and logging remove woody species. Woody plants can sustain low levels of use, but heavier browsing or removal can:

- deplete root reserves;
- inhibit establishment and regeneration;
- cause the loss of preferred woody species;
- lead to replacement by less desirable woody species; and
- lead to invasion by disturbance or weed species.

There is an 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 collectors of solar energy, will wear the plant down and reduce it's ability to store energy in it's roots for the next season. Long-term, heavy use eliminates the best woody plants.

How much dead wood is there?

The number of dead trees and shrubs or the amount of dead branches in their canopies can be a signal of declining health of a riparian reach. A number of factors could be contributing to this:

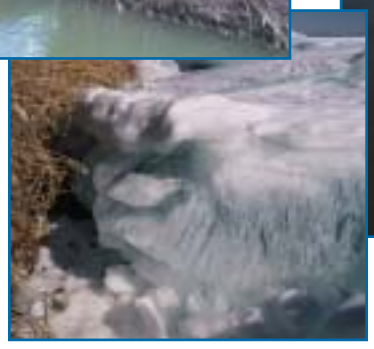
- Large amounts of dead wood may indicate a change in water flow through the system due to either human or natural causes;
- De-watering of a reach, if severe enough, can dry the reach, changing vegetation potential from riparian to upland species;
- Flooding of a reach, or a persistent high water table, from beaver dams, crossings that restrict flow or man-made dams can kill and eliminate some riparian species;
- Heavy use of browse can stress woody plants, resulting in their eventual death;
- Physical damage from rubbing and trampling, if chronic, can result in the death of woody vegetation; and
- Climatic impacts (drought), weather (severe winters), disease and insect infestations can affect woody vegetation.

In all these cases, a high percentage of dead wood reflects declining vegetation health. This can lead to reduced streambank integrity, increased channel incisement, excessive bank and shoreline erosion and reduced shelter values.

A water level increase from a beaver dam flooded and killed these willows.

This willow has been severely browsed, rubbed and trampled by livestock.

Are streambanks and lakeshores held together with deep-rooted vegetation?



Only deep-binding roots, such as those of willows, can protect shorelines from ice, wind and wave erosion.

Kentucky bluegrass roots have very limited bank holding capabilities.

Streamside vegetation maintains the integrity and structure of the streambank by dissipating energy, resists erosion and traps sediment to build and restore banks. On lakeshores and wetland margins, vegetation resists wave action, ice movement and traps sediment.

Root systems bind soil particles together and provide the glue that stabilizes the zone where stream flow and wave energy have the most consistent, regular effect. Vegetation with deep and binding roots best accomplishes this function, especially if there is a diversity of these species found on the reach. Most tree and shrub species provide such deep roots. Herbaceous annuals and weeds lack this quality. Perennial herbs provide it in varying degree. Some species, such as sedges, are excellent streambank stabilizers, while others, such as Kentucky bluegrass and timothy, have shallow root systems and have limited capability.

How much of the riparian area has bare ground caused by human activity?

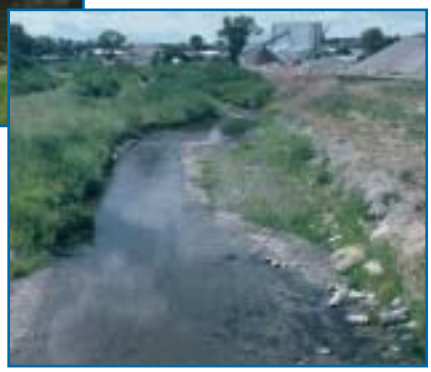
Bare ground is unprotected soil that results from our activities. It's an opportunity for invasion by weed and disturbance species into the vacuum caused by those activities. Bare ground represents a loss of vegetation to filter and buffer sediment, less reduction in energy (hence more wind and water erosion) and a decreased ability to allow water to infiltrate into the aquifer. Sediment deposited during a flood is a natural event and an indication the riparian area is doing what it should- trapping this material.

Human land uses that can cause bare ground include livestock grazing, cultivation, recreation, urban development, roads/trails, timber harvest and industrial activities. Significant bare ground caused by human activity indicates a deterioration of riparian health.

These riparian areas are very susceptible to erosion and the bare soil is a place for weeds to establish. Several riparian functions are impaired.

Has the streambank or shoreline been altered by human activity?

This shoreline has been altered through the clearing of trees.



Alteration can be subtle, like the infilling of the floodplain and the creation of a new, higher bank which doesn't allow the stream access to it's floodplain.

Stable streambanks and shorelines maintain channel configuration, integrity and bank shape. When streambanks and shorelines are physically altered, erosion can increase, moving channel and bank materials, water quality can deteriorate, and instability may increase within the reach and downstream.

Altering the shoreline or streambank vegetation can also have an impact on health. Removal of woody species or emergent plants (e.g. cattails) can increase erosion and disrupt nutrient recycling. Planting of non-native species or allowing invasion of weeds and disturbance-caused plants can inhibit native, deep-rooted ones.

Bank alteration can result from livestock hoof shear, livestock trails/watering sites, recreational trails, flood/erosion control methods, irrigation diversions/return flows, timber harvest, crossings/fords, bridges/culverts, landscaping and channelization/drainage.

Are riparian area soils compacted from use?

Plants filter and trap sediments to build a riparian soil layer of moist, fine textured materials. Roots and underground fauna create soil structure and spaces that allow water infiltration and storage. This is the "sponge" that supports riparian vegetation. This sponge is very susceptible to vehicle traffic, hoof action and compaction. Compaction can be difficult to evaluate and the effect is often related to soil type. Evaluating the amount of pugging, hummocking and rutting provides some measure of soil compaction from livestock and vehicle use in riparian areas. Pugging describes large animal tracks left in soft soil. Pugged areas have a honeycomb appearance and an irregular soil surface difficult to walk across. Hummocking describes the raised mounds of soil above the surrounding ground. Rutting describes deep animal paths or vehicle tracks that indicate significant compaction of riparian soils.

With extensive animal or vehicle compaction, the water-holding capacity of the soil is reduced, normal plant succession is disrupted and the soil surface is exposed and roughened, which increases the possibility of erosion.

The soft soil of this wet meadow has been compacted and reconfigured through hoof action into pugs and hummocks.

Vehicle use when this wetland was mainly dry created ruts which compacted soils, reducing the water holding capacity.

Think of riparian areas as a sponge which collects, stores and slowly releases water. Compaction of the soil that makes up the sponge inhibits this key function.

Can the stream or river access it's floodplain?

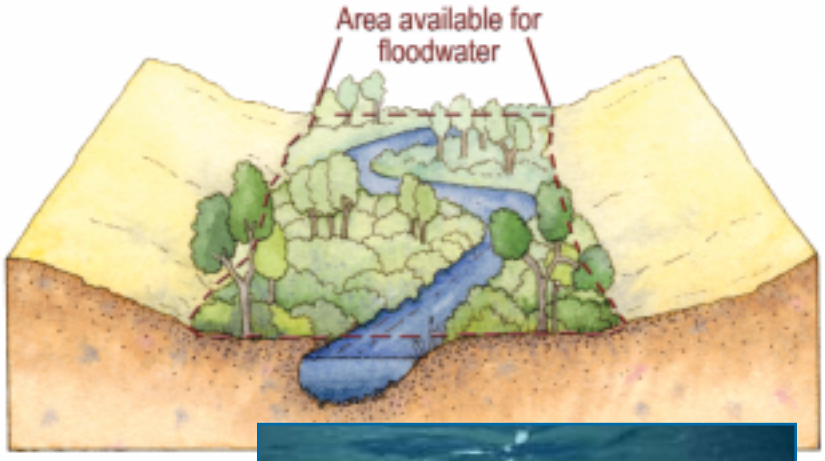
Floodplains, the riparian area that lies beyond the channel, provide a safety valve that allows water in excess of what the channel can hold to escape into a wider area. Floodplains provide temporary storage for high water and an opportunity to slow that water down, reducing energy and allowing sediment to be deposited outside of the channel. Incisement, or downcutting, and constructed features like berms and dykes can limit the ability of streams and rivers to access their floodplains during high water events.

The inability to access a floodplain can result from:

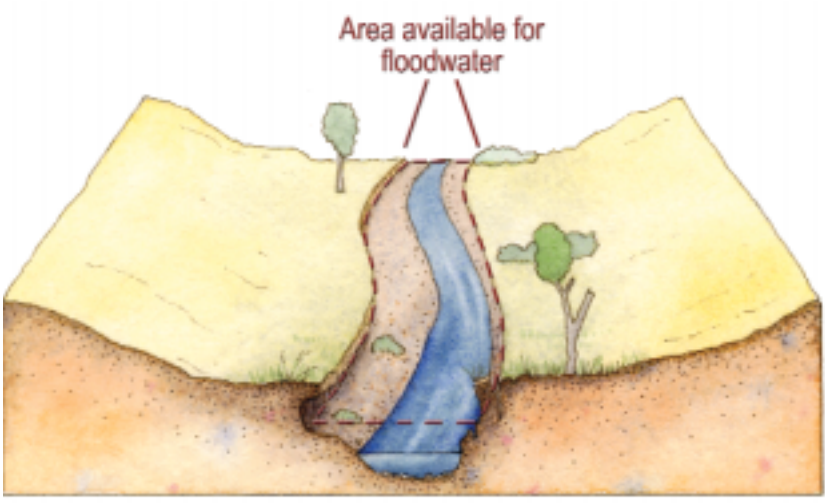
- Watershed scale, cumulative effects of vegetation removal, drainage and roading which affect runoff;
- Local drainage scale changes including vegetation removal, dams, water additions, roading and culvert installations occurring upstream of the reach (and sometimes downstream);
- Reach scale changes including vegetation removal, beaver dam removal, channelization and culverts;
- Natural events including landslides, beaver dam wash-outs and extreme flood events; and,
- Flood and erosion control works.

Incisement of a stream channel and the inability of a river to periodically access its floodplain can result in:

- A lowered water table that affects current vegetation and the potential of the reach for some types of vegetation;
- Increased stream energy with more erosion, sediment, and unstable banks which can persist downstream of the reach and potentially upstream as the stream readjusts;
- Reduced water storage and retention, leading to lower flows or flow ceasing during parts of the year;
- Decreased ability to trap sediment on the floodplain and deal with water quality issues;
- Impairment in the ability of the reach to rebound from natural and human caused impacts; and,
- Decreased productivity, forage, shelter and biodiversity values.



During flooding this river can access a wide floodplain to store water and reduce energy.



Flood water in this incised channel has nowhere to go and all the water and energy are compressed in the channel.

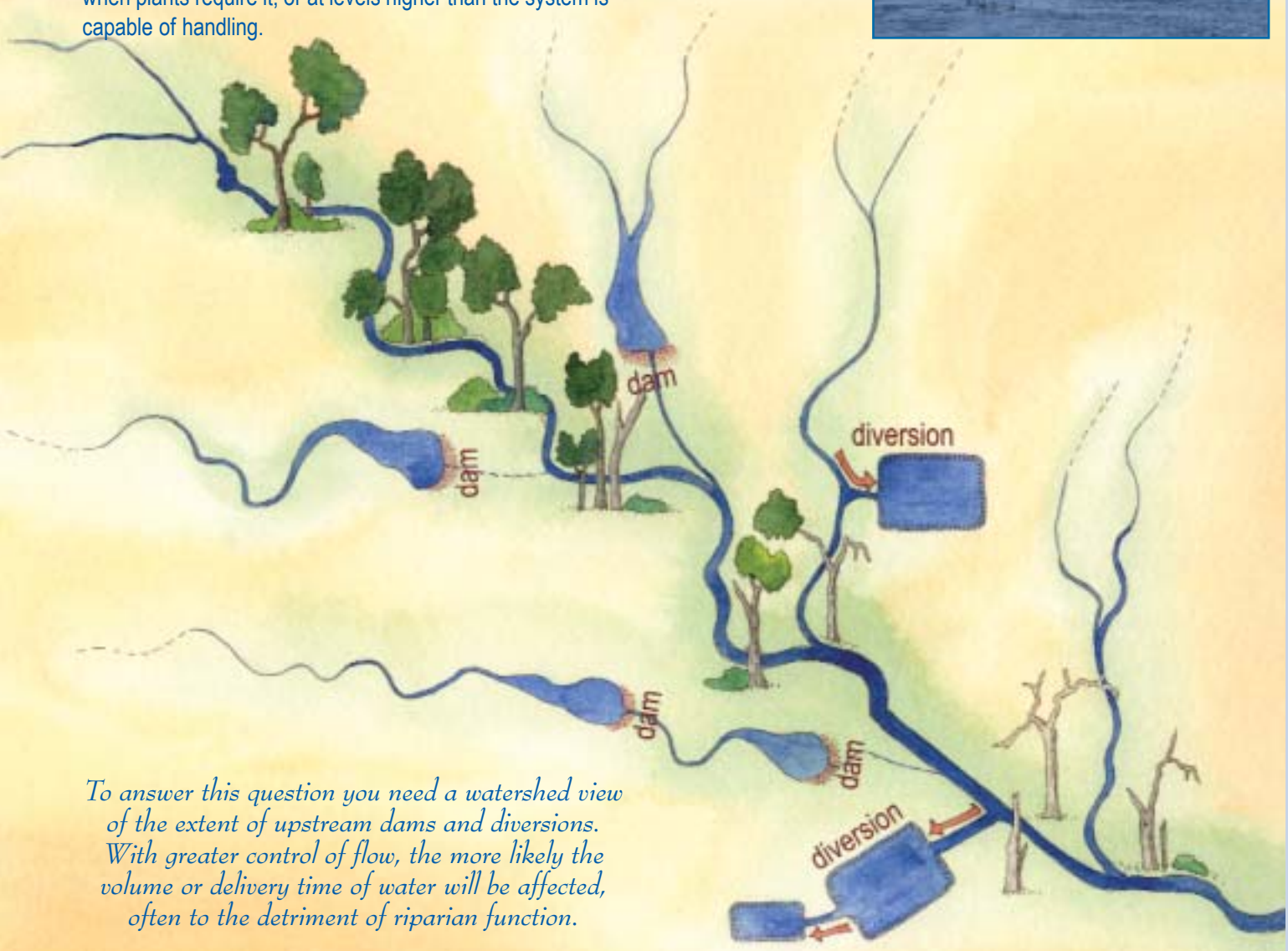
Is water removed and are flows/levels manipulated?

Riparian areas are built and maintained by water. Proper functioning depends on a regular supply of water. The degree to which water is removed or added directly affects riparian health. Dewatering a riparian system, during the critical growing season affects:

- the maintenance and persistence of riparian plant communities;
- the stability of banks and shorelines;
- fish and wildlife habitat; and,
- forage production and the maintenance of shelter.

Riparian areas are adapted to, and depend on, the volume and timing of annual peak flows and levels. The degree to which upstream reaches and tributaries are controlled by dams or diversions influences and affects delivery of water to downstream areas. Water may arrive at times other than when plants require it, or at levels higher than the system is capable of handling.

Significant changes to water flows and levels affects riparian vegetation and riparian health

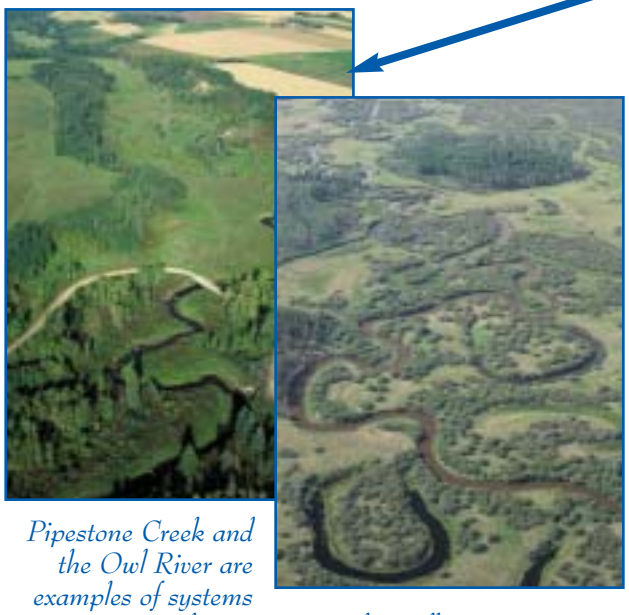


To answer this question you need a watershed view of the extent of upstream dams and diversions. With greater control of flow, the more likely the volume or delivery time of water will be affected, often to the detriment of riparian function.

Riparian Characteristics Measured

There is an overlap in measurements between different sizes and types of riparian systems. This table provides a sense of what characteristics are measured for each type and size of riparian system.

Characteristics	Riparian System: Streams & small rivers	Large rivers	Lakes, wetlands
Vegetative cover of floodplain, shoreline or bank	✓	✓	✓
Invasive plant species (weeds)	✓	✓	✓
Disturbance related plant species	✓	✓	✓
Preferred tree and shrub establishment and regeneration	✓	✓	✓
Utilization of preferred trees and shrubs	✓	✓	✓
Decadent and dead wood	✓	✓	
Shoreline or bank root mass protection	✓	✓	
Human caused bare ground	✓	✓	✓
Compaction: Pugging, hummocking, rutting	✓	✓	✓
Shoreline, bank and vegetation altered by human activity	✓	✓	✓
Floodplain accessibility	✓	✓	
Water manipulation - dewatering, control of flows/levels		✓	✓



Pipestone Creek and the Owl River are examples of systems in the "Streams and Small Rivers" category

The Red Deer River is in the "Large River" category

Lower Therien Lake and the wetland complex next to it are examples of the "Lakes and Wetlands" category