GREEN ZONE

Riparian Health Assessment for Streams & Small Rivers

CARING FOR THE

June 2005

Field Workbook

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To obtain additional copies of this workbook:

Visit our website **www.cowsandfish.org** and follow the links to **Community Tools** and an online order form.

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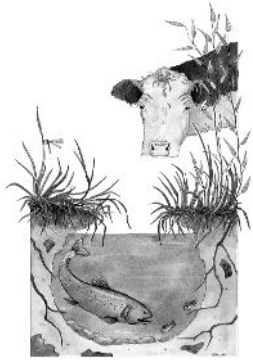
Riparian Health Assessment for Streams and Small Rivers

FOREWORD

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

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 printing of the Field Workbook incorporates the feedback from dozens of training workshops involving hundreds of participants.

Riparian health assessment forms part of a larger package of awareness about riparian areas, leading to choices on managing these vital landscapes. When used as part of the Cows and Fish program, it provides a starting point for future plans and management decisions.



WHAT'S IN THIS WORKBOOK? CONTENTS

INTRODUCTION

Why use this workbook?

When we look at a riparian area, what we see and how we interpret our observations is often based on our backgrounds, experiences and perceptions. Even though we may be standing on the same streambank we don't often "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 stream or small river. 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 stream or small river system. 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 on your own place. The workbook gives you a place to record and store your measurements. It will start you down the road to recognising 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 livestock producers, landowners, land/resource managers and others who want to learn to judge riparian health. Community groups, municipalities, counties and watershed groups will find this workbook helpful in understanding the procedures of riparian health assessment and to interpret the results of watershed level inventories.

Where can I use it?

This workbook is designed for streams and small river systems in Alberta. 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 large river systems, or in lakes, ponds and wetlands. Check with the Cows and Fish program for other riparian health assessment tools (www.cowsandfish.org).

℞ RIPARIAN HINTS

Where Does This Workbook Apply?

- ✓ Streams or rivers that are easily crossed by humans or livestock
- ✓ Systems that are generally less than 15 m (50 ft) in width
- ✓ Tributaries of major rivers
- ✓ Permanent streams, intermittent streams
- ✓ Coulees and draws

★ **Other assessment tools are available for lakes, ponds, wetlands and large river systems.**

How to use the workbook

This Field Workbook was designed to be used 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 **Caring for the Green Zone: Riparian Areas - A User's Guide to Health**, an illustrated awareness guide which provides more detail on the concept of riparian health.
- This workbook can be used with the **Riparian Vegetation Classification** guides, reference documents that describe the major riparian plant communities and their management requirements for several of the natural regions of Alberta.
- 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 Cows and Fish program.
- Once you have some training and experience, the workbook will allow you to carry out riparian health assessment and monitoring on your own landbase.
- The workbook will also help you to interpret the results of a riparian health assessment or inventory that may be undertaken in your community.

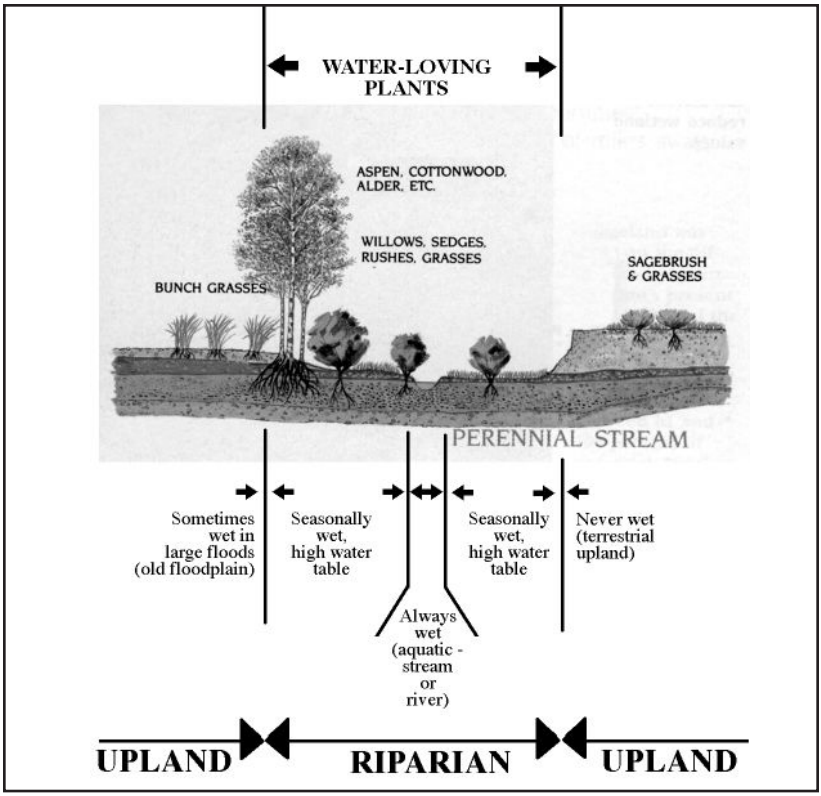
BACKGROUND

What's Riparian?

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 river or stream) 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;
- vegetation that responds to, requires and survives well in abundant water; and
- soils that are often modified by abundant water (as in high water tables), stream processes (like sediment deposition) and lush, productive and diverse vegetation.

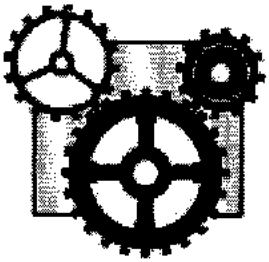
Riparian areas are part of a larger, continuous landscape that grades from wet to dry. Sometimes it will not be easy to determine precisely where a riparian area begins and ends. However, rivers, streams, drainages and springs all have riparian areas adjacent to them. There will most often be a defined channel, that continuously or seasonally carries flowing water, and a floodplain where high flows will periodically escape the channel. Beaver ponds, seeps, wet meadows on the floodplain, coulees and draws are part of the riparian area. Use the illustration on the next page to help you recognize what a riparian area looks like.



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 reach of stream, or an entire stream or a watershed composed of many streams, to perform a number of key ecological functions.

℞ RIPARIAN HINTS



What Do Healthy Riparian Areas Do?
Key Ecological Functions

- ✓ Trap sediment
- ✓ Build and maintain streambanks
- ✓ Store flood water and energy
- ✓ Recharge the aquifer
- ✓ Filter and buffer water
- ✓ Reduce and dissipate stream 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, benefits, functions and values; and
- stability -- landscapes that maintain themselves, persist and are sustainable.

The following table indicates key riparian functions and reasons the functions are important:

What are the relationships between functions and why are these functions important?

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
Build and Maintain Banks	• Balances erosion with bank restoration- reduces effects of erosion by adding bank elsewhere • Increases stability and resilience • Maintains or restores profile of channel- extends width of riparian area through higher water table
Store Water and Energy	• Stream safety valve- stores high water on the floodplain during floods • Reduces flood damage • Slows flood water allowing absorption and storage in aquifer
Recharge Aquifer	• Stores, holds and slowly releases water • Maintains surface flows in rivers and streams • Maintains high water table and extends width of productive riparian area
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
Reduce and Dissipate Energy	• Reduces velocity which slows erosion and material transport • Provides erosion protection and slows meander rate • Aids in sediment capture
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

Some Basics of Riparian Health Assessment

No one characteristic can provide a complete picture of riparian site health or health trend. Riparian health assessment, however, knits together several key health characteristics, including vegetative (plants) and physical (soils and hydrology) features. The assessment procedure relies heavily on vegetative 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, and helping you to understand the successional trend on a site.

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

- an indication of trend toward or away from the potential of the site (what the site could be);
- utilization rates of certain types of vegetation that are key to riparian function (e.g. woody plants); and
- 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 major effects on riparian function and may be more difficult to remedy than changes in vegetation. Examples include:

- extensive downcutting of the channel that 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 will reduce the site's capability to trap sediment, build soil, and protect soil from erosion and removal from the reach; and

- trampling and compaction that will reduce moisture-holding 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 most often a result of what has happened or is happening upstream. Sometimes health can be affected by what occurs downstream, 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 weeds or disturbance species;
- low forage production;
- shelter declining;
- downcutting of the channel;
- many eroding, slumping banks;
- bare soil exposure; and
- few fish or wildlife present.

What riparian health assessment does is put those 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 11 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 impairment of 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 the following table to see the differences between “Assessment” and “Inventory”.

Avoid making comparisons using the assessment method with streams 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 stream, between adjacent streams 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, either deposited on the substrate of the stream or dumped on the floodplain and banks;
- diversion or removal of water upstream;
- additional water added to the stream;
- changes in streamflow (timing of flow, duration of flooding, higher peak flows, lower flows) resulting from damming, major modification to vegetation cover, drainage or road networks; and
- extreme flooding from greater than normal precipitation or fast snowmelt.

Watershed scale evaluations, using the Riparian Health Inventory and instream flow assessment, may be required to analyse these effects.

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
• 11 questions or parameters evaluated	• 79 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 easy to 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? Some History and Uses

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 so that we can 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.

In response to many concerns in the United States, the University of Montana, through its 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. It has been adapted to include riparian situations that will be encountered in Alberta and may be useful for other jurisdictions.

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.

- Assessment 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.

- This 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.

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 flow conditions are close to normal -- assessments should not be done during peak spring run-off or immediately after a major storm.
- To be consistent, either do your assessment before or after grazing use -- ensure follow-up assessments follow the same timing and that different pastures assessed in the same year have similar timing of use.

Pick your site

Start by walking or riding the length of stream or river you want to assess. That will give you the opportunity to make observations and choose sites to assess health. If time is available, or the stream length is short, you might want to consider assessing all of the stream 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 reach of stream and that will provide an overall impression of health.

To determine a site that is representative, become familiar with the entire length of stream and riparian area. What you are picking is a short reach that will represent the average condition of a long stretch of river or stream. Vegetation, use/utilization, channel characteristics and stream gradient in the representative reach should all reflect what is found in and is common to a longer reach. If there is too much variation, or a tributary joins, divide the stream into similar units and then select a representative piece from each unit.

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 stream
• 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 stream.

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

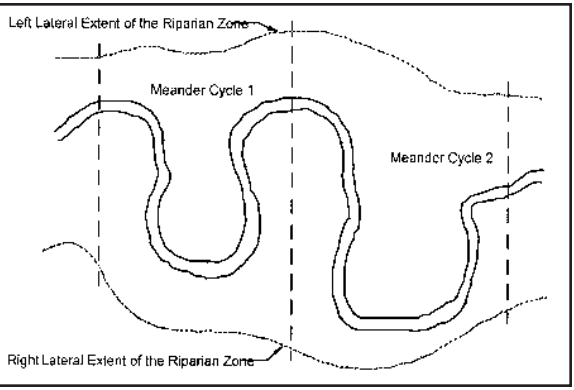
The first step is to determine the length of the reach. For measurements on smaller systems:

- the length of reach should be two channel meander cycles, especially on small streams. Review the illustration to see how to use stream meanders to pick a reach length.

Streambank problems will be overestimated if the reach is located mostly on an outside curve and underestimated if it is mostly on an inside curve. A complete meander cycle has equal inside and outside curvature. Scale will be a consideration in determining reach length. On smaller streams, a 200 m (650 ft) reach length will most often include two meander cycles. For rivers and streams 10 to 15 m (30 – 50 ft) wide, 200 m may be inadequate to do so.

- If it is impractical to assess a full meander cycle, you should assess a minimum of 200 m of river length.

Reach length based on stream meanders



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

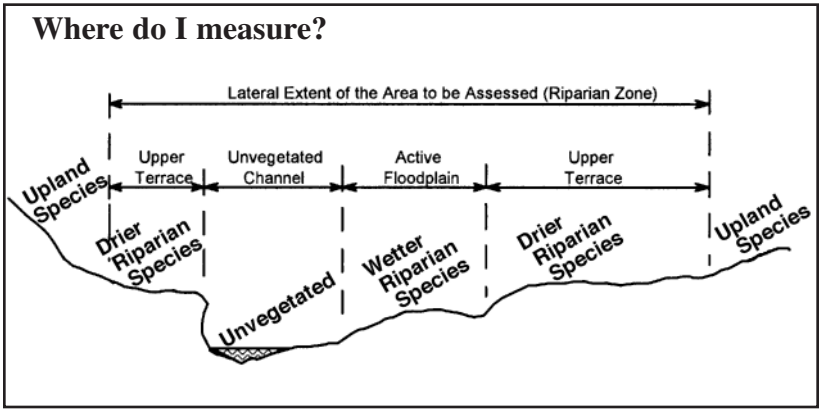
Reach width

The next step is to determine riparian area width, within the upstream and downstream reach boundaries. The area to be assessed starts at the water and may include that portion of the aquatic area (the wetted channel) where persistent emergent vegetation (plants growing in the water such as cattails and sedges) exists. 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. Streams that go dry during the growing season have riparian areas and the channel may remain unvegetated after the water is gone. The non-vegetated channel is not included in the measurements; assume it has water in it, as a permanent stream would, and make all the same observations. The exception to this is a channel where the vegetation has been removed by human causes (e.g. grazing, logging, cultivation or construction). In these situations, the disturbed channel is considered as exposed soil surface (bare ground). Both sides of the stream channel should be assessed, unless the stream is a property boundary, each side has different management or the stream cannot be easily crossed by you or livestock.

That's the easy part. Now you have to find the outer edge of the riparian area. Review the definition of "riparian area" again. The outer boundary of the riparian area exists where:

- vegetation changes from plants responding to or requiring abundant water to drier, upland types;
- topographic changes like terraces, cutbanks or steep banks signal a clear line between the greener, lusher or denser vegetation and the upland;
- old channels or meander scars exist that show movement patterns of the stream and may still indicate a high ground water table; and
- flood water reaches seasonally, or on a regular basis, as high water breaks out of the stream channel.

A combination of vegetation changes, topographic breaks and 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 active floodplain, the streambanks and, sometimes, areas within the stream channel with emergent vegetation. When in doubt, it is better to overestimate the width or extent of the riparian zone than to underestimate it. Review the illustration to help you see "where do I measure?".



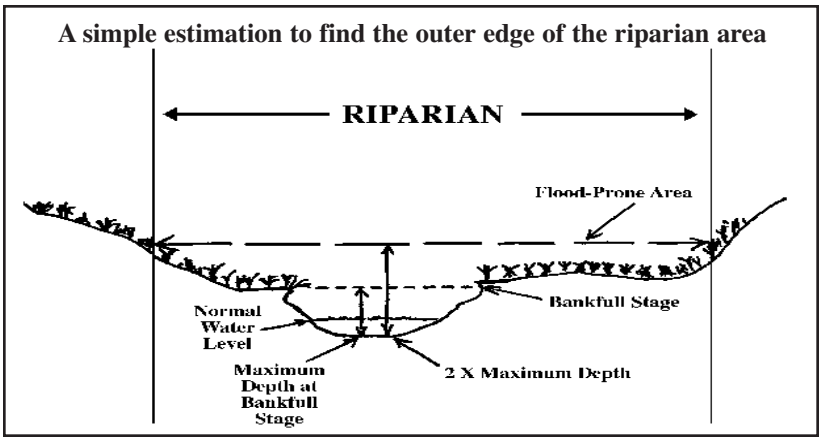
In those cases where it just isn't obvious where the transition exists between riparian and upland areas, a simple estimation of the "floodprone" zone may be helpful. The floodprone zone is that area occupied by high water that escapes the stream channel on a regular basis (at least every 1 to 2 years on average). That zone often equates to the riparian area.

Try this:

- Stand on the edge of the stream, at a riffle (shallow) area and establish a "bankfull" level; where high water will begin to escape the channel during floods. You can locate the bankfull level with the following observations:
  - the elevation at the top of depositional features like sand, silt or gravel bars;
  - the line of staining on boulders or rocks;
  - a major break in the slope of the banks;
  - a change in bank material from coarse substrate within an active channel to deposited material of a smaller size; and
  - exposed roots below an intact, vegetated soil layer indicating erosion.

- Estimate what the maximum depth of the stream would be at that bankfull level.

- Double your estimated depth, and then project that line, with your eye, across the floodplain. Where that line touches is the outer edge of the floodprone zone, and the area enclosed by that line is most of the riparian area. Use the illustration to guide you through this estimation of the outer edge of the riparian area.



Observations have confirmed that this is a useful guide for riparian area identification on most stream types. It is an indication of flood events and high water levels that have a consistent and recurring influence on riparian area structure and vegetation. Some streams, because of excessive downcutting and continual instability, may not have a floodplain, or the stream valley is only accessed by high water during extreme flood events (greater than 1:50 year events). Here, the riparian area will be very narrow.

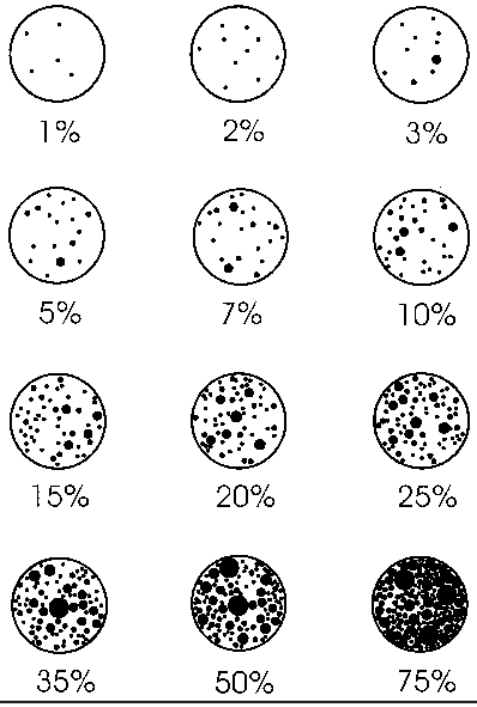
Reach tips

Assessments generally should not cross fences, roads or areas with different management. If the stream to be assessed crosses more than one management unit (e.g. pasture), 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. To eliminate this bias, 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, and 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: your reach selection will be done with this in mind. Before you start to do an assessment, turn to the "Field sheet" on Page 71 and fill in, under "site description", where the upstream and downstream reach boundaries are located. 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 stream channels migrate and change. Your memory of the locations may be imperfect. Take a photograph to help jog your memory in the future.

Notes:

GETTING STARTED

There are 11 questions to answer that relate to components of the riparian reach you have selected. Many deal with the element of "coverage", that is, how much of the reach area is covered, influenced or affected 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 aquatic part. Calculate the area. Now you have some context to determine coverage for many of the questions (e.g. 10 m^2 of tree seedlings in a 1000 m^2 reach equals 1% coverage). As you become more practiced you can use the cover class standards shown here.

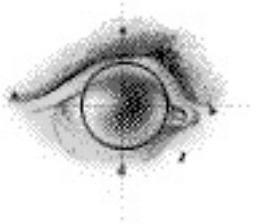


Cover class standards for judging vegetation canopy cover and bare soil

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.

℞ 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 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 reduce energy and trap sediment? Do these plants have the type of root systems that are deep and that bind streambank 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 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 determine. To determine vegetation potential, where it is not immediately evident, you can:

- use the Riparian Vegetation Classification guide;
- observe vegetation present upstream or downstream of the reach or search for stumps, snags or roots remaining on the site;
- consider vegetation present on similar reaches or nearby streams 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, 5 and 6 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 questions 5 and 6.

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 stream reach. 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 use, wildlife use, wildlife and fish observations, water clarity and flow stage;
    - summarize the flood 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.

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

Notes:

RIPARIAN HEALTH ASSESSMENT QUESTIONS (1-11)

1. How much of the riparian area is covered by vegetation?

Vegetation cover of the floodplain and streambanks

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

- traps sediment and stabilizes 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 the illustrations to help you estimate canopy cover on the reach.

- Sediment deposited on the reach is considered "bare ground" for this question.

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).

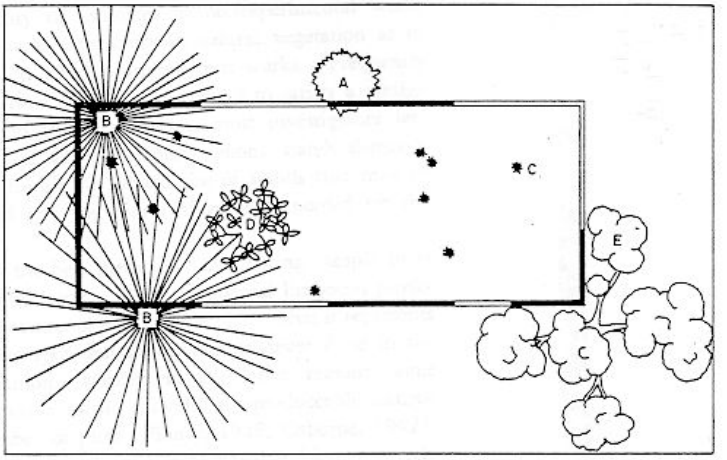
0 = Less than 75% of the reach soil surface is covered by plant growth (greater than 25% bare soil).

Scoring Tip: Soil not covered by plants, litter, moss, downed wood, or rocks larger than 6 cm (2.5 in) is considered bare ground. Count standing rooted, dead or living plants as vegetative cover.

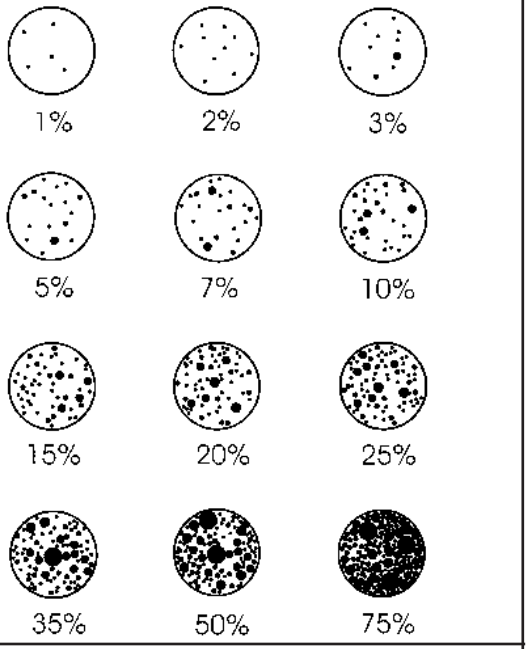
Foliar Cover

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”.



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?



Cover standards from 1 to 75% canopy cover.

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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 weeds?

Invasive plant species

Invasive plants are "alien species whose introduction does or is likely to cause economic or environmental harm". They are often referred to as "noxious weeds."

- The presence of invasive species indicates a threat to the reach or indicates a degraded ecosystem.
- While some of these species may contribute to some riparian functions, their negative impacts reduce overall reach health.
- This question considers both canopy cover and the degree of infestation of the reach.
- The term canopy cover is used here to describe the area of the reach that has become invaded by weeds and may be of concern to the manager.
- Infestation is a function of weed plant density and patchiness or evenness over the reach. Infestation of a reach by invasive species is evaluated based on their density distribution in the reach.
- Record on the worksheet the species and the density distribution (see table on the next page) of all noxious weeds observed as you move across the reach being assessed.
- Measurement of canopy cover and density/distribution are done separately.

Canopy Cover

Scoring:

3 = No invasive species (noxious weeds) on the reach.

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

1 = Invasive plants present with total canopy cover between 1 and 15 percent of the reach.

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

Density/Distribution

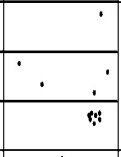
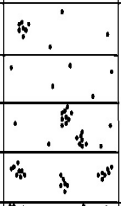
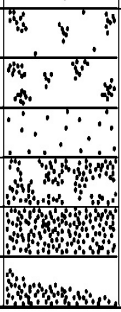
Scoring:

3 = No invasive species (noxious weeds) on the reach.

2 = Invasive plants present with density/distribution in categories 1, 2, or 3.

1 = Invasive plants present with density/distribution in categories 4, 5, 6, or 7.

0 = Invasive plants are present with density/distribution in categories 8 or higher.

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 noxious weeds are considered collectively, not individually.

Scoring Tip 2: You should use a weed list that is standard for the locality and should indicate which species you found. Refer to Page 87 for our list.

Examples of invasive species (see appendix for a complete list)

Common Name	Latin Name
nodding thistle	*Carduus nutans*
spotted knapweed	*Centaurea maculosa*
Canada thistle	*Cirsium arvense*
hound's tongue	*Cynoglossum officinale*
leafy spurge	*Euphorbia esula*
broad-leaved/dalmatian toadflax	*Linaria dalmatica*

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What do weeds tell us?

Weeds normally provide a strong message about riparian health. Weeds 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 weeds due to over-grazing or some other land use or natural disturbance.

- ✓ **NO WEEDS**
  - ✓ Unable to establish, reach is well vegetated, no bare soil and no seed source
- ✓ **ONE WEED**
  - ✓ Potential for invasion, seeds are available
- ✓ **SEVERAL WEEDS**
  - ✓ Present threat for quick invasion
  - ✓ Space is available for them to move in
- ✓ **MANY WEEDS**
  - ✓ System is degraded

3. How much of the riparian area is covered by disturbance-caused vegetation?
Disturbance-increaser undesirable herbaceous species

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 weeds, 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 (weeds) considered in the previous question **are not** reconsidered here.

- The species list in the appendix (starting on Page 87) will help you identify those species that are disturbance-caused,undesirable herbaceous species.

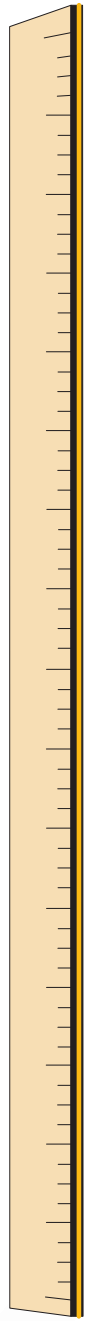
Scoring:

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.



Examples of disturbance-increaser undesirable herbaceous species (refer to the appendix for a complete list)

Common Name	Latin Name
foxtail barley	*Hordeum jubatum*
timothy	*Phleum pratense*
plantains	*Plantago spp*
Kentucky bluegrass	*Poa pratensis*
common dandelion	*Taraxacum officinale*
stinkweed	*Thlaspi arvense*
clovers	*Trifolium spp*

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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.

4. Is Woody Vegetation Present and Maintaining Itself?

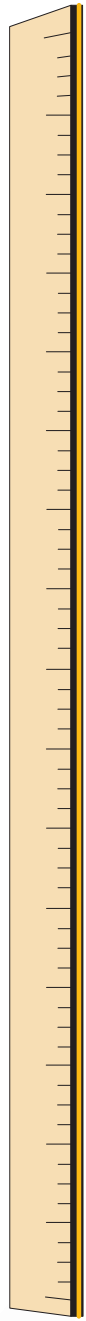
Preferred tree and shrub establishment and regeneration

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 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 the table on page 43 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 exotic 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 29), 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.

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
silverberry / wolfwillow	*Elaeagnus commutata*	Shrub
Russian olive	*Elaeagnus angustifolia*	Tree / Shrub
tamarisk / salt cedar	*Tamarix* spp.	Shrub
caragana	*Caragana* spp.	Shrub
European / common buckthorne	*Rhamnus cathartica*	Shrub

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How To Know If Trees and Shrubs Belong Here

- ✓ Use the **Riparian Vegetation Classification** available from the Cows and Fish program.
- ✓ 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.

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Examples of Preferred Trees and Shrubs

Trees: Cottonwoods, aspen, poplars, birches, conifers

Shrubs: Alders, hazelnut, pin cherry, chokecherry, cranberry, honeysuckle, willows, dogwood, buffaloberry, gooseberry, raspberry

5. Is Woody Vegetation Being Used?
Utilization of preferred trees and shrubs

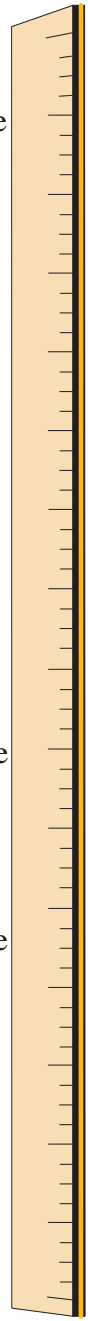
Because woody species have such an important role to play in riparian health, measurements of the level of use helps us understand whether they will persist in the reach. Livestock will often browse woody plants, especially in late summer and fall. Wildlife, including beaver, make use of woody plants 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 or weed 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 the table 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;
- 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).

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

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

Scoring Tip 1: If you have established that the reach has no potential for preferred woody vegetation (see page 29), replace the actual score and possible score with N/A and readjust the total score accordingly.

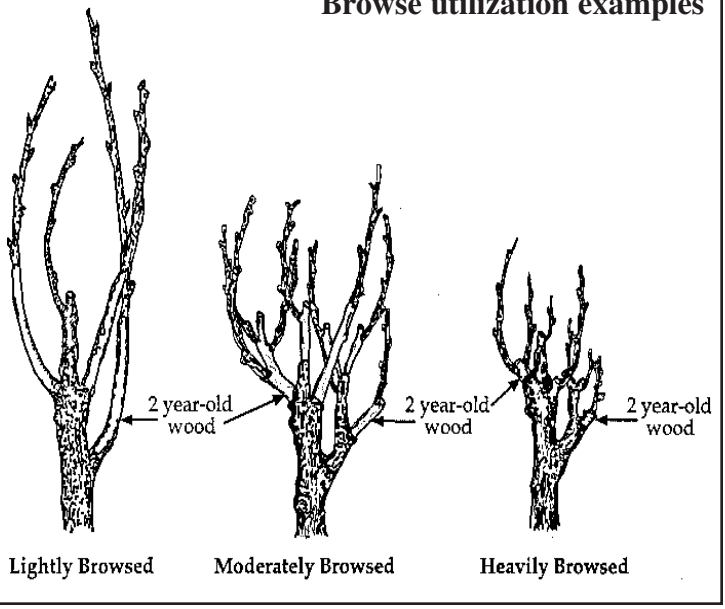
Scoring Tip 2: Beaver or people may cut an entire tree or shrub. If beaver cut stems are encountered, measure these as "heavy" utilization.

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

Do not include these species when evaluating a reach for utilization

Common Name	Latin Name	Category
snowberry / buckbrush	*Symphoricarpos* spp.	Shrub
rose	*Rosa* spp.	Shrub
hawthorn	*Crataegus* spp.	Shrub
shrubby cinquefoil	*Potentilla fruticosa*	Shrub
silverberry / wolfwillow	*Elaeagnus commutata*	Shrub
Russian olive	*Elaeagnus angustifolia*	Tree / Shrub
tamarisk / salt cedar	*Tamarix* spp.	Shrub
caragana	*Caragana* spp.	Shrub
European / common buckthorne	*Rhamnus cathartica*	Shrub

Browse utilization examples



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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 dead wood is there?

Standing decadent and dead woody material

The amount of decadent and dead wood can be a signal of declining health of a reach. The term decadent is used in the broader sense to include not only mature trees slowly dying but also younger age classes of woody vegetation affected by a number of factors:

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

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

Consider these categories:

- dead trees and shrubs that are still standing; and
- decadent trees and shrubs that show clear signs of stress with 30% or more dead branches in the upper canopy.

Healthy trees and shrubs will have some dead branches in their canopies, but are not considered in this question.

For this question, first assess the amount of **woody** canopy cover on the reach. Then estimate how much of that woody cover is **decadent** or **dead**. The illustrations on page 50 will help guide your estimation.

Scoring:

3 = Less than 5% of the total canopy cover of woody species is decadent or dead.

2 = 5% to 25% of the total canopy cover of woody species is decadent or dead.

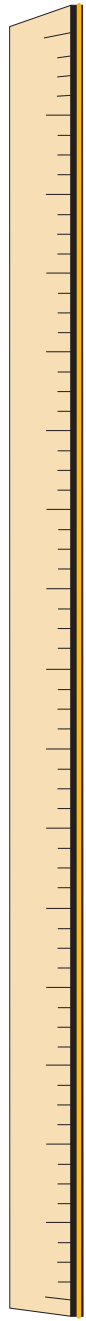
1 = 25% to 45% of the total canopy cover of woody species is decadent or dead.

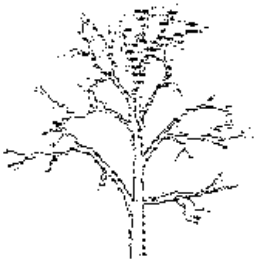
0 = More than 45% of the total canopy cover of woody species is decadent or dead.

Scoring Tip 1: If you have established that the reach has no potential for woody vegetation (see page 29), replace the actual score and possible score with N/A and readjust the total score accordingly.

Scoring Tip 2: Only standing decadent and dead material is included, not material lying flat on the ground.

Scoring Tip 3: Consider individual trees and shrubs, not the entire woody canopy, to answer this question.





No live branches - Dead

More than 30% dead branches - Decadent

Less than 30% dead branches - Alive

No dead branches - Alive

The amount of decadent and dead wood in a tree or shrub canopy can be an indicator of stress to woody plants.

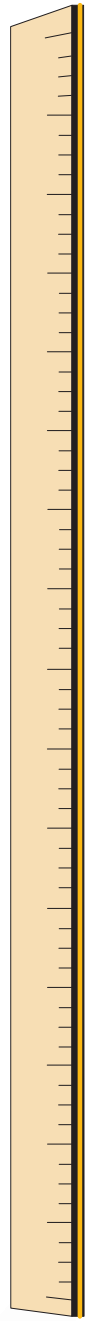
7. Are the streambanks held together with deep-rooted vegetation?

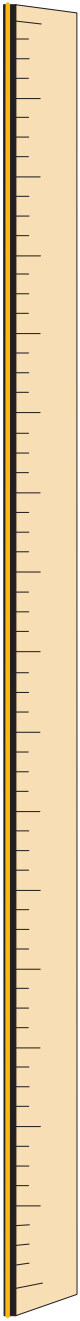
Streambank root mass protection.

The role of streamside vegetation is to maintain the integrity and structure of the streambank by dissipating energy, resisting erosion and trapping sediment to build and restore banks. The root systems of plants bind substrate particles together and provide the "glue" that stabilizes the zone where stream flow and energy have the most consistent, regular effect. Vegetation with deep and binding roots best accomplishes this function, especially if there is a diversity of these species found on the reach. Review the illustration on page 54 to distinguish the below-ground attributes of various kinds of streamside vegetation.

Most tree and shrub species provide such deep roots. Herbaceous annuals and weeds lack this quality. Perennial herbs provide it in varying degrees. Some rhizomatous species, such as sedges, are excellent streambank stabilizers while others, such as Kentucky bluegrass and timothy, have shallow root systems and do not fulfill this key role. To consider the relative value of the vegetation present to perform this key function, you will need to consider the size of the stream, the gradient, soil/substrate makeup and flow/flood patterns. Use the table to help you measure streambank root mass protection for the system you are assessing.

- Walk or observe both sides of the stream reach.
- Evaluate vegetation species from the toe of the slope (at the water's edge during normal low flow) to a variable distance beyond the top of the bank, onto the floodplain.





- The zone to consider extends from the normal low flow stage to where the water level would be at during flooding. On very high cutbanks, the zone to be evaluated does not extend into the upland, but rather measure root mass protection in the riparian area (this may only be near the bottom of tall cliffs). Plants that have deep, binding root mass should be present over that range:
    - on small rivers, evaluate up to 10 m (30 ft) on the floodplain;
    - on large streams, evaluate up to 5 m (15 ft) on the floodplain;
    - on small streams, evaluate up to 3 m (10 ft) on the floodplain; or
    - on intermittent drainages, evaluate up to 1 m (3 ft) on the floodplain.

Scoring:

6 = More than 85% of the streambank has a deep, binding root mass.
4 = 65% to 85% of the streambank has a deep, binding root mass.
2 = 35% to 65% of the streambank has a deep, binding root mass.
0 = Less than 35% of the streambank has a deep, binding root mass.

System Size	Trees	Preferred Shrubs	Other Shrubs	Native Grasses Forbs	Introduced Grass	Disturbance Species	Weeds
Small River	E	E/G	F/P	F/P	P	P	P
Large Stream	E	E	F/P	F	P	P	P
Small Stream	E	E	G	G	P	P	P
Intermittent Stream	E	E	E	E	G/F	P	P

Legend for Table:

E - Excellent - *these species have all the necessary properties of deep, binding and large root mass appropriate to stream size.*

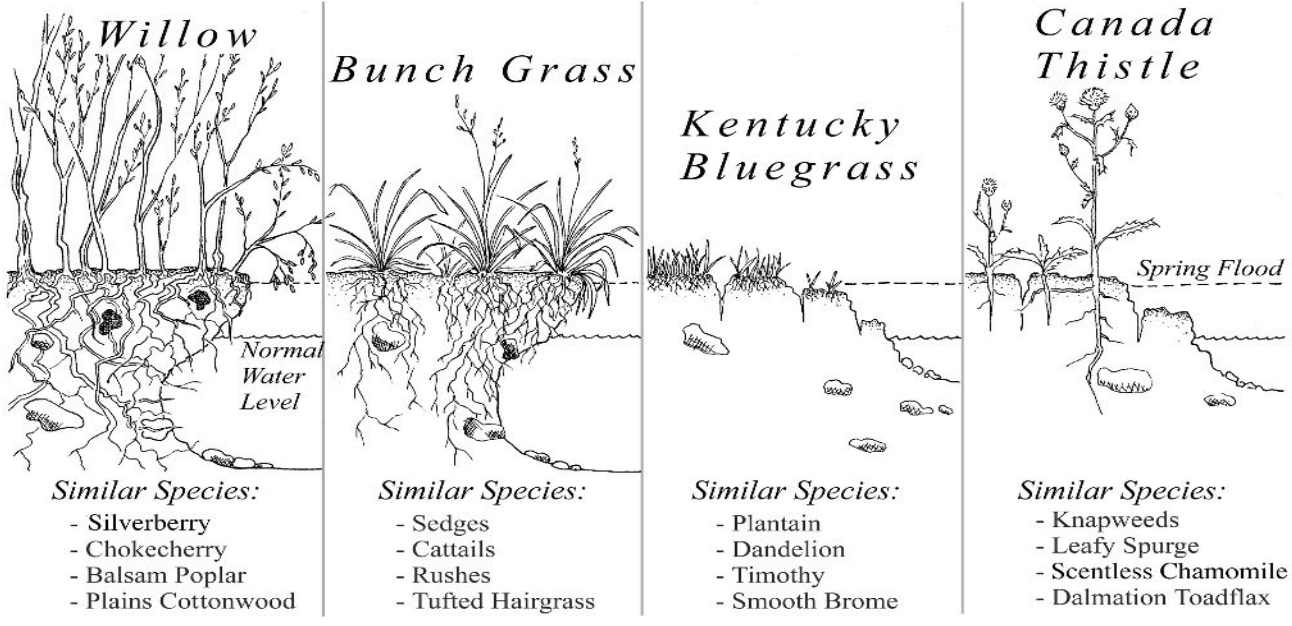
G - Good - *species meet most of the requirements for holding streambank materials together.*

F - Fair - *marginal ability to perform stabilizing function based on high density of plants or presence of other preferred species.*

P - Poor - *vegetation unable to hold streambanks together under normal circumstances.*

Trees e.g. - *cottonwoods, aspen, poplar, conifers, birch*
Preferred Shrubs e.g. - *willows, saskatoon, dogwood, alder, silverberry, chokecherry, cranberry*
Other Shrubs e.g. - *rose, snowberry (buckbrush), shrubby cinquefoil*
Perennial Grasses, Forbs e.g. - *sedges, cattails, tufted hairgrass, other bunch grasses and sod-forming grasses*
Introduced Grasses e.g. - *Kentucky blue grass, timothy, smooth brome, quack grass*
Disturbance Species - *see Appendix*
Weed Species - *see Appendix*

This table is based on hundreds of observations over a broad range of stream types.



In this example, willow and bunch grasses provide a deep binding root mass, while Kentucky Bluegrass and Canada Thistle do not.

8. How much of the riparian area has bare ground caused by human activity?
Human-caused bare ground.

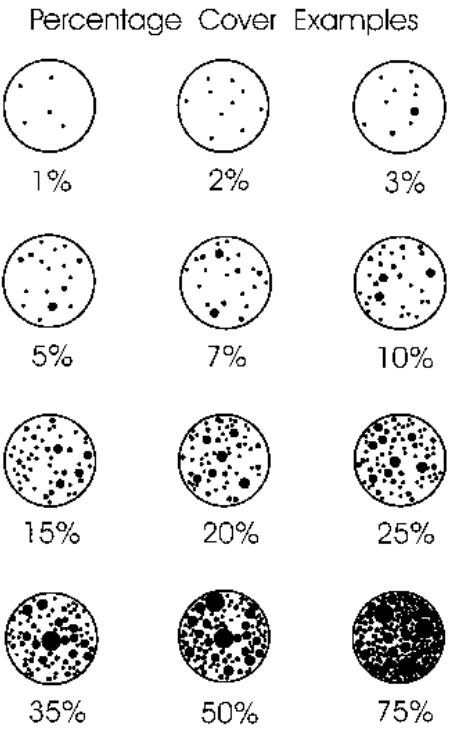
Soil not covered by plants, litter, moss, downed wood or rocks larger than 6 cm (2.5 in) is considered bare ground. Bare ground is unprotected soil that is capable of being eroded by rain drops, overland flow or wind. Bare ground can exist under a tree or shrub canopy and still be subject to erosion 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, saline/alkaline areas and unvegetated channels in ephemeral streams, is excluded from this question.
- Human land uses causing bare ground include livestock grazing, cultivation, recreation, urban development (pavement, concrete), roads/trails, timber harvest and industrial activities.

Consider the entire riparian reach in this question. Estimate what percentage of the reach has human-caused bare ground using the cover standards illustration 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.



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 recent sediment deposition? **NO.**

9. Have the streambanks been altered by human activity?
Streambanks structurally altered by human activity.

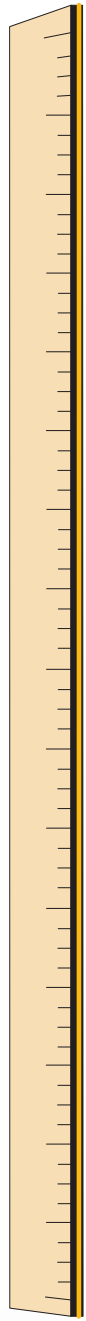
Stable streambanks maintain channel configuration, integrity and bank shape. When streambanks are physically altered, erosion can increase mobilizing channel and bank materials, water quality can deteriorate, and instability can increase within the reach and downstream.

- Bank alteration can result from livestock hoof shear, livestock trails/watering sites, recreational trails, flood/erosion control methods, irrigation diversions/return flows, timber harvest, crossings/fords, bridges/culverts, landscaping and channelization/drainage.
- Include pugging and hummocking on the banks.
- Consider those direct **human** activities that have resulted in cracking, slumping, shearing, removal or reconfiguration of streambank materials that leave the streambank altered in shape, unstable or vulnerable.
- **Natural** slides, slumps and eroding banks are not considered in this question.

In rating this question, consider the bank area from the water's edge up to 0.5 m (20 in) beyond the top of the bank. The bank top is that point where the upper bank levels off to the relatively flat surface of a floodplain or terrace. Include both sides of the stream reach.

Scoring:

6 = Less than 5% of the bank is structurally altered by human activity.
4 = 5% to 15% of the bank is structurally altered by human activity.
2 = 15% to 35% of the bank is structurally altered by human activity.
0 = More than 35% of the bank is structurally altered by human activity.



10. Is the reach compacted, bumpy or rutted from use? ***Human physical alterations to the reach (beyond the banks).***

Changes in floodplain profile, shape, contour and soil structure due to human activities will alter infiltration of water, increase soil compaction and change the amount of sediment contributed to the waterbody. These changes reduce the water-holding abilities of the soil (the riparian "sponge"), thus impacting water storage and aquifer recharge. Filtration, nutrient uptake, floodplain maintenance and primary productivity may be altered as a result.

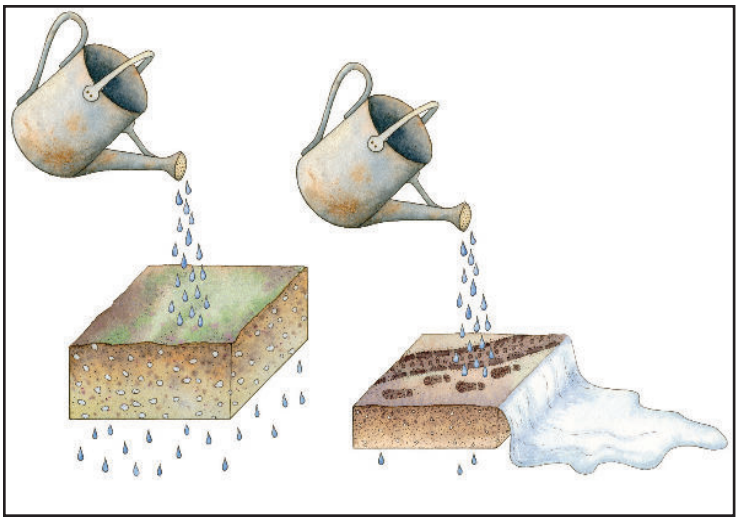
Soil compaction may be difficult to evaluate and is influenced by soil type. Include all physical alterations, such as pugging, hummocking, rutting, man-made surfaces (eg. compacted paths, pavement, buildings), constructed watercourse changes (eg. ditches, diversions, berms), soil tillage, addition of material (eg. fill, rip rap), landscaping, construction or other physical alterations. **Do not assess streambanks**, as they are assessed in question #9.

Scoring:

- **3** = Less than 5% of the reach has been physically altered by human activity.
- **2** = 5% to 15% of the reach has been physically altered by human activity.
- **1** = 15% to 25% of the reach has been physically altered by human activity.
- **0** = More than 25% of the reach has been physically altered by human activity.

Hummocking and **pugging** results from livestock hoof action (occasionally people or rarely wild ungulates). Pugs are the depressions hooves or feet leave in soft soil; hummocks are the raised humps of soil 15 cm (6 in) or higher that result from the soil being pushed up from the pug.

Rutting is considered compacted trails or ruts (usually 5 cm [2"] or greater) from people, vehicles or livestock or highly managed ungulate populations (compacted and compressed soil is present).



Compressing the sponge reduces the amount of water that soaks in!

11. Can the stream access its floodplain?

Stream channel incisement (vertical stability).

Floodplains, the riparian area that lies beyond the stream channel, provide a safety valve that allows water in excess of what the channel can hold to escape into a wider area. Floodplains provide temporary storage for high water and an opportunity to slow that water down, reducing energy. Incisement, or downcutting, can limit the ability of the stream to access its floodplain during high water events. Streams are incised when down-cutting has significantly lowered the channel so that the average two-year flood cannot escape the existing channel.

Incisement can result from:

- watershed-scale, cumulative effects of vegetation removal, drainage and roading which affect runoff;
- local drainage-scale changes including vegetation removal, dams, water additions, roading and culvert installations occurring upstream of the reach (and sometimes downstream);
- reach scale changes including vegetation removal, beaver dam removal, channelization and culverts; and
- natural events including landslides, beaver dam wash-outs and extreme flood events.

Incisement can result in:

- a reduced water table that affects current vegetation and the potential of the reach for some types of vegetation;
- increased stream energy with more erosion, sediment, and unstable banks which can persist downstream of the reach and potentially upstream as the stream readjusts;

reduced water storage and retention leading to lower

flows or flow ceasing during parts of the year;
- impairment in the ability of the reach to rebound from natural and human caused impacts; and
- decreased productivity, forage, shelter and biodiversity values.

Incisement stages have been categorized by Rosgen (1996). His textbook or field guide may be useful materials to assist you in classifying your reach. These incisement stages range from unincised channels where high flow regularly spills onto the floodplain, to entrenched channels where water rarely escapes, possibly only during extreme flood events. Intermediate stages have slightly incised channels where the floodplain can be accessed but is relatively narrow. These intermediate stages represent streams in transition, either improving or degrading.

To rate the reach you are standing on you will need to:
- carefully consider the descriptions of the various stages;
- review the illustrations for the "best fit", recognizing that rarely will your reach look exactly like the figures;
- reflect on past flood history, not the extreme events, but the normally occurring high water events and levels; and
- do some estimates of how much floodplain is available relative to the channel width of the stream.

The stages are often distinguished from one another based on the amount of floodplain width available relative to the stream channel width, at the bankfull stage. Bankfull is the point at which water begins to spill onto the floodplain. Review the following illustration and the

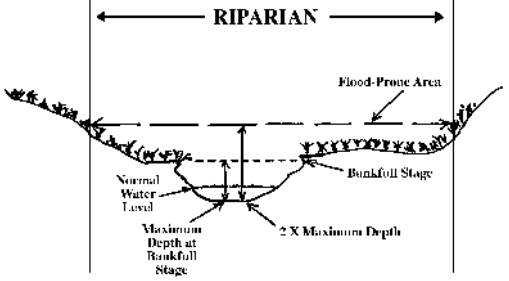
instruction on page 24. Do the same eye estimates to establish the floodprone zone. What you will be comparing is the width of the stream channel, at the bankfull stage, with the width of the floodplain, from the bankfull edge to the outer edge of the floodprone zone on both sides of the stream. This estimation will help you understand if the floodplain is less than, equal to or greater than the bankfull channel width. The wider the floodplain is relative to the channel width, the greater the opportunity to store water and energy during high water events.

If you are evaluating an intermittent or ephemeral stream with no visible, defined channel consider the following:

- these are systems that only flow for a few days (rarely weeks) in the spring or after a rain storm;
- the volume of flow is insufficient to create a visible, unvegetated channel; and
- for these systems, if the width of the riparian area is vegetated with perennial forms, rate them as being vertically stable and unincised.

If you are evaluating a river with substantial flows and a wide channel, this question becomes difficult to answer. For systems of that size you should use the large river form to evaluate riparian health.

How much floodplain can the stream access?



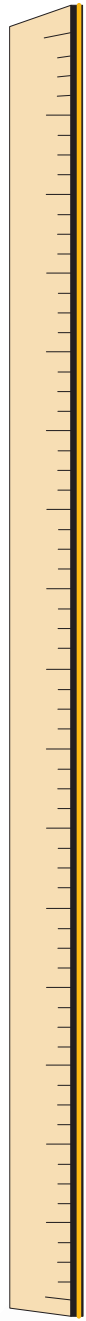
Scoring:

9 = Stages 1a, 1b and 1c. Channel vertically stable and not incised; 1-2 year flows access a floodplain appropriate to stream size and flow volume. Active downcutting not evident. Any old incisement is now characterized by a broad floodplain inside which perennial riparian plant communities are well established.

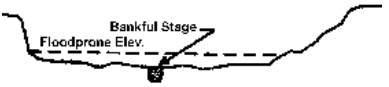
Stage 1a. A stable, unincised, meandering meadow channel. Flows greater than bankfull (1-2 year event) spread over a floodplain more than twice the bankfull channel width.

Stage 1b. A fairly stable, unincised, wide valley bottom channel with broad curves and point bars. These systems typically cut laterally on the outside of curves and deposit sediment on inside point bars, but bankfull flows (1-2 year events) still have access to a floodplain more than twice the bankfull channel width.

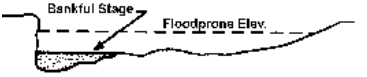
Stage 1c. A stable, unincised mountain or foothill channel with limited sinuosity and slopes greater than 2%. These channels are well armored with bedrock, boulders and cobble and are not prone to downcutting. Although bankfull flow stage is reached every 1-2 years, the floodplain is often narrower than twice the bankfull channel width. Overflow conditions will not be as obvious as in 1a or 1b but armoring maintains the channel.

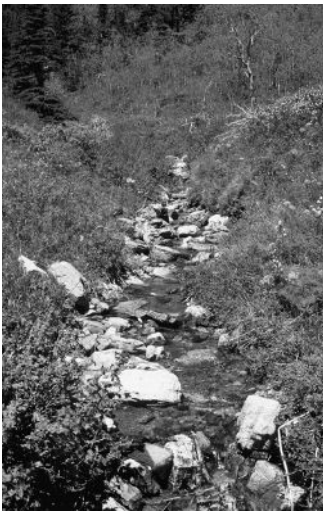


Stage 1a (9 points)

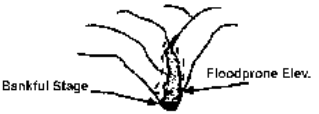


Stage 1b (9 points)



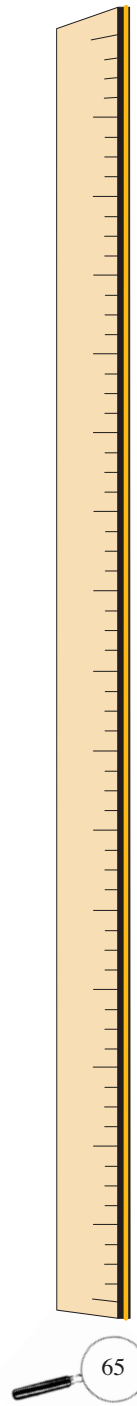


Stage 1c (9 points)

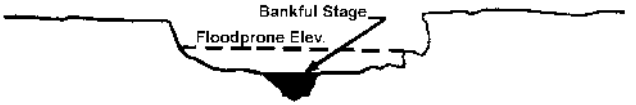


6 = Stage 2. Channel slightly incised. The 1-2 year high flow event can access only a narrow floodplain less than or equal to twice the bankfull channel width. Perennial riparian vegetation is well established. This stage includes: (a) an improving phase that resembles 1a or 1b reestablishing in a narrower floodplain at a new, lower level; or (b) a degrading phase where a 1a is beginning to downcut into the existing floodplain.

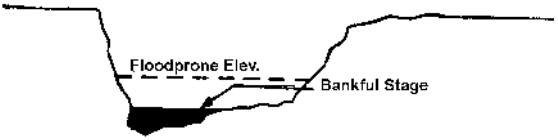
3 = Stage 3. Channel moderately incised. The 1-2 year flows may not access the floodplain but higher flows (less than a 5-10 year event) can access a narrow floodplain less than twice the bankfull channel width. This stage includes: (a) deep incisements that are starting to heal. New floodplain development is present but is very limited. Channels are wide and shallow and unable to regularly (1-2 year event) access a floodplain. Some pioneer plants are beginning to establish on new sediment surfaces; or (b) an incisement that continues to downcut and cannot regularly access a floodplain.



Stage 2 (6 points)



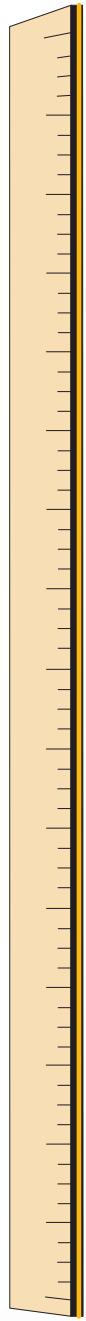
Stage 3 (3 points)



0 = Stages 4a and 4b. Channel vertically unstable and deeply incised. Resembles a ditch or gully. Active downcutting is likely ongoing. Only extreme floods overtop the banks, and no floodplain development has begun.

Stage 4a. A deeply incised stream with a wide, shallow channel. Commonly found in fine substrates (sand, silt and clay). Banks are very erodible. Only limited vegetation, primarily pioneer species, is present.

Stage 4b. A narrow, deep "gully" system, downcut to the point where only the most extreme flood overtops the banks. Banks consist of fine materials which are constantly eroded. Vegetation is rarely present.



Stage 4a (0 points)

Stage 4b (0 points)

HOW TO USE THE FIELD SHEET

In the following section, a field sheet is provided for you to record the results of your training exercise or to apply the riparian health assessment on your own land base. 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:

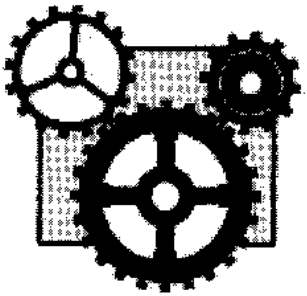
- if preferred woody species are being browsed, note the species that show the heaviest use levels;
- list the species of invasive species (weeds) or disturbance-caused species that you have observed and where they are located;
- extra space is provided on the back of the sheet for more detailed comments on any of the 11 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; and lastly,
- 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?

A total of 15 field sheets are provided. This will allow you to record scores for multiple sites as well as repeated measures over time. You can store the sheets in the workbook, or tear them out and file them away with photographs and other grazing management records.

How Do I Use the Results?

The field sheet knits together the 11 separate questions into one measure of riparian health. **Go to the section following the field sheets to consider what the health score tells you, so 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 streambanks
- ✓ Store flood water and energy
- ✓ Recharge the aquifer
- ✓ Filter and buffer water
- ✓ Reduce and dissipate stream energy
- ✓ Maintain biodiversity
- ✓ Create primary productivity

RIPARIAN HEALTH ASSESSMENT - FIELD SHEET

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

Stream/River: _____

Site Description: _____

_____

					Scores or N/A	
					Actual	*Possible*
1. Vegetative Cover of Floodplain and Streambanks						
6	***4***	***2***	***0***		____	____
2. Invasive Plant Species						
3	***2***	***1***	***0***	**(cover)**	____	____
3	***2***	***1***	***0***	**(density)**	____	____
3. Disturbance-increaser 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. Standing Decadent and Dead Woody Material						
3	***2***	***1***	***0***		____	____
7. Streambank Root Mass Protection						
6	***4***	***2***	***0***		____	____
8. Human-Caused Bare Ground						
6	***4***	***2***	***0***		____	____
9. Streambank Structurally Altered by Human Activity						
6	***4***	***2***	***0***		____	____
10. Reach Structurally Altered by Human Activity (excl. banks)						
3	***2***	***1***	***0***		____	____
11. Stream Channel Incisement (vertical stability)						
9	***6***	***3***	***0***		____	____
				TOTAL	____	____

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* →	

RIPARIAN HEALTH ASSESSMENT - FIELD SHEET

Comments

1. Vegetative Cover of Floodplain and Streambanks

2. Invasive Plant Species

3. Disturbance-Increaser Undesirable Herbaceous Species

4. Preferred Tree and Shrub Establishment and Regeneration

5. Utilization of Preferred Trees and Shrubs

6. Standing Decadent and Dead Woody Material

7. Streambank Root Mass Protection

8. Human-Caused Bare Ground

9. Streambank Structurally Altered by Human Activity

10. Pugging, Hummocking and/or Rutting

11. Stream Channel Incisement (vertical stability)

Sketch stream reach here	*Show photo locations*

Now What?
What To Do When You Finish the Assessment

What does the health score mean?

The riparian health score is a cumulative measure of the 11 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 stream 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 the stream, 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 Alberta'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 condition.

- 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 the health scores to plan management objectives.

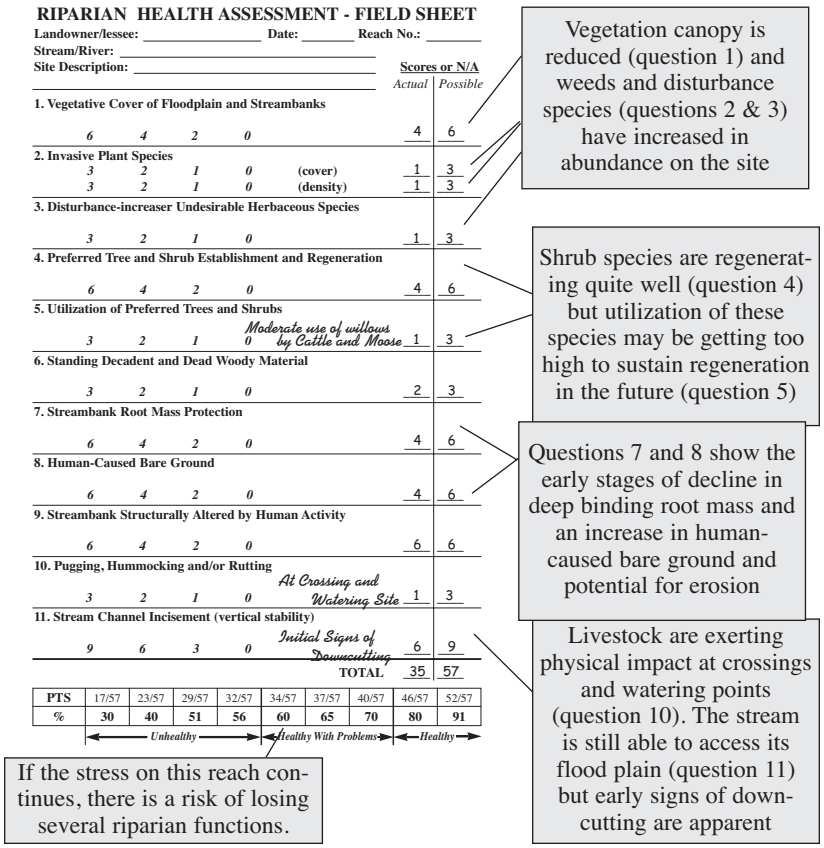
Take time to review the overall health score and the rating for each of the 11 questions.

- 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.

A sample field sheet

This sample reach on the Smith Ranch receives an overall rating of 61% based on an actual score of 35 points out of a possible score of 57 points (35/57 x 100 = 61%). This score puts the stream reach in the "healthy but with problems" category – most riparian functions are being performed, but signs of stress are evident.

- In this example, all questions apply and have been scored.
- Review the captions on the example worksheet to see what each score tells you about riparian health.



RIPARIAN HEALTH ASSESSMENT - FIELD SHEET

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

Stream/River: _____

Site Description: _____

	Scores or N/A	
	Actual	*Possible*
1. Vegetative Cover of Floodplain and Streambanks		
6 4 2 0	4	6
2. Invasive Plant Species		
3 2 1 0 (cover)	1	3
3 2 1 0 (density)	1	3
3. Disturbance-increaser Undesirable Herbaceous Species		
3 2 1 0	1	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 *Moderate use of willows by Cattle and Moose*	1	3
6. Standing Decadent and Dead Woody Material		
3 2 1 0	2	3
7. Streambank Root Mass Protection		
6 4 2 0	4	6
8. Human-Caused Bare Ground		
6 4 2 0	4	6
9. Streambank Structurally Altered by Human Activity		
6 4 2 0	6	6
10. Pugging, Hummocking and/or Rutting		
3 2 1 0 *At Crossing and Watering Site*	1	3
11. Stream Channel Incisement (vertical stability)		
9 6 3 0 *Initial Signs of Downcutting*	6	9
TOTAL	35	57

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*

Vegetation canopy is reduced (question 1) and weeds and disturbance species (questions 2 & 3) have increased in abundance on the site

Shrub species are regenerating quite well (question 4) but utilization of these species may be getting too high to sustain regeneration in the future (question 5)

Questions 7 and 8 show the early stages of decline in deep binding root mass and an increase in human-caused bare ground and potential for erosion

Livestock are exerting physical impact at crossings and watering points (question 10). The stream is still able to access its flood plain (question 11) but early signs of downcutting are apparent

If the stress on this reach continues, there is a risk of losing several riparian functions.

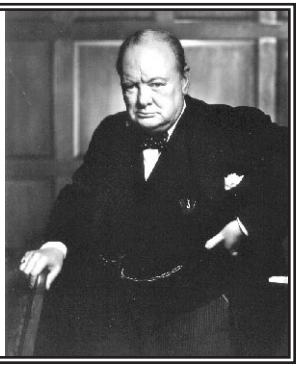
Riparian health scores and grazing management

The most important aspect of riparian health assessment is to use the scores to help you formulate management changes. A few examples are provided here.

- **Example 1** A wintering site may score very low on question 4 (woody regeneration) and question 5 (woody utilization), yet have mid-range to high scores for all other questions. This result alerts the manager to the loss of woody species that are so critical for bank binding, yet so vulnerable to winter browsing. Can changes be made to grazing season or the use and placement of supplemental feeds to help woody species regenerate? (see **Caring for the Green Zone – Riparian Areas and Grazing Management**)
- **Example 2** A pasture scores in the "healthy but with problems" category, with the score for question 9 (stream bank alteration) and question 10 (pugging and hummocking) receiving the lowest scores. With generally higher scores in other categories, this may alert the manager to the fact that livestock use of the riparian area is mostly for water. Stock impact is, therefore, mostly confined to physical pressure with little effect on vegetation from grazing. Perhaps off-stream water can be supplied to reduce the physical impacts.

℞ RIPARIAN HINTS

THAT'S IT! Once you reach a health score and you also understand the riparian health category it represents, it's the END OF THE BEGINNING!



℞ RIPARIAN HINTS

What Do the Health Scores Tell Me? Is My Crick Sick? Take a Reading . . .

If the score is 80 or higher . . .

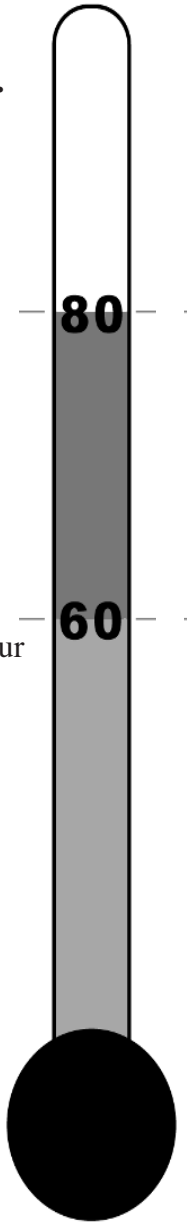
- Congratulations!
- This score means that your riparian area is performing the functions you want it to.
- You should make a record of your present management practices for future reference and share that information with others.

If the score is between 60 and 80 . . .

- Don't jump off the bridge - 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 the list on the inside back cover.
- What are the main areas of concern?
  - Woody species, weeds, bare soils?
- What can you do to change management?
  - More rest, off-stream water, rotational grazing, fencing?



CREDITS

Cover and illustrations on pages 50, 54 by Elizabeth Saunders, Sandpiper Environmental Consultants, Monarch, Alberta.

Figure on page 8 adapted from: Chaney, E., W. Elmore and W.S. Platts, 1990. **Livestock grazing on western riparian areas**. U.S. EPA 45p

Figures on pages 21, 23, 47, 63, 65 and 67 adapted from: Hansen et al. 2000.

Figure concept by Lorne Fitch, ASRD, Lethbridge: page 24.

Figures on pages 27, 35 and 56 by Colin Stone, Public Lands Division, ASRD, Peace River.

Figure on page 34, reprinted from: Daubenmire, R. 1959. **A canopy-coverage method of vegetational analysis.** Northwest Science 33: 43-64.

Figure on page 37, by Darlene Moisey, Public Lands Division, ASRD, Lethbridge

Field sheet concepts by Barry Adams, ASRD, Lethbridge: pages 71, 72 and 77.

OTHER REFERENCES FROM COWS AND FISH

Awareness Documents

- **Caring for the Green Zone - Riparian Areas and Grazing Management.** 2003. 3rd Edition. Cows and Fish program, Lethbridge. 46 pages.
- **Riparian Areas: A User's Guide to Health.** 2003. Cows and Fish program, Lethbridge. 46 pages.

Riparian Health and Classification Tools

- **Riparian Health Assessment for Streams and Small Rivers - Field Workbook.**
- **Riparian Health Assessment for Lakes, Sloughs and Wetlands - Field Workbook.** [this booklet]
- **Classification and management of riparian and wetland sites of Alberta.** W. H. Thompson and P. L. Hansen.
  Note that 2 are available:
  - Grassland Natural Regions and Part of Adjacent Subregions;
  - Parkland Natural Region and Dry Mixedwood Natural Subregion
- **Riparian Manuals & Forms for Alberta and associated areas:**
  Health Assessment (Survey) OR Inventory for:
  - Streams and Small Rivers
  - Large Rivers (Assessment only)
  - Lakes, Wetlands, and Sloughs

Cows and Fish Fact Sheets:

- Value of Wetlands
- Lakes and Wetlands
- Crops, Creeks and Sloughs
- The Cows and Fish Process
- Facing the Issues
- Water Quality & Riparian Areas
- Riparian Health Training
- Biodiversity and Riparian Areas
- Riparian Health Assessment and Inventory
- Invasive and Disturbance-caused Plants in Riparian Areas
- Riparian Health Checklists: Looking at my Lakeshore *OR* Streambank
- Getting Past the Talk - Working with Communities
- Riparian Demonstration Sites - a guide to selection and development
- Riparian Profile and Reference Sites
- Community Stories
- Producer Stories from Alberta Farms and Ranches

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

For a full list of Cows and Fish Tools, visit:
http://www.cowsandfish.org

OTHER REFERENCES

Alberta Lotic Wetland Health Assessment for Streams and Small Rivers (Survey) User Manual and Form; Alberta Lentic (lakes and wetlands) Wetland Health Assessment User Manual and Form

http://www.cowsandfish.org/health.html

Guide to Restricted and Noxious Weeds of Southern Alberta. A field publication of the Agricultural Fieldmen of Alberta. Contact your Municipal Agricultural Service Board for a copy.

Hansen, Paul L., William H. Thompson, Robert C. Ehrhart, Dan K. Hinckley, Bill Haglan, and Karen Price. 2000. **Development of Methodologies to Evaluate the Health of Riparian and Wetland Areas.** In: Proceedings of the Fifth International Symposium of Fish Physiology, Toxicology and Water Quality, Hong Kong, China, November 10-13, 1998. Vance Thurston, Editor. United States Environmental Protection Agency, Office of Research and Development, Washington, DC, 20460. EPA/600/R-00/015. pp. 233-244

Range Health Assessment for Grassland, Forest and Tame Pasture. 2003. Adams, B.W., G. Ehlert, C. Stone, M. Alexander, D. Lawrence, M. Willoughby, D. Moisey, C. Hincz and A. Bogen. Public Lands Division, Alberta Sustainable Resource Development. Pub. No. T/044. 105 pp.

Rosgen, D.L. 1996. **Applied River Morphology.** Wildland Hydrology, Pagosa Springs, Colorado. 390 pp.

Rosgen, D.L. and H.L. Silvey. 1998. **Field Guide for Stream Classification.** Wildland Hydrology, Pagosa Springs, Colorado. 193 pp.

Stone, C. and D. Lawrence. 2000. **Northern Range Plants.** Alberta Agriculture, Food and Rural Development, Public Lands Division. 200 pp.

Stream and Riparian Area Management: A Home Study Course for Managers. Montana State University.

Wilkinson, K. 1990. **Trees and Shrubs of Alberta.** Lone Pine Pub. 129 pp.

APPENDIX

Weeds and Disturbance-Caused Undesirable Species for Riparian Health Assessments

Why have a detailed species list for weeds and disturbance-caused undesirable plants?

A comprehensive list of weeds and disturbance-induced species is necessary for riparian inventory and assessment. In order to accurately determine the health of a riparian area, those completing the assessments need to know which species in the native plant community would be present with natural disturbance and which would not. In other words, which ones are disturbance-induced species (native or introduced, they increase or become more prevalent due to higher than natural levels of disturbance or activities) and weeds (non-natives, see **What is a weed?** below). In addition to the potential economic losses to land managers from weeds, weeds may be vigorous competitors that prevent a healthy, native riparian community from providing important riparian functions like sediment trapping, bank stabilization and filtration.

What is a weed?

The Weed Control Act of Alberta designates weeds into three categories: *restricted*, *noxious* and *nuisance*. By law, **restricted weeds** must be eradicated because of their highly competitive nature. Restricted weeds pose a serious threat to agriculture and the environment because they spread rapidly and are difficult to control. **Noxious weeds** have potential for rapid spread and can cause severe crop losses resulting in economic hardship. By law, weeds in the noxious category must be controlled to prevent their spread. **Nuisance weeds** (part of the list of disturbance-caused undesirables used in riparian health assessment) are the most common weeds and are usually widespread across the province. Nuisance weeds can cause econom-

ic losses, but are so biologically suited to their environment that they cannot be effectively eradicated. **Disturbance-caused undesirable herbaceous species** is a term used in riparian health assessments to include most nuisance weeds as well as many other plant species that respond to site disturbance. Disturbance-caused undesirable species include native and non-native species that tend to increase with site disturbance, and are regarded as undesirable because they do not perform optimal riparian functions (e.g. provide deep-binding root mass for bank protection). Such site disturbance is often linked to a downward trend for plant communities from the potential natural community, and reduced riparian function or "health".

Impact of weeds

It is important to control the spread of noxious and restricted weeds: left uncontrolled, these weeds may eventually create an unnatural monoculture. Because a monoculture consists of only one species, it provides minimal structural and habitat diversity, which may reduce or limit the ability of that area to provide wildlife habitat or perform ecological functions. Invasive non-native plants severely impact wildlife by replacing the vegetation they utilize for shelter or food.
Weeds compete for nutrients, water and sunlight normally available to native plant species. Some weeds have the ability to alter soil chemistry with subtle but harmful effects on native plant species, and consequently, the animals that rely upon them. Weed invasions may result in more runoff and erosion because weeds generally do not provide adequate ground cover and lack deep, soil-binding root systems. Agricultural production, stream flow during dry periods, and wildlife habitat may be reduced or even eliminated. If you consider all of these negative effects, you can well imagine the thousands of dollars lost to the Alberta economy each year if these weeds are left uncontrolled.

How to use this species list

The list of designated weeds (restricted, noxious, and nuisance) is based on the Weed Designation Regulations of the Weed Control Act of Alberta, most current at the time this list was created. This list was generated to create a consistent list for Alberta, so if you plan to add species or modify this list, be sure to talk to other plant community and riparian experts in the area first. Individual counties and municipal districts occasionally have by-laws that rate the regulated species (restricted, noxious, and nuisance) more stringently. Contact a local agricultural representative to confirm weed designations in your area. Contact the Queen's Printer Bookstore (Edmonton or Calgary) for up-to-date copies of acts or regulations. This invasive weed and disturbance-caused species list was developed in conjunction with information from the Alberta Weed Designation Regulations and extensive experience and testing by Cows and Fish team members and Public Lands Division (Sustainable Resource Development). There may be other invasive or disturbance-caused species or you may find that some species respond differently to disturbance, depending upon the region you are working in.

Understanding the Species List Table

ID Code (in the species table) refers to the seven letter code used to record the Latin (scientific) name of a species during riparian health assessments and inventories. Typically, the first four letters are composed of the beginning of the genus, while the last three letters of the code are the start of the species name. If the genus is only three letters, then four letters are taken from the species portion. These codes are used for consistency and speed of data collection. If you are unfamiliar with the codes or scientific name, ensure that whatever common name you use is verified with a scientific name at a later date, since common names tend to be more variable (and less common) than you might think.

Regulated (in the species table) refers to *the designation given to weeds (restricted, noxious, or nuisance) under the Weed Designation Regulations*.

Based on Cows and Fish program and Public Lands Division (ASRD) experience:

- **disturbance-caused undesirable herbaceous** species are not regulated and are therefore listed as '**0**' under 'Regulated'.

Based on the Weed Designation Regulation (for the Weed Control Act) in Alberta:

- **restricted** weed species are listed as '**1**' under Regulated': because of the serious management implications these species pose, they are indicated in **bold type;**
- **noxious** weeds are indicated by '**2**' under 'Regulated'; and
- **nuisance** weeds are listed below as '**3**' under 'Regulated'

Riparian Health Plant Category (in the species table) refers to the categorization of these plants for riparian health assessment purposes. **'I'** refers to those species considered ***invasive species*** (all restricted, most noxious species, and a few nuisance species); **'D'** refers to ***disturbance-caused undesirable herbaceous species*** (which includes a few noxious weeds, most nuisance weeds and those non-regulated species that are disturbance-caused species).

- **restricted** weed species are listed as '**I**' (*invasive species*);
- **noxious** weed species are chiefly listed as '**I**' (*invasive species*), with a few listed as '**D**' (*disturbance-caused undesirable herbaceous species*);
- **nuisance** weeds are chiefly listed as '**D**' (*disturbance-caused undesirable herbaceous species*). In some cases, a nuisance species is categorized as *invasive* ('**I**') if it tends to be particularly aggressive in riparian areas.

Species	Latin Name	Common Name	Regulated	Riparian Health
BROMTEC	*Bromus tectorum*	downy chess/brome	3	I
CARASPP	*Caragana* spp.	caragana	0	I
CARDCHA	*Cardaria chalepensis*	hoary cress	2	I
CARDPUB	*Cardaria pubescens*	globe-podded hoary cress	2	I
CARDNUT	***Carduus nutans***	**nodding thistle**	**1**	**I**
CENTDIF	***Centaurea diffusa***	**diffuse knapweed**	**1**	**I**
CENTMAC	***Centaurea maculosa***	**spotted knapweed**	**1**	**I**
CENTREP	*Centaurea repens*	Russian knapweed	2	I
CENTSOL	***Centaurea solstitialis***	**yellow star thistle**	**1**	**I**
CHRYLEU	Chrysanthemum *leucanthemum*	ox-eye daisy	2	I
CIRSARV	*Cirsium arvense*	Canada thistle	2	I
CONVARV	*Convolvulus arvensis*	field bindweed	2	I
CUSCGRO	***Cuscuta gronovii***	**common dodder**	**1**	**I**
CYNOOFF	*Cynoglossum officinale*	hound's tongue	2	I
ECHIVUL	*Echium vulgare*	viper's-bugloss; blueweed	2	I
ELAEANG	*Elaeagnus angustifolia*	Russian olive	0	I
ERODCIC	*Erodium cicutarium*	stork's bill	2	I
EUPHCYP	*Euphorbia cyparissias*	cypress spurge	2	I
EUPHESU	*Euphorbia esula*	leafy spurge	2	I
GALIAPA	*Galium aparine*	cleavers	2	I
GALISPU	*Galium spurium*	false cleavers	2	I
KNAUARV	*Knautia arvensis*	blue buttons; field scabious	2	I
LINADAL	*Linaria dalmatica*	broad-leaved/ Dalmatian toadflax	3	I
LINAVUL	*Linaria vulgaris*	butter-and-eggs/ toadflax	2	I
LOLIPER	*Lolium persicum*	Persian darnel	2	I
LYCHALB	*Lychnis alba*	white cockle	2	I
LYTHSAL	*Lythrum salicaria*	purple loosestrife	2	I
MATRPER	*Matricaria perforata*	scentless chamomile	2	I
MYRISPI	***Myriophyllum spicatum***	**Eurasian water milfoil**	**1**	**I**
ODONSER	***Odontites serotina***	**late-flowering eyebright/ red bartsia**	**1**	**I**
RANUACR	Ranunculus acris	tall buttercup	2	I

Species	Latin Name	Common Name	Regulated	Riparian Health
RHAMCAT	*Rhamnus cathartica*	European/common buckthorne	0	I
SILECUC	*Silene cucubalus*	bladder campion	2	
SONCARV	*Sonchus arvensis*	perennial sow thistle	2	I
TAMASPP	*Tamarix* spp.	tamarisk/salt cedar	0	I
TANAVUL	*Tanacetum vulgare*	common tansy	2	I
AGROPEC	*Agropyron pectiniforme*	crested wheat grass	0	D
AGROREP	*Agropyron repens*	quack grass	3	D
AMARRET	*Amaranthus retroflexus*	red-root pigweed	3	D
ANTESPP	*Antennaria* spp	pussy-toes; everlastings	0	D
APOCAND	*Apocynum androsaemifolium*	spreading dogbane	2	D*
ARCTMIN	*Arctium minus*	common burdock	0	D
AVENFAT	*Avena fatua*	wild oat	3	D
AVENSAT	*Avena sativa*	oats	0	D
BRASNAP	*Brassica napus*	canola (Argentine)	0	D
BRASKAB	*Brassica kaber (see also Sinapis arvensis)*	wild mustard	3	D
BRASRAP	*Brassica rapa*	canola (Polish)	0	D
BROMINE	*Bromus inermis*	smooth brome	0	D
BROMJAP	*Bromus japonicus*	Japanese brome	0	D
CAMPRAP	*Campanula rapunculoides*	creeping bellflower/ garden bluebell	3	D
CAPSBUR	*Capsella bursa-pastoris*	shepherd's purse	3	D
CERSARV	*Cerastium arvense*	field mouse-ear chickweed	3	D
CERSNUT	*Cerastium nutans*	long-stalked chickweed	0	D
CERSVUL	*Cerastium vulgatum*	common mouse-ear(ed) chickweed	3	D
CHENALB	*Chenopodium album*	lamb's quarters	0	D
CONVSEP	*Convolvulus sepium*	hedge bindweed/ wild morning-glory	3	D
CREPTEC	*Crepis tectorum*	narrow-leaved/ annual hawk's beard	3	D
DESCPIN	*Descurainia pinnata*	green tansy mustard	3	D
DESCSOP	*Descurainia sophia*	flixweed/tansy mustard	3	D
ERUCGAL	*Erucastrum gallicum*	dog mustard	3	D
ERYSCHE	*Erysimum cheiranthoides*	wormseed mustard	3	D

Species	Latin Name	Common Name	Regulated	Riparian Health
FAGOTAR	*Fagopyrum tartaricum*	tartary buckwheat	3	D
FRAGSPP	*Fragaria* spp	strawberries	0	D
GALETET	*Galeopsis tetrahit*	hemp-nettle	3	D
HORDJUB	*Hordeum jubatum*	foxtail barley	0	D
HORDVUL	*Hordeum vulgare*	barley	0	D
LAMIAMP	*Lamium amplexicaule*	henbit	3	D
LAPPECH	*Lappula echinata*	bluebur	3	D
MALVROT	*Malva rotundifolia*	round-leaved mallow	3	D
MELISPP	*Melilotus officinalis and alba*	yellow and white sweet clover	0	D
NESLPAN	*Neslia paniculata*	ball mustard	3	D
PHLEPRA	*Phleum pratense*	timothy	0	D
PISUSAT	*Pisum sativum*	peas (field)	0	D
PLANSPP	*Plantago* spp	plantains	0	D
POACOMP	*Poa compressa*	Canada bluegrass	0	D
POAPRAT	*Poa pratensis*	Kentucky bluegrass	0	D
POLYCON	*Polygonum convolvulus*	wild buckwheat	3	D
POLYPER	*Polygonum persicaria*	lady's thumb	3	D
POTEANS	*Potentilla anserina*	silverweed	3	D
POTENOR	*Potentilla norvegica*	rough cinquefoil	3	D
POTEREC	*Potentilla recta*	sulfur cinquefoil	0	D*
RAPHRAP	*Raphanus raphanistrum*	wild radish	3	D
SALSKAL	*Salsola kali*	Russian thistle	3	D
SCLEANN	*Scleranthus annuus*	knawel	2	D*
SECACER	*Secale cereale*	rye (cereal)	0	D
SETAVIR	*Setaria viridis*	green foxtail	3	D
SILECSE	*Silene cserei*	smooth catchfly/ biennial campion	3	D
SILENOC	*Silene noctiflora*	night-flowering catchfly	3	D
SINAARV	*Sinapis arvensis*	wild mustard	3	D
SONCOLE	*Sonchus oleraceus*	annual sow thistle	3	D
SPERARV	*Spergula arvensis*	corn spurry	3	D
STELMED	*Stellaria media*	common chickweed	3	D
TARAOFF	*Taraxacum officinale*	common dandelion	3	D
THLAARV	*Thlaspi arvense*	stinkweed	3	D
TRIFSPP	*Trifolium* spp	clovers	0	D
TRITAES	*Triticum aestivum*	wheat	0	D
VACCPYR	*Vaccaria pyramidata*	cow cockle	3	D
XTRITIC	*X Triticosecale*	triticale	0	D

**The categorization of this species may change.*

+ Regulated refers to these categories: 0-not regulated; 1-restricted; 2-noxious; 3-nuisance

x Indicates suggested categorization of the species in riparian health assessment/inventories: I-invasive species; D-disturbance-caused undesirable species

* The categorization of this species may change

NOTE: Other non-native or agronomic species may be 'D' too, but are not listed here. If you find a species that is not listed here but should be considered in riparian health assessment or inventory, record it and note that it was included. Consistency is important: remember that if you add species you should consult with Cows and Fish or other plant community experts in your area.

Notes:

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Alberta, Canada T2P 2C8
403-221-8360

Canadian Cattlemen's Association
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Alberta, Canada T2E 7H7
403-275-8558

Alberta Environment
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Edmonton, Alberta
Canada T5K 2J6
780-427-6310

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

Alberta Sustainable Resource Development (ASRD)
Public Lands Division
Agriculture Centre
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403-382-4298

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

Fisheries and Oceans Canada
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Alberta, Canada T2E 8X4
403-292-6549

Agriculture and Agri-Food Canada Prairie Farm Rehabilitation Administration (PFRA)
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Cows and Fish Website:
http://www.cowsandfish.org

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