Lakes, sloughs and wetlands

Riparian Health Assessment

Field Workbook


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Riparian Health Assessment

Lakes, Sloughs and Wetlands

by Saskatchewan PCAP Greencover Committee

Acknowledgement

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To obtain additional copies of this workbook contact:

PCAP
Box 4752
Regina, SK S4P 3Y4
Phone: (306) 352-0472
E-mail: pcap@sasktel.net

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Riparian Health Assessment

Lakes, Sloughs and Wetlands

Photo courtesy of Glen McMaster

FOREWORD

This workbook describing riparian health assessment has been written for those people who can most effectively influence riparian areas and their management - landowners, farmers, ranchers, lakeshore residents, agency and organization staff and others who use and value these green zones and wet areas.

Riparian health assessment blends many fields of science and undergoes periodic additions and modifications. In addition, the language describing the method of assessing riparian health undergoes continual revision, to clarify, expand and increase understanding. This workbook incorporates the feedback from dozens of training workshops involving hundreds of participants.

Riparian health assessments form part of a larger package of awareness about riparian areas, leading to choices on managing these vital landscapes. It provides a starting point for future plans and management decisions.

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INTRODUCTION

Why Use This Workbook?

When we look at a riparian areas (the wet area next to lakes, wetlands, springs, sloughs, streams and rivers), what we see and how we interpret our observation is often based on our backgrounds, experiences and perceptions. Even though we may be standing on the same lakeshore or wetland margin, we often don't "see" all the same things. Riparian health assessment is a tool that allows us all to "tune our eyes", begin to appreciate the key pieces of the riparian landscape and evaluate what we see. It is an ecological measuring stick that provides some structure to our observations and allows us to evaluate the condition or health of a lake, slough, or wetland. We need to use riparian health assessment to build a common language so we can communicate better with one another, maybe reduce the arguments, and begin to move toward fixing what's broken in riparian areas and maintaining what is healthy. This workbook gets us on that road together.

What Will the Workbook Do For Me?

This workbook is for use in the field. It will help you learn the basics of evaluating the riparian health of a lake, slough or wetland. **Riparian health assessment requires instruction and practice;** both should be easier with the use of this workbook. With knowledge and experience gained from classroom and field training you will be able to apply this riparian health assessment procedure in your own area. It will start you down the road to recognizing riparian health on your home turf, which is the first step to making better management decisions to maintain or restore your riparian areas. This workbook also sets a standard, so we all use a common measuring technique.

Who is It For?

This workbook is for farmers, ranchers, lakeshore residents, landowners, land/resource managers and others who want to learn to evaluate riparian health. Community groups, municipalities and watershed groups will find this workbook helpful in understanding the procedures of riparian health assessment and to interpret the results of watershed level riparian health inventories.

Where Can I Use It?

This workbook is designed for lakes, sloughs and wetlands in Saskatchewan. It will be useful for other jurisdictions, with modifications to acknowledge vegetation differences. Different tools are available and should be used when measuring riparian health in stream or river systems. It has not been tested on bogs and fens. Contact the Saskatchewan Watershed Authority or Agriculture and Agri-Food Canada - Prairie Farm Rehabilitation Administration for further information (Appendix 4).

RIPARIAN HINTS

Where does this workbook apply?

- Lakes, wetlands, sloughs, marshes, springs or seeps (non-flowing waterbodies)
- Temporary, seasonal, semi-permanent, and permanent wetlands, sloughs and lakes
- Dry: lakes, wetlands, sloughs, marshes, and seeps

* Other assessment tools are available for streams, rivers, and coulees/draws.

How to Use the Workbook

This Field Workbook has been designed to use with other riparian awareness materials, to train people to quickly assess riparian health and to interpret the results of a health evaluation.

- This workbook is designed for use with ***Managing Saskatchewan Wetlands: A Landowner's Guide*** (Available online at www.swa.ca under stewardship publications), which is an illustrated awareness guide that provides more detail on the concept of riparian health.
- This workbook can also be used with the **Classification and management of riparian and wetland sites of the Saskatchewan prairie ecozone and parts of adjacent subregions** (Available online at www.swa.ca under stewardship publications). This publication is a reference document that describes major riparian plant communities and their management requirements for several of the natural regions of Saskatchewan.
- To be effective, riparian health assessment requires some basic preparatory classroom time and field training. This workbook will help you to participate in a riparian health training session, such as those put on by the Saskatchewan Watershed Authority, Prairie Conservation Action Plan and Agriculture and Agri-Foof Canada - Prairie Farm Rehabilitation Adminstration.
- Once you have some training and experience, the work book will allow you to carry out riparian health assessment and monitoring on your own land base.
- The workbook will also help you to interpret the results of a riparian health assessment or inventory that may be undertaken in your community.
- The workbook contains examples of field sheets to be used for recording scores (additional field sheets can be obtained from www.pcap-sk.org or www.swa.ca).

BACKGROUND

What is a Riparian Area?

To measure the health of a riparian area, you first need to understand what "riparian" means. Riparian areas are transitional: they exist between the aquatic part (the water-filled basin of the lake or wetland) and the surrounding terrestrial (or upland) area. Think of them as "wetter than dry" but "drier than wet". There is considerable variation in riparian areas, where water, soil, and vegetation interact. Common to all riparian areas are the following features:

- a combined presence and abundance of water, either on the surface or close to the surface, even when the water body may appear dry;
- vegetation that responds to, requires and survives well with abundant water; and
- soils that are often modified by abundant water (as in high water tables), lake and wetland processes (like sediment deposition and nutrient cycling) and lush, productive and diverse vegetation.

Riparian areas are part of a larger, continuous landscape that grades from wet to dry. Sometimes it will not be easy to determine precisely where a riparian area begins and ends. However, lakes, sloughs, wetlands, and ponds all have riparian areas adjacent to them, as do streams and rivers. There will most often be a basin that continuously or seasonally holds standing water, and an adjacent area where high water levels may periodically escape the basin. This workbook deals only with evaluating the riparian health of lakes, wetlands, ponds, and sloughs. Figure 1 will help you recognise what a riparian area looks like.

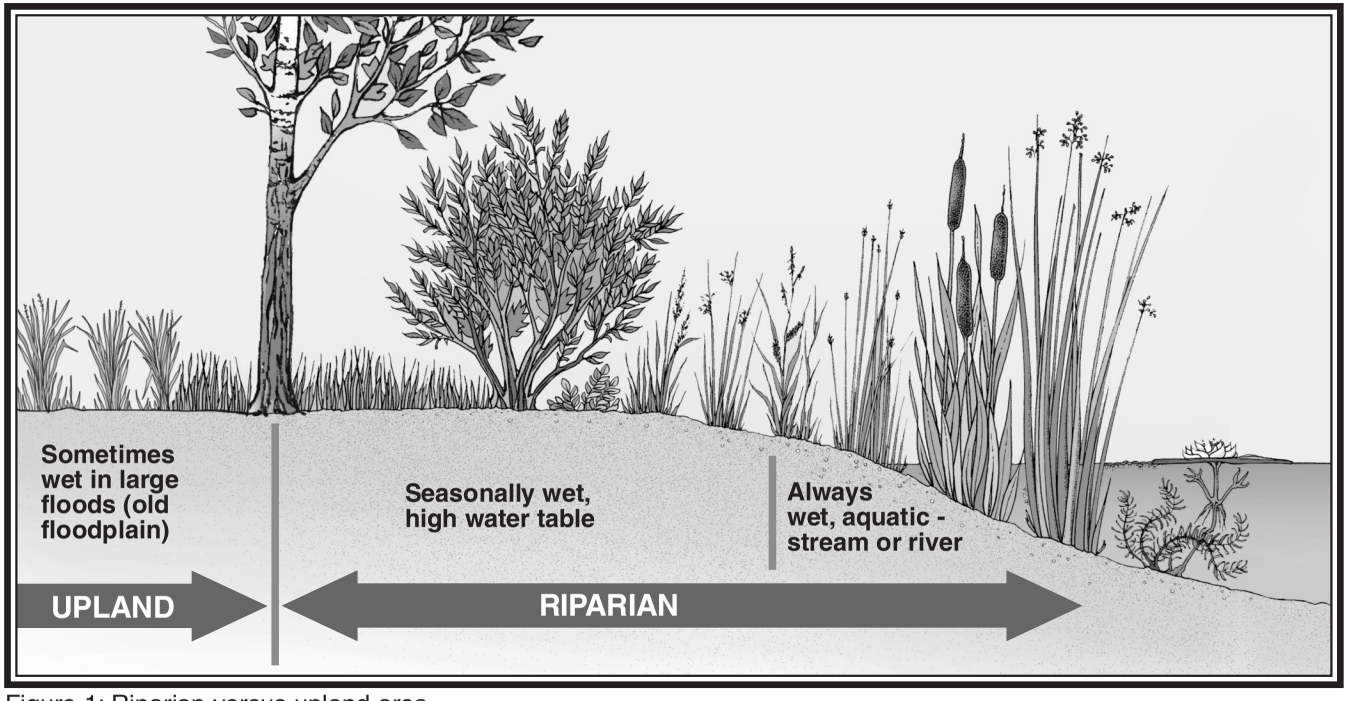


Illustration by Chris Jordison

Figure 1: Riparian versus upland area

What is Riparian Health?

The word "health" conveys an impression of something that is in properly functioning condition - things working well. If health is applied to us, it relates to the ability of our bodies to perform certain functions within a measured set of standards. Our bodies undertake functions like respiration, circulation, digestion, filtration, cell repair, energy storage and movement. If these functions are occurring, within standards, we are healthy. In a similar way, landscapes, including riparian areas, perform certain functions. "Riparian health" means the ability of a section or entire lake, slough, wetland, stream, river or a watershed composed of many lakes, wetlands, or rivers to perform a number of key ecological functions.

RIPARIAN HINTS

What do healthy riparian areas do?
Key ecological functions

- Trap and store sediment
- Build and maintain banks and shores
- Store water and energy
- Recharge aquifers
- Filter and buffer water
- Reduce and dissipate energy
- Maintain biodiversity
- Create primary productivity

Why Does Riparian Health Matter?

We depend on not only our own health to sustain us but on the health of the environment in which we live. Riparian health matters for the same reason our own health matters! Healthy, functioning riparian areas offer us:

- resiliency - the ability to bounce back from floods, droughts and human caused problems;
- ecological services - a long list of goods, services, bene fits, functions, and values; and
- stability - landscapes that maintain themselves, persist and are sustainable.

The following tables and diagrams explain key riparian functions of lakes, wetlands and sloughs and why they are important:

Table 1: Riparian functions: Sediment trapping and filtration

Riparian Functions	Why is this function important?
Trap sediment	• Sediment adds to and builds soil in riparian areas • Sediment aids in soil's ability to hold and store moisture • Sediment can carry contaminants and nutrients - trapping it improves water quality • Excess sediment can harm the aquatic environment
Filter and buffer water	• Reduces amount of contaminants, nutrients and pathogens reaching the water • Uptake and absorption of nutrients by riparian plants • Traps sediment, improves water quality and enhances amount of vegetation to perform filtering and buffering function

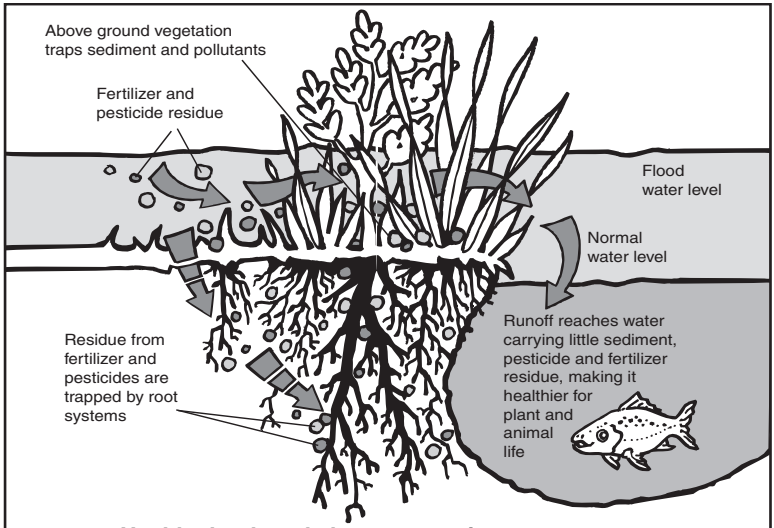


Illustration by Chris Jordison

Figure 2: Riparian functions: Sediment trapping and filtration

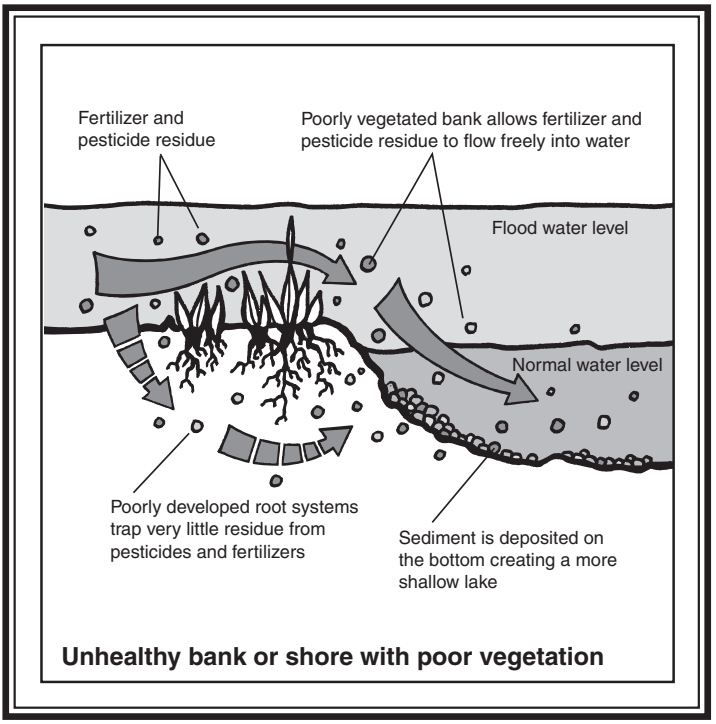


Figure 3: Riparian functions: Poor sediment trapping and filtration

Figure 4: Healthy wetland

Table 2: Riparian functions: Bank and shore protection and development

Riparian Functions	Why is this function important?
Protect and maintain banks	• Balances erosion with bank restoration- reduces effects of erosion by adding bank elsewhere • Increases stability and resilience • Maintains or restores bank and shore contour and shape, which is important for spawning fish

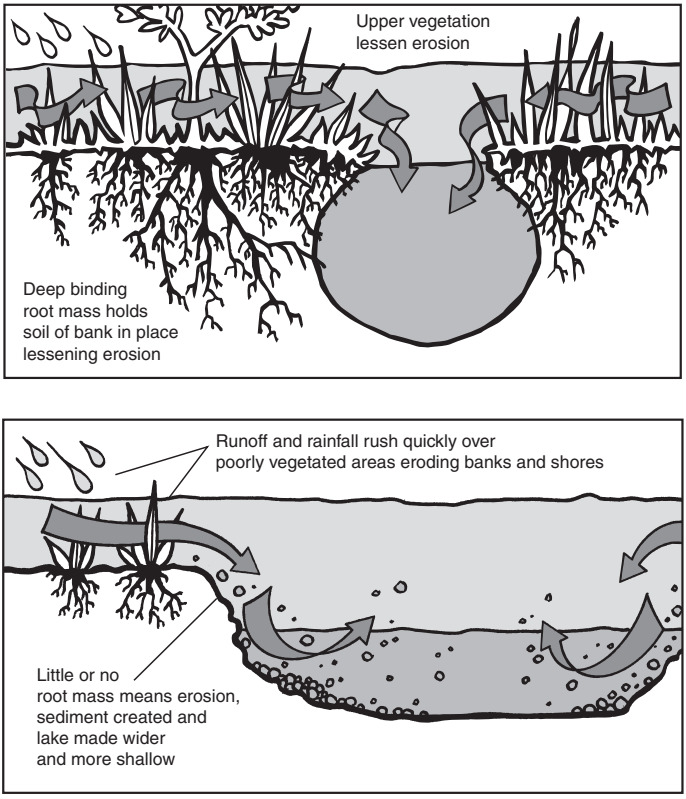


Illustration by Chris Jordison

Figure 5: Riparian functions: Bank and shore protection and development

Table 3: Riparian Functions: Aquifier recharge

Riparian Functions	Why is this function important?
Recharge aquifier	• Stores, holds and slowly releases water • Maintains water levels in lakes and wetlands • Maintains high water table and extends width of productive riparian area

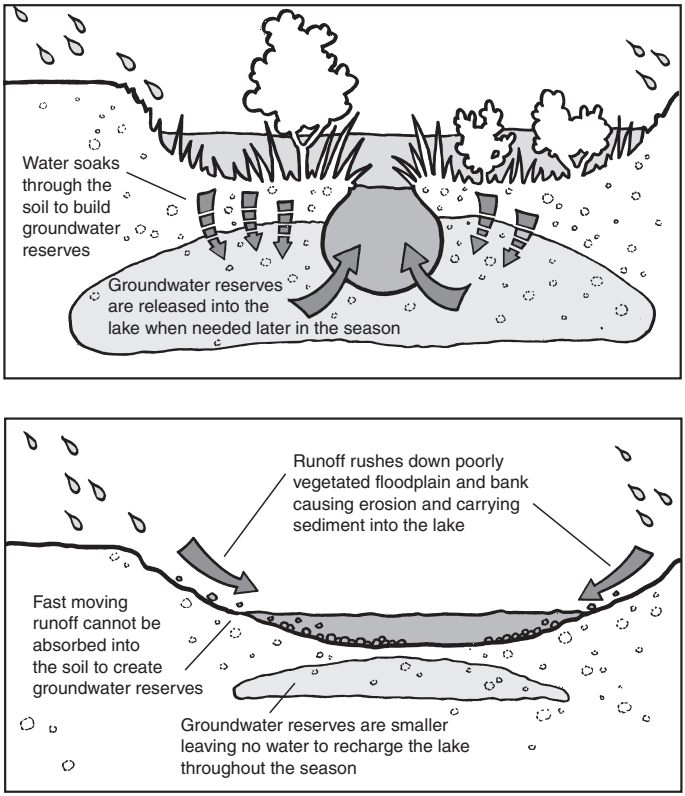


Illustration by Chris Jordison

Figure 6: Riparian Functions: Groundwater recharge

Table 4: Riparian Functions: Water and energy storage, reduction in water velocioty, biodioversity and primary production

Riparian Functions	Why Is this function important?
Store water and energy	• Watershed safety valve - stores high water on the floodplain during floods • Reduces flood damage • Slows flood water allowing absorption and storage in aquifer
Reduce and dissipate energy	• Reduces velocity which slows erosion and material transport • Provides erosion protection and slows meander rate
Maintain biodiversity	• Creates and maintains habitats for fish, wildlife, invertebrates and plants • Connects other habitats to allow corridors for movement and dispersal • Maintains a high number of individuals and species
Create primary productivity	• Increases vegetation diversity and age-class structure - links to other riparian functions • Ensures high shelter and forage values • Enhances soil development • Assists nutrient capture and recycling

More on the Value of Wetlands and Sloughs

In addition to the information in the table above on why riparian functions are important, there are more reasons to value these areas. They also:

- Recharge groundwater
- Increase soil moisture
- Control salinity
- Create recreational opportunities
- Influence local weather
- Increase forage production
- Increase crop yield
- Sequester carbon
- Create economic benefits
- Remove nutrients and pollutants

Dry wetlands and sloughs continue to provide many benefits, particularly when the wet cycle returns and they begin to fill. Compared to the many values included in the above list, draining and then developing or cultivating these areas as crops has a questionable return to the landowner and society.

Wetlands Control Salinity

Keeping wetlands intact reduces the spread of salts. Often, wetlands accumulate salts, so draining and cultivating through them can spread the salts over a larger area, increasing the size of the problem.

- Large, permanent wetlands and sloughs usually receive groundwater (discharge). As the water evaporates, salts are left behind, resulting in high salinity.
- Smaller and less permanent wetlands or sloughs often do not receive much groundwater, but instead recharge (add to) groundwater, so salts usually move downward. If you drain these wetlands, the outer edges may act as a source of salt, but salinity may go unnoticed until cultivated, and then it reduces the soil's suitability for growing crops.

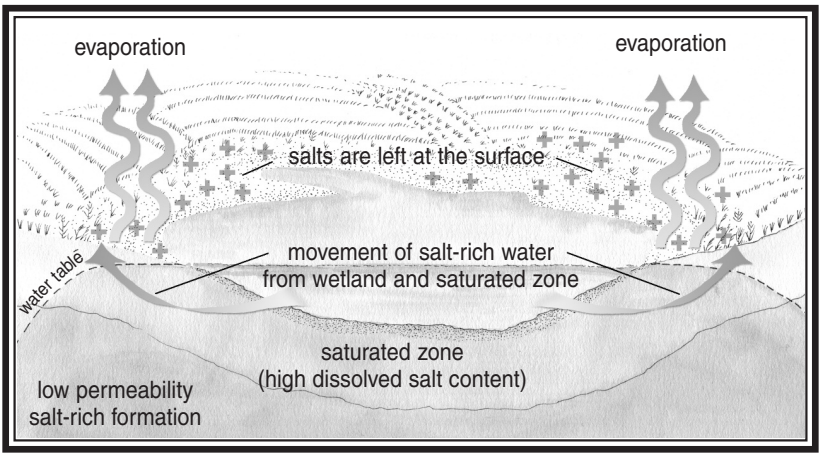


Figure 7: Control of salinity

Wetlands Stabilise Flows

Wetlands and sloughs are connected to groundwater and surface water in other waterbodies.

- Wetlands act as natural sponges to store and slowly release water from floods, rain, or snowmelt. These releases help maintain stream flows during dry periods.

- Studies show that significantly larger peak flows occur when less than 10% of the watershed is in wetlands; flood protection improves with more wetlands and sloughs in good riparian health.

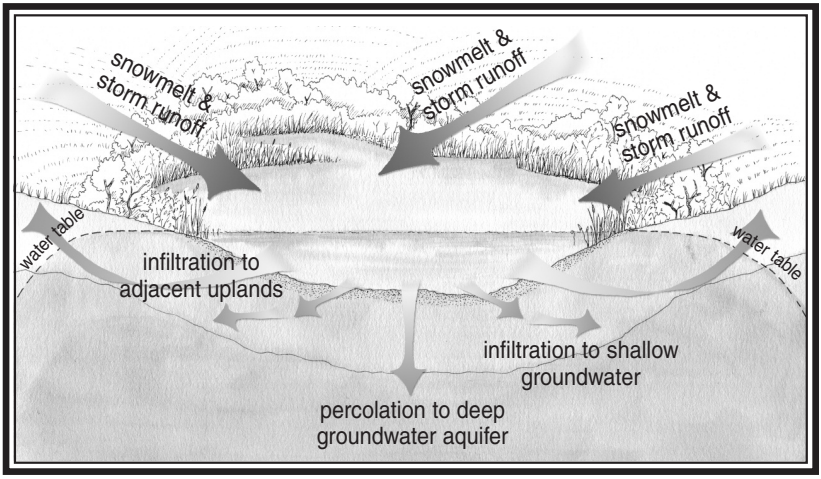


Figure 8: Stabilizing flow

Wetlands Affect Local Weather

- Lakes, wetlands and sloughs are linked to the water cycle, including weather. Draining them can lower the local or regional water table and reduce potential precipitation.
- Water evaporates from wetlands and transpires from trees and other riparian plants, creating water vapour; the water vapour condenses, creating local circulations that produce clouds, thunderstorms and local or regional precipitation.
- Wetlands are slow to heat and cool, and therefore have a moderating effect on local temperature, maintaining lower temperatures in summer and increasing minimum temperatures during cooler periods.
- You may get benefits from distant wetlands

Riparian Areas Filter Nutrients

- Plants around the waterbody trap sediment from runoff, filter out nutrients and keep sediment out of the water.
- Phosphorus (P) is often attached to sediment in runoff, and preventing it from reaching the water is good, since in water, P can cause excess algal growth and deplete oxygen.
- Roots capture nitrate and incorporate it into plant growth.
- Nutrient forms may be changed (particularly various forms of carbon, nitrogen (N), and phosphorus) before entering surface or groundwater, which improves water quality.
- How effective filtration is depends on the width of vegetated area, plant types, size of contributing area, slope, and amount and speed of runoff.

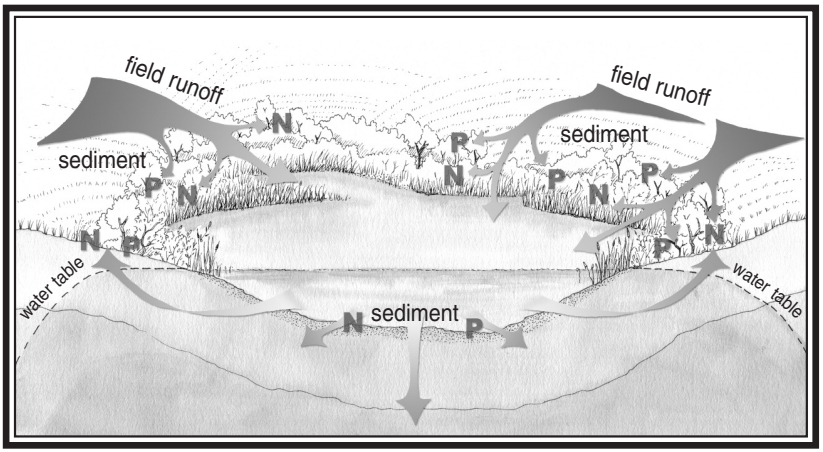


Figure 9: Nutrient filtration

Wetlands Increase Soil Moisture and Recharge Groundwater

Wetlands are hydraulically connected to shallow groundwater (the water table). Water infiltrates into shallow groundwater from recharge wetlands. Small amounts of water also reach the deep groundwater.

- Riparian plants transpire ("exhale") water, causing or increasing hydraulic pressure that draws groundwater closer to their roots and the surface; this pulls water from the wetland to outer riparian and upland soils via horizontal groundwater flow, creating sub-irrigation and increasing moisture for crops. Crops on uplands can draw ground-water from up to 2 m depth.
- Fallowing fields may cause shallow groundwater to move toward the wetland, away from the upland, because there is little or no hydraulic pressure in the field.
- Direction and quantity of water movement varies as hydraulic pressure from plants changes, with more movement in spring/summer (towards the upland), and less movement in fall (towards the wetland).
- Shrubs and broad-leaved plants can draw water from up to 2 m below surface; trees can draw water from up to a 14 m depth.
- Riparian plants trap snow and slow runoff, increasing available surface water.

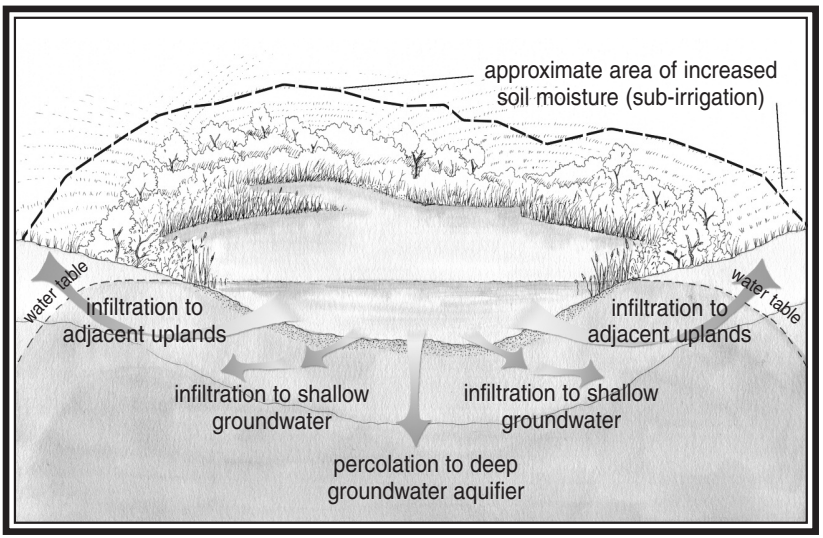


Figure 10: Groundwater recharge

Wetland have Economic Value

- Wetlands are particularly valuable for livestock shelter and forage.
- Field research suggests it may be more costly to drain and crop wetlands than to keep them intact. Contact Cows and Fish for more information.
- The sum of ecological, recreational and flood control benefits of wetlands are much greater than the small potential returns from draining and cropping them.

Some Basics of Riparian Health Assessment

No one characteristic can provide a complete picture of riparian site health or health trend. Riparian health assessment knits together several key health characteristics, including vegetative (plants) and physical (soils and hydrology) features. The assessment relies heavily on vegetation characteristics because they reflect and interact with the effects of soils and hydrology that form, and operate in, riparian areas. Plants and their characteristics are seen and interpreted more easily than those for soils and hydrology, providing you with an early indication of riparian health, helping you to understand the successional trend on the site.

The types of plants present on a site provides some insight into:

- whether there is a trend toward or away from the potential of the site;
- the utilisation rates of certain types of vegetation that are key to riparian function (e.g. woody plants); and
- the effectiveness of the vegetation in performing the key ecological functions of riparian areas.

In addition to vegetative features, riparian health assessment also considers physical factors for both ecological and management reasons. Changes in soils or hydrology can have significant effects on riparian function and may be more difficult to remedy than changes in vegetation.

Examples include:

- extensive artificial removal of water will lower the water table, shrink the size of the riparian area, change the vegetation to drier or upland types, and reduce forage and shelter values;
- chronic overuse and removal of vegetation that creates bare soil reduces the site's ability to trap sediment, build soil and protect soil from erosion; and
- trampling and compaction reduces moisture-holding capacity and storage ability in the soil profile.

There is an interrelationship between physical and vegetative features. Reaches with significant hydrological and soil changes will likely show changes in plant community structure and potential. Changes in vegetation, the "glue" of riparian systems, may have a rebounding effect on hydrologic and soil features.

The health of a riparian reach is a function or a result of what has or is happening in the upland, and/or on the adjacent riparian area. Sometimes health can be affected by what occurs at a distance too. Health can often be linked directly to current management on the site or the effects of previous management.Sometimes there may already be clues to problems:

- many invasive species or disturbance species;
- low forage production;
- shelter and habitat declining;
- many eroding, slumping banks;
- extensive bare soil; and,
- few fish or wildlife present

Riparian health assessment puts these observations into a format that allows you to understand the significance of the site changes and to measure the condition of the reach against a standard. This is what your doctor does when you have a check-up.

Riparian health assessment gets you to focus your observations and measure 9 parameters on the reach you've selected. The observations and measurements you will make relate to the ability of the reach to perform key ecological functions that translate to health.

Limitations of Riparian Health Assessment

Riparian health assessment balances the need for a simple, quick and easily-taught index of health against the reality of a complex landscape with many variable situations (management and environment). This approach may not work perfectly every time, and it requires some practice to become proficient. In most cases, it provides a reasonably accurate and repeatable measure of riparian health. With training, you can use this tool to help you pursue sound management decisions.

Riparian health assessment is not designed for an in-depth and comprehensive analysis and investigation of ecological processes and issues. Riparian health assessment may provide the first step in clarifying whether an issue or problem exists and in identifying areas of concern. The next step, Riparian Health Inventory, involves more measurements, taken in greater detail. It is often used at a drainage or watershed scale to provide a more comprehensive analysis of riparian function.

Riparian health assessment does not directly measure fish production, wildlife habitat, forage produced, water quality or other goods, products and benefits of healthy, functioning riparian areas. It does follow, though, that impaired riparian area function results in decreased potential of the site to produce these items. Assessment is an indirect method of determining the potential of the site. Riparian Health Inventory, a more detailed measuring stick, does allow a relationship to be established between health and some aspects of riparian area benefits and values. Refer to Table 5 to see the differences between "Assessment" and "Inventory".

Avoid making comparisons using the assessment method with lakes, or wetlands of different types, different sizes, or from outside the immediate locality or watershed. Appropriate comparisons using this method can be made between reaches of one lake, between adjacent wetlands of similar size and type, and between repeated assessments at the same site.

A single riparian health assessment provides a rating at only one point in time

Like a health check-up for us, once may not be enough. A single assessment cannot define the absolute status of site health or reliably indicate trend (whether the site is improving, degrading or stable), but it may provide a warning signal. To monitor trend and to account for the range of variation possible on a site, health assessments should be repeated, in subsequent years, at the same location, at the same time of year.

There is no simple way to measure some changes to riparian area health, even though these may be obvious and visible. These changes may result from problems that exist elsewhere in the drainage or in the watershed and are not part of the site being assessed. However, the effect of these distant impacts on the health rating of the site may be negative and result from:

- excessive amounts of sediment, deposited on the substrate (bottom) of the waterbody or dumped on the shore/banks;
- diversion or removal of water in upstream areas, or directly from the waterbody;
- addition of water to the lake, slough or wetland;
- changes in flow into or out of the waterbody (timing of flow, duration of flooding or high water, higher peak flows, lower volumes) resulting from damming, major modification to vegetation cover, drainage or road networks; and
- extreme flooding or overfilling from greater than normal precipitation or fast snowmelt.

Watershed scale evaluations, using the Riparian Health Invent-ory, instream flow assessment and water level monitoring may be required to analyse these effects.

Table 5: Assessment vs Inventory: What's the difference?

ASSESSMENT	INVENTORY
• Understanding the basic pieces of riparian areas	• Measuring, analysing and recording; detecting ecological problems, diagnosing them and decision making
• Most useful at the site level	• Useful at the site, drainage and watershed level
• 9 questions or parameters evaluated	• 9 questions or parameters evaluated
• Minimal training and experience required	• Significant training, background and experience required for proficiency
• A first step; overview, initial or preliminary impression of condition	• Comprehensive measurement and evaluation
• Quick and relatively easyto grasp; useful for awareness and education	• More time required for measurement and analysis; uses include problem diagnoses, management decisions, monitoring and watershed scale evaluations
• Identify and stratify reaches for inventory	• Detailed measurements to determine watershed condition, aid in preparation of management plans and monitoring
• Assess current condition	• Measures current condition and evaluates site potential; identifies the current plant community and the successional pathway with current management

Why Develop Riparian Health Assessment?

Riparian areas are the focus of attention, because of their agricultural benefits, the biodiversity values they represent and for concerns about water quality. Some riparian areas have declined in their ability to perform the ecological functions that relate directly to these benefits and values. Often, the health of these valuable landscapes has changed over time, even though that decline isn't readily apparent. We need to understand the current status of riparian areas to improve or maintain their health. The first step is to determine the condition or health of the site. Once we know the health of a site, we have a mechanism to link management actions to improving or maintaining ecological function.

Some History and Uses

In response to many concerns in the United States, the University of Montana, through the Riparian and Wetland Research Program, devised a system to survey and measure the overall health or condition of a riparian site. Many scientific disciplines participated to determine what the key ecological functions of riparian areas were and how these could be measured with a relatively quick and easy assessment technique. This method was initially used to evaluate riparian health on approximately 8,000 km of rivers and streams in Montana, Idaho, Wyoming, North Dakota and South Dakota. The testing and refinement of the method was expanded to include Alberta, British Columbia and Saskatchewan. With this experience, the method has evolved into the present riparian health assessment. The following methodology has been adopted from a workbook produced by the Cows and Fish Program in Alberta, with the original method concept developed by Dr. Paul Hansen and William Thomson of Montana. It includes riparian situations found in Saskatchewan, but may be useful for other areas.

There are four equally important purposes behind the development and use of a riparian health assessment:

- Riparian health assessment is a standard method to allow landowners, land/resource managers and others to quickly assess current health, and to identify the presence, scale and magnitude of issues and problems.
- It can be repeated, over time, to monitor changes that may result from natural variation or management actions and choices.
- It can be a catalyst to begin thinking about management changes to correct declines in riparian health or to verify and continue management that maintains health.
- It is an educational tool, to allow those who use, manage and value riparian areas to better understand key functions, identify a way to measure those functions and to serve as a vehicle for better communications among riparian users.

Photo courtesy of Tom Harrison

Figure 11: Unhealthy wetland

Notes:

HOW TO ASSESS RIPARIAN HEALTH

When to Do Your Assessment

- When plants are in the growth phase and can be identified (June, July, August and September).
- When water levels are close to normal - assessments should not be done during peak spring run-off or immediately after a major storm that increases water levels.
- If repeating an assessment on a site or monitoring a site for changes, complete follow-up assessments at the same time of year.
- If the management regime includes grazing, to be consistent, either do your assessment before or after grazing use.

Pick Your Site

Start by walking or riding the length of shore you want to assess. This will give you the opportunity to make observations and choose sites to assess health. You will be assessing a **reach** - a stretch of shore with its width determined by the extent of the riparian area (from open water to the upland) and with length based on a number of selection criteria (see below). If time is available, or the wetland or lake is small, you might want to consider assessing the entire shore length. If time and distance are impediments, you have a couple of choices:

- pick a "critical" site, one that may be sensitive, or already has some specific problems, for assessment; or
- choose a "representative" site that is typical of a much longer stretch of shore and that will provide an overall impression of health.

To select a site that is representative, become familiar with the entire length of shore and riparian area. What you are picking is a short reach that will represent the average condition of a longer stretch of shoreline. Vegetation, use/utilization, shore and bank characteristics and slope in the representative reach should all reflect what is found in and is common to a longer reach. If there is too much variation, divide the shore into units that differ and then select a representative piece from each different unit and do separate assessments.

Table 6: The reasons for picking either or both critical and representative reaches may include:

CRITICAL	REPRESENTATIVE
• Problem spots indicating management concern	• Overall impression or average of riparian condition for a long stretch of shore
• Sensitive areas, including key habitats for plants, fish or wildlife	• Broader measurement of management actions or choices
• Places that may respond to management change quickly	• Broader measurement of vegetation characteristics, especially key indicators like woody vegetation, weeds or disturbance species
• Shorter reaches, easy to monitor	• Longer reaches for more comprehensive monitoring

It may be useful to assess both critical and representative reaches to understand both the strengths and weaknesses of a stretch of shore.

Identify a Reach to Assess

A site is a spot on the ground to begin from; **a reach has length and width. A reach is the place to start pacing over, to measure and to complete a health assessment.**

Reach length

The first step is to determine the length of the reach. For measurements on small bodies of water and wetlands, the length of the reach may include the entire shore and riparian area around that system. For large bodies of water and wetlands it may be necessary to divide the shore into separate lengths or select a representative length (see previous page). To select a reach length that is representative of the entire shore, choose a site that is typical of the topography, vegetation and soils within the riparian area and the water and wind action on the shore (eg. bays versus points). A good rule of thumb is to assess a **minimum of 200 m** of shore length. If your property is less than 200 m in length, for example a lakeshore cottage lot, complete an assessment on the full length of your property. If you have a small wetland or slough, you should assess the entire waterbody.

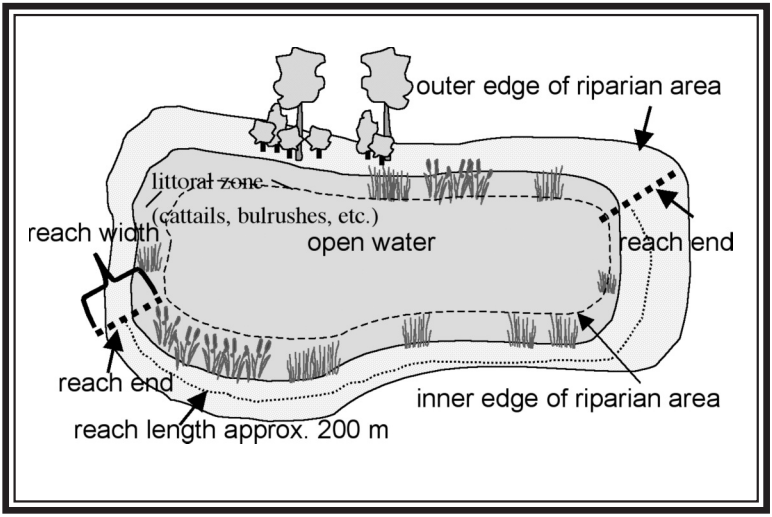


Figure 12: How to identify a reach

If you have defined your reach as "critical", a length should be picked that is appropriate to what you want to assess.

Reach width

The next step is to determine riparian area width, within the reach length. The area to be assessed starts at the open water and includes the portion of the aquatic area where persistent emergent vegetation (plants growing up through the water such as cattails, bulrushes and sedges) exists (these plants may go out to 2 m deep water). This forms the inner edge of the riparian area. For those situations where there is no emergent vegetation, the aquatic area is not included in the assessment.

Lakes and wetlands that go dry or have receding water levels still have riparian areas and the lake/wetland basin may remain unvegetated after the water is gone. This non-vegetated area is included in the measurements; make all the same observations. Vegetation may also have been removed by human causes (eg. grazing, mowing, logging, cultivation or construction) and these areas are also included.

That's the easy part; now you have to find the outer edge of the riparian area. Review the definition of "riparian area" on page 9 and Figure 1. The outer boundary of the riparian area exists where:

- vegetation changes from plants responding to or requiring abundant water to drier, upland types;
- topographic change like terraces or banks that signal a clear line between the greener, lusher or denser vegetation of the riparian area and the upland;
- old terraces or banks exist that show movement patterns of water levels and may (but not always) indicate a high groundwater table and;
- past or near where flood water reaches seasonally, or on a regular basis, as high water breaks out of the lake/wetland basin.

A combination of vegetation changes, topographic breaks and water/flood evidence (or local knowledge of flooding extent) will help you find the edge. The area between the aquatic and terrestrial zones will have vegetation dominated by water loving plants or plants that respond well to abundant moisture, the aquatic area will generally have emergent vegetation (eg. cattails, bulrushes). If you are unsure of where riparian ends and upland starts, it is better to overestimate the width or extent of the riparian area than to underestimate it. Figure 13 will help you find the outer edge of the riparian area.

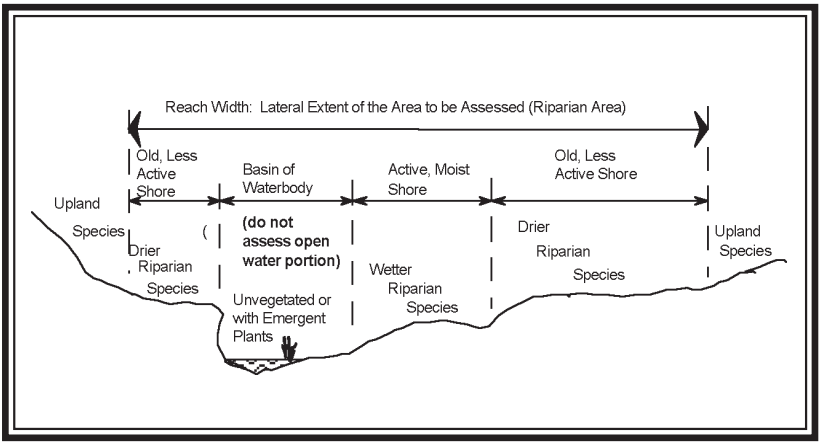


Figure 13: The width of a riparian area

Reach tips

Assessments generally should not cross fences, property lines, roads or areas with different management. If the shoreline to be assessed crosses more than one management unit (eg. pasture or property line), at least one reach should be assessed in each unit. Fences, roads and sometimes trails exert a strong influence on livestock movement, grazing patterns and other traffic (eg. people and off-highway vehicles). To eliminate this bias, try to locate your reaches at least 75 m (250 ft.) from the influence of a fence or a road. An exception to this might occur where holdings are small, roads or trails are throughout the length of your reach or where there are many fences, because these factors could also exert a major influence on overall riparian health. In these situations you may want to measure the effect or influence of fences and roads on riparian condition and your reach selection will be done with this in mind.

Before you start to do an assessment, make sure to include a site description of the reach length boundaries under "site description" on your field sheet. Next year, or in a few years time, you may not be able to find them if you haven't penned a reminder to yourself. Link them with some visible landmark or measure the distance to them from that landmark. You might want to put in a couple of fence posts, rebar pounded flush with the ground or some other easily relocated item. Keep in mind that shorelines migrate and change. Your memory of the locations may be imperfect. Take a photograph to help jog your memory in the future and remind you of the visible signs of health present today.

GETTING STARTED

There are 9 questions to answer that relate to components or factors of the riparian reach you have selected. Many deal with the element of "coverage", that is, how much of the reach area is covered by vegetation or structural impacts. The categories to choose from are expressed in percentages of the reach area. Start by pacing off the length and width of the reach (excluding the open water/aquatic part but including the area with emergent vegetation). Calculate the area. Now you have some context to determine coverage for many of the questions (eg. 10 m^2 of tree seedlings in a 1,000 m^2 reach equals 1% coverage). As you become more practiced you can use the cover class standards in Figure 14.

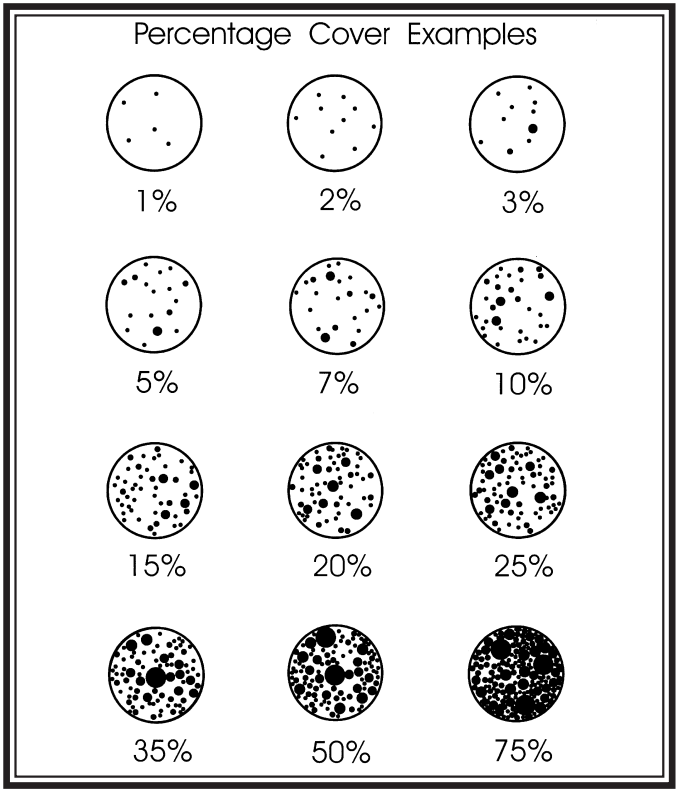


Figure 14: Cover class standards for judging vegetation canopy cover and bare soil

Most of the factors rated in this assessment are based on measurements using your eyes and your judgement. It may seem imprecise but with practice this method is repeatable and reasonably accurate. Extreme precision is not required for riparian health assessment since we are not attempting to determine an absolute value, only a broad impression of health. However, practice and training are invaluable to ensure consistency and appropriate use of the method.

RIPARIAN HINTS

Tuning your eye

- Riparian Health Assessment is about tuning your eye to see what pieces might be missing from a riparian system.
- It gets you beyond "if it's green, it's good".
- It helps you understand the pieces - how they fit together and how to rate the key pieces of the riparian area.

The maximum possible scores vary between the factors. This weighting system between the factors measured reflects the:

- relative importance of the factor;
- influence on or relationship to other factors; and
- significance of the factor to an ecological function or functions.

Things You Will Face

Move around
Don't stand in one place to do the assessment. You will need to move around the entire reach, evaluating factors and mentally accumulating observations that you will then sum up. If you stand in one spot you will end up with an assessment of only what you observed in a narrow sphere around you. This may not give you an accurate, unbiased assessment for the reach.

Consider riparian functions
If a question on a particular reach perplexes you, go back and reconsider "Riparian Functions". Ask yourself if the factor measured is contributing to ecological function. An example might be a site covered with weeds or disturbance species. Are these plants present on the reach during high water to dissipate wave energy and trap sediment? Do these plants have the type of root systems that are deep and that bind shore materials together? If the answer is no, then these plants do not contribute to ecological function and you should rate the site low for these categories.

Should it have wood or not?
Some questions on the assessment will not apply on all reaches. Reaches without the potential for woody species (trees and shrubs) will not be rated on factors involving regeneration or utilization. On some prairie systems, on wet meadows with saturated soils, on severely disturbed riparian areas and on reaches with a history of chronic overuse, vegetation potential can be difficult to deter mine. To determine vegetation potential, where it is not immediately evident, you can:

- use the Classification and Management of Riparian and Wetland sites;

- observe vegetation present outside of the reach in the adjacent riparian areas or search for stumps, snags or roots remaining on the site;
- consider vegetation present on similar reaches of nearby lakes, sloughs or wetlands in the area;
- use archival photographs or pictures in family albums that indicate vegetation presence in previous times; and
- ask the elders of the community for their memories of woody species.

If, at the end of this evaluation, you conclude the reach has no potential for tree and shrub growth, eliminate questions 4 and 5 and readjust the maximum possible total score accordingly. If the site does have potential, but no woody species are currently present, answer question 4 but eliminate question 5.

Other considerations and observations

- No measurement system can capture all of the variation you are likely to encounter, nor will the categories in the questions exactly resemble what you see on the lake or wetland. You will have to select the answer you think is the closest, or the best fit, for the condition you observe.
- Because there is a spread between the scores you may be tempted to pick a number that reflects an average. The only choices for scores are those indicated. Make your best estimate and enter the value in the "actual" column of the Field Sheet.
- You must consider only the conditions that you observe at the time of the assessment. Don't guess on what conditions might have been previous to the assessment or speculate on future conditions.

- Don't stop when you've completed the scores. Make observations in the "Comments" section. Use the comments section to:
  - expand on the information and measurements, especially if you are considering making management changes;
  - describe the reach in some detail and provide some characteristics of the vegetation types or plant distribution, especially weeds;
  - note your impressions of grazing, cultivation, recreational and wildlife use, fish and/or wildlife observations and water clarity and levels;
  - summarize the flood or water level history of the reach, making note of time of high water and when the last major flood occurred;
  - note the vulnerability or sensitivity of some sites or reaches; and
  - make note of things happening outside the reach or beyond the riparian area, especially land uses that contribute to current condition or could affect future condition.

Take a photograph that captures the condition of the reach at the time of your evaluation. Include, in that photograph, a recognizable landmark that will allow you to retake the photograph in subsequent years. You may also want to take photographs at each end of the reach to help you identify these end locations later.

These observations can help you relate current condition to management, especially as you track reach health over time.

Notes:

RIPARIAN HEALTH ASSESSMENT QUESTIONS (1-9)

1. How Much of the Riparian Area is Covered by Vegetation?

Vegetation cover of the riparian area

Vegetation reduces the erosive forces of raindrop impacts and the velocity of water moving over the shore or along the shore and banks. Vegetation cover also:

- traps sediment and stabilizes shore and banks;
- absorbs and recycles nutrients;
- reduces the rate of evaporation; and
- provides shelter and forage values.

Vegetation cover is visually estimated using the canopy cover method. Use Figures 15-17 to help you estimate canopy cover on the reach.

Note: Exposed shoreline or lake bed and sediment deposited on the reach are considered "bare ground".

Scoring:

6 = More than 95% of the reach soil surface is covered by plant growth (less than 5% bare soil).

4 = 85% to 95% of the reach soil surface is covered by plant growth (5-15% bare soil).

2 = 75% to 85% of the reach soil surface is covered by plant growth (15-25% bare soil).

0 = Less than 75% of the reach soil surface is covered by plant growth (greater than 25% bare soil).

Scoring Tip 1: Vegetation cover includes all standing, rooted plants (live or dead). Do not include litter or downed wood as vegetation cover.

Scoring Tip 2: Do not consider the area of the reach covered by water, such as the water between cattail plants.

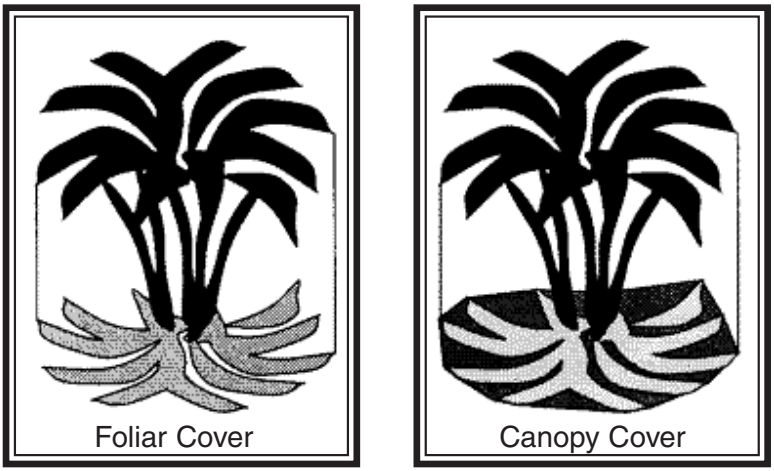


Figure 15: Foliar versus canopy cover

Imagine a line drawn about the leaf tips of the undisturbed canopies and project that coverage onto the ground. This projection is considered "canopy coverage".

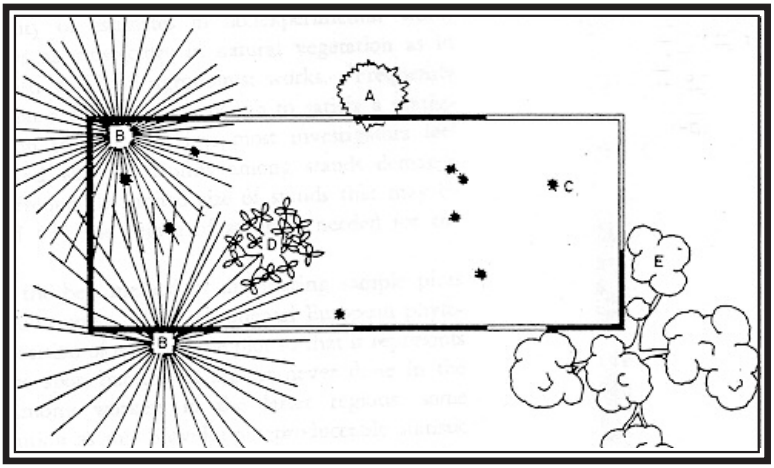


Figure 16: Estimation of vegetation canopy cover

Vegetation canopy cover is estimated for the riparian reach, in much the same way as for this plot frame. Imagine that you are observing the reach from above and estimate the vegetation canopy cover for all plant species combined. What percentage of the stream reach is covered by plant growth?

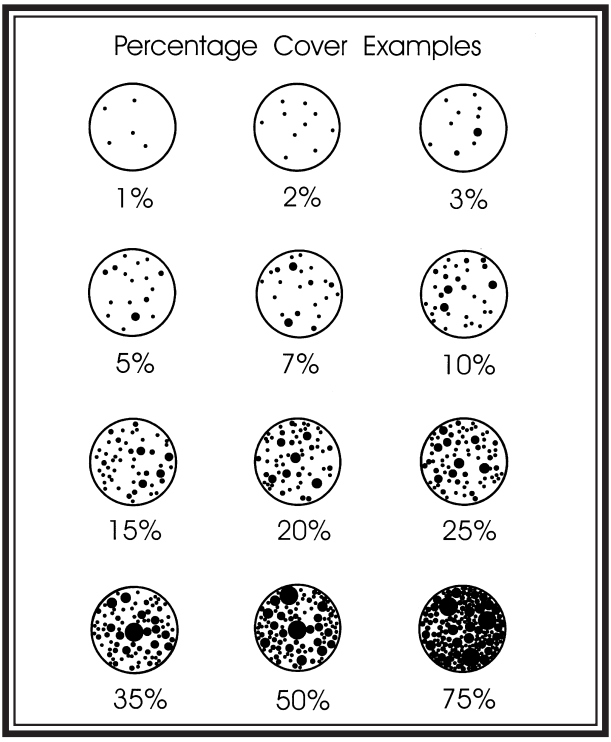


Figure 17: Cover standards from 1 t0 75% cover

RIPARIAN HINTS

Vegetation canopy protects soil

- Like a tent or umbrella, vegetation canopy protects streambanks and soil from the erosive impact of raindrops.
- It takes a lot of trees and shrubs to create this canopy over the ground.

2. How Much of the Riparian Area is Covered by Invasive Species?

Invasive species:

- Are often introduced, i.e. non-native.
- Are likely to cause economic and environmental harm.
- Indicate a degraded ecosystem and are a general threat to riparian areas.
- May contribute to some riparian functions, but their negative impacts reduce the overall health of the riparian area.
- See Appendix 1 for more information about invasive species.

a) Canopy cover

The term canopy cover is used here to describe the area of the reach that is invaded by invasive plants and which therefore may be of concern to managers.

Record the name and canopy cover of each invasive plant species present throughout the reach. See Table 8 and Figure 18 for examples of invasive plant species and Appendix 2 for a complete list.

Scoring:

3 = No invasive plants on the reach.

2 = Invasive plants are present with a total canopy cover of less than 1% of the reach.

1 = Invasive plants are present with a total canopy cover of 1-15% of the reach.

0 = Invasive plants are present with a total canopy cover of more than 15% of the reach.

b) Distribution pattern

Use Table 7 to evaluate the distribution of invasive species throughout the reach.

Record the name and distribution pattern of each invasive plant species present throughout the reach. See Table 8 and Figure 18 for examples of invasive plant species and Appendix 2 for a complete list.

Scoring:

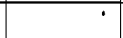
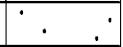
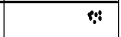
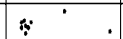
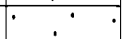
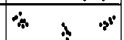
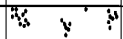
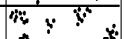
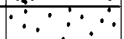
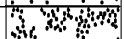
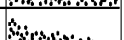
3 = No invasive plants on the reach.

2 = Invasive plants are present with a distribution pattern of 1-3.

1 = Invasive plants are present with a distribution pattern of 4-7.

0 = Invasive plants are present with a distribution pattern of 8 or higher.

Table 7: Score table of distribution patterns of invasive species

CLASS	DESCRIPTION OF ABUNDANCE	DISTRIBUTION PATTERN	SCORE
0	No invasive plants on the reach		3
1	Rare occurrence		2
2	A few sporadically occurring individual plants		
3	A single patch		
4	A single patch plus a few sporadically occurring plants		1
5	Several sporadically occurring plants		
6	A single patch plus several sporadically occurring plants		
7	A few patches		
8	A few patches plus several sporadically occurring plants		0
9	Several well spaced patches		
10	Continuous uniform occurrence of well spaced plants		
11	Continuous occurrence of plants with a few gaps in the distribution		
12	Continuous dense occurrence of plants		
13	Continuous occurrence of plants associated with a wetter or drier zone within the reach.		

Scoring Tip 1: All invasive species are considered collectively, not individually.

Scoring Tip 2: Refer to Appendix 2 for a list of riparian invasive species in Saskatchewan.

Table 8: Examples of invasive species (see Appendix 2 for a complete list)

Common name	Latin name
common burdock	*Arctium minus*
smooth brome grass	*Bromus inermis*
nodding thistle	*Carduus nutans*
Canada thistle	*Cirsium arvense*
Russian olive	*Elaeagnus angustifolia*
leafy spurge	*Euphorbia esula*
scentless chamomile	*Matricaria perforata*

Photo courtesy of Don Fontaine

Scentless chamomile

Photo courtesy of Don Fontaine

Leafy spurge

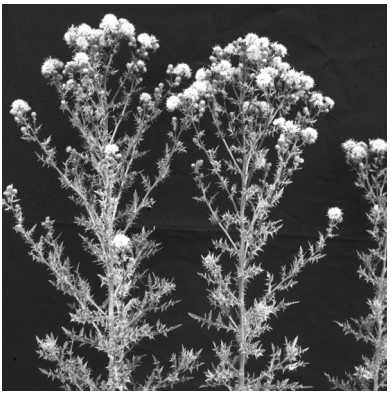


Photo courtesy of Steve Dewey, Utah State University, Bugwood.org

Canada thistle

Photo courtesy of Malin Hansen

Smooth brome

Figure 18: Examples of invasive species

RIPARIAN HINTS

What do invasive species tell us?

Invasive species normally provide a strong message about riparian health. Invasive species most often invade riparian areas where disturbance has resulted in available niche space such as bare soil or openings in the vegetation canopy. These micro-habitats are normally occupied by native plants, but are now available to invasive species due to over-grazing or some other land use or natural disturbance.

√ NO INVASIVE SPECIES
- Unable to establish, reach is well vegetated, no bare soil and no seed source

√ ONE INVASIVE SPECIES
- Potential for invasion, seeds are available

√ SEVERAL INVASIVE SPECIES
- Present threat for quick invasion
- Space is available for them to move in

√ MANY INVASIVE SPECIES
- System is degraded

3. How Much of the Riparian Area is Covered by Disturbance-caused Vegetation?

A large cover of disturbance-caused, undesirable herbaceous species, either native or introduced, indicates alteration of the normal plant community that would occur on the site.

- Like invasive species, disturbance-caused species are well adapted to an environment of continual stress, where the competitive advantage of better riparian species has been diminished.
- Their presence or abundance may indicate a long history of heavier grazing use.

These species may have some grazing value, but tend to:

- be shallow rooted and less productive; and
- have limited value for bank binding and erosion prevention, especially if they are annuals.

Invasive species considered in the previous question **are not** reconsidered here.

- See Table 9 and Figure 19 for examples of disturbance-caused, undesirable herbaceous species.
- The species list in Appendix 2 will help you identify disturbance-caused, undesirable herbaceous species.

Scoring:

3 = Less than 5% of the reach covered by disturbance caused undesirable herbaceous species.

2 = 5% to 25% of the reach covered by disturbance-caused undesirable herbaceous species.

1 = 25% to 45% of the reach covered by disturbance-caused undesirable herbaceous species.

0 = More than 45% of the reach covered by disturbance-caused undesirable herbaceous species.

Table 9: Examples of disturbance-caused, undesirable herbaceous species (see Appendix 2 for a complete list)

Common name	Latin name
quack grass	*Elytrigia repens*
foxtail barley	*Hordeum jubatum*
Kentucky bluegrass	*Poa pratensis*
perennial sow-thistle	*Sonchus arvensis*
commom dandelion	*Taraxacum officinale*
stinkweed	*Thlaspi arvense*
clovers	*Trifolium* spp.

RIPARIAN HINTS

What are disturbance-caused species?

- Plants which are absent, or present in low amounts, in undisturbed areas but that invade reaches with continuous use.

Why are they a concern?

- They do a poor job of binding the soil and preventing erosion.
- They show a history of overuse.

Photo courtesy of Malin Hansen

Foxtail barley

Photo courtesy of Steve Dewey, Utah State University, Bugwood.org

Perennial sow-thistle

Photo courtesy of Malin Hansen

Common dandelion

Photo courtesy of Dean Wm. Taylor

Kentucky blue grass

Figure 19: Examples of disturbance-caused undesirable herbaceous species

4. Is Woody Vegetation Present and Maintaining Itself?

Preferred tree and shrub establishment and regeneration

Most, but not all, riparian areas can support woody vegetation (trees and shrubs). Where trees and shrubs exist, they play an important role in riparian condition. Their root systems generally are excellent bank 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 play a role in modifying shorelines and stream valleys. A good indicator of 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.

Not all trees and shrubs are equally important, useful or desirable for maintaining ecological function. Several species of woody vegetation are excluded from this evaluation of establishment and regeneration. See Table 10 for a list of these species.

Why are they excluded?

- These species often reflect long-term disturbance of the reach.
- They tend to increase and predominate under long-term, heavier grazing pressure.
- There is rarely a problem in maintaining their presence on a reach.
- They are far more abundant on disturbance sites than are preferred woody species.
- Their abundance masks the ecological significance of the smaller amount of preferred species.

- They are generally small in height and have less shelter value.
- Their root systems may not be as capable of stabilizing banks and reducing erosion as those of preferred species.
- They are less palatable to browse users.
- In particular, for example, Russian olive and salt cedar are aggressive, invasive, undesirable non-native species.

For this question, first determine the total canopy cover of all preferred woody vegetation on the reach. Then estimate what percentage of the total canopy cover is composed of seedlings and saplings (the youngest age classes) following these guidelines:

For trees:

- consider seedlings to be up to 1.5 m (5 ft) tall with a stem diameter of up to 2.5 cm (1 in); and
- tree saplings could be greater than 1.5 m tall with a stem diameter up to 12.5 cm (5 in).

For shrubs:

- seedlings and saplings can be quite variable so consider relative heights to obvious mature plants; look for recent growth that is below your knee in height; these age classes will generally have stems less than the diameter of your thumb; they will be pliable compared with mature growth.

For woody plants in general:

- sometimes heavy browse use produces a plant with short stature; don't confuse these mature plants with seedling/sapling age classes; and
- growth and size of seedlings/saplings may be enhanced on some sites where growing conditions are ideal; look less at height and observe stem diameter and the pliable nature of the stems.

Scoring:

6 = More than 15% of the total canopy cover of preferred trees/shrubs is seedlings and saplings.

4 = 5% to 15% of the total canopy cover of preferred trees/shrubs is seedlings and saplings.

2 = Less than 5% of the total canopy cover of preferred trees/shrubs is seedlings and saplings.

0 = Preferred tree/shrub seedlings or saplings absent.

Scoring Tip 1: If you have established that the reach has no potential for preferred woody vegetation (see page 37-38), replace the actual score and possible score with N/A and readjust the total score accordingly.

Scoring Tip 2: It takes a lot of seedlings/saplings to equal the canopy of one mature tree or shrub.

Table 10: Do not include these species when evaluating a reach for regeneration

Common Name	Latin Name	Category
Snowberry/Buckbrush	*Symphoricarpos* spp.	Shrub
Rose	*Rosa* spp.	Shrub
Hawthorn	*Crataegus* spp.	Shrub
Shrubby cinquefoil	*Potentilla fruticosa*	Shrub
Russian olive	*Elaeagnus angustifolia*	Tree/Shrub
Tamarisk/Salt cedar	*Tamarix* spp.	Shrub
Caragana	*Caragana* spp.	Shrub
European/Common buckthorn	*Rhamnus cathartica*	Shrub

RIPARIAN HINTS

How to know if trees and shrubs belong here

- Use the Classification and Management of Riparian and Wetland Sites (2001) available online at www.swa.ca
- Look upstream or downstream at the next field or neighbouring property.
- Look at other similar stream reaches or streams nearby.
- Check for historical photos or in family albums.
- Ask the elders in the community for their memories of woody species.

Table 11: Examples of preferred trees and shrubs

Common Name	Latin Name	Category
Green alder	*Alnus crispa*	Shrub
Saskatoon	*Amelanchier alnifolia*	Shrub
Bog birch/dwarf birch	*Betula glandulosa*	Shrub
Birch	*Betula* spp.	Tree
Red osier dogwood	*Cornus stolonifera*	Shrub
Beaked hazelnut	*Corylus cornuta*	Shrub
Honeysuckle	*Lonicera* spp.	Shrub
Spruce	*Picea* spp.	Tree
Balsam poplar	*Populus balsamifera*	Tree
Cottonwood	*Populus deltoides*	Tree
Aspen	*Populus tremuloides*	Tree
Pin cherry	*Prunus pensylvanica*	Shrub
Chokecherry	*Prunus virginiana*	Shrub
Northern gooseberry	*Ribes oxyacanthoides*	Shrub
Wild red raspberry	*Rubus idaeus*	Shrub
Willows	*Salix* spp.	Shrub
Buffaloberry	*Shepherdia* spp.	Shrub
Common cranberry	*Vaccinium oxycoccus*	Shrub

5. Is Woody Vegetation Being Used?

Utilization of preferred trees and shrubs

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

- deplete root reserves;
- inhibit establishment and regeneration;

- lead to replacement by less desirable woody species;
- cause the loss of preferred woody species; and
- lead to invasion by disturbance-caused or invasive species.

Not all woody species are palatable or used by animals. Some species do not contribute significantly to riparian condition and stability although some utilization may occur. Other species may persist under high use but are not good indicators to evaluate the effect of utilization. These species are excluded from this evaluation of utilization. See Table 12 on the next page for a list of these species.

To establish the amount of utilization:

- first, randomly pick 2 to 3 plants of each of the preferred woody species found on the reach; (See Table 11 for a list of preferred woody species)
- for each plant, select a branch that would be available or accessible to browsing animals;
- count the total number of leaders (twigs) on the branch;
- now count only the older leaders (2nd year growth and older) that have been clipped off by browsing;
- determine the percentage of utilization by comparing the number of leaders browsed with the total number of leaders available on the branch; and
- do not count current year's use since an estimate in mid-season does not accurately reflect actual use, because browsing can continue year-round.

Scoring:

3 = None (0% to 5% of available second year and older leaders of preferred species are browsed).

2 = Light (5% to 25% of available second year and older leaders of preferred species are browsed - Figure 20).

1 = Moderate (25% to 50% of available second year and older leaders of preferred species are browsed - Figure 20).

0 = Heavy (more than 50% of available second year and older leaders of preferred species are browsed - Figure 20).

Scoring Tip 1: If you have established that the reach has no potential for preferred woody vegetation (see page 37-38), replace the actual score and possible score with N/A and readjust the total score accordingly.

Scoring Tip 2: Beaver or people may cut an entire tree or shrub. If beaver cut stems are encountered, measure these as "heavy" utilization.

Scoring Tip 3: Long-term heavy use by livestock may result in umbrella-shaped shrubs. Count those as heavy utilization.

Table 12: Woody species excluded for utilization evaluation

Common Name	Latin Name	Category
Snowberry/Buckbrush	*Symphoricarpos* spp.	Shrub
Rose	*Rosa* spp.	Shrub
Hawthorn	*Crataegus* spp.	Shrub
Shrubby cinquefoil	*Potentilla fruticosa*	Shrub
Russian olive	*Elaeagnus angustifolia*	Tree/Shrub
Tamarisk/Salt cedar	*Tamarix* spp.	Shrub
Caragana	*Caragana* spp.	Shrub
European/Common buckthorn	*Rhamnus cathartica*	Shrub

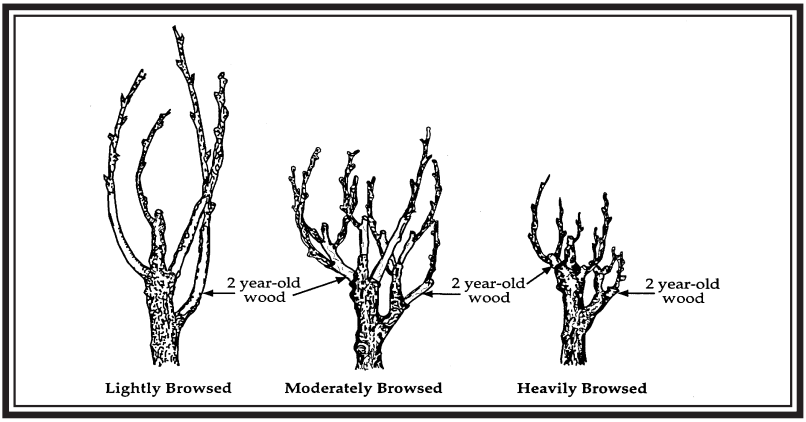


Figure 20: Browser utilization samples

RIPARIAN HINTS

Use affects woody plant vigour

- Light to moderate use helps plants maintain vigour
- Heavy use reduces vigour
- Long-term, heavy use eliminates the best woody plants

**** Like the old stockman's saying:***
"If you keep down the shoot, you kill the root."

6. How Much of the Riparian Area Vegetation Has Been Changed?

Human alteration of the vegetation

Vegetation in riparian areas is key to holding soils on the bank and shore together, limiting erosion. Stems, leaves and roots slow water down and reduce the erosive force from runoff or wave action, and in winter resist ice damage. Vegetation also filters water, reducing sediment or contaminants reaching the water. The plant community provides the basis for habitat, shelter and food for wild-life. If we modify the natural plant community, either by changing or replacing species or proportions of species present, we reduce or disrupt how the area can perform these functions.

Activities that may result in changes to the plant community composition include (but are not limited to): clearing, home/yard development, creation of lawns, seeding of tame species, timber harvest, heavy grazing over many years, and recreational traffic or activities leading to removal of vegetation.

Changes in the vegetation or plant community included in this question are long-term or permanent changes, such as:

- Loss or change of plant community structural layers, for example:
  - shrubs may be missing in a plant community that would normally have trees, shrubs, grasses and forbs.
  - tall shrubs may be missing in a plant community that normally would have tall and short shrubs, grasses and forbs.
  - tall herbaceous species (grasses and forbs) may be missing in a plant community that normally would have tall, medium and short grasses and forbs.
- Native plants being replaced by non-native plants.
- Loss of species diversity, with only a few species remaining.
- Changing community composition (eg. replacing willows with buckbrush).
- Changing proportions of species (eg. native wild-flowers have increased and cover areas previously covered by native grasses).
- Complete removal of vegetation (eg. clearing of cattails from the near shore area).

Transient or short term removal that does not lead to altered plant community composition **is not** included in this question.

Scoring:

6 = Less than 5% of the reach vegetation is altered by human activity.

4 = 5% to 15% of the reach vegetation is altered by human activity.

2 = 15% to 35% of the reach vegetation is altered by human activity.

0 = 35% or more of the reach vegetation is altered by human activity.

Scoring Tip 1: Remember to include the area out to 2 m deep water if you have emergent plants (eg. cattails or bulrushes), or if the site should have them, but they have been removed.

Scoring Tip 2: Do not count the same area for vegetation alteration and physical alteration (Question 7) unless there are clearly both vegetation changes and structural changes to the bank or shore. Eg. If all the trees are cut down, it is vegetation change; if the ground is bulldozed to remove roots, then it is both vegetation and physical alteration.

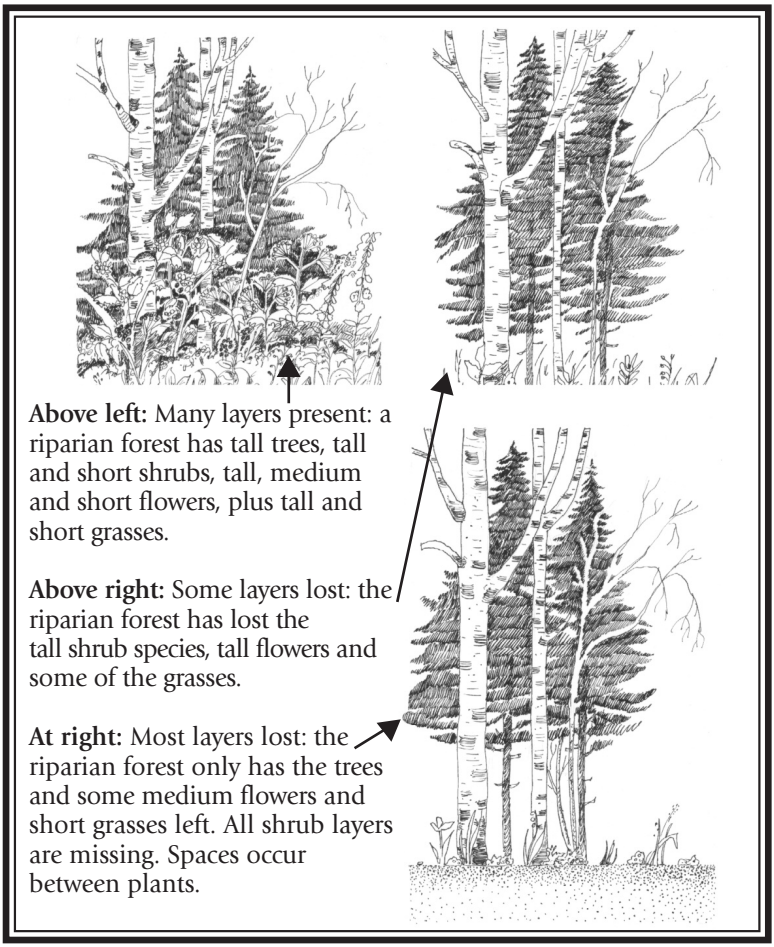


Figure 21: What does change in the plant community look like?

Changes to plant communities include losses of certain layers or group of species, and reducing or increasing the proportion of some species compared to other species.

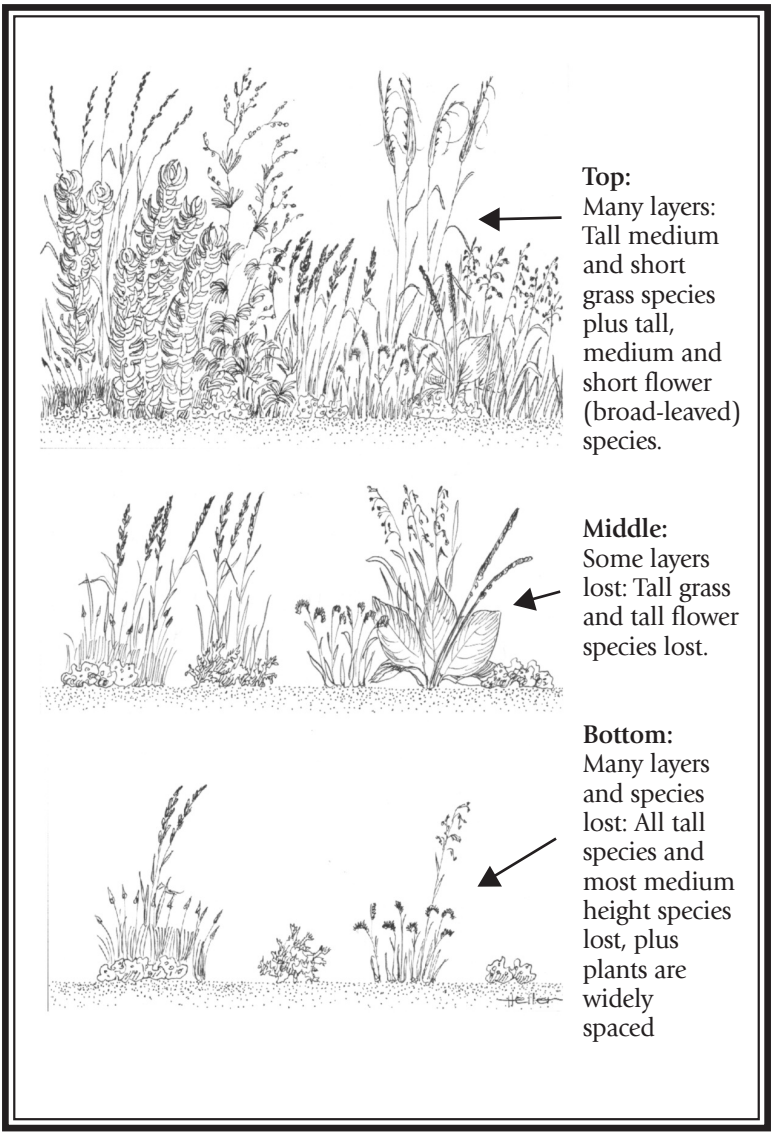


Figure 22: Changes to a riparian plant communirty without trees may be less obvious, but are still important.

7. How Much of the Shore and Bank Has Been Physically Changed?

Human alteration of the riparian physical site

Changes in shore and bank shape, contour, and soil structure due to human activities will alter infiltration of water, increase soil compaction, and change the amount of sediment naturally contributed to the waterbody. These physical changes reduce the water-holding capacity of the soil, thus impacting storage of water and aquifer recharge. Filtration and nutrient uptake, shore and bank maintenance, and primary productivity may all be altered as a result of physical changes.

Scoring:

12 = Less than 5% of the reach has been physically altered by human activity.

8 = 5% to 15% of the reach has been physically altered by human activity.

4 = 15% to 35% of the reach has been physically altered by human activity.

0 = 35% or more of the reach has been physically altered by human activity.

Examples of physical changes included in this question:

- hummocking and pugging by livestock (pugs are the depressions large animal hooves leave in soft soil; hummocks are the raised humps of soil 15 cm (6 in) or higher that result from the soil pushed up from the pug);
- rutting: compacted trails or ruts (ruts are usually 5 cm [2″] or greater) from people, vehicles or livestock (ruts or trails are compacted and compressed soils);
- roads, bridges, pipeline crossings, docks, boat launches or other types of construction and development;

- landscaping and reshaping of bank/shore, including use of riprap, sand or other materials; and
- clearing of vegetation that modifies shore or bank structure/shape.

Scoring Tip 1: Remember to examine the area out to 2 m deep water if you have emergent plants (eg. cattails or bulrushes), or if the site should have them, but they have been removed.

Scoring Tip 2: Do not count the same area for vegetation alteration (Question 6) and physical alteration unless there are clearly both vegetation changes and physical changes to the bank or shore.

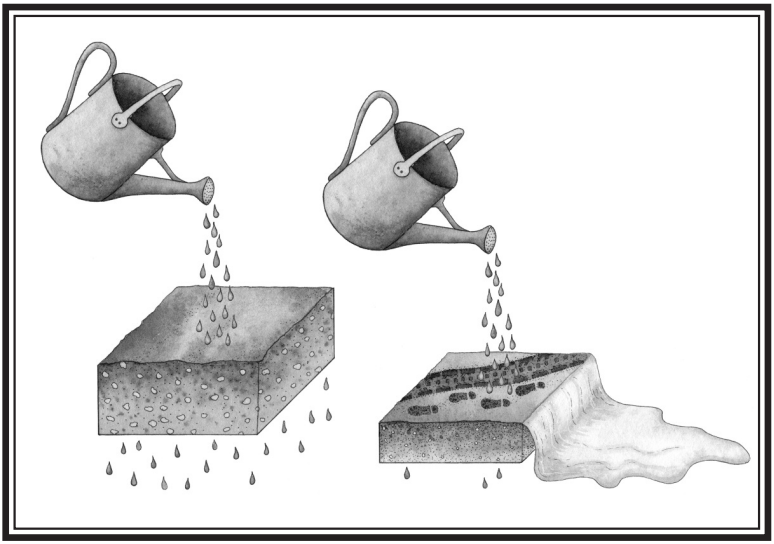


Figure 23: Soil is similar to a sponge in that compacting and compressing reduces the amount of water that soaks in.

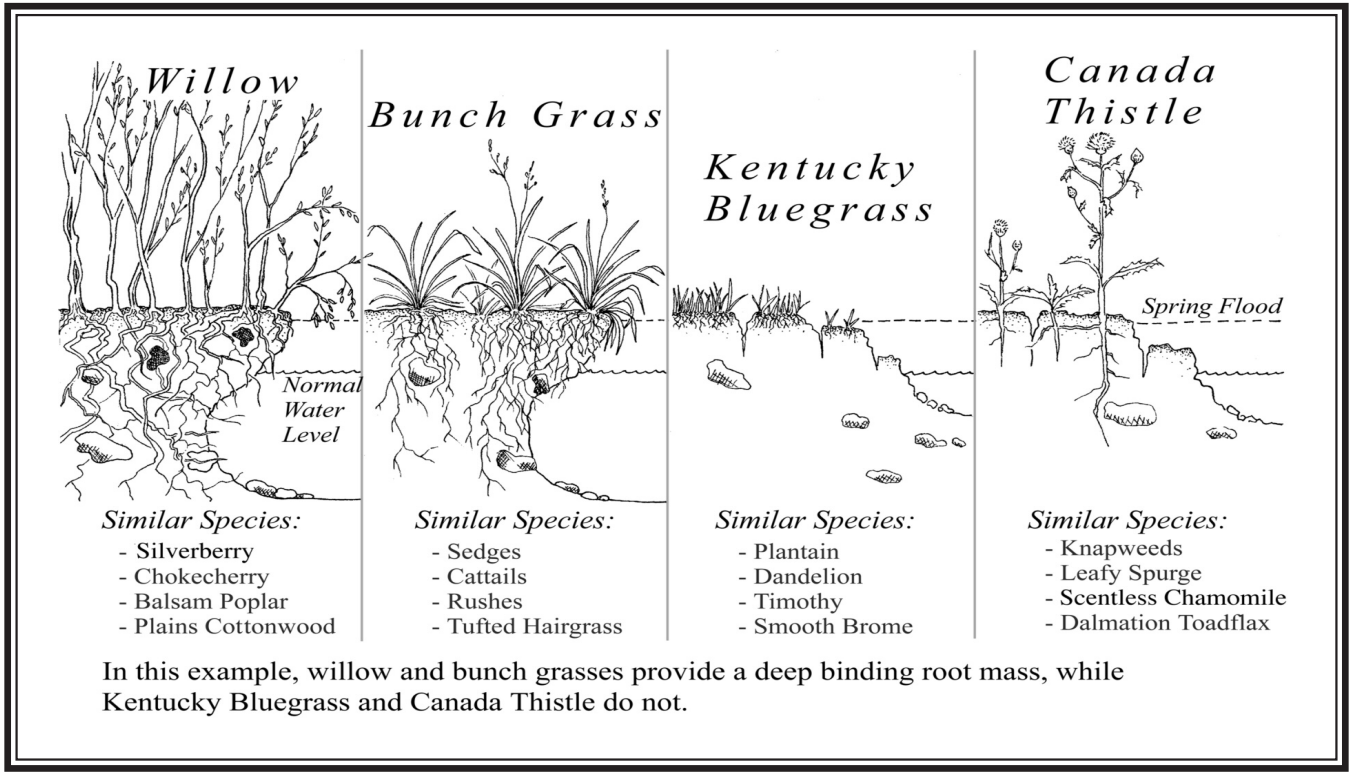


Figure 24: Belowground attributes of bank and shore vegetation

8. How Much of the Riparian Area Has Bare Ground Caused by Human Activity?

Human-caused bare ground

Soil not covered by plants, litter or duff, downed wood or rocks larger than 6 cm (2.5 in) is considered bare ground. Bare ground is unprotected soil that is capable of being eroded by rain drops, overland flow or wind. Bare ground can exist under a tree or shrub canopy and still be subject to erosion from overland flow. It represents an opportunity for erosion and invasion by disturbance or weed species.

- Significant bare ground caused by human activity indicates a deterioration of riparian health.
- Bare ground resulting from natural events or processes, including erosion, deposition, landslides, wildlife, salinity/alkalinity, and drought is excluded from this question.
- Human land uses causing bare ground may include livestock grazing, cultivation, recreation, development, roads/trails, timber harvest and industrial activities.

Consider the entire riparian reach in this question. Estimate, looking down from your eye level, what percentage of the reach has human-caused bare ground using the cover standards illustration on the next page as a guide.

Scoring:

6 = Less than 1% of the reach is human-caused bare ground.

4 = 1% to 5% of the reach is human-caused bare ground.

2 = 5% to 15% of the reach is human-caused bare ground.

0 = More than 15% of the reach is human-caused bare ground.

Scoring Tip: DO NOT include hardened, impervious surfaces (eg. asphalt, concrete); they will not erode or provide invasive species an opportunity to grow. They will alter the score when considering Question 1 vegetation cover (which they are not).

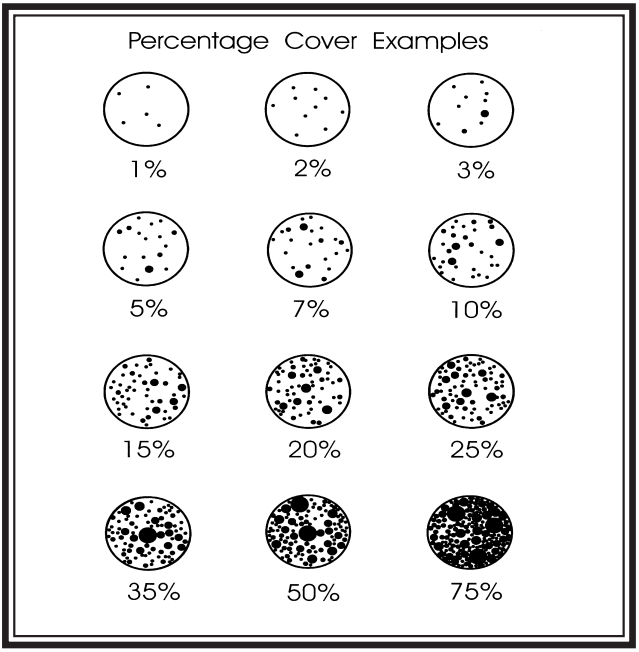


Figure 25: Cover standards for estimating percent bare ground

RIPARIAN HINTS

Estimating human-caused bare ground

- Vegetation canopy and bare ground measurements are interrelated. Before judging bare ground, go back and check your vegetation canopy estimate (see Question 1). Example: High vegetation canopy means low bare ground and low vegetation canopy may mean high bare ground.
- Does human-caused bare ground include recently exposed soil due to drought? **NO.**

9. Has the Water Level Been Artificially Modified?

Degree of artificial withdrawal or raising of water level

Lakes, wetlands and sloughs have naturally fluctuating water levels, both between different times of the year, and between years. Humans sometimes remove water, changing the timing or degree of fluctuation, which can inhibit maintenance of healthy riparian plant communities. In extreme cases, this may result in extensive areas of exposed shore, providing opportunities for weeds, increasing erosion, and preventing establishment and maintenance of native plant communities.

Artificially raising water levels, through drainage of other areas into the waterbody, or weirs and control structures, preventing release of water may result in flooding or prevent the normal timing and scale of natural fluctuations.

Look for signs of drainage, pumping, diversion, or other means by which water may be added or removed from the lake or wetland. Consider the scale of the waterbody in relation to the scale of addition or removal. For example creating a drainage ditch from a shallow 1 ha (2 acre) slough may quickly result in significant removal of water, whereas a ditch of the same size and slope will have a much smaller impact on a lake 10 km (6 mi) in diameter.

Scoring:

9 = The waterbody is not subjected to artificial water level change.

6 = The degree of artificial water level change is minor.

3 = The degree of artificial water level change is moderate.

0 = The degree of artificial water level change is extreme.

Scoring Tip 1: If you are cannot assess this question with reasonable certainty, it is better to not answer it and remove the question from the total score.

Scoring Tip 2: In wetlands that do not have surface water (standing water) normally, their water table may be altered by artificial means-look for drainage ditches or changes in normal drainage patterns.

Table 13: Effects resulting from artificial water level changes

Severity of artificial water level change	
Not Subjected	The waterbody or wetland is not subjected to artificial water level change
Minor	The waterbody or wetland is subject to no more than minor artificial water level change. The shore area remains vegetated, and withdrawal of water is limited or slow enough that vegetation is able to maintain growth and prevent exposed soil. A relatively narrow band affected by the water level fluctuation may support only annual plants.
Moderate	The waterbody or wetland is subject to moderate quantities, speed and/or frequency of water level change. Where water is removed, some pioneer plants are able to vegetate at least half of the exposed area resulting from drawdown. Where water is added, some flooding may occur at levels or times not typical to the area/season.
Extreme	The waterbody or wetland is subjected to extreme changes in water level due to the volume (extent), speed and/or frequency of water addition or removal. Frequent or unnatural levels of flooding occur where water is added, including extensive flooding into riparian and/or upland areas; or no natural drawdown occurs, reducing the vegetation gradient expected on waterbodies of that type and shore slope. In drawdown situations, a wide, unvegetated band remains.

HOW TO USE THE FIELD SHEET

The following section includes a number of field sheets for you to record the results of your training exercise or to apply the riparian health assessment on your own land base Additional field sheets can be obtained from www.pcap-sk.org and www.swa.ca. The field sheet provides a permanent record for future reference and monitoring. In addition to health scores, space is also available to record specific details of what you have observed.

For example:

- If preferred woody species are being browsed, note the species that show the heaviest use levels.
- List the species of invasive species or disturbance-caused species that you have observed and where they are located.
- Extra space is provided on the back of the sheet for more detailed comments on any of the 9 questions.
- There is also space to make a small sketch of where the stream reach occurs in a particular pasture and to note where photographs may have been taken.
- Another very important step is to consider the current management of the field you are in. This information should also be recorded and attached to the field sheet:
    - what is the current grazing intensity in the pasture (heavy, moderate, light)?
    - how long is the pasture grazed each year?
    - when are rest periods provided?
    - what livestock distribution tools are being used (salt, off-stream water, supplemental feed)?
    - if this is a cropped field, how is it managed?

Make sure to take several pictures of the reach, shore and banks, as it will make it easier to remember the site and see changes over time.

How Do I Use the Results?

The field sheet knits together the 9 separate questions into one measure of riparian health. Go to the section "Interpreting Results" on page 79 to learn what the health scores mean. Then you can take the first steps to apply the results of the health rating to your management practices.

RIPARIAN HINTS

What do healthy riparian areas do?
Key ecological functions

- Trap sediment
- Build and maintain banks and shores
- Store flood water and energy
- Recharge the aquifer
- Filter and buffer water
- Reduce and dissipate energy
- Maintain biodiversity
- Create primary productivity

Silver Buffaloberry
Illustration by Rhondi Taylor-Davis

RIPARIAN HEALTH ASSESSMENT - FIELD SHEET

Landowner/lessee:_____ **Date:**_____ **Reach No.:** _____

Wetland/Slough/Lake:_____

Site Description:_____

_____

	Scores or N/A	
	Actual	*Possible*
1. Vegetative Cover of Riparian Area		
6 4 2 0	____	____
2. Invasive Plant Species		
Canopy Cover		
3 2 1 0	____	____
Density Distribution		
3 2 1 0	____	____
3. Disturbance-Caused Undesirable Herbaceous Species		
3 2 1 0	____	____
4. Preferred Tree and Shrub Establishment and Regeneration		
6 4 2 0	____	____
5. Utilization of Preferred Trees and Shrubs		
3 2 1 0	____	____
6. Human Alteration of Riparian Area - Vegetation		
6 4 2 0	____	____
7. Human Alteration of Riparian Area - Physical		
12 8 4 0	____	____
8. Human-Caused Bare Ground		
6 4 2 0	____	____
9. Degree of Artificial Addition / Removal of Water		
9 6 3 0	____	____
TOTAL	____	____

Health Score = Total actual score / Total possible score = _____

%	0-59	60-79	80-100
	← Unhealthy →	← Healthy With Problems →	← Healthy →

RIPARIAN HEALTH ASSESSMENT - FIELD SHEET

Comments

1. Vegetative Cover of Riparian Area

---

2. Invasive Plant Species

Canopy Cover

Density Distribution

---

3. Disturbance-Caused Undesirable Herbaceous Species

---

4. Preferred Tree and Shrub Establishment and Regeneration

---

5. Utilization of Preferred Trees and Shrubs

---

6. Human Alteration of Riparian Area - Vegetation

---

7. Human Alteration of Riparian Area - Physical

---

8. Human-Caused Bare Ground

---

9. Degree of Artificial Addition / Removal of Water

Sketch riparian reach here	*Show photo locations*

RIPARIAN HEALTH ASSESSMENT - FIELD SHEET

Landowner/lessee:_____ **Date:**_____ **Reach No.:** _____

Wetland/Slough/Lake:_____

Site Description:_____

_____

	Scores or N/A	
	Actual	*Possible*
1. Vegetative Cover of Riparian Area		
6 4 2 0	____	____
2. Invasive Plant Species		
Canopy Cover		
3 2 1 0	____	____
Density Distribution		
3 2 1 0	____	____
3. Disturbance-Caused Undesirable Herbaceous Species		
3 2 1 0	____	____
4. Preferred Tree and Shrub Establishment and Regeneration		
6 4 2 0	____	____
5. Utilization of Preferred Trees and Shrubs		
3 2 1 0	____	____
6. Human Alteration of Riparian Area - Vegetation		
6 4 2 0	____	____
7. Human Alteration of Riparian Area - Physical		
12 8 4 0	____	____
8. Human-Caused Bare Ground		
6 4 2 0	____	____
9. Degree of Artificial Addition / Removal of Water		
9 6 3 0	____	____
TOTAL	____	____

Health Score = Total actual score / Total possible score = _____

%	0-59	60-79	80-100
	← Unhealthy →	← Healthy With Problems →	← Healthy →

RIPARIAN HEALTH ASSESSMENT - FIELD SHEET

Comments

1. Vegetative Cover of Riparian Area

---

2. Invasive Plant Species

Canopy Cover

Density Distribution

---

3. Disturbance-Caused Undesirable Herbaceous Species

---

4. Preferred Tree and Shrub Establishment and Regeneration

---

5. Utilization of Preferred Trees and Shrubs

---

6. Human Alteration of Riparian Area - Vegetation

---

7. Human Alteration of Riparian Area - Physical

---

8. Human-Caused Bare Ground

---

9. Degree of Artificial Addition / Removal of Water

Sketch riparian reach here	*Show photo locations*

RIPARIAN HEALTH ASSESSMENT - FIELD SHEET

Landowner/lessee:_____ **Date:**_____ **Reach No.:** _____

Wetland/Slough/Lake:_____

Site Description:_____

_____

	Scores or N/A	
	Actual	*Possible*
1. Vegetative Cover of Riparian Area		
6 4 2 0	____	____
2. Invasive Plant Species		
Canopy Cover		
3 2 1 0	____	____
Density Distribution		
3 2 1 0	____	____
3. Disturbance-Caused Undesirable Herbaceous Species		
3 2 1 0	____	____
4. Preferred Tree and Shrub Establishment and Regeneration		
6 4 2 0	____	____
5. Utilization of Preferred Trees and Shrubs		
3 2 1 0	____	____
6. Human Alteration of Riparian Area - Vegetation		
6 4 2 0	____	____
7. Human Alteration of Riparian Area - Physical		
12 8 4 0	____	____
8. Human-Caused Bare Ground		
6 4 2 0	____	____
9. Degree of Artificial Addition / Removal of Water		
9 6 3 0	____	____
TOTAL	____	____

Health Score = Total actual score / Total possible score = _____

%	0-59	60-79	80-100
	← Unhealthy →	← Healthy With Problems →	← Healthy →

RIPARIAN HEALTH ASSESSMENT - FIELD SHEET

Comments

1. Vegetative Cover of Riparian Area

---

2. Invasive Plant Species

Canopy Cover

Density Distribution

---

3. Disturbance-Caused Undesirable Herbaceous Species

---

4. Preferred Tree and Shrub Establishment and Regeneration

---

5. Utilization of Preferred Trees and Shrubs

---

6. Human Alteration of Riparian Area - Vegetation

---

7. Human Alteration of Riparian Area - Physical

---

8. Human-Caused Bare Ground

---

9. Degree of Artificial Addition / Removal of Water

Sketch riparian reach here	*Show photo locations*

RIPARIAN HEALTH ASSESSMENT - FIELD SHEET

Landowner/lessee:_____ **Date:**_____ **Reach No.:** _____

Wetland/Slough/Lake:_____

Site Description:_____

_____

	Scores or N/A	
	Actual	*Possible*
1. Vegetative Cover of Riparian Area		
6 4 2 0	____	____
2. Invasive Plant Species		
Canopy Cover		
3 2 1 0	____	____
Density Distribution		
3 2 1 0	____	____
3. Disturbance-Caused Undesirable Herbaceous Species		
3 2 1 0	____	____
4. Preferred Tree and Shrub Establishment and Regeneration		
6 4 2 0	____	____
5. Utilization of Preferred Trees and Shrubs		
3 2 1 0	____	____
6. Human Alteration of Riparian Area - Vegetation		
6 4 2 0	____	____
7. Human Alteration of Riparian Area - Physical		
12 8 4 0	____	____
8. Human-Caused Bare Ground		
6 4 2 0	____	____
9. Degree of Artificial Addition / Removal of Water		
9 6 3 0	____	____
TOTAL	____	____

Health Score = Total actual score / Total possible score = _____

%	0-59	60-79	80-100
	← Unhealthy →	← Healthy With Problems →	← Healthy →

RIPARIAN HEALTH ASSESSMENT - FIELD SHEET

Comments

1. Vegetative Cover of Riparian Area

---

2. Invasive Plant Species

Canopy Cover

Density Distribution

---

3. Disturbance-Caused Undesirable Herbaceous Species

---

4. Preferred Tree and Shrub Establishment and Regeneration

---

5. Utilization of Preferred Trees and Shrubs

---

6. Human Alteration of Riparian Area - Vegetation

---

7. Human Alteration of Riparian Area - Physical

---

8. Human-Caused Bare Ground

---

9. Degree of Artificial Addition / Removal of Water

Sketch riparian reach here	*Show photo locations*

RIPARIAN HEALTH ASSESSMENT - FIELD SHEET

Landowner/lessee:_____ **Date:**_____ **Reach No.:** _____

Wetland/Slough/Lake:_____

Site Description:_____

_____

	Scores or N/A	
	Actual	*Possible*
1. Vegetative Cover of Riparian Area		
6 4 2 0	____	____
2. Invasive Plant Species		
Canopy Cover		
3 2 1 0	____	____
Density Distribution		
3 2 1 0	____	____
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6 4 2 0	____	____
5. Utilization of Preferred Trees and Shrubs		
3 2 1 0	____	____
6. Human Alteration of Riparian Area - Vegetation		
6 4 2 0	____	____
7. Human Alteration of Riparian Area - Physical		
12 8 4 0	____	____
8. Human-Caused Bare Ground		
6 4 2 0	____	____
9. Degree of Artificial Addition / Removal of Water		
9 6 3 0	____	____
TOTAL	____	____

Health Score = Total actual score / Total possible score = _____

%	0-59	60-79	80-100
	← Unhealthy →	← Healthy With Problems →	← Healthy →

RIPARIAN HEALTH ASSESSMENT - FIELD SHEET

Comments

1. Vegetative Cover of Riparian Area

---

2. Invasive Plant Species

Canopy Cover

Density Distribution

---

3. Disturbance-Caused Undesirable Herbaceous Species

---

4. Preferred Tree and Shrub Establishment and Regeneration

---

5. Utilization of Preferred Trees and Shrubs

---

6. Human Alteration of Riparian Area - Vegetation

---

7. Human Alteration of Riparian Area - Physical

---

8. Human-Caused Bare Ground

---

9. Degree of Artificial Addition / Removal of Water

Sketch riparian reach here	*Show photo locations*

INTERPRETING RESULTS
What to Do When You Finish the Assessment

What does the health score mean?

The riparian health score is a cumulative measure of the 9 factors that you have considered on the reach you selected. If you picked a critical reach, the score is the condition for a short stretch of lake or wetland you thought might have problems, be sensitive to use or had some other values. If you picked a representative reach, the score is the average condition for a long stretch of lake or wetland, within one pasture or management unit. Note that the questions can have different possible scores. This gives questions a different weighting factor depending on what they are considered to contribute to a healthy functioning system.

When you have added up the scores for the individual questions to get a total score, calculate what the percentage is, based on the total possible score. The range on the bottom of the score sheet will help you to do this. The score you have derived for the reach falls into one of those categories. These categories (healthy, healthy but with problems, and unhealthy) describe the reach condition and the reach's ability to perform riparian functions.

What do the health categories tell me?

- A health score of 80% or greater means the reach has scored in the top category called "**healthy**". This tells you that all riparian functions are being performed and the reach exhibits a high level of riparian condition. Healthy, functioning riparian areas are resilient, provide a long list of benefits and values, and are stable.
- A health score between 60 and 79% puts the reach in the "**healthy but with problems**" category. Many riparian functions are still being performed, but some clear signs of stress are apparent. The reach may not be as capable of rebounding from floods and use,

it may be vulnerable to erosion and some of the potential of the riparian area has been lost. This is like an amber warning light that there could be problems ahead and management changes should be actively considered. At the same time, with effective management changes, it is likely that a return to a healthier condition is within your grasp.

- A health score of less than 60% means the reach is in an "**unhealthy**" category. Most riparian functions are severely impaired or have been lost. The reach has lost most of its resiliency, stability is compromised and much of the potential of the riparian area has been sacrificed. At this point, red lights are flashing and we need to stop and reflect on current management. Immediate changes are necessary to keep the reach from declining further and to begin the process of healing and restoration.

What should our goals be for riparian area health? Clearly, we all want these landscapes to be resilient and stable, and provide us with a long list of ecological services, whether we are livestock producers, farmers, anglers, bird watchers, hikers or downstream water drinkers. Riparian health can vary across the province, from stream to stream and within single drainages, ranging from healthy to unhealthy. Some of this variation relates to how riparian landscapes have evolved. Natural disturbances like floods, grazing from native ungulates, fire, drought, beavers and landslides have always affected riparian condition. The results of these disturbances meant health could vary over time and from reach to reach. Because of the natural resilience of these systems, however, it is likely that ecological function was restored relatively quickly. Our use of these landscapes represents an additive and cumulative effect which has often compromised resilience. That could be a consequence of what has happened on the reach or what has happened upstream or downstream of the reach. Additional variation in health conditions can be attributed to our use of riparian areas and, in some cases, that use has lead to a decline in condition.

Consider these general goals for riparian area health:

- We need to quickly stabilize the number and length of reaches in an "unhealthy" category and actively restore them to a better condition.

There may always be a small percentage of sites in this category. The occasional crossing site, pressure point or naturally unstable bank may not contribute to an overall decline in reach health or make the reach more vulnerable to floods and other disturbance events. When these sites are the exception and not the general average for a stream, the resilient tendency of the reach compensates.

- We want to carefully watch and actively manage those reaches in a "healthy but with problems" category.

This category could include the majority of Saskatchewan's riparian areas. The economic, environmental and social values of these areas are high and we don't want to become complacent about their condition. Active management implies monitoring. We should ensure that the trend over time is positive, indicating improvement in reach conditions.

- We must keep "healthy" reaches intact, learn from the management that maintains them and apply that knowledge to other areas that are not in as good a condition.
- We need to recognize the most powerful restoration tool we have at our disposal is the natural resilience of these riparian systems, especially the vegetation components.

If we can recognize the stresses, reduce the pressures, be patient and let the system rebound, condition will improve, assuming most of the key pieces are still intact. If some of those key pieces (like woody vegetation) have gone missing restoration will be difficult and time consuming.

- We not only need to consider the reaches we stand on, we also need to look upstream and downstream.

Often, we can improve or maintain health with reach management but sometimes, because of distant effects, we need to work with our neighbours, within our communities and at a watershed level to reach our goals.

Using health scores to plan management objectives

Take time to review the overall health score and the rating for each of the 9 questions.

- The total score will tell you if riparian health is good (healthy), if there is cause for concern (healthy but with problems) or if there exists a need for urgent action (unhealthy).
- The scores for individual questions will help you to recognize the riparian "pieces" that have gone missing from the riparian reach.

Sedge Wren
Illustration by Chris Jordison

A sample field sheet:
LIVESTOCK GRAZING EXAMPLE
Riparian Health Assessment - Field Sheet

Below, a reach on Twin Moose slough, belonging to the Allan's, receives a health rating of 70%. The site got a score of 40 out of a possible 57 points (40/57 X 100 = 70%). This score puts the stretch of shore in the "healthy, but with problems" category - most riparian functions are being performed, but signs of stress are evident.

- In this example below, all questions apply and have been given a health rating.
- Review the comments to see what each score tells you.

RIPARIAN HEALTH ASSESSMENT - FIELD SHEET

Landowner/lessee: *Doolie and Myrtle Allan* **Date:** *July 15/02*

Wetland/Slough/Lake: *Twin Moose Slough*

Site Description: *Willow-sedge-cattail/bulrush area of slough*

	Scores or N/A	
	Actual	*Possible*
1. Vegetative Cover of the Riparian Area		
6 4 2 0	4	6
2. Invasive Plant Species		
Canopy Cover		
3 2 1 0	2	3
Density Distribution		
3 2 1 0	1	3
3. Disturbance-Caused Undesirable Herbaceous Species		
3 2 1 0	2	3
4. Preferred Tree and Shrub Establishment and Regeneration		
6 4 2 0	4	6
5. Utilization of Preferred Trees and Shrubs		
3 2 1 0	2	3
6. Human Alteration of Riparian Area - Vegetation		
6 4 2 0	4	6
7. Human Alteration of Riparian Area - Physical		
12 8 4 0	8	12
8. Human-Caused Bare Ground		
6 4 2 0	4	6
9. Degree of Artificial Addition / Removal of Water		
9 6 3 0	9	9

Total Score = 40/57 x 100 = 70% ~ *Healthy, but with problems*

PTS	17/57	23/57	29/57	32/57	34/57	37/57	40/57	46/57	52/57
%	**30**	**40**	**51**	**56**	**60**	**65**	**70**	**80**	**91**
◄.....	*Unhealthy*				*Healthy With Problems*			*Healthy*	►

Here's what the Riparian Health Assessment tells you... The Comments sheet (next page) has the details

Vegetation cover is slightly reduced and Canada thistle and Kentucky bluegrass have increased

Some young shrubs are present; there is light browsing on woody species

Kentucky bluegrass has replaced some of the native sedges, reducing deep-binding root mass

Some hoof shear and trampling has increased erosion potential and may be impacting the water's ability to soak in

LIVESTOCK GRAZING EXAMPLE - COMMENTS
Riparian Health Assessment - Field Sheet

Comments

Twin Moose Slough July 15/2002

1. Vegetative Cover of the Riparian Area

5% of the reach is not covered by plants

2. Invasive Plant Species (Canopy Cover and Density Distribution)

Canada thistle is present with low cover and with a single patch and a few individuals

3. Disturbance-Caused Undesirable Herbaceous Species

10% cover from foxtail barley, dandelion and Kentucky bluegrass

4. Preferred Tree and Shrub Establishment and Regeneration

A mixture of mature and old willows, with some saplings and seedlings

5. Utilization of Preferred Trees and Shrubs

Above 25% of the second year and older growth is utilized

6. Human Alteration of Riparian Area - Vegetation

More than 5% of the riparian area is altered. Grazing has led to some changes to the plant community - some willows and tall sedges have been replaced by Kentucky bluegrass

7. Human Alteration of Riparian Area - Physical

Hummocking and pugging occurs on less than 5% of the area

8. Human-Caused Bare Ground

About 3% of the area is bare soil caused by hoof shear and trailing

9. Degree of Artificial Addition / Removal of Water

The slough is not subjected to artificial drawdown or removal

Sketch riparian reach here	*Show photo locations*

Livestock Grazing Example - Recommendations

The overall health score is 70% or healthy, but with problems. This large slough and its riparian area are performing most riparian functions. There is some naturally caused stress (drought) and some stress caused by livestock grazing. The latter is what we want to focus on managing. There are a number of things they might consider doing based on the riparian health assessment:

- The Allan's could look at their present grazing system and determine that salt can be placed further away from Twin Moose slough, as the water and green forage already act to attract the cattle to graze this area.

- They may want to consider some fine-tuning of their rotational grazing system such as deferring the grazing of this pasture from spring (current use) to later summer grazing, when the soils are drier and less susceptible to trampling.

- With assistance from their local weed inspector or agri cultural fieldman, they may consider control of the invasive weeds, focused on the specific areas where the weeds are present.

- To check on how their management changes are working, they should consider monitoring the riparian area over the next couple of years to see if any positive health score changes have occurred. If so, a pat on the back! If not, investigate further and try some alternatives perhaps reexamining their stocking rate is required to reduce the grazing pressure.

A sample field sheet:
LAKESHORE RESIDENT EXAMPLE

Below, a reach on Speckled Lake, belonging to the Tucker's receives a health rating of 58%. The site got a score of 33 out of a possible 57 points (33/57 x 100 = 58%). This score puts the stretch of shore in the "unhealthy" category - most riparian functions are impaired or lost.

- In this example below, all questions apply and have been given a health rating.
- Review the comments to see what each score tells you.

RIPARIAN HEALTH ASSESSMENT - FIELD SHEET

Landowner/lessee: *Dan and Sue Tucker* **Date:** *July 15/02*

Wetland/Slough/Lake: *Speckled Lake, Sunset Bay Subdivision, Lot 7*

Site Description: *Shoreline of lake about 1/4 mile in width*

	Scores or N/A	
	Actual	*Possible*
1. Vegetative Cover of the Riparian Area		
6 4 2 0	6	6
2. Invasive Plant Species		
Canopy Cover		
3 2 1 0	2	3
Density Distribution		
3 2 1 0	2	3
3. Disturbance-Caused Undesirable Herbaceous Species		
3 2 1 0	0	3
4. Preferred Tree and Shrub Establishment and Regeneration		
6 4 2 0	0	6
5. Utilization of Preferred Trees and Shrubs		
3 2 1 0	0	3
6. Human Alteration of Riparian Area - Vegetation		
6 4 2 0	0	6
7. Human Alteration of Riparian Area - Physical		
12 8 4 0	8	12
8. Human-Caused Bare Ground		
6 4 2 0	6	6
9. Degree of Artificial Addition / Removal of Water		
9 6 3 0	9	9

Total Score = 33/57 x 100 = 58% ~ *Unhealthy*

PTS	17/57	23/57	29/57	32/57	34/57	37/57	40/57	46/57	52/57
%	**30**	**40**	**51**	**56**	**60**	**65**	**70**	**80**	**91**

Unhealthy | *Healthy With Problems* | *Healthy*

Here's what the Riparian Health Assessment tells you... The Comments sheet (next page) has the details

Vegetation cover is well-established. Canada thistle is present

Lawn grass has replaced most native plants, reducing deep binding root mass

Mowing of shrubs is preventing a healthy woody plant community

Riprap is temporarily preventing some erosion, but imported sand is eroding into lake, adding sediment and nutrients

LAKESHORE RESIDENT EXAMPLE - COMMENTS

Riparian Health Assessment - Field Sheet

Comments

Speckled Lake July 22, 2002

1. Vegetative Cover of the Riparian Area

More than 95% of the reach is covered by plants - this is good

2. Invasive Plant Species (Canopy Cover and Density Distribution)

Canada thistle is present with just a few individuals

3. Disturbance-Caused Undesirable Herbaceous Species

The majority of the area is lawn grass (Kentucky bluegrass)

4. Preferred Tree and Shrub Establishment and Regeneration

The neighbour's shoreline has a good supply of willows, but this area of shoreline has been mowed and no young shrubs or trees are present.

5. Utilization of Preferred Trees and Shrubs

Willows have been continually mowed on the site and never got very tall. Repeated mowing has killed some and resulted in few willows being left.

6. Human Alteration of Riparian Area - Vegetation

Nearly complete change of plant community from willows, sedges, etc to planted lawn grass. Mowing prevents non-lawn species from surviving and planting replaced almost all native species.

7. Human Alteration of Riparian Area - Physical

About 10% of the area has been physically altered by a combination of an old boat dock, imported sand, and riprap.

8. Human-Caused Bare Ground

There is almost no bare ground, with less than 1% of the area bare due to human activities - this is good.

9. Degree of Artificial Addition / Removal of Water

Lake is not subjected to artificial drawdown or removal

Sketch riparian reach here	*Show photo locations*

Lakeshore Resident Example - Recommendations

The assessment of 58% indicates there are serious problems with the health and function of the shoreline riparian area of Speckled Lake. In particular, most of the native vegetation has been removed and replaced with a combination of lawn grass, imported sand, riprap, and historically, a boat launch. There are a number of things that the Tucker's might consider in terms of how they use and manage their riparian area to return some functions:

- it is quite likely that the removal of the deep binding root mass of the shrubs and sedges has created erosion problems and required the cottager to riprap the beach. Encouraging and allowing the native plants to return, particularly along the water's edge, will begin to stabilize the area and reduce erosion.

- to bring the riparian area back to a more healthy state, reducing or eliminating mowing would allow greater plant structure as well as make it possible for more native, non-lawn species to survive. If mowing continues, try limiting it to the area necessary to access the boat launch.

- because of the relatively small area, invasive weed control is likely best done through hand pulling/digging.

- over the long-term, the entire area should be allowed to return to as many native species as possible (eg. tall sedges and willows). If interested, speeding up the process through planting might be an option, using local plants, perhaps collected from a willing neighbour on the lake.

RIPARIAN HINTS

What do the health scores tell me? Is my lakeshore lame? Take a reading...

If the score is 80 or higher . . .

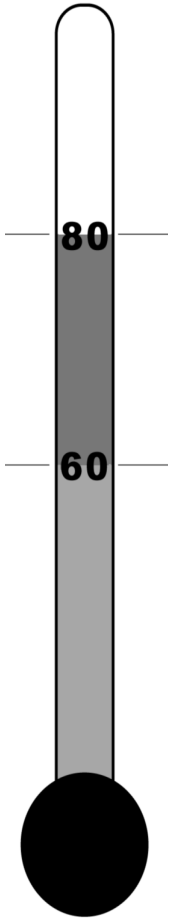
- Congratulations!
- This score means that your riparian area is performing the functions you want it to.
- You should make a record of your present management practices for future reference and share that information with others.

If the score is between 60 and 80 . . .

- Many riparian functions are still being performed, but your riparian area is showing signs of stress.
- Time to start paying attention to management practices on this site.

If the score is less than 60 . . .

- This riparian area needs attention!
- Who can you contact for advice? See contact list in Appendix 4.
- What are the main areas of concern? - Woody species, invasive species, bare soils?
- What can you do to change management? - More rest, off-stream water, rotational razing, fencing?



CREDITS

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APPENDIX 1

Invasive and Disturbance-caused Species in Riparian Areas

This riparian health assessment workbook distinguishes between invasive species and disturbance-caused species.

1. Invasive species are considered a larger threat to agricultural and natural systems than disturbance-caused species since they are likely to rapidly invade native vegetation, crop or pastures once established. Invasive species are divided into noxious and non-noxious species. Noxious species are regulated by the *Saskatchewan Noxious Weeds Act*, (accessible online at: www.qp.gov.sk.ca/documents/English/Statutes/Statutes/N9-1.pdf), which states that "Every owner or occupant of land shall destroy noxious weeds on his land and prevent the spread of noxious weeds to other lands."

2. Disturbance-caused species are undesirable plants that are promoted by disturbance and often indicate human-caused alteration of the natural plant community. Some disturbance-caused species are considered noxious and regulated by the *Noxious Weeds Act*. Disturbance-caused species may not invade, but are often very persistent and highly competitive and therefore often prevent desirable species from colonizing. In addition, disturbance-caused species often have shallow roots and do not provide deep-binding root mass for bank protection. These species are, therefore, linked to reduced riparian function and health.

Species list

The species list (Appendix 2) contains plant species that are considered invasive or disturbance-caused in Saskatchewan. In order to accurately determine the health of a riparian area the assessor needs to be familiar with the species on the list. It is, therefore, essential to consult the list before conducting an assessment. The designation of weeds differs among provinces and among habitats, so it is imperative to use this list if conducting riparian assessments in Saskatchewan.

How to use the species list
The list of designated weeds is based on Saskatchewan Ministry of Environment and Saskatchewan Ministry of Agriculture weed regulations and the *Saskatchewan Noxious Weeds Act*. The list is the most current list as of 2007, but since the list is updated on an ongoing basis it is a good practice to contact a local agricultural representative or ecologist to confirm weed designations before conducting an assessment.

To simplify the use of the species list, species have been divided into invasive and disturbance-caused plant species:

I: Invasive plant species. These species are likely to invade native vegetation and alter ecological functions, and should be treated as invasive plant species when conducting assessments.

D: Disturbance-caused plant species. These species indicate disturbed vegetation and altered ecological functions, and should be treated as disturbance-caused plant species when conducting assessments.

The species list also indicates if species are noxious:

N: Noxious plant species. These species are regulated under the *Saskatchewan Noxious Weeds Act* and should be treated as invasive plant species when conducting assessments.

Photo courtesy of Patrick Breen, Oregon State University, Bugwood.org

Russian olive (Invasive) *Elaeagnus angustifolia*

Photo courtesy of Don Fontaine

Russian knapweed (Invasive) *Acroptilon repens*

APPENDIX 2

Invasive and Disturbance-caused Species List

Scientific Name	Common Name	Growth Form	Category	Noxious
Abutilon theophrasti	velvet-leaf	annual forb	D	
Acroptilon repens	Russian knapweed	perennial forb	I	N
Agropyron cristatum	crested wheatgrass	perennial graminoid	I	
Agrostemma githago	purple cockle	annual forb	D	N
Amaranthus retroflexus	red-root pigweed	annual forb	D	
Anthemis cotula	mayweed	annual forb	D	
Arctium minus	common burdock	biennial forb	D	
Artemisia absinthium	absinth	perennial forb	I	
Avena fatua	wild oat	annual graminoid	D	N
Bassia hyssopifolia	five-horn smother-weed	annual forb	D	
Brassica juncea	Chinese mustard	annual forb	D	
Brassica rapa	bird rape	annual forb	D	N
Bromus inermis	smooth brome grass	perennial graminoid	I	
Bromus japonicus	Japanese brome	annual graminoid	I	N
Bromus tectorum	downy brome	annual graminoid	I	N
Butomus umbellatus	flowering rush	aquatic plant	I	
Camelina microcarpa	small-seeded false flax	annual forb	D	N
Campanula rapunculoides	creeping bellflower	perennial forb	D	
Capsella bursa-pastoris	shepherd's purse	annual forb	D	
Caragana arborescens	caragana	shrub	I	
Cardaria chalepensis	hoary cress	perennial forb	I	
Cardaria draba	heart-podded hoary cress	perennial forb	I	N
Cardaria pubescens	globe-podded hoary cress	perennial forb	I	
Carduus nutans	nodding thistle biennial	forb	I	N
Centaurea diffusa	diffuse knapweed	annual forb	I	N
Centaurea maculosa	spotted knapweed	biennial forb	I	N
Centaurea solstitialis	yellow star-thistle	annual forb	I	
Cerastium vulgatum	common mouse-ear chickweed	perennial forb	D	
Chenopodium album	lamb's quarters	annual forb	D	
Chenopodium murale	nettle-leaf goosefoot	annual forb	D	
Chorispora tenella	common blue-mustard	annual forb	D	
Cirsium arvense	Canada thistle	perennial forb	I	N
Cirsium vulgare	bull thistle	biennial forb	I	

Scientific Name	Common Name	Growth Form	Category	Noxious
Conium maculatum	poison hemlock	biennial forb	I	
Conringia orientalis	hare's-ear mustard	annual forb	I	N
Convolvulus arvensis	field bindweed	perennial forb	I	N
Crepis tectorum	narrow-leaved hawk's beard	annual forb	D	
Cynoglossum officinale	hound's-tongue	biennial forb	I	
Dactylis glomerata	orchard grass	perennial graminoid	D	
Daucus carota	wild carrot	biennial forb	D	
Descurainia sophia	flixweed	annual forb	D	
Echinochloa crus-galli	barnyard grass	annual graminoid	D	
Echium vulgare	viper's-bugloss	biennial forb	I	
Elaeagnus angustifolia	Russian olive	shrub	I	
Elytrigia repens	quack grass	perennial graminoid	D	N
Eragrostis cilianensis	stinkgrass	annual graminoid	D	
Erodium cicutarium	stork's bill	biennial forb	I	
Erucastrum gallicum	dog mustard	annual forb	D	
Euphorbia cyparissias	cypress spurge	perennial forb	I	
Euphorbia esula	leafy spurge	perennial forb	I	N
Fagopyrum tataricum	tartary buckwheat	annual forb	D	N
Galeopsis tetrahit	hemp-nettle	annual forb	D	
Galium aparine	cleavers	annual forb	I	N
Galium spurium	false cleavers	annual forb	I	
Gypsophila paniculata	baby's breath	perennial forb	I	
Hesperis matronalis	dame's rocket	perennial forb	D	
Hibiscus trionum	flower-of-an-hour	annual forb	D	
Hordeum jubatum	foxtail barley	annual graminoid	D	
Hordeum vulgare	common barley	annual graminoid	D	
Hyoscyamus niger	black henbane	biennial forb	D	
Hypochaeris radicata	spotted cat's-ear	perennial forb	D	
Knautia arvensis	blue buttons	perennial forb	I	
Kochia scoparia	kochia	annual forb	D	
Lactuca serriola	prickly lettuce	annual forb	D	
Lamium amplexicaule	henbit	annual forb	D	
Lappula echinata	bluebur	annual forb	D	N
Lepidium perfoliatum	clasping pepper-grass	annual forb	D	
Leucanthemum vulgare	oxeye daisy	perennial forb	I	
Linaria dalmatica	dalmatian toadflax	perennial forb	I	N

Scientific Name	Common Name	Growth Form	Category	Noxious
Linaria vulgaris	yellow toadflax	perennial forb	I	N
Lolium persicum	Persian darnel	annual graminoid	I	N
Lythrum salicaria	purple loosestrife	perennial forb	I	N
Malva parviflora	small whorled cheeseweed	annual forb	D	
Malva rotundifolia	round-leaved mallow	annual forb	D	N
Marrubium vulgare	common hoarhound	perennial forb	D	
Matricaria perforata	scentless chamomile	annual / biennial forb	I	N
Medicago lupulina	black medic	perennial forb	D	
Melilotus alba	sweet clover (white)	biennial forb	D	
Melilotus officinalis	sweet clover (yellow)	biennial forb	D	
Myriophyllum spicatum	Eurasian water milfoil	perennial aquatic	I	
Neslia paniculata	ball mustard	annual forb	D	N
Odontites serotina	late-flowering eyebright	annual forb	I	
Phleum pratense	timothy	perennial graminoid	D	
Plantago lanceolata	English plantain	biennial forb	D	
Plantago major	common plantain	perennial forb	D	
Poa annua	annual bluegrass	annual graminoid	D	
Poa compressa	Canada bluegrass	perennial graminoid	D	
Poa pratensis	Kentucky bluegrass	perennial graminoid	D	
Polygonum convolvulus	wild buckwheat	annual forb	D	N
Polygonum persicaria	lady's thumb	annual forb	D	
Polypogon monspeliensis	annual rabbit-foot grass	annual graminoid	I	
Potamogeton crispus	curly pondweed	perennial aquatic	D	
Potentilla recta	sulfur cinquefoil	perennial forb	D	
Ranunculus acris	tall buttercup	perennial forb	I	
Raphanus raphanistrum	wild radish	annual forb	D	
Rhamnus cathartica	European common buckthorn	shrub	I	
Ribes rubrum	cultivated red currant	shrub	I	
Salsola kali	Russian thistle	annual forb	D	N
Saponaria officinalis	bouncing-bet	perennial forb	I	
Scleranthus annuus	knawel	annual forb	D	
Senecio vulgaris	old-man-in-the-spring	annual forb	D	
Setaria viridis	green foxtail	annual graminoid	D	N
Silene cserei	smooth catchfly	biennial forb	D	
Silene latifolia ssp. Alba	white cockle	biennial/perennial forb	D	N

Scientific Name	Common Name	Growth Form	Category	Noxious
Silene noctiflora	night-flowering catchfly	annual forb	D	N
Silene vulgaris	bladder campion	perennial forb	D	N
Silybum marianum	blessed milk-thistle	annual / biennial forb	I	
Sinapis arvensis	wild mustard	annual forb	D	N
Sisymbrium altissimum	tumble mustard	annual forb	I	N
Sonchus arvensis	perennial sow-thistle	perennial forb	D	N
Sonchus oleraceus	annual sow-thistle	annual forb	D	N
Spergula arvensis	corn spurry	annual forb	D	
Stellaria media	common chickweed	annual forb	D	
Syringa vulgaris	common lilac	shrub	I	
Tamarix chinensis	salt cedar	shrub	I	
Tanacetum vulgare	common tansy	perennial forb	I	
Taraxacum officinale	common dandelion	perennial forb	D	N
Thlaspi arvense	stinkweed	annual forb	D	N
Tragopogon dubius	goat's-beard	biennial forb	D	
Trifolium hybridum	alsike clover	perennial forb	D	
Trifolium pratense	red clover	biennial forb	D	
Trifolium repens	white clover	perennial forb	D	
Ulmus pumila	Siberian elm	shrub	I	
Vaccaria hispanica	cow cockle	annual forb	D	N
Verbascum thapsus	common mullein	biennial forb	D	

Photo courtesy of Lynn Sosnoskie, University of Georgia, Bugwood.org

Wild buckwheat (Disturbance caused) *Polygonum convolvulus*

Photo courtesy of Mary Ellen (Mel) Harte, Bugwood.org

Stinkweed / field penny cress (Disturbance caused) *Thlaspi arvense*

APPENDIX 3

Glossary

Canopy cover - the ground area covered by vegetative growth. Different plant species can provide varying degrees of cover depending on their overall size and abundance.

Critical site - one that may be sensitive, or already has some specific problems, for assessment.

Disturbance-caused undesirable herbaceous species - native or introduced non-woody plant species that are well adapted to disturbance or an environment of continual stress.

Deep binding roots - the type of plant roots that hold together most of the shore or banks, in the face of regular waves, runoff and flooding.

Human-caused bare ground - areas devoid of vegetation as a result of human activity. This can include vehcle roads, recreational trails and livestock trails.

Invasive plant species - are likely to invade native vegetation, crop or pastures once established. May alter ecological functions. Some invasive species are classified as noxious species and are regulated by the Saskatchewan Noxious Weeds Act.

Lentic - this term means *standing* or *still water* (i.e. lakes, wetlands and sloughs).

Lotic - this term means *flowing water* (i.e. streams and rivers).

Pioneer species - plant species that are early or first to establish on recently made available habitat (eg. bare soil patch). Often these are annual weeds, but some native wildflower species, such as fireweed (not actually a weed) are also pioneer species.

Pugging and hummocking - the depressions (pugs) and raised mounds of soil (hummocks) resulting from large animals walking through soft or moist soil.

Reach - a stretch of shore assessed for riparian health, with width based on the extent of the riparian area (from open water to the upland) and with length based on selecting a representative or critical site within one management (and ownership) unit.

Representative site - a site that is typical of a much longer stretch of shore and that will provide an overall impression of health for that longer area.

Rutting - the compacted trails or ruts from people, vehicles or livestock, with trails compressed more than 5 cm (2 in) deep.

Sinuosity - the ratio of the channel length between two points on a channel to the straight-line distance between the same two points (ie: a measure of meandering).

Snags - dead standing trees

Structural alteration - physical changes to the shape or contour of the shore or banks caused by human influences. Some examples are livestock trampling, riprap and excavation.

Tree and shrub regeneration - the presence of seedlings and saplings, or the new growth.

Tree and shrub utilisation - browse (eating by animals), rubbing off, or cutting/removal of woody growth on trees and shrubs (only utilisation of second year and older growth included in riparian health assessment).

Watershed - the area of land that drains into a single waterbody. While a small wetland will usually have a small watershed or drainage basin, a large river (eg. North Saskatchewan River) will have a very large watershed, composed of many smaller watersheds of other waterbodies.

Woody plant species - refers to trees and shrubs. These plants serve different riparian functions than grasses and broad-leaf plants, since they are typically more resilient and longer-lived, with deeper root systems.

APPENDIX 4

Contact List

Agriculture and Agri-Food Canada - Agri-Environment Services Branch (AAFC - AESB)

Headquarters
AAFC-AESB
#408- 1800 Hamilton St.
REGINA SK S4P 4L2
Phone: (306) 780-5070
Fax (306) 780-5018

Regional offices
South Saskatchewan Region
#603 - 1800 Hamilton St.
REGINA SK S4P 4L2
Phone: (306) 780-5110

Swift Current District Office
P.O. Box 1088
L.B. Thompson Place
Gate #2, SPARC, Airport Rd.
SWIFT CURRENT SK S9H 3X3
Phone: (306) 778-5000
Fax: (306) 778-5020

Maple Creek District Office
P.O. Box 430
Highway 21 & 2nd Ave.
MAPLE CREEK SK S0N 1N0
Phone: (306) 662-5520
Fax: (306) 662-3166

Gravelbourg District Office
P.O. Box 155
314 Main St.
GRAVELBOURG SK S0H 1X0
Phone: (306) 648-2214
Fax: (306) 648-3402

Weyburn District Office
21-110 Souris Ave.
WEYBURN SK S4H 2Z8
Phone: (306) 848-4488
Fax: (306) 848-4499

Moose Jaw District Office
1410A Caribou St. W
MOOSE JAW SK S6H 7S9
Phone: (306) 691-3370
Fax: (306) 691-3103

Melville District Office
P.O. Box 130
#109 - 290 Prince William Dr.
MELVILLE SK S0A 2P0
Phone: (306) 728-5790
Fax: (306) 728-6558

North Saskatchewan Region
#1011-11 Innovation Blvd.
SASKATOON SK S7N 3H5
Phone: (306) 975-4693
Fax: (306) 975-4594

Rosetown District Office
P.O. Box 1420
219 Main St.
ROSETOWN SK S0L 2V0
Phone: (306) 882-4272
Fax: (306) 882-4055

North Battleford District Office
#121 - 9800 Territorial Place
NORTH BATTLEFORD SK S9A 3N6
Phone: (306) 446-4050
Fax: (306) 446-4060

Watrous District Office
P.O. Box 1150
#107E - 3rd Ave. E
WATROUS SK S0K 4T0
Phone: (306) 946-8720
Fax: (306) 946-3318

Melfort District Office
P.O. Box 1748
Bay 3 - 102 McKendry Ave. W
MELFORT SK S0E 1A0
Phone: (306) 752-4442
Fax: (306) 752-1991

Agroforestry Development Centre
P.O. Box 940
#2 Government Rd.
INDIAN HEAD SK S0G 2K0
Phone: (306) 695-2284
Fax: (306) 695-2568

Canada- Saskatchewan
Irrigation Diversification Centre
P.O. Box 700
901 McKenzie St. S
OUTLOOK SK S0L 2N0
Phone: (306) 867-5400
Fax: (306) 867-9656

Agriculture and Agri-Food Canada - Semiarid Prairie Agricultural Research Centre (SPARC)

SPARC
P.O. Box 1030
Airport Rd.
SWIFT CURRENT SK S9H 3X2
Phone: (306) 778-7200
Fax: (306) 773-9123
Web address:
www4.agr.gc.ca/AAFC-AAC/display-afficher.do?id=1180634963149&land=eng

Ducks Unlimited Canada (DUC)

National office

Oak Hammock Marsh
Conservation Centre
P.O. Box 1160
STONEWALL MB R0C 2Z0
Phone: (204) 467-3000
Fax: (204) 467-9028

Regional offices

Regina Regional Office
P.O. Box 4465, 1030 Winnipeg St.
REGINA SK S4P 3W7
Phone: (306) 569-0424
Fax: (306) 565-3699

Saskatoon Regional Office
Unit 300 - 3530 Millar Ave.
SASKATOON SK S7P 0B6
Phone: (306) 665-7356
Fax: (306) 931-4108

Yorkton Regional Office
Hwy 16 W, P.O. Box 1299
YOKRTON SK S3N 2X3
Phone: (306) 782-2108
Fax: (306)786-2108

North Battleford Regional Office
202 - 1301 101st St.
NORTH BATTLEFORD SK S9A 0Z9
Phone: (306) 455-2575
Fax: (306) 445-4016

Melfort Regional Office
Highway 3 W, P.O. Box 2139
MELFORT SK S0E 1A0
Phone: (306) 752-2791
Fax: (306) 752-9799

Wadena Regional Office
77 1st St. NE, P.O. Box 670
WADENA SK S0A 4J0
Phone: (306) 338-3677
Fax: (306) 338-2199

Meadow Lake Regional Office
201 2nd St W, P.O. Box 727
MEADOW LAKE SK S9X 1C7
Phone: (306) 236-6662
Fax: (306) 236-5153

Estevan Regional Office
77 - 1st St. NE, P.O. Box 670
ESTEVAN SK S0A 4J0
Phone: (306) 338-3677
Fax: (306) 338-2199

Native Plant Society of Saskatchewan (NPSS)
P.O. Box 21099
SASKATOON SK S7H 5N9
Phone: (306) 668-3940
Fax: (306) 258-2244
Email: info@npss.sk.ca
Web address: www.npss.sk.ca

Nature Conservancy of Canada

Saskatchewan Office
#100 - 1777 Victoria Ave.
REGINA SK S4P 4K5
Phone: (306) 347-0447
Toll Free: 1-866-662-7275
Fax: (306) 347-2345
Email: saskatchewan@natureconservancy.ca
Web address:
www.natureconservancy.ca

Nature Saskatchewan

#206, 1860 Lorne St.
REGINA SK S4P 2L7
Phone: (306) 780-9273
Toll Free in SK: 1-800-667-4668
Fax: (306) 780-9263
Email: info@naturesask.ca
Web address:
www.naturesask.ca

Prairie Conservation Action Plan (PCAP)

P.O. Box 4752
Main Floor, Canada Centre,
Ipsco Place
REGINA SK S4P 3Y4
Phone: (306) 352-0472
Fax: (306) 569-8799
Email: pcap@sasktel.net
Web address: www.pcap-sk.org

Saskatchewan Ministry of Agriculture

Head office

3085 Albert St.
REGINA SK S4S 0B1
Phone: (306) 787-5140
Web address:
www.agriculture.gov.sk.ca

Agriculture Knowledge Centre
Phone: (866) 457-2377
Fax: (306) 694-3938
Out-of-province: (306) 694-3727
Email: aginfo@gov.sk.ca
Web address:
www.agriculture.gov.sk.ca/AKC

Regional offices

Regina Regional Office
515 Henderson Dr.
REGINA SK S4P 3V7
Phone: (306) 787-9773

Saskatoon Regional Office
3830 Thatcher Ave,
SASKATOON SK S7K 2H6
Phone: (306) 933-7986

Swift Current Regional Office
P.O. Box 5000
350 Cheadle St. W
SWIFT CURRENT SK S9H 4G3
Phone: (306) 778-8218

Kindersley Regional Office
P.O. Box 1690, 409 Main St.
KINDERSLEY SK S0L 1S0
Phone: (306) 463-5513

Watrous Regional Office
P.O. Box 520, 403 Main St.
WATROUS SK S0K 4T0
Phone: (306) 946-3230

Prince Albert Regional Office
P.O. Box 3003
800 Central Ave.
PRINCE ALBERT SK S6V 6G1
Phone: (306) 953-2363

Yorkton Regional Office
38 - 5th Ave. N
YORKTON SK S3N 0Y8
Phone: (306) 786-1531

Weyburn Regional Office
P.O. Box 3003
110 Souris Ave.
WEYBURN SK S4H 2Z9
Phone: (306) 848-2857

Outlook Regional Office
P.O. Box 9
420 Saskatchewan Ave. W
OUTLOOK SK S0L 2N0
Phone: (306) 867-5575

North Battleford Regional Office
1192 - 102nd St.
NORTH BATTLEFORD SK S9A 1E9
Phone: (306) 446-7964

Tisdale Regional Office
P.O. Box 1480
1150 - 99th St.
TISDALE SK S0E 1T0
Phone: (306) 878-8842

Saskatchewan Ministry of Environment

Regina Office
3211 Albert St.
REGINA SK S4S 5W6
Phone: (306) 787-2314
Web site:
www.environment.gov.sk.ca

Saskatoon Office
112 Research Dr.
SASKATOON SK S7K 2H6
Fax: (306) 933-5773

Swift Current Office
350 Cheadle St. W
SWIFT CURRENT SK S9H 4G3
Fax: (306) 778-8212

Prince Albert Office
P.O. Box 3003
PRINCE ALBERT SK S6V 6G1
Fax: (306) 953-2502

Saskatchewan Forage Council (SFC)

P.O. Box 1715
OUTLOOK SK S0L 2N0
Phone: (306) 966-2148
Fax: (306) 867-8120
Web address:
www.saskforage.ca

Saskatchewan Invasive Alien Species Project

NPSS
P.O. Box 21099
SASKATOON SK S7H 5N9
Phone: (306) 668-3940
Fax: (306) 258-2244
Email: info@npss.sk.ca
Web address: www.npss.sk.ca

Saskatchewan Sheep Development Board (SSDB)

2213C Hanselman Court
SASKATOON SK S7L 6A8
Phone: (306) 933-5200
Fax: (306) 933-7182
Email: sheepdb@sasktel.net
Web address: www.sksheep.com

Saskatchewan Soil Conservation Association

P.O. Box 1360
INDIAN HEAD SK S0G 2K0
Phone: (306) 695-4233
Fax: (306) 695-4236
Email: info@ssca.usask.ca
Web address: www.ssca.ca

Saskatchewan Stock Growers Association (SSGA)

PO Box 4752
Main Floor, Canada Centre,
Ipsco Place
REGINA SK S4P 3Y4
Phone: (306) 757-8523
Fax: (306) 569-8799
Web address:
www.skstockgrowers.com

Saskatchewan Watershed Authority (SWA)

Head Office
111 Fairford St. E
MOOSE JAW SK S6H 7X9
Phone: (306) 694-3900
Fax: (306) 694-3944
Web address: www.swa.ca

Other Offices

Regina Office
Park Plaza
#420 - 2365 Albert St.
REGINA SK S4P 4K1
Phone: (306) 787-0726
Fax: (306) 787-0780

Saskatoon Office
Innovation Place
101 - 108 Research Dr.
SASKATOON SK S7N 3R3
Phone: (306) 933-7442
Fax: (306) 933-6820

Regional offices

Northeast (Nipawin)
Regional Office
P.O. Box 2133
#201 1st Ave. E
NIPAWIN SK S0E 1E0
Phone: (306) 862-1750
Fax: (306) 862-1771

East Central (Yorkton)
Regional Office
2nd Floor, 120 Smith St. E
YORKTON SK S3N 3V3
Phone: (306) 786-1490
Fax: (306) 786-1495

Southeast (Weyburn)
Regional Office
P.O. Box 2003
City Centre Mall
3rd Floor, 110 Souris Ave.
WEYBURN SK S4H 2Z9
Phone: (306) 848-2345
Fax: (306) 848-2356

Northwest (North Battleford)
Regional Office
#402 Royal Bank Tower
1101 101st St.
NORTH BATTLEFORD SK S9A 0Z5
Phone: (306) 446-7450
Fax: (306) 446-7461

Southwest (Swift Current)
Regional Office
P.O. Box 5000
E.I. Wood Building
3rd Floor, 350 Cheadle St. W
SWIFT CURRENT SK S9H 4G3
Phone: (306) 778-8257
Fax: (306) 778-8271

Saskatchewan Wildlife Federation (SWF)

9 Lancaster Road
MOOSE JAW SK S6J 1M8
Phone: (306) 692-8812
Fax: (306) 692-4370
Email: sask.wildlife@sasktel.net
Web site: www.swf.sk.ca

APPENDIX 5

Reference Material

Many of the publications below can be accessed by contacting the Saskatchewan Watershed Authority or by downloading them from ww.swa.ca. The publications can be found under stewardship publications.

Ambrose, N., G. Ehlert, K. Spicer-Rawe. 2004. Riparian health assessment for lakes, sloughs, and wetlands –field workbook. Modified from Fitch, L., B.W. Adams and G. Hale. 2004. Riparian health assessment for streams and small rivers – field workbook. Cows and Fish Program. Lethbridge, Alberta.

Fitch, L., B.W. Adams and G. Hale. 2004. Riparian health assessment for streams and small rivers – field workbook. Cows and Fish Program. Lethbridge, Alberta.

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Huel, D. 2002. Streambank stewardship: your guide to caring for riparian areas in Saskatchewan. Saskatchewan Watershed Authority. Regina, Saskatchewan.

Lahring, H. 2003. Water and wetland plants of the prairie provinces: a field guide for Alberta, Saskatchewan, Manitoba and the northern United States. Canadian Plains Research Centre. Regina, Saskatchewan.

Soulodre, E. Streambank Stewardship Directory. Saskatchewan Watershed Authority. Regina, Saskatchewan.

Thompson, W. and P, Hansen, 2001. Classification and management of riparian and wetland wites of the Saskatchewan prairie ecozone and parts of adjacent subregions. Saskatchewan Watershed Authority, Regina, Saskatchewan.

Riparian areas fact sheets

Beaver: Creator or Destroyer? Saskatchewan Watershed Authority. Regina, Saskatchewan.

Economics of Riparian Grazing Management. Saskatchewan Watershed Authority. Regina, Saskatchewan.

Farming Along the Stream. Saskatchewan Watershed Authority. Regina, Saskatchewan.

Health of Riparian Areas in Southern Saskatchewan. Saskatchewan Watershed Authority. Regina, Saskatchewan.

Living on the Edge: Wildlife Along the Stream. Saskatchewan Watershed Authority. Regina, Saskatchewan.

Ranching Along the Stream. Saskatchewan Watershed Authority. Regina, Saskatchewan.

What makes a Healthy Riparian Area? Saskatchewan Watershed Authority. Regina, Saskatchewan.


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Saskatchewan
Prairie Conservation
Action Plan

Cows and Fish

PCAP Greencover Partners

Agriculture and Agri-Food Canada
Agriculture et Agroalimentaire Canada

SRC
smart science solutions

Saskatchewan Ministry of Agriculture

Saskatchewan Watershed Authority

Saskatchewan Ministry of Environment

Saskatchewan STOCKGROWERS Association

Nature Conservancy Canada

Conservation de la nature Canada

Ducks Unlimited Canada
Conserving Canada's Wetlands

Nature Saskatchewan

SAMA

University of Saskatchewan

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