

# 1 ABOUT THIS GUIDE

## GRAZING MANAGEMENT

This guidebook focuses on the needs of producers to economically graze livestock while ensuring the grazed areas are able to function naturally. These functions are collectively termed Pasture, Range and Riparian Health and form the basis for a Grazing Management Plan. Also, note the following:

- ◆ **this guide is also intended to be used in conjunction with the Riparian Management Field Workbook of the Canada-British Columbia Environmental Farm Plan Series**
- ◆ **this guide contains grazing management recommendations and monitoring strategies intended for the management of private “deeded” and leased grazinglands**

<b>Grazinglands</b>	Grazinglands include any vegetated land that is grazed or has the potential to be grazed. This includes areas that vary from intensively managed pastures to rangelands.
<b>Rangelands</b>	Land on which the indigenous vegetation (climax or natural potential) is predominantly grasses, grass-like plants, forbs, or shrubs and is managed as a natural ecosystem.
<b>Grazingland Management</b>	Grazingland management is the manipulation of the soil-plant-animal complex in pursuit of a desired result.

The health of grazing lands can be maintained or sustained by following the principles outlined in this guide.

## PASTURE AND RANGE HEALTH

**Pasture and Range health** is defined as the “*degree to which the integrity of the soil, vegetation, water and air, as well as the ecological processes of the grazing land ecosystem, are balanced and maintained*”. Ecological processes include the **nutrient cycle, water cycle, and energy flow** and thus refer to the ability of grazinglands to perform important natural functions like:

- ◆ produce plant biomass including forage for livestock and wildlife
- ◆ maintain the soil and protect the site from erosion
- ◆ capture and beneficially release water
- ◆ cycle nutrients and energy
- ◆ maintain biological diversity
- ◆ store carbon

The majority of this publication has been taken from the publication developed by the Montana State University Extension Service, titled “Monitoring Montana Rangeland” and the United States Department of

Agriculture’s “National Range and Pasture Handbook” and “Guide to Pasture Condition Scoring”. In addition, where practicable, this methodology has also incorporated information from other more intensive methodologies referred to in the reference section.

The methodology used in this management guide is intended for livestock producers who wish to increase their understanding of how they can assist in maintaining a functional:

- ◆ **nutrient cycle** (the cycle of nutrients such as nitrogen and phosphorus through the physical and biotic components of the environment);
- ◆ **water cycle** (the capture, storage and redistribution of precipitation); and
- ◆ **energy flow** (conversion of sunlight to plant and animal matter) on their grazing lands

This method was designed to assist livestock producers in preventing and decreasing environmental impacts on their farm while maintaining or increasing profits. It is also a useful tool that may assist in achieving your objectives as outlined in your Grazing Management Plan. Finally, it is important to note that future revisions of this methodology will occur as science and experience provide additional information on indicators of rangeland health and its assessment.

## RIPARIAN HEALTH

Riparian areas attract livestock and wildlife by providing water, forage, and shelter. The degree of this attraction is dependant on the grazing season. For example in the hot dry summer months, the forage found in a riparian area may be the only green forage available on a range or dry land pasture. Combine this with water availability and shade and it is easy to see why these areas are extremely attractive to livestock.

The **Riparian Management Field Workbook** publication of the **Canada-British Columbia Environmental Farm Plan Series** is designed to assist those interested in determining the health of their *riparian areas*.

## WHY SHOULD I CONSIDER PASTURE AND RANGE HEALTH ?

Healthy pasture and rangelands will provide a long list of goods and services for society. For livestock producers this means economically and environmentally sustainable grazing opportunities along with a functional watershed and soil protection. Numerous habitat and wildlife benefits will also occur if pastures and rangelands are managed in a healthy manner.

Additional benefits include:

- ◆ reduced feed costs
- ◆ maintenance and/or improvement of forage production (even through drought!)
- ◆ increased flexibility around season of use
- ◆ reduced weeds and associated control costs
- ◆ reduced fertilizer costs

- ◆ quality wildlife and fisheries habitat
- ◆ prevention of soil erosion
- ◆ timber production
- ◆ water quality and watershed protection; and
- ◆ large soil carbon sinks

The assessments in this guide consist of a group of indicators that can be used to determine the pasture and range health of a representative area. There are two assessments in this guidebook. The first one titled, *Native Range Assessment* is for grazing lands dominated by native plant species (e.g. forested grazinglands and grasslands dominated by native grasses including bluebunch and slender wheatgrass, Idaho and rough fescue, naturalized Kentucky bluegrass grasslands) whereas the second one, *Tame Pasture Assessment*, is for pastures dominated by domestic species (e.g. bromegrasses, orchardgrass, crested wheatgrass, etc.). Note that the questions found in these assessments are slightly different.

Please refer to the **Riparian Management Field Workbook** publication when assessing sites dominated by wetlands or meadows including those dominated by sedges and hair grass.

Assessments provide a snapshot in time assessment of the apparent trend and health of the pasture selected. Follow-up assessments can also be used to determine the trend of your grazinglands. Trend indicates whether your grazinglands are improving, remaining static, or getting worse under current management and climatic conditions. This is useful in providing some insight on future grazing management decisions.

The indicators, presented in the form of a question, in these assessments (Table 1 below) were selected because they provide a general idea as to the status of the three ecological processes (nutrient cycle, water cycle, and energy flow) that are otherwise too difficult, expensive, or inconvenient to measure. Moreover, these assessments provide an opportunity to look at grazing lands differently and outline concerns that can be discussed with other interested parties such as the Ministry of Agriculture, Food and Fisheries, Ministry of Water, Land and Air Protection, and Department of Fisheries and Oceans Canada.

Section 2 provides more detail as to how these questions attempt to address pasture and range environmental concerns.

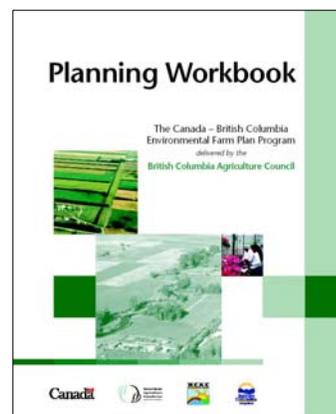
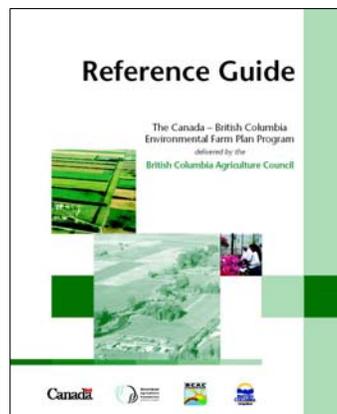
Table 1	Indicators Used to Assess Pasture or Range
1.	Do desirable plants make up more than one-half of the vegetation cover or weight?
2.	Are desirable plant species abundant in all age and size classes?
3.	Does leaf length, seed production, colour, and overall productivity of desirable plants indicate strong vigour?
4.	Is there any evidence of overuse (hedging caused by livestock browsing) on shrubs and trees?
5.	Is litter and plant residue fairly abundant and some composed of desirable plants?
6.	Is the area free of evidence indicating soil compaction, soil movement including its loss?
7.	Are plant roots exposed or are there other signs of pedestalling?

## HOW DOES IT FIT WITH MY ENVIRONMENTAL FARM PLAN?

The **Environmental Farm Plan (EFP)** is a voluntary process to help producers identify areas where environmental improvements should occur on the farm. **The Canada-British Columbia Environmental Farm Plan: Reference Guide** provides information on various environmental regulations and makes suggestions for environmentally sound practices. It is the primary reference for completing the worksheets in the **Canada-British Columbia Environmental Farm Plan: Planning Workbook**.

The EFP Planning Workbook asks some basic questions regarding pasture and range health on your farm. If you have already completed an Environmental Farm Plan, you may have identified action items or areas of improvement for your grazing management. Where appropriate, developing a Grazing Management Plan can help in improving the management and health of the pastures and ranges on your farm.

This **Grazing Management Guide** is a companion document to the EFP Reference Guide and Planning Workbook shown below. This guidebook outlines tame pasture and native range assessments and offers factsheet information to guide producers in designing a Grazing Management Plan based on concerns identified in the EFP. The information applies to all grazing in BC but, it is specifically directed to deeded and leased lands.



# 2 ASSESSING YOUR GRAZINGLANDS

## THE THREE-STEP PROCESS

### Step 1 Assessing Your Pasture or Range

The assessment of a pasture or range involves answering a series of questions which differ depending on whether a native range (grasslands and forests) or tame (domestic) pastures is being assessed.

*Use the Native Range Assessment for forested grazinglands and grasslands dominated by native grasses including bluebunch and slender wheatgrass, Idaho and rough fescue and naturalized Kentucky bluegrass grasslands.*

→Page 7

*Use the Tame Pasture Assessment for grazinglands dominated by tame species (crested wheatgrass, bromegrasses, orchardgrass etc.).* →Page 19

The results of the assessment are then tallied. A score of **5** or greater indicates that the grazing land is in fair to good shape. Scores of **7** or greater indicates that the pasture is most-likely in excellent shape. Scores of less than **5** may indicate a problem with your current grazing management practices and thus warrants further investigation.

### Step 2 Identify Any Concerns from the Assessment and Select Revised Management Practices as Required

If the assessment scored is less than **5**, consider further investigating the questions that caused reductions in the score. Scores between **5** and **7** may also warrant further investigation.

These investigations should try and determine whether:

- a) livestock management changes need to be made;
- b) the assessment occurred during a period of climatic extremes (e.g., drought);
- c) the pasture is subjected to excessive wildlife numbers or recreational activities (e.g., off road vehicle use etc.); and
- d) current conditions are based on past or current management activities.

If management changes are required, refer to the factsheets at the back of this document and/or the “**Rangeland Handbook for BC**” (available from the

British Columbia Cattlemen's Association) for management options and ideas.

### Step 3 Develop a Grazing Management Plan, Monitor Results, and Adjust Practices as Required

**Step 1: Do the Health Assessment**

- Use the Native Range and/or Tame Pasture Assessments to determine the condition of your grazing lands.

**Step 2: Identify Any Concerns from the Assessment and Select Revised Management Practices Where Required**

- Identify concerns and practices that address them.
- Use Grazing Management Factsheets 1 through 6 to select revised management practices where required.

**Step 3: Develop Grazing Management Plan, Monitor Results, and Adjust Practices if Required**

- Develop a Grazing Management Plan that includes revised management practices.
- Use Grazing Management Factsheet 7 for monitoring techniques, Factsheet 8 for Drought Management Options, and this document for designing a Grazing Management Plan.

## STEP 1 ASSESSING YOUR PASTURE OR RANGE

Before completing the assessment(s), divide the pasture into units that are obviously different. That is, separate deciduous forest (poplar, birch) from open coniferous forest (Douglas fir, lodgepole pine, ponderosa pine) and from closed coniferous areas (forests that livestock absolutely avoid) and, tame pasture from native grassland.

All riparian areas should be treated as separate units and assessed (if needed) using the **Riparian Management Field Workbook** publication of the **Canada-BC Environmental Farm Plan (EFP) Series**.

Now decide whether the assessment is needed to determine the average health of a pasture or the health of a specific problem area, especially those areas that may require monitoring over time.

### Assessment Location

All grazing management plans should identify *key areas* that allow grazing use to be monitored. A *key area* is defined as a relatively small portion of a pasture that is selected because of its location, use, or grazing value as a

monitoring point for grazing use. It is assumed that key areas, if properly selected, will reflect the overall acceptability of current grazing management over the entire pasture. A key area should not include areas of livestock concentration, such as stream crossings, bridges, fence lines, and driveways. That is, these areas should be located at least 100m from fence lines and accessible water. Although it is preferable to have a key area for every pasture, it is also important to limit the number of areas so that monitoring can occur in a timely and acceptable manner. Overall, a *key area* should serve as an indicator of grazing use for the pasture and not include areas of livestock concentration.

#### Assessment Timing

Health assessments should occur when plants are easily identifiable. If possible, avoid sampling immediately after grazing. Common health assessment windows are as follows:

- ◆ in the lower elevations of the Southern Interior (grasslands and open forests), from late May to late June
- ◆ in the Northern Interior, Peace River Region and the higher elevations of the Rocky Mountain Trench and Southern Interior, from July to mid August
- ◆ Timing may change in wetter or drier years
- ◆ follow-up assessments should then be completed during similar seasons and under similar grazing conditions

## ASSESSING NATIVE RANGE

Use Table 2, below, for assessing native range. Refer to Table 5, page 19, if managing tame species (crested wheatgrass, brome grasses, orchardgrass, etc.).

<b>Table 2 Native Range Assessment</b> (Includes grassland and forested range)			
Circle your estimate of each factor. Assessment score is the sum of all circled numbers.			
	Yes	Maybe	No
1. Do the desirable plants make up more than one-half of the vegetation cover or weight?	+2	0	-2
2. Are desirable plant species abundant in all age and size classes?	+2	0	-2
3. Does leaf length, seed production, colour and overall productivity of desirable plants indicate strong vigour?	+1	0	-1
4. Is there any evidence of overuse (browsing or hedging) on shrubs and trees?	-1	0	+1
5. Is litter and plant residue fairly abundant and some composed of desirable plants?	+1	0	-1
6. Is there evidence of soil compaction, soil movement, or its loss?	-2	0	+2
7. Are plant roots exposed or are there other signs of pedestalling?	-1	0	+1
<b>Total Score (total 10)</b>			

## Detailed Explanation of Native Range Assessment Questions

Use this assessment for pastures (rangelands) dominated by native plants. If the pasture is dominated by tame species (crested wheatgrass, bromegrasses, orchardgrass, etc.), please refer to the Tame Pasture Assessment, page 19.

### Native Range Question 1.

*Do desirable plants make up more than one-half of the vegetation cover or weight?*

- ◆ Significant disturbances like continuous heavy grazing, prolonged periods of drought or high precipitation, invasive species invasion, frequent burning, intensive recreational activity, and timber removal can all impact plant community composition. Heavy grazing weakens desirable forage plants, thus shifting the competitive advantage to low growing, disturbance induced, undesirable plants including low growing native plants such as pussytoes, strawberry, yarrow or other exotic invasives including dandelion, knapweed, Canada thistle, leafy spurge etc. Undesirable plants can include those that are invasive and crowd out desirable species or are poisonous. Examples of desirable and invasive plants are provided in Tables 2 and 3, respectively. See Appendix 1 for a more comprehensive list of invasive plants.
- ◆ Desirable plants are those plants that contribute positively to the management objectives of the site while maintaining the nutrient and water cycles as well as maximizing energy flow. In most cases, on private grazing lands, desirable plants should be those plants that:
  - are perennial
  - readily consumed and persistent
  - provide consistent and high amounts of forage
  - prohibit the introduction or spread of invasive plants
  - provide enough litter and residue to conserve soil moisture and maintain soil stability
- ◆ in grassland situations, desirable plants typically include
  - low shrubs (e.g., low valley grasslands)
  - tall grasses and forbs
  - medium grasses and forbs
  - ground cover (grasses, forbs, moss, and lichen)
- ◆ in forested situations, desirable plants typically include
  - low, medium and tall shrubs
  - tall forbs and grasses
  - medium forbs and grasses
  - ground cover (moss and forbs)

### Scoring Hints

If this question is difficult to answer, find a reference site that occurs in a similar plant community. This reference site can be an area that is lightly to moderately grazed. In forested plant communities, these reference areas occur well within the forest, generally over 100 meters from fences, water sources, trails, cut-lines, etc., or on the other side of fences or natural barriers. In grasslands, reference sites are often located over 500 meters from

water and away from fence lines. They can also occur on the other side of a fence or natural barrier or in areas that are separated from highly utilized areas by rugged topography. It is important that the reference plant community has adequate resistance to and resilience from most disturbances.

<b>Table 3 Example of Desirable Native Plants</b>						
	<b>Location</b>	<b>Shrubs</b>	<b>Tall Grasses</b>	<b>Short Grasses</b>	<b>Perennial Forbs</b>	<b>Groundcover</b>
<b>Grassland</b>	<b>Okanagan</b>	Bitterbrush Big sagebrush Rabbit-brush	Bluebunch wheatgrass Idaho fescue Needlegrasses	Junegrass Sandberg's bluegrass	Pasture sage Balsamroot	Lichens Moss
	<b>Fraser Basin</b>	Big sagebrush Rabbit-brush	Bluebunch Wheatgrass Idaho and Rough fescue (southern locales) Needlegrasses		Wild blue flax Pale comandra Pasture sage Balsamroot	
	<b>Peace River</b>	Snowberry Rose Saskatoon	Western porcupine grass Slender Wheatgrass	Junegrass Sedges	Pale comandra Goldenrod	
<b>Forest</b>	<b>Ponderosa Pine</b>	Big sagebrush Saskatoon	Bluebunch wheatgrass Idaho and Rough fescue (southern locales)	Junegrass Sandberg's bluegrass	Balsamroot Lemonweed	Lichens Moss
	<b>Interior Douglas-fir</b>	Saskatoon Soopolallie Snowberry Spirea	Pinegrass Bluebunch wheatgrass	Sedges	Aster	Moss
	<b>Aspen</b>	Rose Cranberry Black Twinberry Soopolallie	Hairy wild-rye Bluejoint		Aster Fireweed Peavine Vetch	Moss

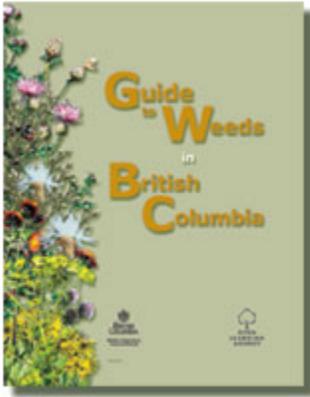
The following websites provide useful information on the identification of the plants mentioned in this table.

1. Photographic guide to common range plants of British Columbia  
Website address: <http://www.cwnp.org/photoindex.html>
2. National Resource Service Plant Database.  
Website address: <http://plants.usda.gov/>

<b>Table 4 Examples of Invasive Plant Species *</b>	
<b>Weed Species</b>	<b>Scientific name</b>
Blueweed	<i>Echium vulgare</i>
Canada Thistle	<i>Cirsium arvense</i>
Dalmatian Toadflax	<i>Linaria dalmatica</i>
Diffuse Knapweed	<i>Centaurea diffusa</i>
Hound's-tongue	<i>Cynoglossum officinale</i>
Leafy spurge	<i>Euphorbia esula</i>
Orange Hawkweed	<i>Hieracium aurantiacum</i>
Oxeye Daisy	<i>Chrysanthemum leucanthemem</i>
Scentless Chamomile	<i>Matricaria maritime</i>
Spotted Knapweed	<i>Centaurea maculosa</i>
Sulphur Cinquefoil	<i>Potentilla recta</i>

\* See Appendix 1, page 43 for a more comprehensive list of invasive plants.

**For information on how to identify these invasive plants, please see the following two documents.**



**1. Guide to Weeds in BC (adjacent)**

This guide is prepared as a reference for farmers, ranchers, resource managers, students, the public and other users of rangeland.

Profiling 80 weeds, the guide includes identification, impact, legal status, habitat, local distribution, biology, ecology, and management strategy for each weed.

Available online: <http://www.weedsbc.ca/>

**2. Field Guide to Noxious and other Selected Weeds of British Columbia**

This field guide has been prepared to help farmers, ranchers, resource managers, and the public identify British Columbia's noxious weeds.

Available online: <http://www.agf.gov.bc.ca/cropprot/weedguid/weedguid.htm>

**Examples of Desired Plant Communities**



A Southern Interior grassland composed of more than one-half highly-productive and desirable large bunchgrasses grasses.



A lodgepole pine forest composed of more than one-half productive and desirable grasses (predominately pinegrass).



A Northern Interior cutblock composed of a mixture of desirable shrubs, forbs and grasses.



Peace River aspen stand will an abundance of desirable plants including highly productive grasses, forbs and shrubs.

## Native Range Question 2.

### *Are desirable plant species abundant in all age and size classes?*

To maintain or improve the health of pastures it is extremely important to ensure that desirable plants are abundant in all age and size classes. This not only ensures the continued recruitment of desirable plants, it also favours a more diverse plant community with varied canopy structures and rooting depths. These communities assist in maintaining the nutrient and water cycles and maximizing energy flow by using sunlight, water, and nutrients from different zones in the canopy and soil. Desirable plants in all age and size classes also provide habitat for numerous wildlife species including browsing opportunities for ungulates and feeding and nesting sites for birds and small mammals. If recruitment is not occurring and existing plants are either dying or dead, the health of the pasture in question is in decline. Healthy pastures have a mixture of many age and size classes.

Heavy grazing tends to limit the abundance of desirable plants in both age and size classes. For example, overuse of shrubs in grassland and forest situations will reduce wildlife habitat of some species. Heavy grazing can also reduce the structural diversity (removal of different grass size classes) in grassland plant communities. In most native grassland communities, patchy grazing is preferred when managing for habitat diversity. It is also important to note that some wildlife species prefer large areas of uniform use.

- ◆ In grassland situations, expect to see the following desirable plants in a variety of age and size classes.
  - low shrubs (e.g., low valley grasslands)
  - grasses and forbs
  - ground cover (moss and lichen)
- ◆ In forested situations, expect to see the following desirable plants in a variety of age and size classes.
  - low, medium, and tall shrubs
  - forbs and grasses
  - ground cover (moss and forbs)
- ◆ Note that a loss in desirable species, age and size classes may be due to climatic conditions and historical management and thus may have nothing to do with current management.
- ◆ The presence of mosses and lichens maximizes energy flow, nutrient, and water cycling while the loss of these species may be attributed to over-use (trampling) or non-use (shading by litter).

## Scoring Hint

If unsure as to whether some age/size classes desirable plants are missing, look for grazing/browsing impacts on plants. For example, browsing of unpalatable shrubs like soopolallie, snowberry, or sagebrush usually indicates that more desirable plants have been reduced or eliminated by overuse.

**Native Range  
Question 3.**

*Does leaf length, seed production, colour, and overall productivity of desirable plants indicate strong vigour?*

Plant vigour is reflected by the size of a plant and its parts in relation to its age and the environment in which it is growing. It is important to note however, that periodic drought is common in dry land environments and will lower the apparent vigour and annual productivity of desired plants.

Plants with low vigour have a greater potential to be replaced by weedy invasives and other low quality or poisonous plants.

- ◆ when determining vigour, concentrate on the vigour of individual desirable plants



Peace River aspen stand showing poor vigour, productivity and a loss of desirable tall forbs and shrubs.



Peace River aspen stand showing excellent vigour, productivity and a mixture of desirable tall forbs, grasses and shrubs.



Southern Interior bunchgrass grassland showing poor vigour, productivity and a lack of desirable large bunchgrasses.



Southern Interior bunchgrass grassland showing excellent vigour, productivity and a dominance of large, more robust bunchgrasses.

**Native Range  
Question 4.**

***Is there any evidence of overuse (hedging) on shrubs and/or trees?***

In forested and some grassland situations, shrubs and trees are desirable plant species that not only provide an important food source at certain times throughout the year, but also provide numerous habitat values for a wide array of wildlife species. This includes browsing opportunities for ungulates and feeding and nesting sites for birds and small mammals. Some amount of browsing of shrubs is expected and preferred, but overuse by livestock often signals that the grasses and forbs within the pasture are being overgrazed.

Livestock often browse shrubs and trees in the early spring or late summer and fall when other preferred plants are absent or dormant. Light to moderate use often helps maintain plant vigour while heavy use will reduce vigour. Prolonged, heavy use will eliminate the best woody plants.

Answer **Yes**, if you fall under the category of heavy use after completing the following test.

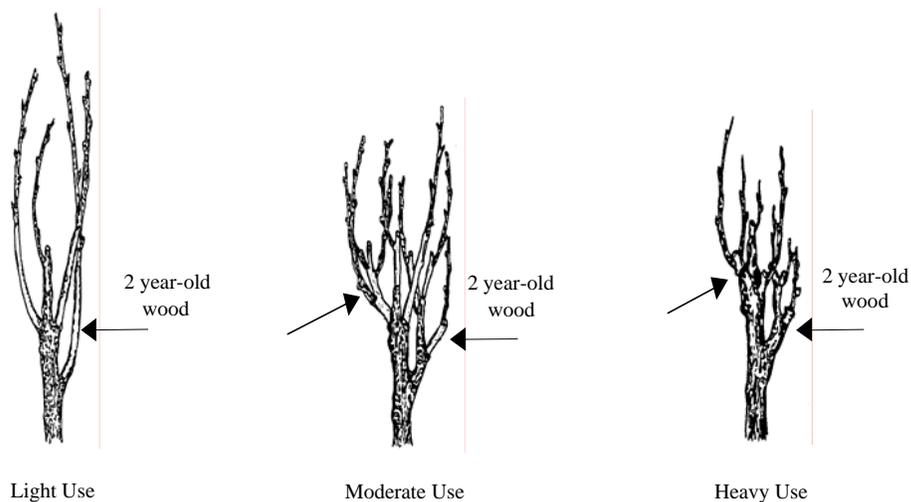


Photo of a heavily used willow.

***Evidence of shrub or tree overuse:***

- ◆ first, randomly pick 2 to 3 plants of each of the preferred woody species (e.g. willow, saskatoon, rose, dogwood)
- ◆ 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

The diagram below will assist you in answering this question.



## Scoring Hints

**Light Use-** Shrubs of this nature generally have open, loose crowns and produce a large quantity of vigorous twigs. Frequently, these plants are either all or largely available. Their appearance is that of healthy, fast-growing plants. Unused (non-browsed) plants are included here.

**Moderate Use-** These shrubs possess moderately open crowns but show signs of some hedging. Plants that are used to this degree exhibit varying levels of vigour and begin to take on a ragged appearance. Some of the twigs are readily available while the remaining twig growth is generally unavailable due to the tight growth forms and presence of larger clubbed stems on the periphery of the crown.

**Heavy Use-** A closed, compact rounded appearance is usually characteristic of heavy use on a mature plant. Generally, very little twig growth is present on the exterior portion of the shrub, as most of the twig growth is confined to the interior. A decadent plant often shows signs of close hedging on the few larger stems that produce limited leader growth. Young plants are generally not very common in a closely hedged shrub community.

In addition to determining tree and shrub use, the following indicators may be used to determine whether tree/shrub populations are expanding, stable, or diminishing:

- ◆ expanding populations – age distribution within these populations is generally pyramid shaped with many young (small size) individual plants forming a wide base, fewer middle-aged plants (medium sized), and very few old (large) plants at the top
- ◆ stable Populations – age distribution within these populations is generally “bullet” shaped, with approximate equal amounts of young and middle-aged (or size) plants forming the middle and base, and fewer older (larger) plants at the top
- ◆ diminishing populations- age distribution within these populations is generally “urn” shaped, with a narrow base (sometimes absent) of young (small) plants widening toward the older aged (medium sized) plants, then sharply narrowing with the oldest (largest) plants at the top

**Native Range  
Question 5.**

*Is litter and plant residue fairly abundant and some of it composed of desirable plants?*

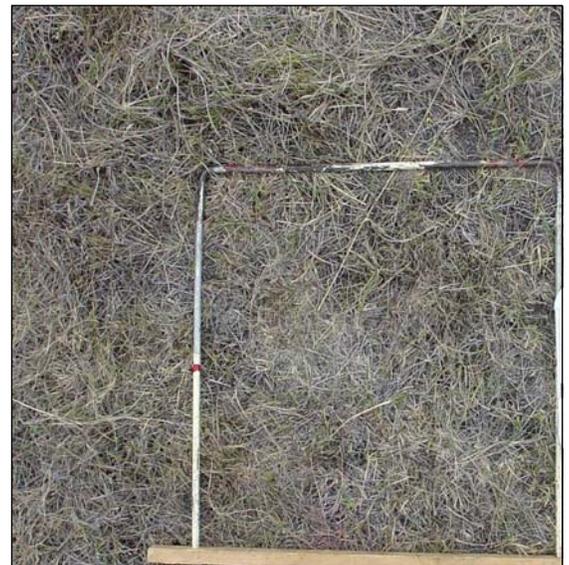
Litter and standing plant residue (dead material), in various states of decay, provides additional surface cover and promotes nutrient cycling by providing organic matter and nutrients to the soil. The additional cover provided by this material reduces soil erosion by wind and water including reducing raindrop impact. Litter and plant residue also promote moisture retention by reducing evaporation and increasing water infiltration into the soil by slowing runoff and providing a pathway into the soil profile.

In general, litter and plant residue is directly related to weather and the degree of forage use each year.

- ◆ To be able to answer **Yes** to this question, 25 to 50 percent of the standing forage mass should either be dead or consist of dying leaves and stems
- ◆ it is also important to note that too much litter and standing plant residue (dead material) will reduce the quality of forage consumed, as well as inhibit new plant shoot growth and seedling emergence. Anything greater than 50 percent may be excessive.



Southern Interior grassland with relatively little litter.



Southern Interior bunchgrass grassland with fairly abundant litter and plant residue (>25%), some of which is composed of desirable plants.

## Native Range Question 6.

### *Is there evidence of soil compaction, soil movement, or its loss?*

When managing native rangelands it is extremely important to prevent human caused soil movement or loss by maintaining adequate plant cover and minimizing the amount of exposed (bare) soil. Any loss of soil will lower the productivity of a site by removing finer soil particles like clays, silts, and organic matter all of which are integral in maintaining soil fertility and the site's moisture holding capacity. The potential for soil movement (i.e., rill and gully formation) increases with increasing slope and the loss of plants, plant residue and litter.

It is also important to minimize soil compaction. Soil compaction decreases the amount of water available to plants by reducing water infiltration into the soil profile. Most compaction occurs when rangelands with saturated soils are grazed or subjected to heavy equipment. Compacted layers often occur less than 15 centimetres from the soil surface. It is also important to note however, that most upland compacted soils in British Columbia tend to recover (i.e., break up of compaction layers) quickly due to frost heaving and earthworm activity.

Drawings and corresponding photographs on the following pages will provide examples of soil compaction, soil movement, and its loss.

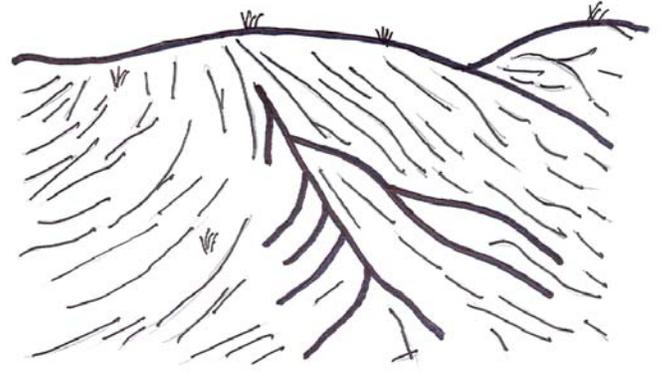
- ◆ answer *Yes*, if any of the following are observed
  - the presence of debris dams of plant residue that build up at obstructions or span between obstructions (sheet erosion)
  - the presence of rills, which are small incised channels that run parallel to one another down a slope. The presence of rills indicate that serious soil loss is occurring
  - the deposition of heavier soil particles downwind of obstructions such as fence lines, buildings and vegetation
  - the movement of litter on the site (i.e., litter concentrated around rocks or woody debris).
  
- ◆ answer *Yes*, if there is a noticeable difference when completing the following test

#### *Evidence of soil compaction:*

- push a metal rod, pencil, or knife into the soil and interpret the ease of penetration
- compare in-field resistance to penetration with resistance found at a grazed fence line
- compacted soil layers will increase the amount of resistance encountered
- the more noticeable the difference in resistance, the greater the compaction is at that site



Example of rills on a Southern Interior grassland.



Example of a gully on a Peace River pasture.



Example of compaction in an aspen poplar forest. Notice the elevated roots.

Other signs of soil disturbance/ loss include:



Trailing



Hoof Shearing

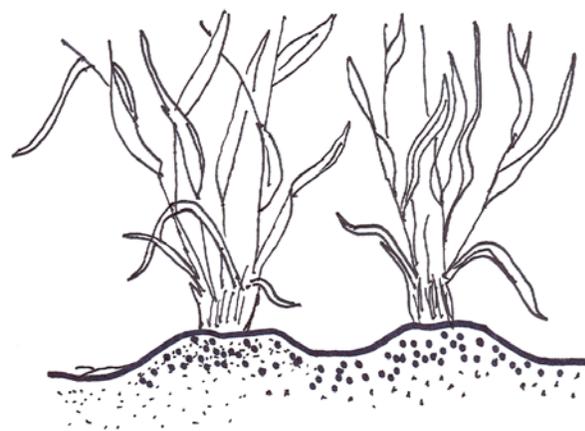
**Please note: Minor amounts of trailing are common on many pastures and ranges. Winter ranges can be especially prone to hoof shearing.**

### Native Range Question 7.

*Are plant roots exposed or are there other signs of pedestalling?*

Pedestalled plants and rocks are another sign that soil loss has occurred. Any loss of soil will lower the productivity of a site by removing finer soil particles such as clays, silts and organic matter all of which are integral in maintaining soil fertility and a sites moisture holding capacity.

- ◆ answer *Yes*, if any of the following are observed
  - plants on pedestals with exposed roots
  - gravel and rocks are exposed or sitting on the soil surface
  - lichen lines are visible on rocks



Notice how the plants appear to be on pedestals.

# ASSESSING TAME PASTURES

Table 5 Tame Pasture Assessment			
Circle your estimate of each factor. Assessment score is the sum of all circled numbers.			
	Yes	Maybe	No
1. Do the desirable plants make up more than one-half of the vegetation cover or weight?	+2	0	-2
2. Are your desirable plants moderately to densely spaced?	+1	0	-1
3. Does leaf length, seed production, colour, and overall productivity of desirable plants indicate strong vigour?	+2	0	-2
4. Is litter and plant residue fairly abundant and some composed of desirable plants?	+1	0	-1
5. Is there area evidence of soil compaction, soil movement, or its loss?	-3	0	+3
6. Are plant roots exposed or are there other signs of pedestalling?	-1	0	+1
<b>Total Score (total 10)</b>			

## Detailed Explanation of Tame Pasture Assessment Questions

### Tame Pasture Question 1.

*Do desirable plants make up more than one-half of the vegetation cover or weight?*

Significant disturbances like continuous heavy grazing, prolonged periods of drought or high precipitation, invasive species invasion, frequent burning, intensive recreational activity, and timber removal can all impact plant community composition. Heavy grazing weakens desirable forage plants, thus shifting the competitive advantage to low growing, disturbance induced, undesirable plants including low growing native plants such as pussytoes, strawberry, yarrow or other exotic invasives including dandelion, knapweed, Canada thistle, leafy spurge, etc.

- ◆ in tame pastures, desirable plants are typically those that have been intentionally planted. Factsheet 9 of the Grazing Management Series provides some examples of desirable pasture mixes for specific precipitation zones
- ◆ undesirable plants include those that are invasive, poisonous and those that become dominant by crowding out desirable species
- ◆ in tame pasture situations, undesirables include woody invaders (rose, aspen, snowberry etc.)
- ◆ desirable plants are typically those plants that contribute positively to the management objectives of a site. In most cases, on private grazing lands, desirable plants should be those plants that
  - are readily consumed and persistent
  - provide consistent amounts of forage (high tonnage)
  - are perennial, except in tame pastures that are specifically being managed for annual species
  - prohibit the introduction or spread of invasive plants
  - provide enough litter and residue to conserve soil moisture and maintain soil stability

**Tame Pasture  
Question 2.**

*Are your desirable plants moderately spaced?*

- ◆ answer this question *Yes* if desirable plants are moderately spaced and the pasture has less than 25% bare ground or undesirable species including woody invaders and weeds

**Tame Pasture  
Question 3.**

*Does leaf length, seed production, colour, and overall productivity of desirable plants indicate strong vigour?*

Plant vigour is reflected primarily by the size of a plant and its parts in relation to its age and the environment in which it is growing. It is important to note however, that periodic drought is common in many dry land environments and will lower the apparent vigour and annual productivity of desired plants. Plants with low vigour have a greater potential to be replaced by weedy invasives and other low quality or poisonous plants.

- ◆ answer this question *Yes* if the desirable plants
  - are healthy, vigorous, green and leafy
  - grow rapidly after defoliation (i.e., grazing or harvesting)
  - have minor or no leaf damage from insects or diseases
  - produce yields near site potential
- ◆ answer *No* if
  - recovery after grazing takes 1 week or longer than normal
  - desirable plants appear unhealthy and small
  - desirable plants dominated by yellowish green leaves

**Tame Pasture  
Question 4.**

*Is litter and plant residue fairly abundant and some of it composed of desirable plants?*

Litter and standing plant residue (dead material), in various states of decay, provides additional surface cover and promotes nutrient cycling by providing organic matter to the soil. The additional cover provided by this material reduces soil erosion by wind and water including reducing raindrop impact and increases water infiltration into the soil by slowing runoff and providing a pathway into the soil profile while also promoting moisture retention by reducing evaporation.

- ◆ in order to answer *Yes* to this question, approximately 10 to 20% of the site should be covered with litter and plant residue (standing dead forage) should not exceed 15%

**Tame Pasture  
Question 5.**

*Is there evidence of soil compaction, soil movement, or its loss?*

**Refer to picture and photo examples located on page 17.**

While managing tame pastures, it is extremely important to prevent human caused soil movement or loss by maintaining adequate plant cover and minimizing the amount of exposed (bare) soil. Any loss of soil will lower the productivity of a site by removing finer soil particles like clays, silts, and organic matter all of which are integral in maintaining soil fertility and a site's moisture holding capacity. The potential of rills and gullies increase as the loss of plant, litter, and residue cover and slope increases.

It is also important to minimize soil compaction. Soil compaction decreases the amount of water available to plants by reducing water infiltration into the soil profile. Most compaction occurs when pastures with saturated soils are grazed or subjected to heavy equipment. Compacted layers tend to occur less than 15 centimetres from the soil surface. It is also important to note however, that most upland compacted soils in British Columbia tend to recovery quickly due to frost heaving and earthworm activity.

- ◆ answer *Yes*, if any of the following are observed
  - the presence of debris dams of plant residue that build up at obstructions or span between obstructions (sheet erosion)
  - the presence of rills, which are small incised channels that run parallel to one another down a slope. The presence of rills indicate that serious soil loss is occurring
  - the deposition of heavier soil particles downwind of obstructions such as fence lines, buildings and vegetation
  - the removal of litter from the site
  
- ◆ answer *Yes*, if there is a noticeable difference when completing the following test

*Evidence of soil compaction:*

- push a metal rod, pencil, or knife into the soil and interpret the ease of penetration
- compare in-field resistance to penetration with resistance found at a grazed fence line
- compacted soil layers will increase the amount of resistance encountered
- the more noticeable the difference in resistance, the greater the compaction is in that pasture

**Tame Pasture  
Question 6.**

*Are plant roots exposed or are there other signs of pedestalling?*

Pedestalled plants are another sign that soil loss has occurred. Any loss of soil will lower the productivity of a site by removing finer soil particles like clays, silts, and organic matter all of which are integral in maintaining soil fertility and a site's moisture holding capacity.

- ◆ answer *Yes*, if any of the following are observed
  - plants on pedestals with exposed roots
  - gravel and rocks are exposed or sitting on the soil surface
  - lichen lines are visible on rocks

## STEP 2 IDENTIFY ANY CONCERNS FROM THE ASSESSMENT AND SELECT REVISED MANAGEMENT PRACTICES

After determining there is a problem, what tools are available to solve it? Various tools are available that vary from passive to intensive management. Before employing a tool, remember that not all tools will be effective for all cases. Each tame or native pasture is distinctive and thus requires unique solutions. Solutions may consist of one tool or a combination of tools. It may also require a significant amount of time (years) to repair grazing areas. Be patient, results will happen with consistent good management.

Here are some suggested management actions to assist in addressing the concerns identified in the assessment. Remember that each tame or native pasture is distinctive with unique characteristics that require unique solutions.

### Addressing Pasture and Range Assessment Concerns

*Do desirable plants make up more than one-half of the vegetation cover or weight?*

It is important to realize that whether or not a plant is desirable is dependant on location, grazing animal and intended use. Managing for healthy grazinglands with productive, well-adapted forage species can be encouraged by:

- ◆ Managing livestock distribution (*see Factsheet 1 Improving Livestock Distribution, Factsheets 4 and 5 Pasture Design*)
- ◆ Preventing overgrazing and providing rest (*see Factsheet 2 Grazing Frequency and Utilization*)
- ◆ Manipulating season of use (*see Factsheet 3 Seasonal Considerations for Grazing Management*)
- ◆ In dry land situations, always managing for drought (*see Factsheet 8, Managing Through Drought*)

Managing tame pastures also requires that forages are matched to the precipitation zone (*see Factsheet 9 Pasture Management*). A good rule of thumb is that to have at least six desirable (productive) plants per square foot (0.3 m<sup>2</sup>). If not, reseeding may be necessary.

If a pasture has significant amounts of invasive plants, an integrated weed management plan should be considered. For more information on weed management, please refer to the following two websites:

- <http://www.weedsbc.ca/resources.html>
- <http://www.agf.gov.bc.ca/cropprot/weedguid/weedguid.htm>

Invasive plants reduce forage production and availability. Managing for healthy, vigorous desirable plants will increase a pasture's resistance to invasive plants including weeds and brush (on pastures).

*Are desirable plant species abundant in all age and size classes?*

The factsheets listed above also contain useful information that will assist in the management of desirable plants so that there is an abundance of all age and size classes. In general, this objective should be achievable if a pasture is being managed for a healthy, vigorous stand of plants.

*Does leaf length, seed production, colour, and overall productivity of desirable plants indicate strong vigour?*

Managing for healthy, vigorous plants not only ensures that a pasture will produce more forage, it also ensures that the plants in the pasture are resisting the invasion of invasive plants and are maximizing the use of most available water, sunlight, and nutrients. Moreover, if desirable plants lack vigour, they will not only produce less forage, but will also take longer to recover from grazing.

If desirable plants lack vigour (poor leaf length, seed production, light green color, high incidence of disease, and low productivity) refer to the following two factsheets:

- ***Factsheet 2 Grazing Frequency and Utilization***
- ***Factsheet 3 Seasonal Considerations for Grazing Management***

After reading these two factsheets, it is extremely important to remember the following principles:

- ◆ All plants require rest to recover from grazing
- ◆ In general, native forages take longer to recover than tame forages
- ◆ Desirable plants require at least some part of the growing season to recover. This is important because healthy plant crowns need actively growing roots to provide regrowth after grazing.
- ◆ Vary the timing of grazing. For example, if grazing in the spring one year, try and graze in the summer the next year, and then fall the year after that.

In order to improve the vigour of a stand it is necessary to ensure that adequate soil nutrients are present to support forage growth. On tame pastures and some grass-dominated range sites, this may mean fertilization, applying manure (please refer to the **Nutrient Management Reference Guide** publication of the **BC Environmental Farm Plan Series**), or winter-feeding on pastures. Also, consider adding a legume forage plant to the pasture. Legumes fix and contribute nitrogen to forage grasses, and thus a tame pasture with greater than 30% legumes may not need additional nitrogen fertilizer. Overall, it is important to ensure that adequate amounts of nitrogen, phosphorous, potassium, and sulphur are present within the soil of the pasture.

On most other native range sites, including forested range, the only recourse (besides fertilization in some cases) is to ensure that adequate amounts of plant residue and litter are present.

***Is there any evidence of overuse (hedging) on shrubs and trees?***

Incidental to light use (0 to 25%) on broadleaf shrubs and trees is common and in most cases, preferred, but heavy use is not. Heavy use (greater than 50%) not only can reduce the vigour of woody plants, it also has the potential to reduce livestock productivity as grazingland health and diet quality declines.

If shrubs or trees are being used to this extent, either supply feed, or move livestock to areas that have forage (grass and broadleaves) available.

***Is litter and plant residue fairly abundant and some composed of desirable plants?***

Ensuring that adequate amounts of litter and plant residue are left following grazing not only ensures that nutrients are returned to the soil, it also improves water infiltration, reduces evaporation and improves the water holding capability of the soil.

If litter and plant residue are not fairly abundant on the pasture, improve ground cover by:

- ◆ enhancing desirable plant production and vigour
- ◆ reducing the amount of forage removed from your grazinglands
  - *See Factsheet 2 Grazing Frequency and Utilization*
- ◆ adjusting the timing of grazing
  - *See Factsheet 3 Seasonal Considerations for Grazing Management*
- ◆ winter-feeding on pastures

***Is the area free of evidence indicating soil compaction, soil movement or its loss?***

If grazinglands are showing signs of soil compaction, soil movement, or its loss, it is extremely important to do anything possible to prevent further damage.

Compacted soils can limit water infiltration, percolation, and water storage as well as plant growth and nutrient cycling. In order to prevent compaction, or if soils are compacted:

- ◆ Avoid grazing, haying and/or traffic when the soil is moist or wet. This is particularly important if pastures are dominated by heavier (clay) soils.
- ◆ Use only designated trails or roads (avoid additional trips).
- ◆ Maintain or increase soil organic matter by fertilizing (tame pastures), increasing plant cover, and vigour.

If soil is being moved or removed from your grazinglands, decrease the amount of bare ground by:

- ◆ encouraging desirable plant growth and vigour
- ◆ ensuring that adequate amounts of litter and plant residue are being left following grazing
- ◆ ensuring that plants are given adequate rest from grazing
- ◆ reducing soil surface disturbances (especially in dry areas)
- ◆ building water bars and directing water flow from roads, trails, or vehicle tracks across the slope or into existing drainage ways
- ◆ maintaining road surfaces and drainage ways

Please review the following factsheets:

- ***Factsheet 2    Grazing Frequency and Utilization***
- ***Factsheet 3    Seasonal Considerations for Grazing Management***
- ***Factsheet 8    Managing Through Drought***

Overall, the best way to ensure that grazinglands are being managed in a sustainable manner is to minimize any human caused soil movement or loss. This is accomplished by managing for desirable plants, plant vigour, and litter and plant residue.

***Are plant roots exposed or other signs of pedestalling?***

If rock or plants within the pasture are pedestalled, it is a good indicator that soil is being lost. Please refer to the above question on how to minimize soil movement or loss.

## STEP 3 DEVELOP A GRAZING MANAGEMENT PLAN, MONITOR RESULTS AND ADJUST PRACTICES

### **Grazing Management Plan**

A carefully prepared and implemented Grazing Management Plan will help alleviate environmental concerns with respect to livestock grazing and help maintain pasture and range health.

Grazing management plans are important components of any operation. A well-designed plan can improve or maintain pasture and range health as well as forage production while optimizing plant and animal performance. Most importantly, plans should ensure profitability by being practical, flexible, and simple to operate.

#### **Grazing management plans should have the following components:**

- ◆ A definition of goals including livestock production and pasture and range sustainability. Examples of various pasture and range sustainability goals include maintaining pasture, range, and riparian health and/or reducing weed and poisonous plant problems;
- ◆ a map of grazing areas including tame and native pastures and all developments such as fences, gates, water sources, etc.
- ◆ the type and number of livestock being grazed in the pastures
- ◆ approximate period of use for each pasture
- ◆ where will the animals be moved? That is, the sequence of use of pastures

### **Livestock Performance**

Grazing management plans should strive to achieve livestock performance objectives. Grazing affects livestock performance primarily by influencing animal nutrition. Nutrition is dependant on forage quantity and quality. Forage quantity is the amount of forage that is available to the grazing animal at the time of turnout and thus determines how long you are able to maintain your animals in a particular pasture (stocking rate). For example, in most cases the amount of forage available in early spring is less than the amount available in the summer. It is extremely important to set stocking rates according to forage quantity and availability. Forage quality, which varies depending on plant species, growth stage, soil, climate, and grazing management, also influences stocking rates. For example, during the spring and early summer forage quality is generally at its peak. This allows the grazing animal, when compared to other seasons, to achieve optimum performance with less forage and little or no supplementation.

### **Optimizing Plant Performance**

Grazing management plans should also be based on the physiological and reproductive requirements of the plants. Most forages are adapted to grazing, but are stressed by grazing. The ability of an individual plant to survive this stress is dependant on numerous factors including:

- ◆ whether or not the plant is native or tame
- ◆ the number of times it is grazed (frequency)
- ◆ the amount of plant material that remains after grazing (intensity; stubble height)
- ◆ the amount of rest the plant is given following grazing and the amount of moisture and nutrients available.

A good management plan acknowledges that native plants are typically less tolerant to grazing than tame species. The plan should also recognize the need to control the frequency and intensity of grazing and most importantly, recognize the need for rest following grazing. This rest period is needed in order to maintain forage productivity as well as pasture and range health.

### **Economics**

Grazing management plans must also be economical. Every improvement, including fencing, fertilization, water developments, etc., must be carefully planned to produce positive economic returns. These returns can come in many forms, such as decreased labour, increased forage production, increased forage availability, and corresponding increases in animal productivity.

### **Flexibility**

Finally, as with all business and resource management plans, it is extremely important to ensure that a plan is practical, reasonably simple, and flexible. Flexibility is important since it allows you to deal with market fluctuations as well as any fluctuations in forage production (i.e., drought, fire, etc.).

### **Rules of Thumb**

- ◆ Grazing management plans should be site-specific and correspond to ranch and farm conditions as well as plan objectives
- ◆ Grazing schedules should be based on the physical and biological characteristics of a site. That is, when determining the timing, frequency, duration, and intensity of livestock grazing the following should be considered:
  - Adequate plant cover and leaf material should be maintained in order to promote photosynthesis, water infiltration, conserve soil moisture, and maintain soil stability.
  - Plant structure should also be encouraged in order to maintain the nutrient and water cycles and maximize pasture production by using sunlight, water, and nutrients from different zones in the canopy and soil. Plant structure also provides habitat for numerous wildlife species including browsing opportunities for ungulates and feeding and nesting sites for birds and small mammals.
  - Spring grazing should be deferred until after new leaf growth has begun or, if taking advantage of the previous year's forage production, before spring growth begins.
  - If possible, limit grazing periods. The shorter the grazing period, the more likely that leaf regrowth will occur and carbohydrate reserves will be replenished before the next grazing period.
- ◆ Grazing schedules should provide periodic rest from grazing during critical growth periods. Rest times should match the ability of the plant species to recover from grazing. This promotes plant vigour, reproduction, and productivity. Also keep in mind that native plants need a longer recovery time than tame species.
- ◆ Grazing schedules should prevent the increase and spread of invasive plants. This includes promoting conditions that facilitate the establishment and maintenance of desirable plants.

## Monitoring

### *What is Monitoring?*

Monitoring is the orderly collection, analysis and interpretation of resource data to evaluate progress toward meeting management objectives such as increased livestock production. This process must be conducted over time in order to determine whether or not management objectives are being met.

### *Why Monitor?*

Monitoring, while labour intensive, is an important component of any grazing management plan. It provides measurables that allow one to determine whether the objectives of the plan are being met. Without it, one is unable to determine what effect grazing has had on the health of tame pastures or native range. This includes determining the trend, or changes, occurring in the condition of your grazinglands.

### *When do I Monitor?*

All monitoring programs should be:

- ◆ Repeated at regular time intervals. Ideal monitoring times in British Columbia vary from May to September depending on location.
- ◆ Conducted before grazing with follow-up monitoring being conducted under similar conditions and if possible at the same time each year.

By repeating the assessments in **Step 2 of this Section**, you can monitor the trend of your grazing lands and highlight the successes or failures of your grazing management practices. Increases in your assessment score indicate a positive trend whereas reductions indicate a negative trend. Note that changes in your assessment score may be due to not only your management practices but also changes in climate, insect and wildlife populations.

In addition to this assessment, you may want to consider adding other methods of monitoring to your program. If you wish to do this, consider adding both long-term and short-term components to the monitoring system.

Long-term monitoring generally takes place every one to five years whereas short-term monitoring may be repeated at any time interval. Overall, it is important that any monitoring program be both systematic and rigorous.

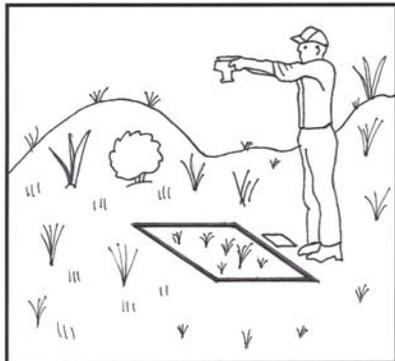
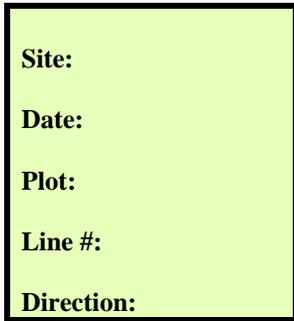
**For more information on Monitoring, please refer to Grazing Management Factsheet – No. 7, Monitoring Options. The establishment of photo-points is recommended for all monitoring programs. The section below provides information on how to establish photo-points.**

### **Photo points:**

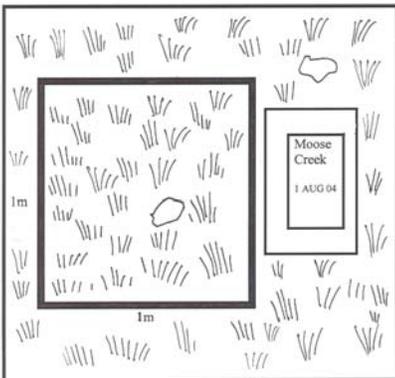
If done correctly, photo points can be a very powerful tool that will assist you in monitoring vegetation (plant) changes over time. Permanent photographs of a landscape are useful for detecting changes in vegetation structure and for visually documenting measured changes.

If you take digital photos, be sure to print and store photos in plastic photo storage sheets. Slide the photo card (**page**) behind the photo in the plastic storage sheet.

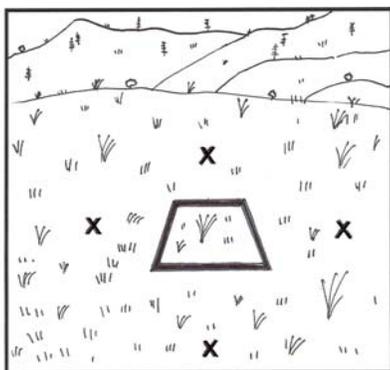
**Example of Photo point ID board:**



Taking an overhead photo



Example of an overhead photo



Taking additional photos

**Materials**

- 1 meter square (3 ft<sup>2</sup>) frame
- four large nails, bridge spikes, or rebar stakes
- compass (if available)
- 35 mm or digital camera with a 50 mm equivalent lens (1:1 ratio). If a wide angle, telephoto, or zoom is used, be sure to record lens and camera information
- photo point (ID) board (chalk or whiteboard) or photo point (ID) card (adjacent) on a clipboard.
- thick marking pen

**Methods**

Once the plot is located, the marking and recording procedure is as follows:

1. Delineate the photo plot by placing a plot frame on the ground. A convenient frame is typically 1 meter square. Mark the plot position by driving large nails, bridge spikes or rebar rods into the plot corners. This will allow precise relocation of the plot for future observations.
2. With a felt pen and a yellow paper pad (white is too bright), make a plot sign to be included in the plot photo. The sign should include the plot identification and date, as well as any other information that seems important. Keep it as short as possible. Place the sign on the ground next to the plot frame.
3. Stand so your shadow is not cast across the plot, and hold your camera at arm's length in front of you, lens pointing down. It may be helpful to stand on something to ensure adequate coverage. Make a vertical photograph.
4. Step back from the plot 5 paces to get an oblique photograph of the plot and the skyline to the rear. The skyline should make up approximately 30% of this and any additional photos.

**If you would like to get additional photos complete step 5. If not, continue onto Step 6.**

5. Repeat the oblique photo procedure from each of the other three sides of the photo plot. If the sun is shining, you probably are going to catch your shadow in at least one of these views. Try to make it as inconspicuous as possible. You now have a record of the plot and its setting in four directions.
6. If you have a compass, determine the bearing of at least one of the oblique photos. Again, this will aid in plot relocation. Also, record the bearing and distance of the photo plot (perhaps one of the corner markers) from a witness marker: rock, fence post, marked tree. If there is not obvious witness, place a steel fence post at a distance of at least 50 feet (to avoid animal attraction).
7. Remove the plot frame. You may wish to spray paint the corner pins to help find them at later dates.
8. When the photographs are processed, file the prints and negatives in the monitoring record book. A convenient way to file both negatives and prints is to use a 5 x 7-inch manila envelope, which can be punched for a three-ring binder or kept in a file. Each study site should have its own envelope. Negatives are particularly valuable, and should be kept in a secure place. Prints also may be displayed in an album or on pages in a binder.

# 3 REFERENCES

Title	Publisher	Material	Year	Location	Phone
Rangeland Health Assessment for Grassland, Forest and Tame Pasture	Alberta Sustainable Resource Development	Field Book	2003	<a href="http://www3.gov.ab.ca/srd/land/publiclands/range.html">www3.gov.ab.ca/srd/land/publiclands/range.html</a>	604-556-3100
Rangeland Handbook for BC	BCCA	Publication	1998	BC Cattlemen's Association Kamloops, BC	250-573-3611
Monitoring Montana Rangeland	Montana State University Extension Service	Publication	1999		
Interpreting Indicators of Rangeland Health, Version 4	USDA	Publication	2000	<a href="ftp://ftp-fc.sc.egov.usda.gov/GLTI/technical/publications/range-health-indicate.pdf">ftp://ftp-fc.sc.egov.usda.gov/GLTI/technical/publications/range-health-indicate.pdf</a>	
Guide to Pasture Condition Scoring	USDA	Publication	2001	<a href="ftp://ftp-fc.sc.egov.usda.gov/GLTI/technical/publications/pasture-score-guide.pdf">ftp://ftp-fc.sc.egov.usda.gov/GLTI/technical/publications/pasture-score-guide.pdf</a>	
Soil Quality Information Sheets (Set of 12)	USDA	Factsheets	2001	<a href="http://soils.usda.gov/sqi/soil_quality/what_is/sqiinfo.html">http://soils.usda.gov/sqi/soil_quality/what_is/sqiinfo.html</a>	
Glossary of Terms used in Range Management	Society for Range Management	Publication	2003	<a href="http://www.rangelands.org/publications.shtml">http://www.rangelands.org/publications.shtml</a>	
National Range and Pasture Handbook	USDA	Publication	2003	<a href="http://www.glti.nrcs.usda.gov/technical/publications/nrph.html">http://www.glti.nrcs.usda.gov/technical/publications/nrph.html</a>	
Riparian Management	BCAC	Publication	2004		
A Users Guide to Assessing Proper Functioning Condition and the Supporting Science for Lotic Areas	USDA USDI	Publication	1998		

USDA = United States Department of Agriculture  
 USDI = United States Department of the Interior  
 BCCA = BC Cattlemen's Association  
 BCAC = BC Agriculture Council

# APPENDICES

- Appendix 1. Examples of Invasive Plant Species
- Appendix 2. Pull-Out Blank Worksheet – Native Range Assessment Form
- Appendix 3. Pull-Out Blank Worksheet – Tame Pasture Assessment Form
- Appendix 4. Grazing Management Factsheets

## Appendix 1.

## Examples of Invasive Plant Species

Weed Species	Scientific name
Anchusa	<i>Anchusa officinalis</i>
Baby's breath	<i>Gypsophila paniculata</i>
Black knapweed	<i>Centaurea nigra</i>
Blueweed	<i>Echium vulgare</i>
Brown knapweed	<i>Centaurea jacea</i>
Bull Thistle	<i>Cirsium vulgare</i>
Canada Thistle	<i>Cirsium arvense</i>
Common Burdock	<i>Arctium minus</i>
Common Tansy	<i>Tanacetum vulgare</i>
Dalmatian Toadflax	<i>Linaria dalmatica</i>
Diffuse Knapweed	<i>Centaurea diffusa</i>
Field Scabious	<i>Knautia arvensis</i>
Giant Knotweed	<i>Polygonum sachalinense</i>
Gorse	<i>Ulex europaeus</i>
Hoary Alyssum	<i>Berteroa incana</i>
Hoary Cress	<i>Cardaria draba</i>
Hound's-tongue	<i>Cynoglossum officinale</i>
Japanese Knotweed	<i>Polygonum cuspidatum</i>
Leafy spurge	<i>Euphorbia esula</i>
Marsh Thistle	<i>Cirsium palustre</i>
Meadow Hawkweed	<i>Hieracium pilosella</i>
Meadow Knapweed	<i>Centaurea pratensis</i>
Nodding Thistle	<i>Carduus nutans</i>
Orange Hawkweed	<i>Hieracium aurantiacum</i>
Oxeye Daisy	<i>Chrysanthemum leucanthemem</i>
Perennial pepperweed	<i>Lepidium latifolium</i>
Plumeless Thistle	<i>Carduus acanthoides</i>
Puncture vine	<i>Tribulus terrestris</i>
Purple Loosestrife	<i>Lythrum salicaria</i>
Rush Skeletonweed	<i>Chondrilla juncea</i>
Russian Knapweed	<i>Acroptilon repens</i>
Scentless Chamomile	<i>Matricaria maritima</i>
Scotch broom	<i>Cytisus scoparius</i>
Scotch Thistle	<i>Onopordum acanthium</i>
Spotted Knapweed	<i>Centaurea maculosa</i>
St. John's-wort	<i>Hypericum perforatum</i>
Sulphur Cinquefoil	<i>Potentilla recta</i>
Tansy ragwort	<i>Senecio jacobaea</i>
Teasel	<i>Dipsacus fullonum</i>
Yellow Iris	<i>Iris pseudacorus</i>
Yellow starthistle	<i>Centaurea solstitialis</i>
Yellow toadflax	<i>Linaria vulgaris</i>

## Appendix 2. Blank Worksheet

# Native Range Assessment Forms

<b>Native Range Assessment</b>			
(Includes grassland and forested range)			
Circle your estimate of each factor. Assessment score is the sum of all circled numbers.			
	Yes	Maybe	No
1. Do the desirable plants make up more than one-half of the vegetation cover or weight?	+2	0	-2
2. Are desirable plant species abundant in all age and size classes?	+2	0	-2
3. Does leaf length, seed production, colour and overall productivity of desirable plants indicate strong vigour?	+1	0	-1
4. Is there any evidence of overuse (browsing and hedging) on shrubs and trees?	-1	0	+1
5. Is litter fairly and plant residue fairly abundant and some composed of desirable plants?	+1	0	-1
6. Is there evidence of soil compaction, soil movement, or its loss?	-2	0	+2
7. Are plant roots exposed or are there other signs of pedestalling?	-1	0	+1
<b>Total Score (total 10)</b>			

<b>Native Range Assessment</b>			
(Includes grassland and forested range)			
Circle your estimate of each factor. Assessment score is the sum of all circled numbers.			
	Yes	Maybe	No
1. Do the desirable plants make up more than one-half of the vegetation cover or weight?	+2	0	-2
2. Are desirable plant species abundant in all age and size classes?	+2	0	-2
3. Does leaf length, seed production, colour and overall productivity of desirable plants indicate strong vigour?	+1	0	-1
4. Is there any evidence of overuse (browsing and hedging) on shrubs and trees?	-1	0	+1
5. Is litter fairly and plant residue fairly abundant and some composed of desirable plants?	+1	0	-1
6. Is there evidence of soil compaction, soil movement, or its loss?	-2	0	+2
7. Are plant roots exposed or are there other signs of pedestalling?	-1	0	+1
<b>Total Score (total 10)</b>			



## Appendix 3. Blank Worksheet Tame Pasture Assessment Forms

<b>Tame Pasture Assessment</b>			
Circle your estimate of each factor. Assessment score is the sum of all circled numbers.			
	<b>Yes</b>	<b>Maybe</b>	<b>No</b>
1. Do the desirable plants make up more than one-half of the vegetation cover or weight?	+2	0	-2
2. Are your desirable plants moderately to densely spaced?	+1	0	-1
3. Does leaf length, seed production, colour and overall productivity of desirable plants indicate strong vigour?	+2	0	-2
4. Is litter fairly and plant residue fairly abundant and some composed of desirable plants?	+1	0	-1
5. Is there area evidence of soil compaction, soil movement, or its loss?	-3	0	+3
6. Are plant roots exposed or are there other signs of pedestalling?	-1	0	+1
<b>Total Score (total 10)</b>			

<b>Tame Pasture Assessment</b>			
Circle your estimate of each factor. Assessment score is the sum of all circled numbers.			
	<b>Yes</b>	<b>Maybe</b>	<b>No</b>
1. Do the desirable plants make up more than one-half of the vegetation cover or weight?	+2	0	-2
2. Are your desirable plants moderately to densely spaced?	+1	0	-1
3. Does leaf length, seed production, colour and overall productivity of desirable plants indicate strong vigour?	+2	0	-2
4. Is litter fairly and plant residue fairly abundant and some composed of desirable plants?	+1	0	-1
5. Is there area evidence of soil compaction, soil movement, or its loss?	-3	0	+3
6. Are plant roots exposed or are there other signs of pedestalling?	-1	0	+1
<b>Total Score (total 10)</b>			

