Rangeland Health Assessment for Grassland, Forest and Tame Pasture

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We wish to express our sincere thanks to all those that have contributed to the development of this health assessment guide. We have had big shoes to fill. The first range condition guide for Alberta was published in 1966 by Sylver Smoliak, Bob Wroe, Alex Johnston, L.M. (Mac) Forbes and Scotty Campbell and has survived the test of time. Now, as they have taught us, it is our turn to build on their work and to try to improve on their practical tool. It is the authors hope that we and others will continue the process of learning and refinement of the tools, now and in the future.

The philosophy of rating ecological function of rangelands has been inspired by riparian health tools developed by Dr. Paul Hansen and William (Bill) Thompson and the Cows and Fish Program. We would like to express our thanks to Paul Hansen and Bill Thompson, Bitterroot Restoration, Corvallis, MT, and to our Cows and Fish colleagues Lorne Fitch, Norine Ambrose, Greg Hale, Kelsey Spicer-Rawe, Kerri O'Shaughnessy and Michael Gerrand.

We have also borrowed heavily from the National Range and Pasture Handbook developed by the National Resource Conservation Services (USDA), and we have also been informed by the ongoing dialogue on range health provided by the International Society for Range Management. We appreciate the useful feedback provided in the early stages of this work by Dr. Jim Romo (University of Saskatchewan, Saskatoon), Dr. Edward Bork (University of Alberta, Edmonton) and Dr. Walter Willms (Agriculture and Agri-Food Canada, Lethbridge).

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ABOUT THIS WORKBOOK

Why Use This Workbook?

Rangelands are complex and diverse, but with practical field training, it is possible to consistently evaluate the condition or health of a range site. Traditional range condition assessment sometimes seems complex and cumbersome. This new methodology provides a visual system that allows users to readily see changes in range health and to provide some early warning when management changes are needed. Like the system of riparian health assessment developed by the Cows and Fish Program in Alberta, range health assessment is intended to help users "tune" their eyes to some key indicators of range health.

Who Is This Workbook For?

This workbook is for livestock producers, resource managers, agency staff, energy companies, protected area managers and anyone with an interest in the protection and maintenance of rangeland plant communities.

What Will The Workbook Do For Me?

The workbook can be used as an aid to field training and a field reference for on the ground range health assessments. The workbook provides pages where health scores can be recorded for future reference.

Where Does It Apply?

The field workbook is designed for application on a full spectrum of range landscapes, including native grassland, native forest and tame pastures. It is also useful for modified rangelands where range plant communities have become dominated by non-native species.

INTRODUCTION

What are Rangelands?

Rangeland (*syn*. Range) is land supporting indigenous or introduced vegetation that is either grazed or has the potential to be grazed and is managed as a natural ecosystem. Rangeland includes grassland, grazeable forestland, shrubland, pastureland and riparian areas (Public Lands Range Resource Management Program 2002). Rangeland ecosystems have traditionally been valued as an important source of forage for the livestock industry. Today there is a growing awareness of the important functions and values that rangelands provide to society. We must act as careful stewards to maintain rangelands in healthy condition. This field workbook is intended as a tool to measure rangeland health and help producers, resource managers and all users to make sustainable use of these lands.

What is Range Health?

We use the term "range health" to mean the ability of rangeland to perform certain key functions. The term health conveys the meaning that all parts that make up the whole, are present and working together. Range health is analogous to the health of the human body. When we are ill or under stress, important functions like circulation, immunity, cell growth, excretion, mental processes or reproduction may be impaired.

For rangelands, the functions of healthy range (Table 1) include: net primary production, maintenance of soil/site stability, capture and beneficial release of water, nutrient and energy cycling and functional diversity of plant species. Healthy rangelands provide sustainable grazing opportunities for livestock producers and also sustain a long list of other products and values. Declines in range health will alert the range manager to consider management changes.

Table 1. Functions of healthy rangelands and why they are important.

Rangeland Functions	Why Is the Function Important?
Productivity	• Healthy range plant communities are very efficient in utilizing available energy and water resources in the production of maximum biomass • Forage production for livestock and wildlife • Consumable products for all life forms (e.g. insects, decomposers etc.)
Site Stability	• Maintain the potential productivity of rangelands • Protect soils that have taken centuries to develop • Supports stable long-term biomass production
Capture and Beneficial Release of Water	• Storage, retention and slow release of water • More moisture available for plant growth and other organisms • Less runoff and potential for soil erosion • More stable ecosystem during drought
Nutrient Cycling	• Conservation and recycling of nutrients available for plant growth • Rangelands are thrifty systems not requiring the input of fertilizer
Plant Species Diversity	• Maintains a diversity of grasses, forbs, shrubs and trees • Supports high quality forage plants for livestock and wildlife • Maintains biodiversity, the complex web of life

Why Do We Need A New Methodology?

The range condition (RC) concept evolved in response to grazing management problems on western rangelands going back to the early 1900's. Alberta's first stocking guide for prairie grasslands was published in 1966 (Smoliak et. al 1966). The range condition approach measures the alteration of plant species composition due to grazing or other disturbances, relative to the climax plant community, the potential vegetation for the site. The RC approach has worked well in semi-arid grasslands and has been well accepted by ranchers and wildlife managers. It relies on descriptions of relatively undisturbed range sites and their plant communities. However, the evolution of scientific thought in North America has highlighted a number of shortcomings of the RC concept. One of the key assumptions is that all declines in range condition are reversible. Experience shows that this may not be the case. Plant succession may establish stable states that are relatively resistant to change, even with decades of rest.

A very significant shortcoming relates to communities that are invaded by non-native species or are seeded to non-native species and show no apparent trend back towards climax with any management treatment. Furthermore, the concept of a single climax or potential natural community under a forest community does not address the dynamic character of the forest under-story as stand succession proceeds.

The traditional range condition approach did not consider management needs of soil. Range managers should be concerned if management practices are leading to accelerated erosion. A more robust range health assessment tool must include soils indicators like site stability. In developing the range health assessment procedure, we have reflected on the discussion of this concept within the International Society for Range Management and among federal and state agencies in the US. Since 1999, an Alberta Range Health Task Group has selected indicators and developed a scoring system to address key ecological processes and the diversity of Alberta rangelands ands tame pastures.

How Is Range Health Measured?

Range health builds on the traditional range condition approach that considers plant community type in relation to site potential, but also adds new and important indicators of natural processes and functions. Range health is measured by comparing the functioning of ecological processes on an area of rangeland to a standard known as an ecological site description. An **ecological site** is similar to the concept of **range site**, but a broader list of characteristics are described. *An ecological site, as defined by the Task Group on Unity and Concepts (1995), "is a distinctive kind of land with specific physical characteristics that differs from other kinds of land in its ability to produce a distinctive kind and amount of vegetation".*

With some background knowledge about the local soils and vegetation, range health is rated for a site by scoring a series of questions that reflect key indicators of healthy range. This chapter will explain the key indicators of range health and their importance. Chapters two, three and four provide the actual range or tame pasture health questions and scores. In chapter five, general field sampling instructions are available along with blank field worksheets. Chapter six provides some insights on what the scores mean and how to interpret them. Additional reference materials are found in the back pages of the workbook.

Why Does Range Health Matter?

Ask anyone what they would prefer, sickness or health. We can all describe what its like to be ill and how much better we can work and play when we are healthy. We can demonstrate the same contrast for rangelands. Healthy rangelands can sustain a broad range of values and benefits (Table 2). When range health declines, so does the flow of values and benefits we might otherwise enjoy.

Table 2. Values and benefits of healthy rangeland.

Rangeland Users	Values and Benefits of Healthy Range
Livestock Producers	• Lower feed costs • Renewable and reliable source of forage production • Stability of forage production during drought • Greater flexibility and efficiency for alternate grazing seasons (e.g. autumn or winter where applicable) • Lower maintenance costs like weed control • Does not require the input of inorganic fertilizers and other soil amendments and additives. • Reduced concern for noxious weeds
Resource Managers	• Quality wildlife habitat • Maintain fisheries habitat • Maintain grazing opportunities • Preventing soil erosion • Timber production • Increased total net benefits
The Public	• Esthetic landscape values • Watershed protection • Water quality • Large soil carbon sinks • Bio-diversity • Opportunities for passive and consumptive recreation like hunting and tourism
Socio-Economics and Governance	• Healthy rangelands provide increased cooperation, increased total benefits to society with fewer conflicts to resolve, less regulation and enforcement. This means lower costs!

What Are the Indicators of Range Health?

Range health questions are indirect measures of the following indicators. An evaluation allows the manager to see whether important ecological functions are being performed.

1. Integrity and Ecological Status

Plant species composition is a fundamental consideration in range health assessment. Plant species composition influences a sites ability to perform functions and provide products and services. Native plant communities evolve within their environment and slowly change over time as environmental factors change. Significant short term changes in plant composition do not normally occur unless caused by significant disturbances like continuous heavy grazing, high levels of recreational traffic, prolonged drought, prolonged periods of high precipitation, exotic species invasion, frequent burning or timber removal.

Plant species changes due to disturbance pressures are predictable:

- Perennial species that tend to be most productive and palatable, are also the most sensitive to disturbance and decline with increased disturbance such as a continuous and heavy grazing regime.
- With heavy grazing, species with greater adaptation to disturbance pressure will increase in abundance because they are provided opportunities to compete successfully. These disturbance-induced, weedy species include pussytoes, yarrow, dandelion and noxious weeds .

Range management objectives tend to favor the later stages of plant succession (late-seral to potential natural community (PNC) or good to excellent range condition). Late seral plant communities tend to be superior in the efficient capture of solar energy, in cycling of organic matter and nutrients, in retaining moisture, in supporting wildlife habitat values and in providing the highest potential productivity for the site. In contrast, early seral stages represent plant communities with diminished ecological processes, which are less stable and more vulnerable to invasion by weeds and non-native species. They also have diminished resource values for livestock forage production, wildlife habitat and watershed protection.

While range management goals on native rangeland generally favor

late seral stages of plant succession, it is important to stress that ecological health and function must also consider the needs of other flora and fauna when formulating range health goals. Integrated range resource planning may identify other seral stages that are required to accommodate the needs of a diversity of species. For example certain breeding birds like horned larks and burrowing owls prefer heavily grazed range with early seral stages, while Sprague's pipit favor lightly grazed range with late seral plant communities. To this end, range health assessment may serve as a useful coarse filter tool to assess habitat quality and to gauge desired outcomes. A deliberate decision to manage for lower seral stages (and lower range health scores) must be guided by informed resource management objectives and not merely as a pretext to accommodate reduced range health scores much like the outdated range management concept of "sacrifice areas".

Managing for lower health scores poses a number of risks including the potential for invasion of exotic agronomic species and noxious weeds. Screening of sites that might be vulnerable to invasive species is an important consideration. Assessing what plant communities are the most suitable and what areas are less vulnerable to invasion by weeds or agronomic species, needs to be carefully evaluated. The goal of creating sites on the landscape that retain early seral stage components will not be met if invasive species expand on to management area.

When disturbance impacts are reduced or removed, the present plant community may react in a number of ways:

- may remain static,
- may move toward a number of native plant communities including the potential natural community,
- or may move to a modified plant community type.

Modified plant communities are communities that have become dominated by non-native species. To the best of our knowledge, long-term rest of these modified plant communities does not return them to native species composition. A separate set of questions is used to determine the health status of these community types.

Tame pastures, are areas of rangeland that have been converted to agronomic species and they can be managed using a modified version of native range health assessment. In this field workbook

there is a special set of questions for rating the health of tame pastures.

Figures 1 & 2 on pages 16 and 17 provide a simplified example of how ecological status can be recognized on the landscape through a successional pathway commonly found in the Foothills Fescue grasslands. The plant communities (figure 1), are primarily native with minor amounts of non-native plants. Range managers normally strive to maintain the reference plant community and later seral communities (figure 1, upper left), which are dominated by rough fescue and Parry's oat grass. With light to moderate levels of disturbance, and relatively stable climatic conditions, the plant community may move back and forth between these upper states.

With prolonged and heavy disturbance pressures, the plant community will shift to more disturbance resistant species (figure 1,

Some Important Ecological Concepts

- **Plant communities** are mixtures of plant species that interact with one another.
- **Succession** is the gradual replacement of one plant community by another over time.
- **Successional pathways** describe the predictable pathway of change in the plant community as it is subjected to different types and levels of disturbance over time.
- **Seral stages** are each step along a successional pathway.
- **Seral stages** begin at the pioneer stage of **early seral**, and progress upward in succession to **mid-seral**, then **late seral** and finally **potential natural community(PNC or climax)**.
- **Reference plant community (RPC)** is the term we use for the potential natural community since we use it as the "reference" for comparison.
- An **ecological site** is a distinctive kind of land with specific physical characteristics that differs from other kinds of land in its ability to produce a distinctive kind and amount of vegetation.
- **Ecological status** is the degree of similarity between the present plant community and the **reference plant community**. Plant communities are **modified** when disturbance has altered them to non-native species (like smooth brome, timothy or Kentucky bluegrass) with a composition of greater than 70% non-native species.

lower left). In this example grazing resistant grasses and forbs are now dominant at successional stages termed mid to early seral. The presence and abundance of disturbance resistant species, like Idaho fescue, lupine or golden bean will help the manager to recognize these lower stages of ecological status.

These mid or early seral plant community can be further degraded with sustained heavy disturbance pressure. If there are invasive species present, the community may proceed across an ecological threshold to become a modified plant community as represented on (figure 2). To the best of our knowledge, the process in this example is not reversible as represented by the "one-way" arrow. Once the plant community has crossed this threshold, the manager must work within the limitations of the modified state. Very heavy disturbance levels will result in communities dominated by undesirable non-native species (lower right). With better range management, it may be possible to encourage a shift to more desirable non-native species (upper right).

This model is a simplified presentation of ecological successional pathways and the threshold between native and range health modified plant communities. Other ecological thresholds often exist along successional pathways. For more detail on these pathways and thresholds please refer to the plant community and carrying capacity guide for the Natural Subregion you are working in (page 115).

2. Community Structure

Nutrient cycling and energy flow is more efficient in diverse plant communities with varied canopy structures and rooting depths that can use sunlight, water and nutrients from different zones in the canopy and soil. Plant community structure is particularly important in maintaining net primary production in forested rangelands, and in the maintenance of habitat values for a spectrum of wildlife. Highest forage yields in grasslands would be associated with high community structure and the lowest yields with uniformly low community structure. Integrated range resource management objectives may require that management objectives for community structure be altered to create more diversity in the landscape. The presence of over to under grazed patches may be an important source of plant canopy structure in prairie grassland environments providing valuable habitat diversity for both wildlife and plants.

Figure 1.

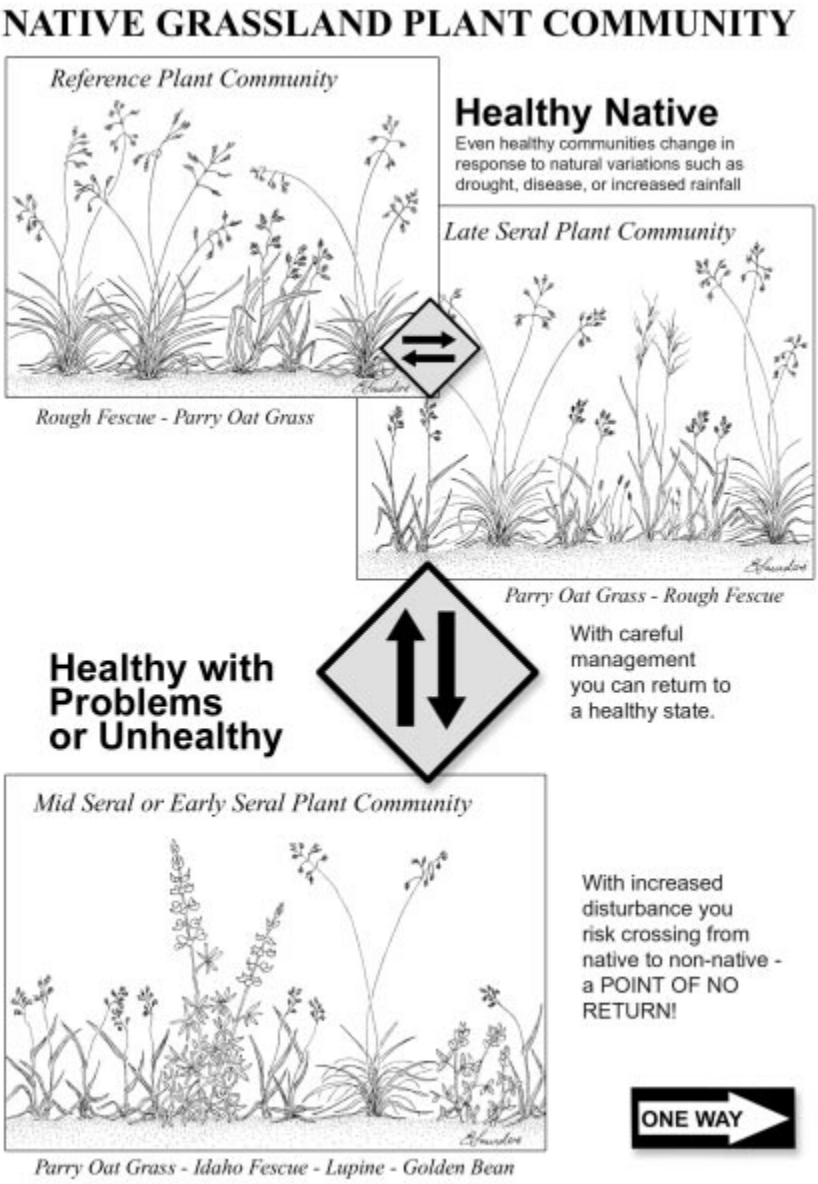
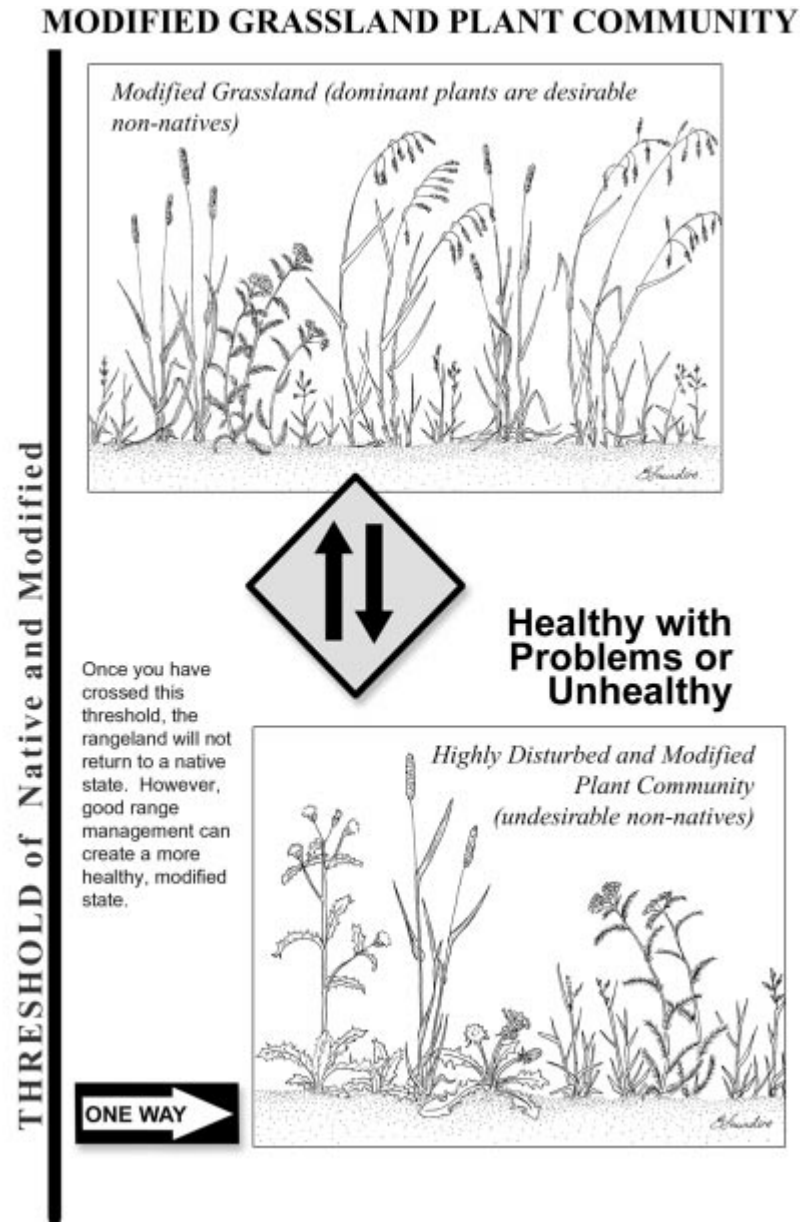

NATIVE GRASSLAND PLANT COMMUNITY
Reference Plant Community
Rough Fescue - Parry Oat Grass
Healthy Native
Even healthy communities change in response to natural variations such as drought, disease, or increased rainfall
Late Seral Plant Community
Parry Oat Grass - Rough Fescue
Healthy with Problems or Unhealthy
With careful management you can return to a healthy state.
Mid Seral or Early Seral Plant Community
Parry Oat Grass - Idaho Fescue - Lupine - Golden Bean
With increased disturbance you risk crossing from native to non-native - a POINT OF NO RETURN!
ONE WAY

Figure 2.


MODIFIED GRASSLAND PLANT COMMUNITY
THRESHOLD of Native and Modified
Modified Grassland (dominant plants are desirable non-natives)
Healthy with Problems or Unhealthy
Once you have crossed this threshold, the rangeland will not return to a native state. However, good range management can create a more healthy, modified state.
Highly Disturbed and Modified Plant Community (undesirable non-natives)
ONE WAY

3. Hydrologic Function and Nutrient Cycling

This indicator deals with abundance and distribution of dead plant material on an ecological site. Plant residue promotes moisture retention and nutrient cycling and is linked to another indicator, site stability (soil exposure and erosion). When functioning properly, a watershed captures, stores and beneficially releases the moisture associated with normal precipitation events. Uplands make up the largest part of the watershed and are where most of the moisture is captured and stored during precipitation events. Live plant material and litter (either standing, freshly fallen or slightly decomposed on the soil surface) is important for infiltration (slowing runoff and creating a path into the soil), reducing soil erosion from wind and water, reducing evaporative losses and reducing raindrop impact.

Litter also acts as a physical barrier to heat and water flow at the soil surface. Litter conserves moisture by reducing evaporation making scarce moisture more effective. Litter removal will reduce forage yields by about 50% in mixed grass prairie and by about 30% during dry years in the foothills. Litter or, organic residue, acts as a nutrient pool on forested sites, is an important rooting medium for many understory plants, protects the soil surface and provides a home for decomposers. Litter performs many of the same functions in tame pastures as it does in native grasslands and forests.

4. Site Stability

Rangelands show varying degrees of natural soil stability depending on climate, site, topography and plant cover. The amount of sediment produced by water and wind erosion from a particular ecological site type is termed geologic erosion. Managers strive to prevent accelerated erosion due to land management practices, by maintaining adequate vegetation cover and minimizing exposed soil. Adequate vegetation cover protects the soil surface from the impact of raindrops, detains overland flow, maintains infiltration and permeability and protects the soil surface from erosion. Soil loss is a serious concern since erosion tends to remove the finer lighter particles like clays, silts and organic matter which are most important to soil fertility and moisture holding capacity. Long term studies show that ongoing soil loss due to overgrazing or other disturbances, will eventually transform the soil into a shallower,

RANGE HEALTH HINTS

Vegetation Canopy Protects Soil

- ✔ Like a tent or umbrella, vegetation canopy protects soil from the erosive impact of raindrops.
- ✔ Most rangeland plant communities are stable and normally have adequate vegetation to prevent soil erosion.
- ✔ Some rangelands like badlands, certain steep river slopes and sand dune environments have natural bare soil and erosional processes are natural.
- ✔ On any type of rangeland, managers should strive to prevent accelerated erosion beyond the natural extent.

drier, less productive and less stable soil type. Excess sediment production has a negative impact on water quality since the fine particles that are eroded have a greater potential to absorb and carry nutrients and chemicals.

Some range sites are normally unstable and erosion and sediment production can be viewed as a natural process (e.g. badlands). Unstable sites will tend to exhibit significant exposed soil and have shallow soil profiles (e.g. seepage and slumping areas, badlands, thin breaks, saline lowlands, solonetzic soils, some sandy soils).

5. Noxious Weeds

Noxious weeds are invasive plants that are alien species to the rangeland plant community. Weeds are seldom a problem in vigorous, well managed rangelands although weed invasion may occasionally happen in healthy stands. Weeds may be introduced to relatively healthy stands through rodent burrows, but generally their presence indicates a degrading plant community. Weeds most often invade range where grazing practices have resulted in available niche space (bare soil, surplus moisture); available micro-habitats normally occupied by range plants, but now available to weeds due

to overgrazing or some other land use or natural disturbance. Noxious weeds diminish the agricultural productivity of a site, threaten biological diversity, reduce structure and function and sustainability of ecosystems. They also reduce the multiple uses and values that range is normally capable of providing.

Grazing management strives to maintain plant vigor and vegetation cover so that space is filled by one or more plant communities that minimize weed invasion.

GETTING STARTED

How to use the field workbook?

The field workbook is a training and awareness tool and a field assessment guide to facilitate rapid, repeatable and consistent assessments of range and pasture health. Some basic training and familiarity with local plant community information is required to use the guide effectively. The workbook is intended for producers and resource managers as a tool to identify the presence, scale and magnitude of range resource issues and problems. It can be used to measure effects and impacts of management changes and to help formulate management objectives and practices to address specific issues. NOTE: Figure 4 on page 26 to select the right assessment.

The field workbook can be used at three levels:

- **Awareness.** Basic training will better "tune your eye" to the elements of range health, so that you can recognize general health impacts on the land.
- **Rapid Assessment.** With study and repeated field training, you can utilize the rapid assessment method provided in this field workbook.
- **Range Inventory.** With expert training and vegetation inventory methods and field forms (available from Alberta Sustainable Resource Development), detailed range vegetation surveys can be completed including range health assessment.

Before You Go to the Field

Range health assessment requires that you have some basic understanding about the plant communities and soils that you intend to assess. Range plant community guides provided by the Rangeland Management Branch, Public Lands Division (ASRD) are important tools in the interpretation of ecological status. Plant community type descriptions provide a standard you can compare to the plant communities on the ground. A complete list of these documents is provided in the "Range Health References" section on page 114.

Make use of all reference materials available to you including:
- Soil survey reports
- Natural Subregion Reports
- Forest Ecosite Guides
- Lists of native plant species including invaders and noxious weeds
- Past range inventory data and reports.

Picking the Site for Range Health Assessment

- Map and stratify the pasture unit you wish to monitor. This will allow you to better select the sites you should sample by separating different soil and vegetation types so that more uniform areas can be selected. Avoid sampling across different vegetation types (e.g. native grassland to tame pasture). Assessment areas should be representative of the dominant plant communities you are concerned about in the pasture. Keep your assessment reflective of one management regime or grazing unit.

- Consider the purpose of where you may sample. Do you want to select a portion of the pasture that is representative of the average for the management unit, or, are you wanting to select a "hot" spot where problems are apparent, which you want to monitor over time?

- If you are in a riparian area, use one of the riparian health assessment guides listed on page 114.

- The assessment area should be representative of the dominant plant communities you are concerned about in the pasture.

- Variability is normal on rangelands. No matter how hard you try to assess within like areas, you will find variation in the assessment parameters and other factors such as grazing pressure present and past. Don't worry about this. What is important is that your assessment captures and be representative of this variation.

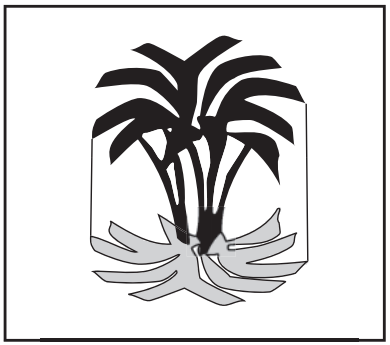
- If the pasture has a significant, uneven distribution of weeds or woody regrowth, you may want to consider dividing the pasture into smaller sample areas.

Estimating Vegetation Cover and Soil Exposure

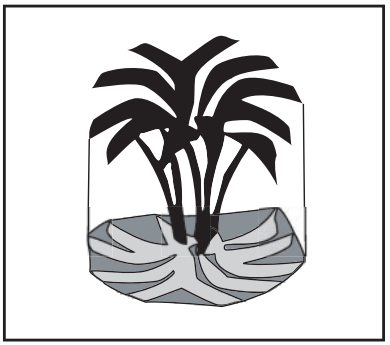
The ability to estimate the cover of plant species and the extent of soil exposure is a valuable skill for accurate range health assessment. Usually cover is defined as the vertical projection of the crown or shoot area of a plant species to the ground surface, expressed as a percent of the area of reference (e.g. a plot frame). Cover can be estimated for an individual plant species, groups of plants, dead vegetation (i.e. litter) or for bare soil. When the cover of all individual plant species are added up, the total cover may exceed 100% because of overlapping foliage from multiple species. Bare soil is the percent of the area of reference where mineral soil is not covered by live or dead vegetation or rocks [greater than 6 in.] and would be vulnerable to erosion from wind, mechanical movement [e.g. as in hoof shear], raindrop impact or overland flow of water.

Estimating vegetation cover requires training and experience to achieve repeatable observations. Most people start out with the basic concept of **canopy** cover as illustrated on the right in figure 3 below, where a line is drawn about the leaf tips of the undisturbed canopies with the this line projected onto the ground, much like an umbrella. However, with experience, the normal progression is to use **foliar** cover as illustrated in figure 3 on the left side. Foliar cover is where vegetation canopy is estimated with a similar projection of the canopy onto the ground below, but the spaces within the vegetation canopy are subtracted from the estimate. In operational range surveys and research studies, Alberta Sustainable Resource Development uses the foliar concept when assessing vegetation cover. Space is provided on the score sheets located on

pages 97 to 102 in this workbook to estimate the cover of four grasses and grass-likes, forbs, shrubs and trees to help you establish the major components of the plant community under evaluation. Procedures for conducting detailed quantitative assessment of range vegetation cover can be obtained from the Rangeland Management Branch (see contact information on page 119).



Foliar cover.



Canopy cover.

Figure 3. Two different approaches to estimating vegetation cover are the foliar cover (left) and the canopy cover (right) approaches.

When Should I Rate Range Health?

When plants can be readily identified. Common health assessment windows for native grasslands and tame pastures:

- In the Grassland Natural Region - mid-June to late July
- In the Boreal Forest and Rocky Mountain Natural Regions - July and August.

- Wetter or drier years will require that you modify assessment windows.
- If you are interested in total current annual forage production, this is best measured towards the end of the growing season and before weathering and/or frosts, commonly late July or early August.
- Repeated assessments over a series of years should be done at similar seasons and grazing conditions.

How much time does an assessment take?

- In the training phase, it may take 45 min to an hour to complete a range health assessment at a single site.
- With experience and the necessary reference materials, health assessments can be completed in 15 to 20 minutes.

Using the Range Health Worksheet

Three types of field worksheets are found at the back of this workbook:

- **Native or Modified Grassland** (page 97),
- **Native or Modified Forest** (page 99) or
- **Tame Pasture** (page 101).

Figure 4 on page 26 will help you to decide which health assessment protocol to select.

Worksheets allow you to record the date and location of your assessment including GPS coordinates. You can estimate range health around a single point, over a fixed distance between two points (termed a transect) or you can average range health over a polygon (a unit of landscape like a soil or vegetation type). Carefully document and describe the area you have sampled for future reference. Space is provided to list major grasses, forbs, shrubs and trees and estimate vegetation cover of the dominant species. Plant species abundance will help you to identify the plant community. Other methods and tools for detailed vegetation inventories are available from the Rangeland Management Branch (last page of workbook)

Photographs and Record Keeping

Consider taking photographs representative of the area for range health assessment. Better yet, locate a permanent location for recording the picture and for future photographs each time you repeat the range health assessment. Over time you will have a visual record to go along with your written information. As always, it is important to keep good records and keep them organized. In addition to range health, please consider keeping rotation pasture records (See page 114 Grazing Record Booklet by Alberta Sustainable Resource Development).

A Few Words of Caution

As with any field workbook, this is just a guide that must be used with good judgment. A complex mosaic of community types will require that you subdivide your sampling area into smaller units.

In addition, you may choose to make written comments to further support the differences. In some cases, a particular question may not fit the observation area. If so you must decide whether or not to include this question in the range health score. If something does not make sense to you, ask more questions and think things over before proceeding. We are interested in your feedback as well. This workbook will improve with your questions and comments. It will be an ongoing process as we strive to make a new method work in a complex world.

What is my next step?

Determine what kind of pasture you are observing. Is it native grassland, forest or tame pasture? Go to the appropriate chapter and work through health assessment questions.

RANGE HEALTH HINTS

A Tool For Training Your Eye to Rangeland Health

Using The Range Health Guide

- ✔ **Awareness. Basic training will better "tune your eye" to the elements of range health.**
- ✔ **Rapid Assessment. With study and repeated field training, you can effectively utilize the rapid assessment method.**
- ✔ **Range Inventory. With expert training, vegetation inventory methods and field forms, detailed range vegetation surveys and range health assessments can be completed.**

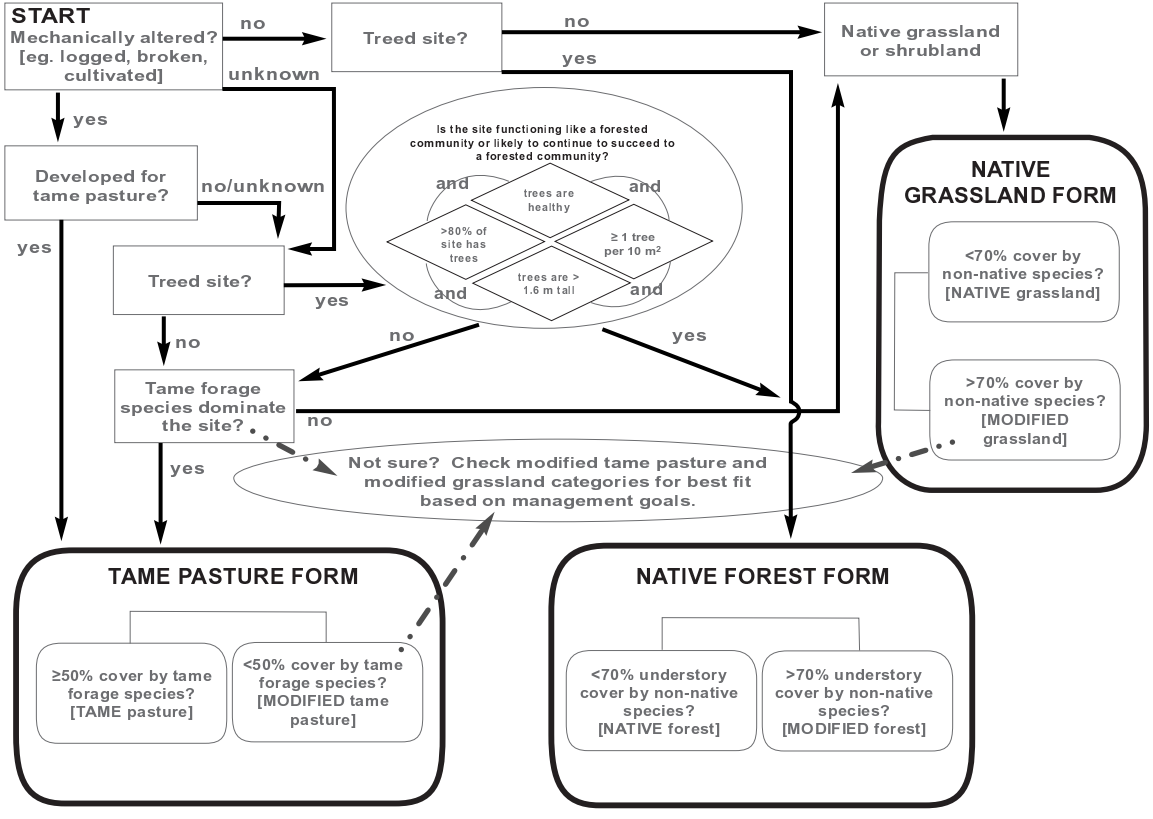


Figure 4
Diagram for selecting the most appropriate range health assessment protocol.

INSTRUCTIONS AND SCORES

Before you proceed with grassland health assessment, review the previous chapter including the sections on the *Indicators of Range Health* and *Getting Started*. This is not a stand-alone tool. Alberta Sustainable Resource Development has developed range plant community guides that provide necessary background information about the plant communities that you may be evaluating (see page 115). Also note the field worksheets on page 97 for recording the health assessment information and comments.

Question 1. Integrity and Ecological Status

What kind of plants are on the site?
What is the plant community?

Plant species composition is the key indicator of grassland health. It strongly influences a sites's ability to perform important ecological functions and to provide products and services. In grassland communities, a few key grass species normally provide most of the biomass and indicate ecological status. Stages of plant succession are based on the dominant plant species as well as key indicator species. These stages are called "seral stages" and they reflect the amount of disturbance to the plant community. With practice, you can use seral stages to recognize ecological status. Examples are provided in the first chapter under: *Indicators of Range Health: 1. Integrity and ecological status* (page 12) with the successional pathways figures on pages 16 and 17.

Traverse the map unit or polygon of interest and estimate plant species composition. Use available reference materials including: plant community guides, benchmark data and eco-site guides that describe potential natural communities and successional pathways.

If the plant community is a native grassland, answer **Question 1 A**. If the **integrity** of the native plant community has been lost and species are mostly non-native (greater than 70% of composition is of non-native species), the plant community is **modified** answer **Question 1 B**.

Questions 1 A
The plant community is a NATIVE GRASSLAND:

What is the ecological status of the native grassland plant community?

Scoring:

24 = The plant community closely resembles the reference plant community for the site and alteration of the plant community due to grazing or other disturbances is light.

Example 1 Dry Mixed Grass: Needle-and-thread - Northern wheatgrass - Thread-leaved sedge
Example 2 Foothills Fescue Grassland: Rough fescue - Parry oatgrass - Idaho fescue
Example 3 Peace River grasslands: Western porcupine grass - Green needle grass - Northern wheat grass

16 = Compared to the reference plant community, the plant community shows minor alteration, due to grazing or other disturbances. Grazing impact is light to moderate.

Example 1 Dry Mixed Grass: Needle-and-thread-Blue grama
Example 2 Foothills Fescue Grassland: Parry oatgrass - Rough fescue and minor amount of non-native invaders like Kentucky bluegrass
Example 3 Peace River Grasslands: Northern wheat grass - Western porcupine grass - June grass

9 = Compared to the reference plant community, the plant community shows moderate alteration, due to grazing or other disturbances, compared to the reference plant community for the site. Grazing impact is moderate to heavy.

Example 1 Dry Mixed Grass: Blue grama - Needle-and-thread
Example 2 Foothills Fescue Grassland: non-native invaders form a significant component of the community, but native plant species are still present
Example 3 Peace River Grasslands: June Grass – Sedge - Northern wheat grass

0 = Compared to the reference plant community, the plant community shows significant alterations, due to grazing or other disturbances, compared to the reference plant community for the site. Grazing impact is heavy to very heavy. If the grassland community you are evaluating is within the Montane, Lower Foothills, Upper Foothills, Foothills Fescue, Foothills Parkland, Central Parkland or Boreal Mixedwood natural subregions and is significantly invaded by non-native species (>70% are non-native) the plant community is **modified** and your should, go to question **1 B**.

Example 1 Dry Mixed Grass: Blue grama - June grass - forb
Example 2 Foothills Fescue Grassland: non-native species dominate the community
Example 3 Peace River Grasslands: Sedge - June grass - forb

Scoring Notes – Question 1 A

- For grassland plant communities, the reference plant community (RPC) is the potential natural community for the site under light grazing disturbance.
- The RPC in grasslands is not assumed to be those grassland plant communities that develop under prolonged periods of rest since the natural system evolved under cyclic disturbances especially fire and grazing.
- In many grassland plant communities, prolonged rest allows a few competitive grass species to become dominant and to shade out other grasses and forbs that are normally important in the plant community.

Question 1 B
The plant community is a MODIFIED GRASSLAND

Percent desirable species of modified grassland community?

This question reflects the need to identify those grassland communities that have been modified to non-native species due to human and/or naturally caused disturbances. Recent data has shown that many native grasslands, once modified, are not likely to change back to a native plant community regardless of management

changes. This is particularly true of grasslands in the Montane, Lower Foothills, Upper Foothills, Foothills Fescue, Foothills Parkland, Central Parkland or Boreal Mixedwood natural subregions. For modified grasslands, the objective is to manage the plant community for it's modified grazing potential and prevent bare soil, erosion, undesirable forage species and weedy species. Use the scoring system provided in Question 1 B. Should the plant community recover to less than 70% non-native plant species, use the scoring system in Question 1 A.

Scoring:

9 = Site is dominated by desirable and productive non-native species. Palatable plants, vigorous with tall stems, large healthy leaves and reproductive as evidenced by seed stalks
Example: Smooth brome - Timothy

5 = Site is mixture of desirable/productive and weedy/disturbance-induced non-native species. Productivity is reduced due to the abundance of lower value species. Palatable plants showing evidence of reduced vigor with shorter stems, smaller leaves and seed heads. Less palatable plants generally vigorous.
Example: Kentucky bluegrass – Timothy - Clover

0 = Site is dominated by weedy and disturbance-induced non-native species. Palatable plants weak, with short stems and leaves and very few to no seed stalks evidenced across site. Less palatable plants also showing signs of reduced vigor from increased use.
Example Dandelion - Plantain

Scoring Notes – Question 1 B

- We anticipate that further field studies will allow us to better understand the successional dynamics of modified plant communities. This coarse filter approach may be replaced with specific directions on how to score these communities with plant community guides.

- To function well, modified grasslands must be dominated by

desirable species with all other health parameters receiving top health scores. A healthy modified plant community is not equal in ecological function to a healthy native plant community. A healthy score for a modified plant community simply recognizes that despite changes in the plant communities integrity, the site is being managed as well as can be expected based on current knowledge.

Question 2.0 Plant Community Structure

Are the expected plant layers present?

Native grasslands normally have a diversity of plant species that vary in size, height and rooting depth. This characteristic of plants to grow in different "layers" is called structure. When plants occupy different layers, they are able to use sunlight, water and nutrients from different zones in the vegetation canopy and soil profile. This provides for efficient nutrient cycling and energy flow, supporting forage production and important habitats for wildlife.

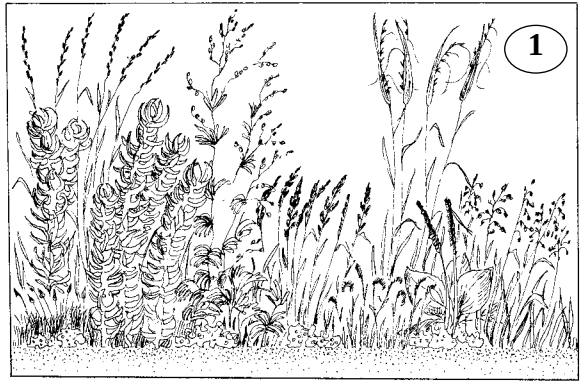
Structural layers in grasslands include: 1) low shrubs, 2) tall graminoids and forbs 3) medium graminoids and forbs and 4) ground cover (graminoids, forbs, moss, lichen). **Always rate life form layers relative to the reference plant community (see Fig. 5).**

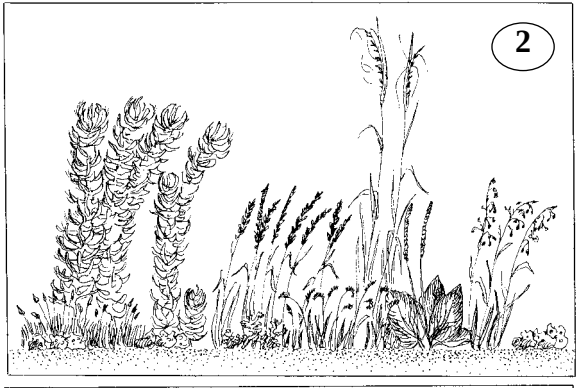
Scoring:

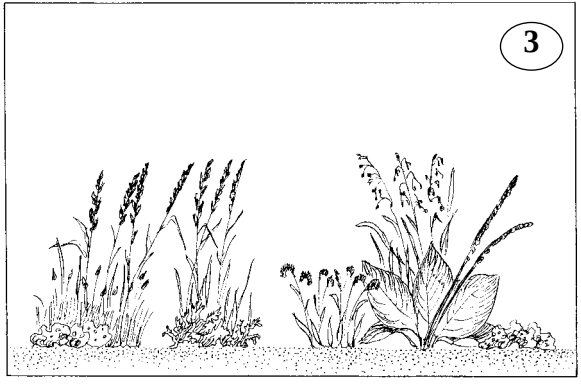
6 = The life form layers closely resemble the reference plant community.
4 = Compared to the reference plant community, one life form layer is absent or significantly reduced.
2 = Compared to the reference plant community, two life form layers are absent or significantly reduced.
0 = Compared to the reference plant community, three life form layers are absent or significantly reduced.

Scoring Notes Question 2

- Use cover of major life form layers from range plant community guides to answer this question. Review benchmark







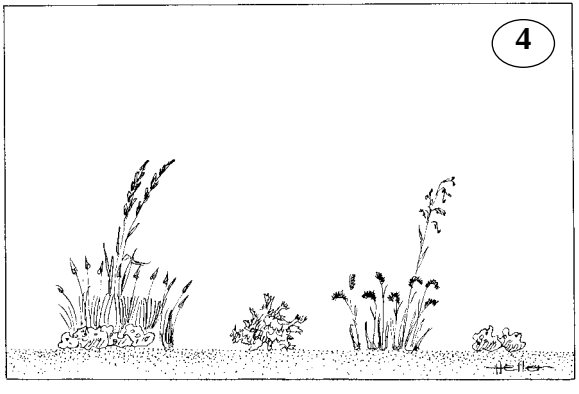


Fig. 5
Changes in grassland plant community structure as disturbance levels increase.
1) All expected layers present.
2) Tall grasses and forbs reduced.
3) Tall layer absent and mid layer reduced. 4) Low grasses and forbs; ground cover reduced.

data, plant community guides, photographs or adjoining lightly or ungrazed areas to gain an understanding of expected plant layers. Where possible, compare the unit to a benchmark on a similar site in the area. Keep notes of the variety of species, life forms and age classes as you move across the unit and compare to the available data.

- In both native and modified plant communities, determine the normal life form layers expressed in the reference plant community and look for these layers, not the species (e.g. A modified plant community, where the RPC was Rough Fescue-Parry oatgrass, now dominated by a vigorous stand of Timothy and Brome, still has a tall graminoid layer and would get full marks for this layer).
- "Significantly reduced" implies that the structural layer is reduced by more than 50% compared to the reference plant community.
- If two structural layers show moderate reduction (25 to 50%), then reduce the score by one category.
- If you think a structural layer is reduced, look to see if it is under stress (e.g. low shrubs with heavy browsing use of the 2nd year and older wood).
- If you are unsure how many structural layers should be present, check for grazing impact on the plants, especially shrubs. Browsing of generally unpalatable shrubs such as snowberry and sagebrush usually indicates more desirable shrubs have been reduced or eliminated by grazing or browsing.
- Note that moss and lichens are important diagnostic layers. These layers can be reduced by trampling (hoof impact), recreation or excessive shading (non-use with heavy litter build up).
- When a natural disturbance removes a life form layer, note the missing layer in the comments section and the likely cause (e.g. insect damage, drought, fire, decadence), but don't downgrade the score.
- Shrubland communities are commonly found between the grassland and forest plant communities in parkland landscapes. Evaluate these transition plant communities on their own unique characteristics because their presence may be part of normal successional processes and may not relate to grazing impacts on site. Consult available range plant community guides to see

how they fit into succession.

- Site management goals may require that you manage for lower structural scores:
  - maintenance of the ratio of grassland:shrub:forest cover in parkland,
  - maintenance of patch diversity for prairie breeding birds and other wildlife - grazing practices adapted to reducing taller layers on a portion of the landscape,
  - manipulation of woody cover adjoining certain riparian area.

Question 3.0 Hydrologic Function and Nutrient Cycling

Does the site retain moisture?
Is the expected amount of litter present?

In grasslands, litter acts as a physical barrier to heat and water flow at the soil surface (review functions of litter on page 18). Litter conserves scarce moisture by reducing evaporation, improving infiltration and cooling the soil surface.

This question evaluates the ability of a site to retain scarce moisture based on amounts of organic residue. Litter weight (lb./ac.) estimates are made in representative areas and compared to "litter normals" that are appropriate to the site being evaluated. Litter is sampled from a number of representative areas by hand raking from a .25 m^2 area or plot frame. Figure 7 provides litter normals for a broad range of natural subregions and range site types. Litter normals are developed from long-term benchmark monitoring of healthy and productive sites under light to moderate grazing. Litter includes ungrazed residue from previous years growth including standing stems, fallen stems and leaf material, and partially decomposed material. Estimate litter across the entire unit. Your reference should be light to moderately grazed range with enough litter to retain moisture. Look at the distribution, evenness and patchiness of litter across the site.

Scoring:

15 = Litter amounts are more or less uniform across site and include standing dead plant material, fallen dead plant material and

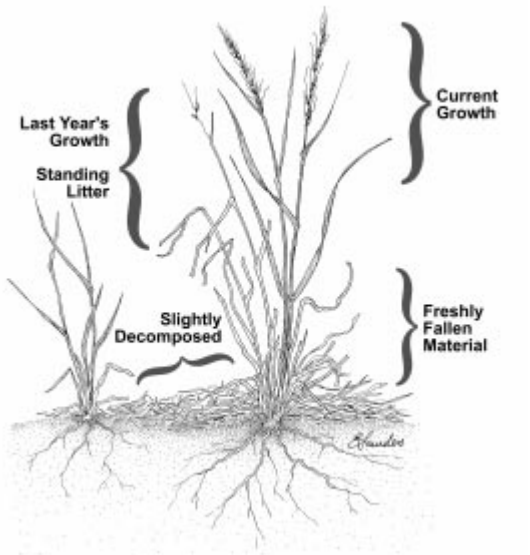


Fig. 6 Types of litter associated with native grasslands and tame pastures.

variably decomposed material on the soil surface. Litter standing crop (lb./ac.) is in the range of 65 to 100% of expected levels under moderate grazing levels.

8 = Litter amounts appear slightly to moderately reduced and are somewhat patchy across the site. The standing dead plant material is less frequent in distribution with fallen dead plant material and variably decomposed material on the soil surface being the dominant litter types. Litter standing crop (lb./ac.) is in the range of 35 to 65% of expected levels under moderate grazing levels.

0 = Litter amounts appear greatly reduced or absent. The extent and distribution of exposed soil has increased. There is little or no standing or fallen litter. Decomposing material on the soil surface is the main type of litter. The distribution of litter is fragmented across the site. Litter standing crop (lb./ac.) is in the range of less than 35% of levels expected under moderate grazing levels.

Scoring Notes – Question 3.1

- In the grassland natural region, litter reserves are closely linked

Rangeland Health Assessment Litter Thresholds (lb/ac)

Natural Subregion (Soil Zone)	Range Sites	Healthy (Base value and >65%) Average	Healthy (Base value and >65%) (65%)	Health but with Problems (65%-35%)	Unhealthy (<35)
Aspen Parkland (Black)	Loamy	1500	(>975)	975 - 525	<525
	Sandy	1100	(>715)	715 - 385	<385
	Sands	800	(>520)	520 - 280	<280
	Choppy sandhills	400	(>260)	260 - 140	<140
Foothills Fescue, Foothills Parkland and Montane (Black)	Thick Black Loamy	1400	(>910)	910 - 490	< 490
	Orthic Black Loamy	1200	(>780)	780 - 420	< 420
	Shallow-to Gravel and Limy	1000	(>650)	650 - 350	<350
	Thin Breaks	500	(>325)	325 - 210	<175
Mixed Grass (Dark Brown)	Loamy (>1100 m*)	900	(>585)	585 - 315	<315
	Loamy (<1100 m*) + Limited	600	(>390)	390 - 210	<210
	Thin Breaks	300	(>195)	195 - 105	<105
Dry Mixed Grass (Brown)	Loamy	400	(>260)	260 - 140	<140
	Blowout	250	(>160)	160 - 85	<85
	Thin Breaks	150	(>95)	95 - 50	<50

*Elevation > means greater than

Fig. 7 Litter thresholds for native grassland communities.

to forage yield. The extra effort it takes to estimate litter levels provides a strong prediction of the sites ability to retain moisture.

- Another option for learning to measure litter amounts is by collecting litter and making your own litter bags. You can then compare these bags to the area being scored for litter. Hand rake litter from a .25 m^2 frame, oven dry it and weigh it into kg/ha (grams x 1.12) or lbs./acre (grams x 35.6). Obtain a variety of bags that represent the thresholds of the RPC found in litter normals (Figure 7).
- Examples of sample weights and corresponding lb./ac. value: (Sample 1 25.5 gms = 910 lb./ac., Sample 2 21.8 gms = 780 lb./ac., Sample 3 18.2 gms = 650 lb./ac., Sample 4 16.4 gms = 585 lb./ac., Sample 5 10.9 gms = 390 lb./ac., Sample 6 7.3 gms = 260 lb./ac., Sample 7 4.5 gms = 160 lb./ac.).
- These values represent most of the key litter threshold values listed in figure 7.
- When rating range health practice hand raking litter from representative areas (from .25 m^2 frames; 50 cm x 50 cm or 18 inches by 18 inches) and then make comparisons to the standards found in the ziplock litter samples or the pictures in figure 7.
- When raking litter don't include in the sample, any herbage that grew in the current year. Only include the standing stems that appear to be from previous growing seasons.
- Compared to native plant communities, modified communities produce less forage during dry periods. Litter on modified sites is more subject to loss from weathering processes. As a result, modified sites may not be capable of sustaining litter reserves at the threshold level for healthy moisture holding capacity.

Question 4.0 Site Stability

Is the site subject to accelerated erosion?
Is there human-caused bare ground?

To estimate "human-caused" bare ground and recognize accelerated erosion, you need to know what normal soil exposure and erosion processes are like for your site. Most sites in Alberta have continuous ground cover. If the ecological site is normally unstable, then you must look for human-caused erosion over and above

normal or geologic rates. Early or initial erosion may require close observation by getting down close to the ground and looking under green live plant cover to see if there is any movement of light surface material (litter or soil). Look for evidence of erosion on any slope as deposition of soil particles at the bottom of slopes.

Use benchmark data or field guides applicable to the site to determine if it is naturally unstable or if the extent of bare ground is within the normal range for the site. Reduced live plant and litter cover from excessive disturbance can lead to erosion. Indicators of a heavy to very heavy grazing regime include abundant manure, hoof tracks and plant pedastalling (Fig. 8). Slopes may show signs of hoof shearing and soil exposure from higher stock or wildlife trampling.

Is the site being observed normally stable or unstable, check below?

Site normally stable: ☐ Site normally unstable: ☐

Scoring:

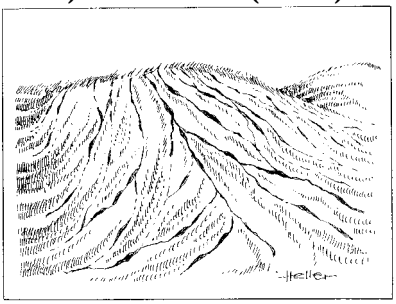
Question 4.1
Evidence of site instability (accelerated erosion, see Fig. 8).

6 = No sign of soil movement, deposition of soil/litter, plant pedestalling, coarse sand or aggregate remnants, flow patterns and/or scouring, or hoof sheering beyond the natural extent for the site.

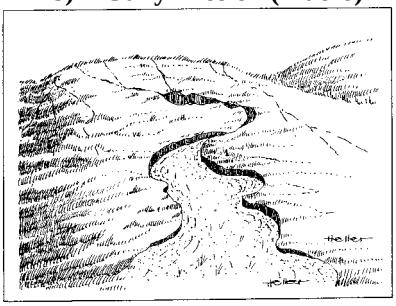
4 = Some evidence of slight soil movement or deposition of soil/litter, plant pedestalling, coarse sand or aggregate remnants, flow patterns and/or scouring, that is human-caused and beyond the natural extent for the site. Old erosion features may be stable and vegetated. Flow patterns may be short and shallow. Extent of exposed soil is only slightly greater than expected for the site.

2 = Moderate amounts of soil movement or deposition of soil/litter, plant pedestaling, flow patterns and/or scouring is visible across site. Erosion features are active but limited to the site

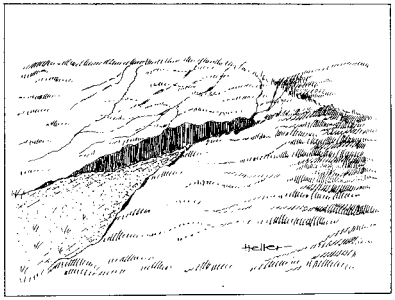
a) Rill Erosion (Macro)



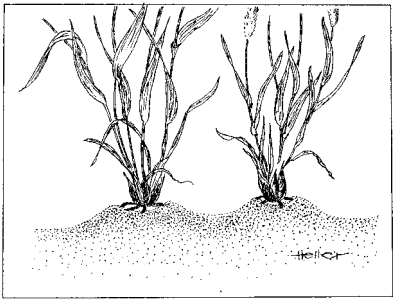
b) Gully Erosion (Macro)



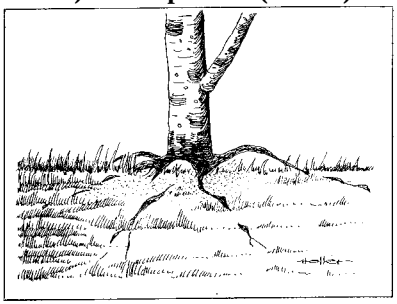
c) Gully Erosion (Macro)



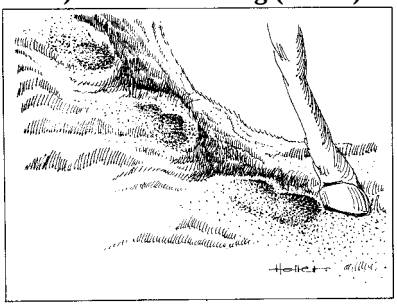
d) Pedastalling (Micro)



e) Compaction (Macro)



f) Hoof Shearing (Micro)



g) Trailing (Macro)

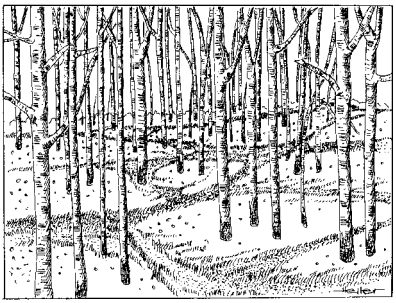


Fig. 8 Examples of soil erosion, compaction, hoof shearing and trailing.

with no off-site movement of material. Flow patterns have a well-defined branching pattern. The extent of exposed soil is obviously greater than expected for the site but vegetation (live plants and litter) still protects most of the site. Signs of hoof sheering may be evident in localized patches.

0 = Extreme amounts of soil movement with material being carried off site. Flow patterns are obvious and fan deposits may be present. Rills are abundant and deep. Gullies are deep with sharp edges. Erosion features are active. Pedestalled plants with exposed roots and rocks exposed or sitting on the surface. Hoof sheering may be common across the site, beyond localized patches. Evidence of instability.

Question 4.2 Increase in human-caused bare soil (read scoring notes first and see Fig. 9 & 10)

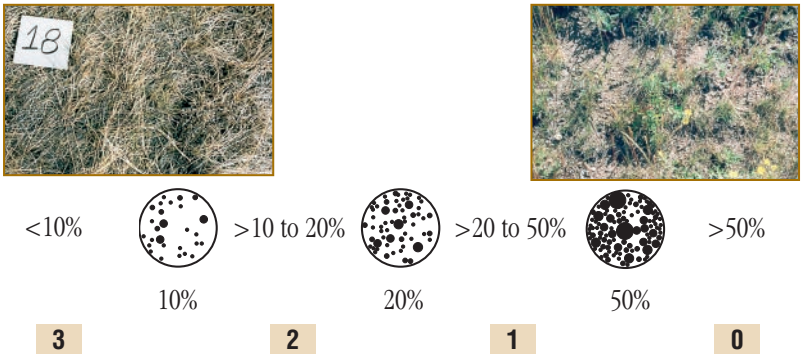
3 = less than 10% cover of exposed soil is human-caused.
2 = greater than 10 and up to 20% cover of exposed soil is human-caused.
1 = greater than 20 and up to 50% cover of exposed soil is human-caused.
0 = greater than 50% cover of exposed soil is human-caused.

Scoring Notes – Question 4.2

General Scoring Comments

- The check box allows you to recognize the significance of hazards associated with increased soil exposure on normally stable sites.
- Human-caused bare soil is the result of disturbance processes that are subject to human control (e.g. grazing, OHV, recreational impacts). Human-caused bare soil is that portion that is over and above what is normally expected for the site.
- To estimate human-caused bare soil, first estimate total bare soil, subtract the amount considered to be expected or naturally occurring. The difference will be considered human-caused bare soil. Report this amount on the field sheet. Take time to record moss and lichen cover as well as this layer helps stabilize the site.

Fig. 9 Increase in human-caused bare soil as disturbance levels increase.



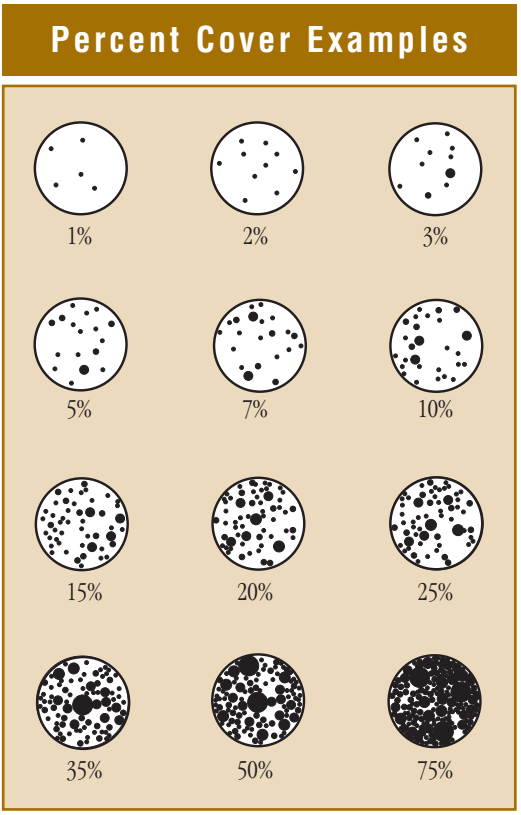


Fig. 10 This graphic helps to develop a mental picture of the percent cover of bare soil or vegetation . It will appear a number of times in this workbook for easy reference.

- Range plant community guides provide soil exposure standards for judging the "human-caused" portion.
- This question focuses on increased soil exposure and the increased potential for soil erosion on range sites that are normally stable and less of a concern where ongoing soil loss is a natural process.

Rodent Burrowing and Bare Soil

- On healthy sites, rodent burrowing activity is normally limited in its extent and impact on the amount of bare soil.
- Bare soil from rodent burrows tends to increase on modified and heavily grazed sites.
- Ground squirrel and pocket gopher activity increases in response to foraging opportunities associated with introduced and weedy species, especially tap-rooted forbs like dandelion.
- Therefore on modified and heavily grazed sites, a significant portion of the bare soil from rodent burrows should be considered human-caused.

Livestock and Wildlife Impacts on Bare Soil

- Large numbers of elk and deer may increase bare soil on preferred range sites.
- Winter ranges may be especially prone to hoof shear resulting in increased bare soil.
- When wildlife impacts result in increased soil exposure, treat it as human-caused and note the source of the impact in the comment section.

Question 5.0 Noxious Weeds

Are noxious weeds present?
Infestation of the polygon with noxious weeds.

This question considers the degree of infestation of the site. Infestation is a function of weed plant density and patchiness or evenness over the monitoring area. All noxious weeds are considered collectively, not individually. Use a weed list that is standard for the locality and indicate which species are included (see the suggested weed list on page 116). Record on the worksheet

the species and density distribution of all noxious weeds observed as you move across the site.

Scoring:

Question 5.1 Cover of Noxious Weeds (see Fig. 10)

3 = No noxious weeds present.

2 = Noxious weeds present with a total cover less than or equal to 1%

1 = Noxious weeds present with a total cover between 1 and 15%

0 = Noxious weeds present with a total cover of greater than 15%

Question 5.2 Density Distribution of Noxious Weeds (see Fig. 11)

3 = No noxious weeds on the site (see Scoring Notes)

2 = Noxious weeds are present at a low level of infestation. (density distribution 1, 2, 3)

1 = Noxious weeds are present at a moderate level of infestation. (density distribution 4, 5, 6, 7)

0 = Noxious weeds are present at a heavy level of infestation. (density distribution 8, 9, 10, 11, 12, 13)

<u>Scoring Notes – Question 5.0</u>

- The cover and density distribution of noxious weeds in the pasture can provide clues as to the health and function of the pasture. Noxious weeds commonly establish where disturbance has increased open ground and available moisture.
- Variations in weed infestation can be averaged across the site. Your observation is a cumulative evaluation of all the noxious weed species present. You can record specific cover and density distribution of specific weed species in the comment section in the field worksheet.
- The density and distribution of dots in figure 11 relates to the

density and distribution of weeds in the sampling area (polygon). Point ratings decline as infestation increases and rating values are on the right margin of the figure.

- Include noxious and restricted weed species defined in the Weed Act (see suggested list of weed species on page 116). Use a weed list that is standard for the community (i.e. your County or Municipal District).
- **Do not** rate nuisance weeds or disturbance species in this question (e.g. dandelion, strawberry, plantain, yarrow).
- If the pasture has a significant, uneven distribution of weeds, you may want to divide the pasture into smaller sample areas.

Fig. 11 Density distribution guide for rating weed infestation.

Density Distribution

Class	Description of abundance in polygon	Distribution	Weeds Score
0	None		3
1	Rare		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 occurrences 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 with a distinct linear edge in the polygon		

INSTRUCTIONS AND SCORES

Before you proceed with the forest health assessment, be sure you have reviewed the first chapter including the sections on the *Indicators of Range Health* and *Getting Started*. This is not a stand-alone tool. Alberta Sustainable Resource Development has developed range plant community guides that provide necessary background information about the plant communities that you may be evaluating (see page 115). Also note the field worksheet on page 99 to record dominant plant species, associated cover values, for recording your scores for each of the range health parameters and making specific comments.

The Forested Health Assessment can be used in deciduous and coniferous forests throughout the province and in the treed areas of the Parkland Natural Regions. Until an assessment tool is developed to evaluate the impact of livestock grazing in regenerating cutblocks, the Forested Health Assessment should be used in these areas.

Timber harvesting and silviculture practices used in cutblocks can have an impact on every category of the health assessment, even in the absence of grazing. It may therefore be difficult to discern whether impacts on range health are due to livestock grazing or timber harvesting. It is recommended that impacts to the regenerating cutblocks be assessed regardless of the cause of the disturbance [i.e. record what you see without judgment to maintain assessment consistency]. Any impacts that can be clearly attributed to one disturbance type or the other should be documented in the comments. The reference plant community to which a cutblock should be compared is a naturally regenerating forest (i.e. after wildfire) of the same successional stage. Information regarding LFH development in the early stages of forest succession is not available at this time, therefore when scoring a cutblock using the Forested Health Assessment, remove question #3 from the scoring and calculate the total health score for the site out of 51 points.

Occasionally, areas that were cleared for tame pasture development, will have a substantial amount of deciduous tree regeneration.

Based on the 2003 Alberta Regeneration Survey Standards, if 80% of the cleared area has at least one healthy, vigorous, undamaged tree taller than 1.6 m in height every $10m^2$ (circular plot of radius 1.78m), the cutblock or clearing can be expected to regenerate to forest. This criteria is therefore a good benchmark to determine if the site is functioning like a forest or a tame pasture.

Areas that meet the criteria described above, should be assessed using the Forested Health Assessment. If woody regrowth management (controlling the timing and intensity of grazing, applying herbicides, breaking, discing, or other mechanical treatments) maintains the tree regeneration below the regeneration standard, then the Tame Pasture Health Assessment should be used. Until an assessment tool is developed to evaluate the impact of livestock grazing in regenerating cutblocks, the Forested Health Assessment should be used in these areas. See decision diagram on page 26.

1. Integrity and Ecological Status

What kinds of plants are on the site?
What is the plant community?

This parameter considers species composition of the plant community.

- Plant species composition is a key indicator of forest health.
- Plant species influence a site's ability to provide forage.
- Shrubs, forbs and grasses provide a diversity of forage and nutrient values.
- Changes to plant species composition can reduce forage production and management flexibility.
- Management goal is to maintain the production potential of the plant community at the level produced under a light to moderate grazing regime. The plant community should resemble its potential or the reference plant community for the site and forest successional stage.
- As grazing pressure increases from light to moderate to heavy and very heavy, there is a change in the understory species composition.

On a forested site, the reference plant community must be

established in relation to the successional status of the forest canopy. For example, on a given ecological site, a forest may establish and progress from deciduous to mixed-wood and eventually to coniferous forest cover. When establishing ecological status, the observer must evaluate the impact that current management is having on the plant community. Range plant community guides provided by ASRD will enable the user to better understand forest succession and determine the appropriate reference plant community.

If the plant community is a native forest, answer **Question 1 A**. If the **integrity** of the native plant community has been lost and species are mostly non-native, the plant community is termed modified (greater than 70% of composition is of non-native species), answer **Question 1 B**.

Question 1 A The plant community is a NATIVE FOREST

What is the ecological status of the native forest community?

Scoring:

18 = Observed plant community resembles the reference plant community. Grazing regime is light to moderate.
Example Aspen-Rose-Tall Forb

12 = Observed plant community changes are minor and representative of a moderate grazing regime.
Example Aspen-Rose-Low Forb

6 = Observed plant community changes are representative of a heavy grazing regime.
Example Aspen-Rose-Clover

0 = Significant changes are present and representative of a very heavy grazing regime.
Example Aspen-Kentucky bluegrass-Dandelion

Scoring Notes Question 1A:

- In some cases the changes in plant community can be the result of the natural maturity of the forest understory. As a sapling poplar stand matures, it shifts along the successional pathway towards a mixed poplar stand and finally a coniferous stand. This takes many years and for our purposes if the aspen stand is 20 to 60 years of age, consider the natural succession influence minor. Our objective is to score the changes caused by grazing.

- If the score is 0, you may wish to consider if the plant community is a modified forest plant community? If so, go to Question 1B.

QUESTION 1 B
The forest plant community is a MODIFIED FOREST
Percent desirable species of the modified forest community?

A modified forest is a forest where more than 70% of its understory species are non-native. When a forest plant community has been grazed at heavy to very heavy stocking rates over a prolonged period, the plant community may look very different from its potential. For example, a normally waist high Aspen-Rose-Tall Forb stand may be changed to an ankle high stand of Aspen-Kentucky Bluegrass-Dandelion.

We are unsure if we can restore a modified forest plant community to its potential as found in Question 1A. It is important to manage for its non-native forage potential while preventing weed and erosion problems.

Scoring:

9 = greater than 70% of the understory is productive non-native forage species such as brome, timothy, Kentucky bluegrass.

5 = greater than 70% of the understory is non-native forage species. Weedy and disturbance-induced species like strawberry, dandelion, and clover are present.

0 = greater than 70% of the understory is non-native forage species. Site is dominated by weedy and disturbance-induced species, and noxious weeds like Canada thistle.

Question 2.0 Plant Community Structure

Are the expected plant layers present (see Fig. 12)?
Are there any changes in forest plant community structure?

Forest plant communities are biologically diverse with a variety of woody, broad-leaved and grass species present. Commonly, shrubs and forbs dominate. The characteristic growth of plants in different "layers" is termed structure. When plants occupy different layers, they are able to use sunlight, water and nutrients from different zones in the vegetation canopy and soil. This diversity supports optimum grazing values for livestock and provides diverse habitats for many wildlife species, and other uses and values.

When rating structure, compare the grazed forest plant community to the plant community appearance under light to moderate grazing. Structural layers in forest communities include five distinct layers:

- overstory tree layer like aspen poplar
- understory trees and a tall shrub layer (e.g. aspen, conifer regeneration, alder or willow)
- low shrubs layer (less than 3 m; e.g. rose, raspberry, low bush cranberry)
- tall forb layer (e.g. fireweed, wild sarsaparilla, cow parsnip, tall grasses)
- ground cover layer including grasses, low forbs, ground shrubs (e.g. bearberry), mosses and lichens

In combination, these five layers provide a diversity of forage species and nutrient values. Structural layers will be reduced as grazing pressure becomes heavy to very heavy (see Fig. 12). As structure declines, so do the values and benefits from the site.

Scoring:

18 = All expected life form layers are present and closely resemble the reference plant community.

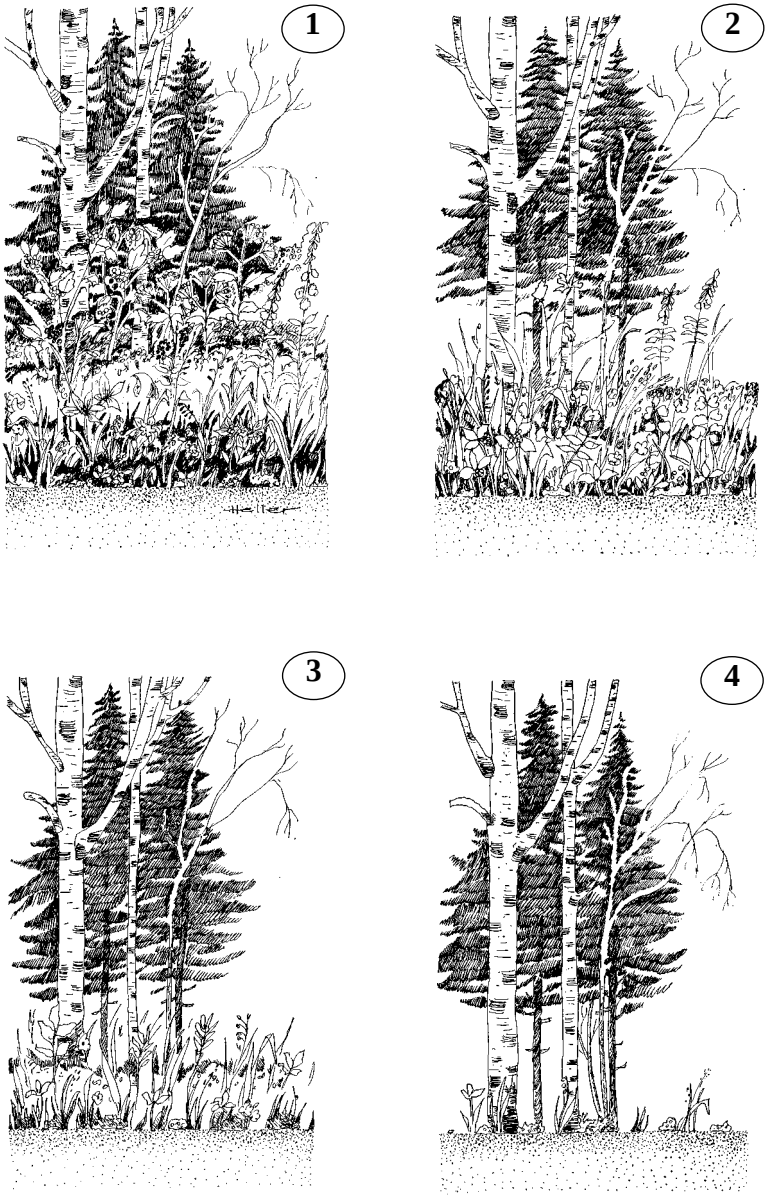


Fig. 7 Changes in forest plant community structure as disturbance increases. 1) All expected layers present. 2) Tall shrubs reduced. 3) Tall and medium shrubs eliminated. 4) Two shrub layers missing, as well as grass and tall forb layers.

12 = One life form layer is absent or significantly reduced compared to the reference plant community.

6 = Two life form layers are absent or significantly reduced compared to the reference plant community.

0 = Compared to the reference plant community three life form layers are absent or significantly reduced.

Scoring Notes Question 2:

If you score 0 for this question, the plant community may be a modified forest. Double check your scoring choice to Question 1 A.

Question 3. Hydrologic Function and Nutrient Cycling

What is the thickness of the Litter Layer (LFH)?

In forest plant communities, water and nutrient cycles are related to the organic layer of litter, fermenting and humified vegetation above the mineral soil (hence the name LFH). In its natural state LFH is a spongy and uncompacted layer. The thickness of the LFH varies between dry and moist sites, so some field sampling is required to determine normal thickness for your site. A healthy LFH layer performs important functions including storing and releasing energy and water, buffering erosive forces, reducing evaporation and providing nutrients for forest plants. By measuring the sponginess of LFH (compressibility and resistance) and thickness, you can obtain an indirect measurement of the health of the nutrient and water cycling processes on the site (Fig. 13). Be sure to review the LFH scoring method (page 54) and definitions before you try this procedure. **Note that "protected areas" refers to areas of the forest understory where cattle access has been limited (Fig. 14). "Grazed" refers to representative grazed areas that are typical for the grazing regime for the site (Fig. 14).**

Scoring:

9 = **LFH Thickness** - When measuring the LFH (knife or shovel) thickness between protected and grazed areas there is no significant difference. For average to moist sites the difference is less than 20% and for dry sites the difference is less than 30%. LFH is continuous and livestock trailing is absent to light.

LFH Compressibility - When measuring the LFH using the pencil between grazed and protected areas there is no significant difference. There is less than 20% difference in effort in the compressibility or resistance to penetration by a pencil between between protected and grazed areas.

6 = **LFH Thickness** - There is a difference in LFH thickness between protected areas and grazed areas. For average to moist sites the difference is between 20 to 30% and for dry sites the difference is between 30 to 40%. LFH is somewhat patchy due to thickness variation.

LFH Compressibility - LFH in grazed areas more compact and more difficult to squeeze; significantly more resistant to penetration (up to 50% more effort required). Some trailing and hoof damage to LFH is noticeable in places. Protected areas and grazed areas show differences in species composition and layers. Residual plant cover and distribution is slightly to moderately reduced and patchy.

3 = **LFH Thickness** Difference in LFH thickness between protected and grazed areas is typically 30 to 40% on average for moist sites and between 40 to 50% for dry sites. LFH is clearly patchy both by measurement and by visual assessment.

LFH Compressibility LFH in grazed areas is significantly compressed and much more resistant to penetration by a pencil relative to that in protected areas (50 to 200% more effort required). Trailing and hoof shearing is common across the site. Protected areas are relatively small and isolated. Residual plant cover and distribution is greatly reduced.

0 = **LFH Thickness** Difference in LFH thickness between grazed and protected areas typically greater than 40% on average to moist sites and greater than 50% on dry sites. LFH thickness is typically less than 1.5 cm on grazed areas.

LFH Compressibility LFH compaction and resistance to penetration very high (greater than 200% more effort required, which might even break the pencil). LFH damage over a significant area by hoof action and distribution is patchy. Protected areas tend to be very small. Residual plant cover and distribution is greatly reduced.

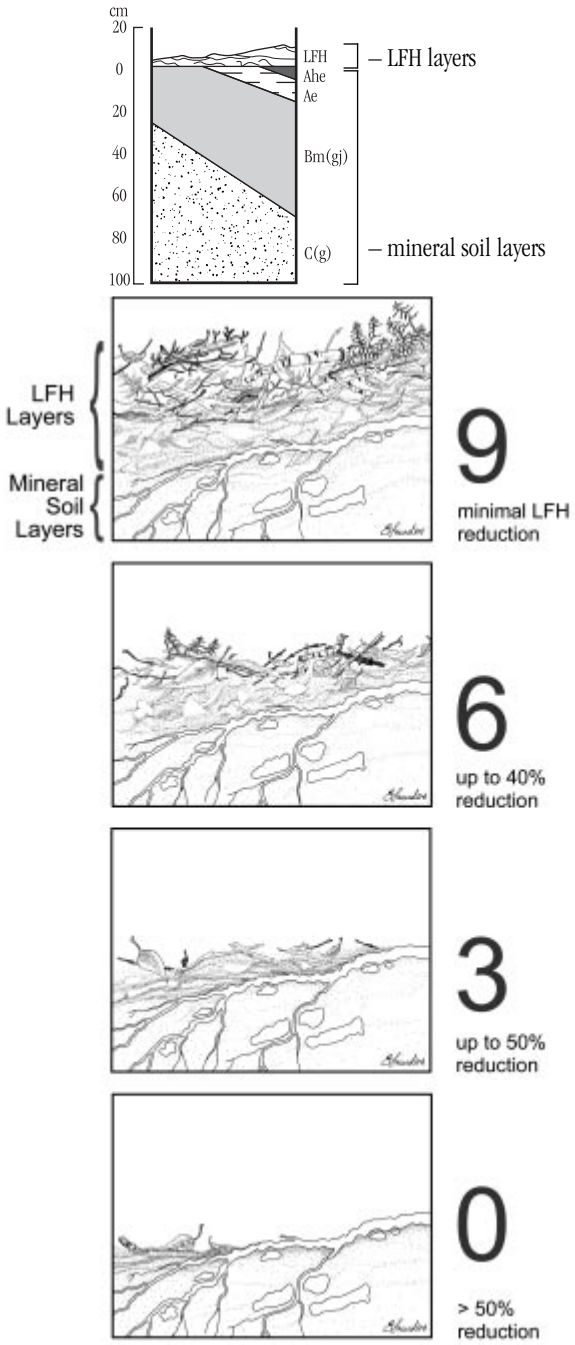


Fig. 13 Impact of increasing grazing pressure on LFH thickness. The inset drawing (above) shows the presence of the LFH layer overlaying mineral soil layers.

Scoring Notes Question 3:

Methods for Estimating LFH Thickness (Fig. 13 & 14)

- You will need a knife or a shovel and a pencil for sampling LFH thickness.
- **Protected areas** refer to areas that grazing animals find difficult to utilize and therefore are likely to be ungrazed or lightly grazed and relatively untrampled (between clumps of closely spaced trees, underneath dense shrub cover, areas with considerable deadfall, areas immediately adjacent to single trees).
- **Representative Grazed areas** are any surrounding areas that are freely accessed by grazing animals. The areas you sample are representative of the grazing regime present on the site.

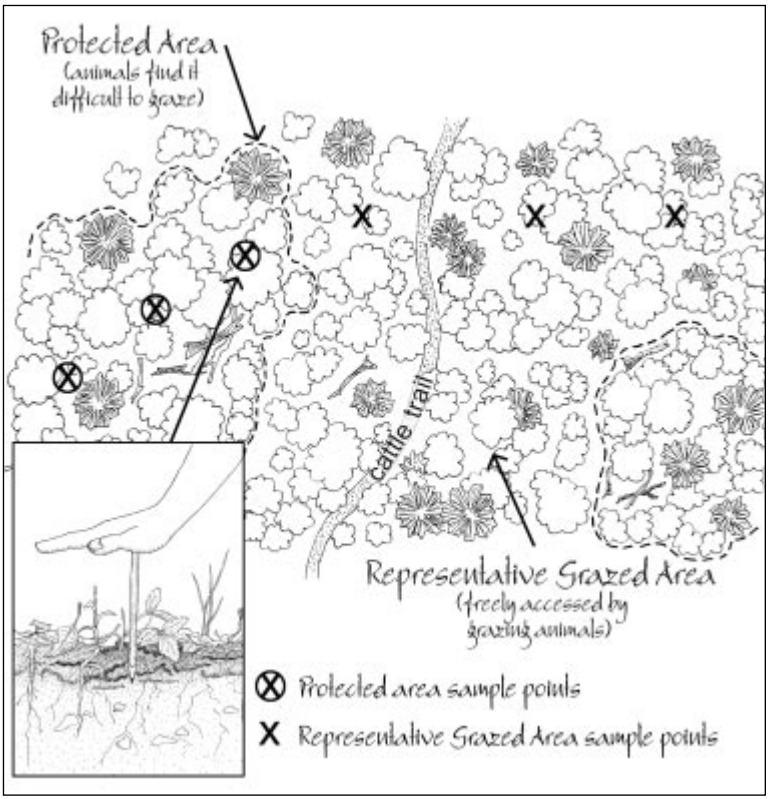


Fig. 14 Example of sample site selection in protected versus representative grazed areas for the "Poke Test".

- The "**LFH Poke (Pencil) Test Method**" can be used to assess LFH thickness and compaction. To do this, place the eraser end of a sharp pencil (or similar object) in the middle of your palm and then, with a straight arm, push the pencil into the LFH. Gauge the resistance you feel as the pencil moves through the LFH. Thickness of the LFH can be estimated by the distance the pencil penetrates before it hits mineral soil. Generally more resistance is found where management has affected the site.
- Pick a representative area and within this area look for representative grazed and protected areas (Fig. 14). Push your pencil into the LFH at various locations to compare the ease of penetration between grazed and protected areas. For a more systematic approach, sample in a transect beginning no closer than 40 cm from a tree and moving out to grazed areas but before you come to a trail.
- If sampling after leaf fall, carefully brush away the leaves from the current year to ensure an accurate measure of LFH thickness.
- Practice the method before sampling to better perfect the "LFH Poke Test Method". You may want to do several samples to represent the variation found, for example do three protected and three similar grazed sites.
- If you need additional information to score the health and function of the LFH, consider the "LFH Shovel (or knife) Test Method". Take samples of the LFH thickness in a protected area compare them to the LFH thickness in an open, similar site. Consider taking at least three samples of each to better represent the variation found. It is very important to sample in the same moisture regime because any thickness differences may be due to natural variation. Use the measurements found here along with the "LFH Poke Test Method" to determine the score that fits best. In the Lower Foothills, indicators of dry sites are southeast and westerly aspects greater than 20% slope and/or coarse-textured, gravelly/sandy soils. Indicator species include common wild rose, blueberry, juniper, buffalo-berry, bearberry, and sometimes green alder. Forbs are sparse and hairy wild rye grass or pine grass are dominant in the southern foothills. Ecosite examples include: Aspen/buffalo berry, Aspen/green alder-hairy wild rye. For further information see ecosite field guides (Beckingham et al. 1996a; Lane et al. 2000).

- In the Central and Dry Mixedwood, indicators of dry sites are southeasterly to westerly aspects greater than 20% slopes and coarse-textured, gravelly/sandy soils. Indicator species include common wild rose, blueberry, Labrador tea and bearberry. Overstory stands appear open and have low shrub understory. Ecosite examples include: Aspen/blueberry-bearberry and Aspen/blueberry-Labrador tea. For further information see ecosite field guides (Beckingham et al. 1996; Willoughby 2003).
- Compared to dry sites, average to moist sites often have fine-textured parent materials (i.e. silts and clays) and are mainly on gentler slopes or where slopes are steep on easterly or northerly aspects. Plant diversity is greater and plant cover is thicker with denser layering. In the Lower Foothills, ecosite examples include Aspen/Saskatoon, Aspen/low-bush cranberry and Aspen/rose. In the Central and Dry Mixedwood ecosite examples include: Aspen/beaked willow, Balsam Poplar-Aspen/honeysuckle-fern, Aspen/forb and Aspen/beaked hazelnut. For further information see ecosite field guides (Beckingham et al. 1996b; Willoughby 2003).

Earth Worms

In the Lower Foothills Natural Subregion of the province you may encounter earthworms in the forest soil. If so, the above LFH thickness thresholds may not apply. How do you tell if earthworms are present?

- soil mixing altering the natural thickness of the LFH.
- earthworm casts (feces), round cylinders about 2 mm in diameter by 5 mm long may be found in clumps.
- the soil mixing provides a light and dark streaking in the soil profile, and parts of the LFH, i.e. the H part may be found below the lightly colored layers.

Question 4.0 Site Stability

Question 4.1 Is there evidence of accelerated erosion?

Accelerated erosion due to human management activities is a serious issue, leading to long-term negative impacts on the site

potential. If we recognize the early signs of accelerated erosion, or increases in human-caused bare ground, we can make management changes before the situation becomes serious.

To estimate "human-caused" bare ground and recognize accelerated erosion, you need to know what normal soil erosion processes are like for a forest plant community. Before you look for human-caused erosion, be sure what the normal expectations are for the site. Sandy forest sites or steep river breaks may be naturally unstable and erodable. The majority of forest range sites in Alberta have continuous ground cover and are stable.

Is the site being observed normally stable or unstable? (check one below)

Site normally stable: ☐ Site normally unstable: ☐

Question 4.1 Evidence of site instability (accelerated erosion) (Use Fig. 15)

Scoring:

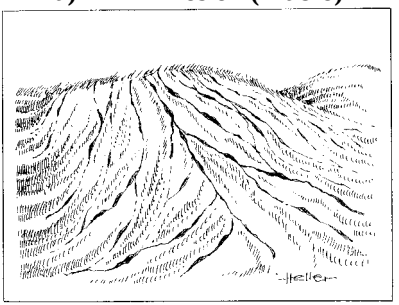
3 = No visual evidence of soil movement, deposition of soil/litter, plant pedestalling, coarse sand or aggregate remnants, hoof shear, soil compaction, flow patterns and/or scouring beyond the natural extent for the site.

2 = Some micro evidence of the above. Hoof shear may be present on micro slopes. Old erosion features may be stable and vegetated or flow patters on site short and shallow. Extent of exposed soil is only slightly greater than expected for the site.

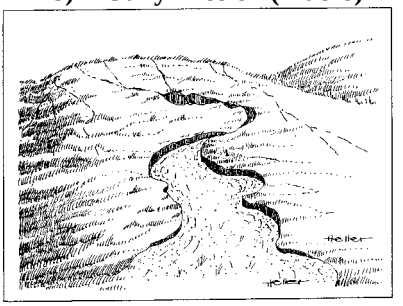
1 = Macro evidence of moderate amounts of soil movement or deposition of the above. Erosion features are active but limited to the site with no off-site movement of material. Flow patterns have a well-defined branching pattern. The extent of exposed soil is obviously greater than expected for the site but vegetation (live plants and litter) still protects most of the site.

0 = Macro evidence of extreme amounts of soil movement with most material being carried off site. Flow patterns are obvious and fan deposits may be present. Rills are abundant and deep.

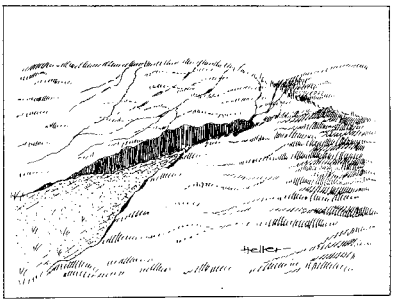
a) Rill Erosion (Macro)



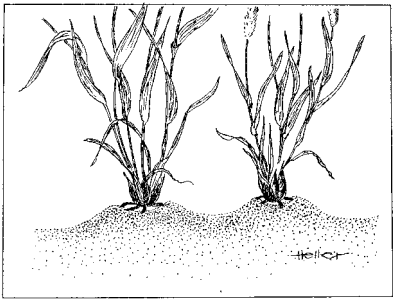
b) Gully Erosion (Macro)



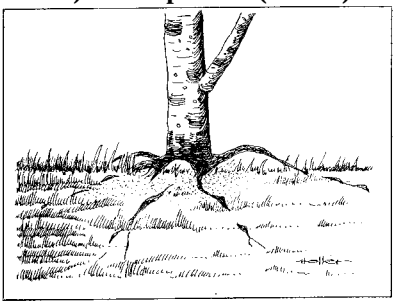
c) Gully Erosion (Macro)



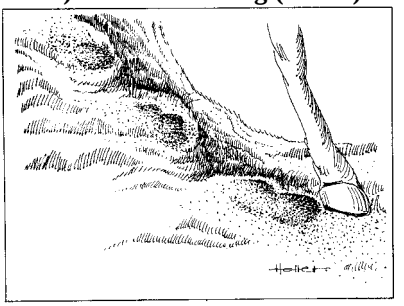
d) Pedastalling (Micro)



e) Compaction (Macro)



f) Hoof Shearing (Micro)



g) Trailing (Macro)

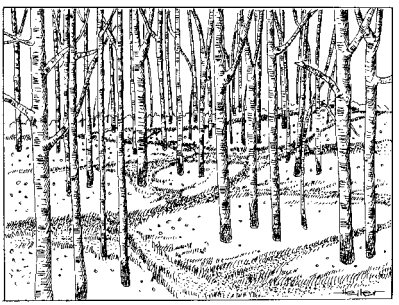


Fig. 15 Examples of soil erosion, compaction, hoof shearing and trailing.

Gullies are deep with sharp edges. Hoof shear is significant. Erosion features are active. Pedestalled plants with exposed roots and rocks exposed or sitting on the surface. Evidence of instability.

Question 4.2 Increase in human-caused bare soil (read scoring notes and see Fig. 16)

Scoring:

6 = less than 1% cover of bare soil is human-caused.

4 = greater than 1 and up to 5% cover of bare soil is human-caused

2 = greater than 5 and up to 15% cover of bare soil is human-caused

0 = greater than 15% cover of bare soil is human-caused

Scoring Notes Question 4:

- The check box allows you to evaluate the significance of greater hazard associated with increase soil exposure to normally stable sites.
- Human-caused bare soil is the result of disturbance processes that are subject to human control (e.g. grazing, OHV, recreational impacts, timber harvesting). Human-caused bare soil is that portion that is over and above what is normally expected for the site.
- To estimate human-caused bare soil, first estimate total bare soil, subtract expected or naturally occurring bare soil and the difference is human-caused bare soil. Report this amount on the field sheet. Take time to record moss and lichen cover as well as this layer helps to stabilize the site.
- Include the bare soil percent found in livestock trails in human-caused portion.
- Ecological site descriptions include soil exposure standards for judging the “human-caused” portion.
- Bare soil from rodent burrows tends to increase on modified or heavily grazed sites

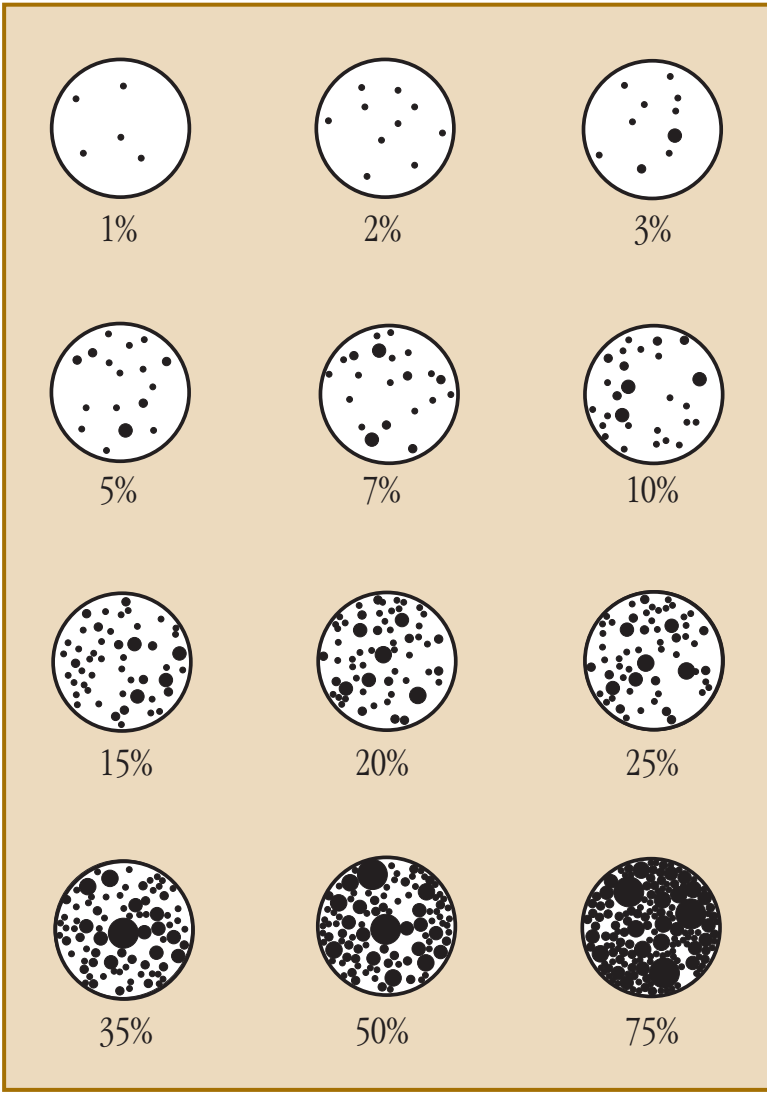


Fig. 16 This graphic helps to develop a mental picture of the percent cover of bare soil or vegetation. It will appear a number of times in this workbook for easy reference.

- Rodent activity increases when there is an increase of weedy, tap rooted species.
- On modified and heavily grazed sites, most of the bare soil from rodent burrows should be considered human-caused bare soil.
- High ungulate use may lead to increased bare soil on their preferred ranges. Winter sites are especially prone to hoof shear resulting in increased bare soil. When wildlife impacts result in increased soil exposure, treat it as human-caused and note the source of the impact in the comments section. For earthworm activity see page 56.

Question 5.0 Noxious Weeds

Are noxious weeds present on the site?
Infestation of the polygon with noxious weeds.

Noxious weeds are invasive plants that are seldom a problem in a healthy and functional plant community. Even in modified plant communities, noxious weeds are not always a problem. When the presence of noxious weeds becomes noticeable, they can have a negative impact on forage production and the many other values of forest rangeland. Detecting the presence of noxious weeds at the early stages can alert you to make changes in management practices to prevent further spread and increase costs of controlling these noxious weeds.

Question 5.1 What is the cover of noxious weeds? (Use Fig. 16)

Scoring:

3 = no noxious weeds present

2 = noxious weeds present with a total cover less than 1%

1 = noxious weeds present with a total cover between 1 to 15%

0 = noxious weeds present with a total cover of greater than 15%

Question 5.2 Noxious Weed Density Distribution Class? (Use Fig. 17)
Scoring:

3 = No noxious weeds present

2 = A low level of noxious weeds found in density distribution class range of 1, 2 or 3

1 = A moderate level of noxious weeds found in density distribution class range of 4, 5, 6 or 7

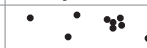
0 = A heavy level of noxious weeds found in the density distribution class range of 8, 9, 10, 11, 12 or 13.

Scoring Notes Question 5:

- The cover and density distribution of noxious weeds in the pasture can provide clues as to the health and function of the pasture. Noxious weeds commonly establish where excessive disturbance has caused an increase in open ground and available moisture.
- Variations in weed infestation can be averaged across the polygon. Your observation is a cumulative evaluation of all the noxious weed species present. You can record specific cover and density distribution of specific weed species in the comment section in the field worksheet.
- The density and distribution of dots in figure 17 relates to the density and distribution of weeds in the sampling area (polygon). Scores decline as infestation increases and the values are on the right side of the figure.
- Include noxious and restricted weed species defined in the Weed Act (see suggested list of weed species on page 116). Use a weed list that is standard for the community (i.e. County or Municipal District). **Do not** rate nuisance weeds or disturbance species in this question (e.g. dandelion, strawberry, plantain, yarrow).
- If the pasture has a significant, uneven distribution of weeds, you may want to consider dividing the pasture into smaller sample areas.

Fig. 17 Density distribution guide for rating weed infestation.

Density Distribution

Class	Description of abundance in polygon	Distribution	Weeds Score
0	None		3
1	Rare		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 occurrences of well spaced plants		
11	Continuous occurrence of plants with a few gaps in the distribution		
12	Continuous dense occurrence of plants		
13	Continuous occurence of plants with a distinct linear edge in the polygon		

INSTRUCTIONS AND SCORES

The Tame Pasture Health Assessment should be used on areas that were originally developed for tame pasture. Do not include areas that were left as native vegetation (e.g. riparian areas, knolls and slopes, buffer strips, patches of forested cover, etc.) or regenerating cutblocks for sustained timber yield.

Forest cover can be cleared by a natural event (i.e. wildfire), or for the purpose of timber harvest or tame pasture development. When the intent is to develop tame pasture, livestock producers usually implement management practices such as controlling the timing and intensity of grazing, applying herbicides, breaking, discing or other mechanical treatments to control the regeneration of trees and shrubs.

Occasionally, areas that were cleared for tame pasture development will have a substantial amount of deciduous tree regeneration. Based on the 2003 Alberta Regeneration Survey Standards, if 80% of the cleared area has at least one healthy, vigorous, undamaged tree taller than 1.6 m in height every 10 m^2 (circular plot radius of 1.78 m), the cutblock or clearing will regenerate to forest. This criteria is therefore a good benchmark to determine if the site is functioning like a forest or a tame pasture.

Areas that meet the criteria described above should be assessed using the Forested Health Assessment. Areas that do not meet the criteria should be assessed using the Tame Pasture Health Assessment. Until an assessment tool is developed to evaluate the impact of livestock grazing in regenerating cutblocks, the Forested Health Assessment should be used in these areas. See decision diagram on page 26.

Before you proceed with the tame pasture health assessment, be sure you have reviewed the sections on the *Indicators of Range Health, Getting Started,* and *Using the field workbook and worksheets* (see page 101 for sample field worksheets). Record dominant plant species, associated cover values (see page 92 for

information on estimating cover) and scores for each of the tame pasture health parameters as shown in the example on page 111. When you have completed the assessment, read the section beginning on page 103 to learn more about what it means and how you can incorporate this information into your management plans.

Question 1.0 Plant Composition

Do introduced forage plants dominate the site?

The tame pasture plant community should resemble its reference plant community, that is, the introduced (i.e. non-native) forage species that were initially seeded. Tame grasses and legumes are fundamental to a productive tame pasture. Maintaining these planted species maximizes forage production. When pastures are homogenous (i.e. dominated by plants that grow at the same time, with similar forage quality, etc.), management is easier and more effective. Therefore, it is important that managers know what plants are currently growing in the pasture.

In some cases, a tame pasture may be modified to the point where introduced forage species no longer dominate the stand. This can be due to individual or a combination of factors, including the development method (e.g. scarifying and broadcast seeding) and past grazing regime. In some situations, the amount of introduced forage species is so low that it is questionable if the pasture can be managed to regain the dominance of introduced forage species. A mixture of tame and native species makes effective management of a pasture difficult, as different species will mature at different rates and require different rest intervals following grazing. If your management goal is to have the pasture revert back to native plants, then consider using the health assessment protocol for native grasslands or forests.

If the management goal is to manage the site as a tame pasture, continue to use this health assessment protocol. The observer must first determine if the pasture is a **tame pasture** (Question 1A) or a **modified tame pasture** (Question 1B). (This decision is based on the % cover of introduced forage plants in the pasture. Refer to page 92 for information on estimating cover.)

- If 50% or greater of the cover in the pasture is from introduced forage plants, proceed to **Question 1A.** The pasture is considered a **tame pasture**.
- If less than 50 % of the cover in the pasture is from introduced forage species, proceed to **Question 1B.** The pasture is considered a **modified pasture**.

An absence of either seeded forages or desirable native forage species is a good indication that the grazing regime may be too heavy and range health is declining.

Question 1A Tame Pasture

To be considered a "tame pasture", at least 50% of the vegetative cover must be from introduced forage species. Introduced forage species include tame forage species that were seeded or that have established in the pasture by natural means (e.g. wind, animals, water) or through livestock grazing. This question indirectly estimates (through cover), the contribution of introduced forage species towards the total productivity of the pasture (adapted from Wroe et al. 1988). The observer should use representative observations or sample plots within the pasture.

To score this question, the observer must first determine the % cover of all introduced forage species as compared to the total % vegetation cover found in the assessment area. In other words, estimate how much introduced forages contribute relative to the total vegetation cover. Do not include bare soil, litter, noxious weed species or woody regrowth in the estimate of total % vegetation cover, as these elements are considered in other health questions. See the scoring notes for further instructions on estimating relative cover.

Scoring:

8 = 90% or greater of the cover is from introduced forage species

6 = 75 to 89% of the cover is from introduced forage species

3 = 50 to 74% of the cover is from introduced forage species

Scoring Notes:

- Introduced forage species do not include native species, noxious weeds, woody plants and weedy or disturbance induced species. See Table 3 for a list of species commonly found in tame pastures. Further information regarding 'noxious' weeds and disturbance species is found in question 5 and on page 116. (NOTE: This list was originally developed for native plant communities so some tame forage species are listed as disturbance species. For the purposes of tame pasture assessment, ignore this classification of tame forages.)
- How to estimate relative cover: when estimating relative cover, you are determining the % cover that part of a group has relative to the % cover of the whole group. The following are some detailed instructions that will assist you making this simple estimate. In your mind's eye, picture only the areas that are covered by live vegetation in your sample frame or plot – exclude bare ground and areas only covered by litter. Also exclude any area that is only covered by 'noxious' weeds or woody regrowth. (For example, if a Canada thistle plant is layered over a dandelion, the area beneath it is also covered by the dandelion so that area would not be removed.) Mentally resize your frame to fit around this new area. Now your frame represents 100% of the area covered by live vegetation and excludes 'noxious' weeds, woody regrowth, litter and bare ground. In your mind, combine the cover of all vegetation by coloring the entire area of the resized frame black. The next step is to estimate how much area a certain part of the vegetation, in this case introduced forage species, takes up in the resized frame. In your mind, combine the cover of all introduced forage species by coloring them all gray. (Ignore overlapping leaves and color the area only once.) Now ask yourself, what percent (or proportion) of the resized frame is gray? Your answer is the relative cover of introduced forage species used to score this question.

Question 1B Modified Tame Pasture

The pasture is "modified" if less than 50 % of the cover in the grazed pasture is from introduced forage species. Modified tame

pastures can be managed for their "modified" potential, while preventing weed and erosion problems. In a modified tame pasture there is more emphasis placed on the contribution of desirable native forage species towards the total productivity.

This question indirectly estimates (through cover), the contribution of native and introduced forage species towards the total productivity of the pasture (adapted from Wroe et al. 1988). The observer should use representative observations or sample plots within the pasture. Only **include** native forage species, plus any introduced forage species that were seeded or that have established in the pasture by natural means (e.g. wind, animals, water) or through livestock grazing). This collection of forage species will be referred to as "**included**" species in following text.

To score this question, the observer must first determine the % cover of all included forage species as compared to the total % vegetation cover found in the assessment area. In other words, estimate how much included forages contribute to the total vegetation cover. Do not include bare soil, litter, woody regrowth or noxious weed species in the estimate of % total cover of all species. See the scoring notes in Question 1A for further instructions on estimating relative cover, keeping in mind that the "relative groups" (i.e. introduced verses included) are different in this question.

Scoring:

6 = 75% or greater of the cover is from included species (i.e. a mixture of desirable native species and introduced forage species)

3 = 40 to 74% of the cover is from included species

0 = less than 40% of the cover is from included species

Scoring Notes:

- Include desirable native forage species that have the potential to make a substantial contribution to forage production and are readily grazed by livestock. Do not include noxious weeds, woody plants and weedy or disturbance induced species. See

Table 3 for a list of species commonly found in tame pastures. Further information regarding 'noxious' weeds and disturbance species is found in question 5 and on page 84. (NOTE: This list was originally developed for native plant communities so some tame forage species are listed as disturbance species. For the purposes of tame pasture assessment, ignore this classification of tame forages.)

- When estimating relative cover, you are determining the % cover that part of a group (in this case 'included' forage species) has relative to the % cover of the whole group (live vegetation, excluding noxious weeds and woody regrowth). See the scoring notes in Question 1A for further instructions on estimating relative cover, keeping in mind that the "relative groups" (i.e. introduced verses included) are different in this question.

Table 3 Commonly occurring plants in tame pastures categorized to assist in answering questions 1 and 2.

Plant name	**1A** introduced forages	**1B** included forages	**2.1** grazing induced forages	**2.2** weedy/disturbance induced non-forages
Introduced				
Kentucky bluegrass	Y	Y	Y	-
smooth and meadow brome	Y	Y	N	-
timothy	Y	Y	N	-
crested wheat grass	Y	Y	N	-
quack grass	Y	Y	Y	-
creeping red fescue	Y	Y	Y	-
alfalfa	Y	Y	N	-
clovers and other legumes	Y	Y	Y	-
dandelion	N	N	-	Y
Native (naturally occurring)				
marsh reed grass	N	Y	N	-
rough fescue	N	Y	N	-
hairy wild rye	N	Y	N	-
wheat grasses	N	Y	N	-
June grass	N	Y	Y	-
needle and thread	N	Y	N	-
Canada bluegrass	N	Y	Y	-
peavine, vetch	N	Y	N	-
pussy-toes (everlasting)	N	N	-	Y
strawberry	N	N	-	Y
yarrow	N	N	-	Y
prickly pear cactus	N	N	-	Y

Question 2.0 Plant Species Composition Shift

Are there changes in the type of plants that are growing in the tame or modified tame pasture?

Introduced and native forage plants may respond differently to a particular grazing regime. Tame or modified tame pastures are most often maintained at moderate stocking levels. When the grazing regime increases to heavy grazing (i.e. a regime that provides continuous heavy grazing without effective rest), plant species changes occur. Under this regime, grazing resistant plants thrive better than plants less resistant to grazing and become dominant in the pasture. Therefore, alfalfa and taller, more productive grasses with high growing points are replaced by grasses and legumes with low growing points and growth forms that are more resistant to grazing (e.g. Kentucky bluegrass, creeping red fescue, and white clover). These plants are considered grazing induced species. (Note: In areas where moisture is not limited, Kentucky bluegrass and creeping red fescue can produce a significant amount of forage. Most often however, moisture is limited and their productivity is severely impaired.)

Good range management should maintain taller, more productive forage species, which are often better able to withstand drought conditions, provide a more stable forage supply, and permit more flexibility in grazing options. Pastures dominated by shorter and shallow rooted species, particularly when or where moisture is limited, provide fewer grazing management options and usually have reduced stocking rates.

Question 2.1 Forage Species Shift

To score this question, the observer must first determine the cover of the taller, more productive species (both introduced and native) relative to the total cover of all forage species. See the scoring notes in Question 1A for further instructions on estimating relative cover, keeping in mind that the part & whole groups are different in this question.

Scoring:

8 = greater than 75% of the forage cover is from tall, productive, introduced and native forage species. Minor amounts of grazing induced species present.

4 = 40 to 74% of the forage cover is from tall, productive, introduced and native forage species. Plants may be declining in health and vigor. Grazing induced species may be replacing the taller, more productive species. Shift may be due to grazing or other causes.

0 = less than 39% of the forage cover is from tall, productive, introduced and native forage species. Plants may be weak and have reduced vigor. Taller, more productive species may have been largely replaced by grazing induced species. Shift in composition due to grazing or other causes.

Scoring Notes:

- When estimating relative cover, you are determining the % cover that part of a group (tall, productive introduced and native forage species) has relative to the % cover of the whole group (live forage plants - do not include weedy and disturbance induced species, non-forage plants, noxious weeds and woody regrowth). See the scoring notes in Question 1A for instructions on estimating relative cover, keeping in mind that the part & whole groups are different in this question.
- See Table 3 for a list of species commonly found in tame pastures.

Question 2.2 Weedy and Disturbance Induced Species Shift

This question considers the abundance of undesirable species such as dandelion, strawberry, yarrow, everlasting and other disturbance induced species that increase with grazing pressure and as the competitiveness of seeded forages or desirable native species declines. As the cover of weedy and disturbance-induced species increases, a corresponding and serious decline in forage production follows. Other changes to watch for include bare soil, soil erosion and low litter reserves.

Scoring:

8 = less than 25% cover from weedy and disturbance induced species.

4 = 26 to 49% cover from weedy or disturbance induced species.

0 = 50% or greater cover from weedy or disturbance induced species.

Scoring Notes:

- See Table 3 for examples of weedy and disturbance induced species commonly found in tame pastures.
- Include nuisance weeds but not noxious weeds. Further information regarding 'noxious' weeds and disturbance species is found in question 5 and on page 116-118. (NOTE: This list was originally developed for native plant communities so some tame forage species are listed as disturbance species. For the purposes of tame pasture assessment, ignore this classification of tame forages.)
- In this question, the % cover being estimated is **absolute** cover, not relative cover as was used in the previous questions. In this case, use your plot or frame to represent 100% of the sample area – no resizing. Then determine the actual percent of your plot or frame that is covered by weedy and disturbance induced species. Refer to page 92 for additional information on estimating cover.

Question 3.0 Hydrologic Function and Nutrient Cycling

Is there adequate litter present to retain moisture?

Litter is linked to rangeland health because it performs several important functions that are vital to the maintenance of resource values for livestock, forage production, wildlife habitat, and watershed protection. Litter's light-tan color will tend to reflect the sun's rays, insulating the soil surface thereby slowing the loss of

moisture and minimizing temperature fluctuations. It also acts as a kind of latticework at the soil surface that promotes infiltration of water. Litter, along with other live plant material, slows runoff and creates a pathway for water to flow into the soil. By improving the retention and percolation of water into a range site, soil erosion by water is greatly reduced. Litter will also reduce wind erosion, the same way that a good stand of stubble will in a grain field, by causing the wind to be deflected upward and by capturing any airborne soil particles. The presence of a litter layer reduces soil exposure to weedy plant species and insects such as grasshoppers that might take advantage of such conditions to establish new plants or lay eggs. As soil micro-organisms break down the litter to humus, nutrients are recycled to support plant vigor and growth, thereby reducing the need for costly applications of inorganic fertilizer.

Litter is of particular importance on tame pastures found in the drier parts of the province (e.g. Dry Mixedgrass, Mixedgrass, Central Parkland and Dry Mixedwood natural subregions). Litter includes any plant residue from previous years growth (standing or fallen stems or leaf material) as well as partially decomposed fragments of plant material lying on the surface (See figure 18). Litter can be distinguished from the current year's growth by its color, integrity (i.e. brittleness, pliability, etc) and sometimes its position. Current year's growth will have a green to yellowish tinge, will be somewhat flexible and will usually be firmly connected to the plant.

Question 3.0 evaluates the ability of a site to retain moisture based

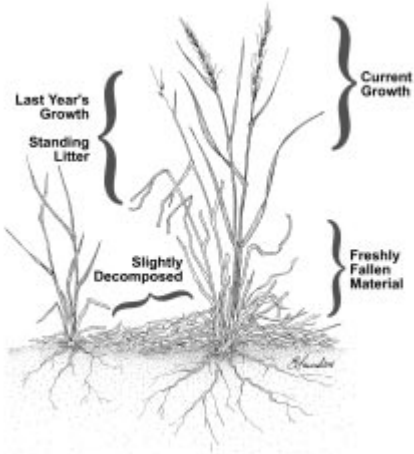


Fig. 18 Types of litter associated with tame pastures.

on the amount of organic residue. Litter estimates provide an indirect measurement of the health and functioning of the nutrient and water cycles. Litter weight estimates (lbs./ac.) are made in representative areas and compared to litter thresholds that are appropriate to the site being evaluated. Your reference area should be a light to moderately grazed tame pasture with enough litter to adequately perform the stated biophysical functions of litter (See Table 1). As litter amounts decline, the benefits that litter provides is usually diminished.

Is it possible to have too much litter? Yes and no. Climate and plant characteristics cause litter to accumulate and break down at different rates. Where local climate conditions restrict plant growth and increase the rate of litter loss and/or break down, it may not be possible to accumulate too much litter. In tame pastures where moisture is less restricted and wind is not a factor, it maybe possible with very light or nonuse of forage to accumulate too much litter. In this case forage production will likely be temporarily reduced due to shading. Overall, the benefits of litter retention far outweigh any potential risk of forage production loss.

The litter thresholds provided are based on averaging litter amounts found on a variety of grazed tame pastures across the province. For a specific climate, soil and mix of species, the actual amount of litter required to contribute to a healthy and functional rangeland may vary. Further studies will help us better define litter thresholds in tame pastures.

A quick estimate of litter levels can be based on the amount of larger litter fragments that can be readily raked up by hand within sample plots (e.g. 50 cm by 50 cm). The observer can then compare this amount to the examples shown in Figure 19. This method of rapidly estimating litter (i.e. hand raking), does not include some of the smaller litter fragments.

The health assessment must be repeatable (i.e. answers do not widely vary among observers) and as objective as possible. In order to achieve this, assessment methods must be standardized and observers instructed on how to deal with complicated factors. Manure is one of these factors. Manure (cow pies) and urine contribute to the nutrient cycle much the same as does plant litter,

Litter Examples

450 lb/ac

250 lb/ac

125 lb/ac

Fig. 19 Litter standards for tame pasture.

however they lack some of the qualities important to the hydrological cycle such as creating pathways for water to flow into the soil. For the purposes of sampling litter, including cow pies has the potential to skew the average amount of litter that is used to score the site, particularly when the pieces are large and/or fresh. Therefore, when estimating litter amounts, avoid sample plots that have large or fresh cow pies. To maintain consistency from observation to observation, and pasture to pasture, only include decomposed pieces of cow pie smaller than about the size of a deer pellet in your estimates.

Scoring:

15 = A distinct litter layer is visible. Litter has a uniform distribution across the pasture with less than 5 % of the pasture lacking adequate cover. Hand raked litter from a ¼ m^2 plot is estimated at 450 lbs./ac. or more, an amount equal to about one handful of litter.

10 = A distinct litter layer is visible, but litter cover is reduced and is no longer uniform. Litter is reduced on about 5 to 25% of the pasture with these areas having little or no litter. Hand raked litter from a ¼ m^2 plot is estimated at about 250 to 450 lbs./ac., an amount equal to about ½ to 1 handful of litter.

5 = A thin litter layer may be visible throughout the pasture or acceptable litter cover may exist only in small scattered patches with the rest of the pasture having little or no litter. About 25 to 67% of the pasture area has inadequate litter cover. Hand raked litter from a ¼ m^2 plot is between 125 and 250 lbs./ac., an amount equal to between ¼ to ½ handful of litter.

0 = Litter is sparse or absent from the majority of the site (greater than 67% of the area). Hand raked litter from a ¼ m^2 plot produces less than 125 lbs./ac., an amount less than ¼ handful of litter.

Scoring Notes:

- The scoring of litter considers litter amounts and distribution

(spread and cover). To award a particular score, the criteria of both the litter amount and litter distribution must be satisfied. For example, a bunch grass pasture that has 450 lbs./ac. of hand raked litter but distribution is limited to the vicinity of the grass clumps would score 10 points (not 15 points).

- In areas that are classified as exceedingly stony and/or have rocky outcrops, the amount and distribution of litter can be affected by surface rock. Large rocks (e.g. > 6 inches in diameter) can contribute to moisture retention and soil protection. Record the % of rock cover in your comments and score the litter as your see it, regardless of rock cover. This method is recommended to maintain consistency of assessments from observer to observer over time and among pastures. Consider the influence of rock cover when making management decisions. For example, if rock is negatively affecting site litter cover, you may decide to: 1) take no management action to increase litter cover (assuming that non-rocky areas have enough litter); or 2) reconsider plans to develop tame pasture on sites with similar rock cover.

Question 4.0 Site Stability

Is the site subject to accelerated erosion and human-caused bare ground?

Recognizing the process of human-caused erosion on tame and modified pastures is very important. Erosion can cause serious losses in the long-term ability of the site to produce forage and provide other values. Early stages of soil erosion indicate the need for immediate changes in management before soil loss becomes serious and costly. It is unlikely that the tame pasture has been developed on a site that is inherently unstable (i.e. unstable under natural vegetation).

Start Question 4.0 by answering the following question, then answer questions 4.1 and 4.2.

Site normally stable?: ☐ or Site normally unstable?: ☐

Question 4.1 Evidence of Accelerated Erosion (see Figure 20)

Scoring:

6 = No macro and micro visual evidence of soil movement, deposition of soil/litter, plant pedestalling, coarse sand or aggregate remnants, hoof shear, soil compaction, flow patterns and/or scouring beyond the natural extent for the site.

4 = No macro evidence as above. Some micro evidence of hoof shear and/or plant pedestalling. Old erosion features may be stable and vegetated or show short and shallow flow patterns on the site. Extent of exposed soil is only slightly greater than expected for the site.

2 = Macro and micro evidence of moderate amounts of soil movement or deposition as described above. Erosion features are active but limited to the site, with no off-site movement of material. Flow patterns have well-defined branches. The extent of exposed soil is obviously greater than expected for the site but vegetation (live plants and litter) still protects most of the site.

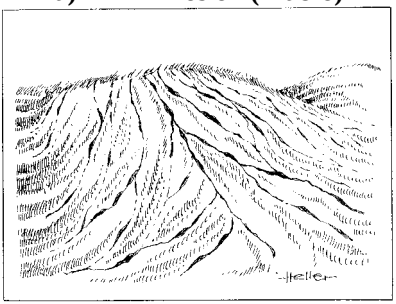
0 = Macro and micro evidence of extreme soil movement with most material being carried off site. Flow patterns are obvious and fan deposits may be present. Rills are abundant and deep. Gullies are deep with sharp edges. Hoof shear is significant. Erosion features are active. Soil erosion has uncovered rocks or caused pedestalled plants with exposed roots.

Scoring Notes:

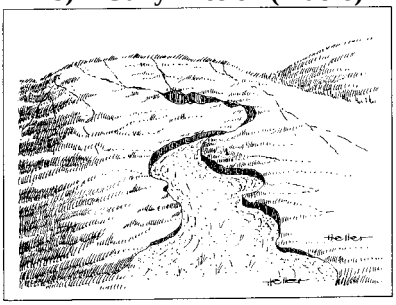
- Look for human-caused erosion above normal or geologic rates expected for the site.

- To observe early erosion signs, you may need to get very close to the ground, looking in and around plants at ground level e.g. look for micro evidence such as dishing (small depressions caused by wind erosion), hoof shear, and pedestalling.

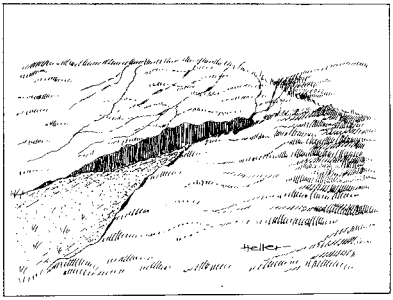
a) Rill Erosion (Macro)



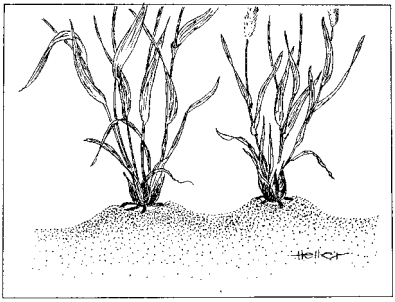
b) Gully Erosion (Macro)



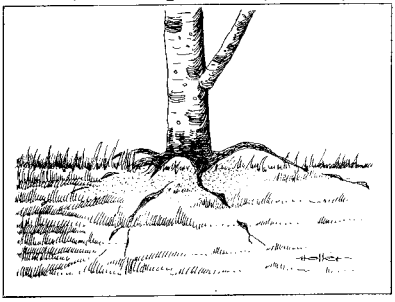
c) Gully Erosion (Macro)



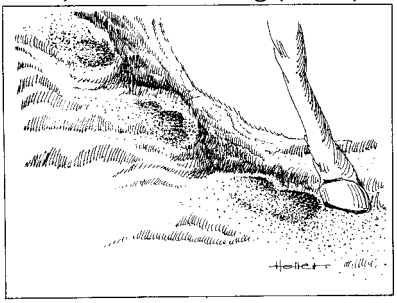
d) Pedastalling (Micro)



e) Compaction (Macro)



f) Hoof Shearing (Micro)



g) Trailing (Macro)

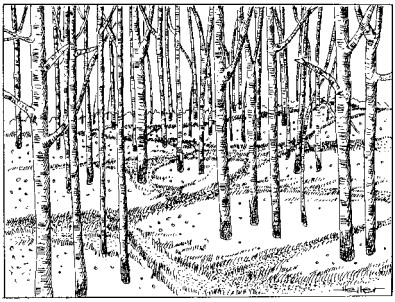


Fig. 20 Examples of soil erosion, compaction, hoof shearing and trailing.

Question 4.2 Human-Caused Bare Soil

Human-caused bare soil will alert you to the need for changes in management. Human-caused bare soil can result from the direct impacts of pasture establishment methods, grazing, equipment use or indirectly where rodent burrowing is in response to weedy species in the pasture. Bare soil is an obvious indicator of loss in forage production and the many other values found in a well-vegetated plant community.

Scoring:

To estimate human-caused bare soil, first determine the percent of bare ground on the site (use Figure 21 to assist you). Then determine what subregion the tame pasture is located in (see Table 4). Next, lookup the associated percent bare soil that is naturally found within that subregion (see Table 4). Then, subtract the naturally occurring bare ground from the observed amount. The result is an estimate of human-caused bare soil used to answer this question. (See examples 1 and 2 below.)

Table 4. Natural Variation of Bare Soil found in Natural Subregions of Alberta

Natural Subregion (soil zone)	Percent naturally occurring bare soil on sites suitable for tame pasture development (range)
Boreal Mixed wood	5 (0 to 5)
Foothills Fescue, Foothills Parkland, and Montane	Loamy sites 5 (1 to 5)
Central Parkland	Loamy sites 5 (1 to 5)
Mixedgrass (Dark Brown)	Loamy sites 7 (3 to 7) Sandy sites 6 (4 to 6) Blowout sites 12 (6 to 12)
Dry Mixedgrass (Brown)	Loamy sites 10 (1 to 10) Sandy sites 12 (5 to 12) Blowout sites 15 (5 to15)

Example 1 for Boreal Mixedwood: total observed bare soil is 20% minus 5% naturally occurring = 15% human-caused bare soil.

Example 2 for Dry Mixedgrass, Blowout site type: total observed bare soil is 50% minus 15% natural occurring = 35% human-caused bare soil.

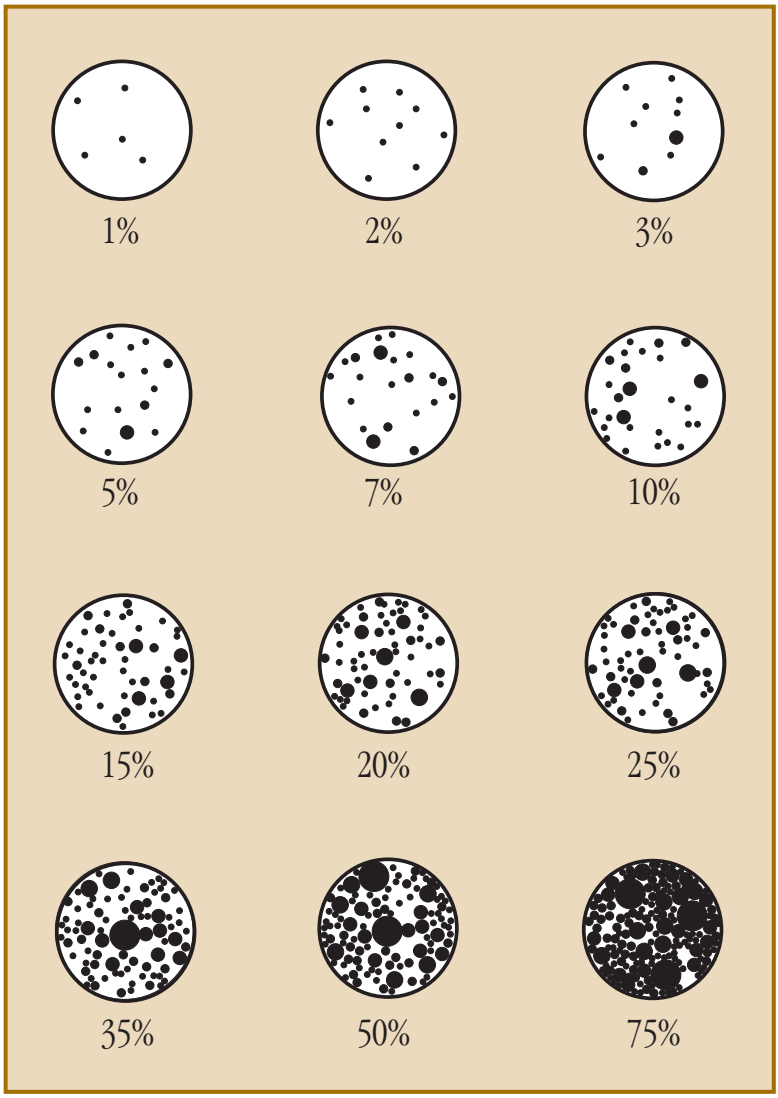


Fig. 21 This graphic helps to develop a mental picture of the percent cover of bare soil or vegetation. It will appear a number of times in this workbook for easy reference.

Use your estimate of human-caused bare ground to answer the appropriate question below. Answer Question 4.2A if the pasture is in the Mixedgrass or Dry Mixedgrass subregion; or answer 4.2B for any other subregion.

4.2A Dry Mixed Grass or Mixed Grass:

3 = 10% or less human-caused bare soil
2 = 11 to 20% human-caused bare soil
1 = 21 to 49% human-caused bare soil
0 = 50% or greater human-caused bare soil

4.2B Foothills Fescue, Foothills and Central Parkland, Montane, Boreal Mixedwood:

3 = 5% or less human-caused bare soil
2 = 6 to 10% human-caused bare soil
1 = 11 to 15% human-caused bare soil
0 = 16% or greater human-caused bare soil

Scoring Notes:

- Bare soil may be present in the early stages of tame pasture establishment before plant density and vegetation canopy increases to normal levels for the site. Be sure to note if the pasture is still in the forage establishment phase (e.g. 1 to 3 years depending on climate). Alternatively, you may wish to consider delaying the assessment until forage has been established.
- If forage establishment methods (e.g. row spacing) have contributed to the human-caused bare soil, record this information in the comments. Review these comments when considering the overall health of the tame pasture and when making management decisions. For example, you may decide to reject sites prone to soil erosion as potential tame pasture sites, or you may decide to adjust establishment methods to reduce the short and long term risks of soil exposure and erosion.
- Consider the amount of bare soil in livestock trails to be part of human-caused bare soil.
- On heavily grazed sites, a significant portion of the bare soil from rodent burrows should be considered human-caused bare

soil. Burrowing rodent populations tend to increase on pastures where there is an abundance of weedy tap rooted species and less vegetation to obstruct the rodent's view of predators.

- High ungulate use may lead to increased bare soil on their preferred ranges. Wintering sites may be especially prone to hoof shear resulting in increased bare soil. When wildlife impacts result in increased soil exposure, treat it as human-caused and note the source of the impact in the comments section. For earthworm activity see page 56.

Question 5.0 Noxious Weeds

Are there noxious weeds on the site?

The cover and density distribution of noxious weeds in the pasture can provide clues as to the health and function of the pasture. Noxious weeds commonly establish where excessive disturbance has caused an increase in bare ground and available moisture and nutrients. (See scoring notes for information regarding included weeds.)

This question considers the degree of weed infestation on the pasture. Infestation is a function of cover, density, and distribution (patchiness or evenness) of weeds over the area being sampled. Record, on the field worksheet, the cover and density distribution of each noxious weed species observed on the area being assessed. Although individually recorded, for scoring all noxious weeds are to be considered collectively. Use the record of individual species to guide weed control programs and the collective cover to score range health.

Question 5.1 Total Cover of Noxious Weeds

Scoring:

3 = no noxious weeds present

2 = noxious weeds present with a total cover less than 1%

1 = noxious weeds present with a total cover between 1% and 15%

0 = noxious weeds present with a total cover of greater than 15%

Question 5.2 Density Distribution of Noxious Weeds

Scoring :

3 = No noxious weeds present

2 = A low level of noxious weeds found in density distribution class 1, 2 or 3

1 = A moderate level of noxious weeds found in density distribution class 4, 5, 6 or 7

0 = A heavy level of noxious weeds found in density distribution class 8, 9, 10, 11, 12 or 13

Scoring Notes:

- For the purpose of scoring range health, include restricted, noxious, and other particularly invasive weed species. Please refer to the text and list on pages 116-118. (Note that the list was originally developed for native plant communities so some tame forage species are listed as disturbance species.) You may also include weeds from a list that is standard for the community (i.e. your County or Municipal District). If you add weeds from the community list, record this in your comments. Generally, **do not** include nuisance weeds or disturbance species for this question (e.g. dandelion, strawberry, plantain, yarrow).
- In this question, the % cover being estimated is **absolute** cover, not relative cover as was used questions 1 and 2.1. In this case, use your plot, polygon or frame to represent 100% of the sample area – no resizing. Then determine the actual percent of this area that is covered by noxious weeds. Make sure your samples are representative of the entire assessment area

(i.e. pasture or polygon). Refer to page 92 for additional information on estimating cover.

- Score the questions using the cumulative (combined) cover of all noxious weeds. (e.g. 10% Canada thistle + 5% downy brome = 15% cover of noxious weeds)
- The density and distribution of dots in Figure 22 represents the density and distribution of weeds in the sampling area (polygon). Point ratings decline as infestation increases. The scores for a particular class are on the right margin of Figure 22.
- If the pasture has a significant, uneven distribution of weeds, you may want to divide it into different polygons.

Density Distribution

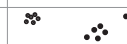
Class	Description of abundance in polygon	Distribution	Weeds Score	Regrowth Score
0	None		3	2
1	Rare		2	
2	A few sporadically occurring individual plants			
3	A single patch			
4	A single patch plus a few sporadically occurring plants		1	
5	Several sporadically occurring plants			1
6	A single patch plus several sporadically occurring plants			
7	A few patches			
8	A few patches plus several sporadically occurring plants		0	
9	Several well spaced patches			0
10	Continuous uniform occurrences 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 with a distinct linear edge in the polygon			

Fig. 22 Density distribution guide for rating weed infestation and woody regrowth.

Question 6.0 Woody Regrowth

Is there a woody regrowth problem?

The kinds, proportions and amounts of woody species that grow in tame or modified tame pasture depend on many factors including:

- site conditions (rocks, soil, natural vegetation type [forest, parkland or grassland]).
- range improvement method used
- grazing management practices
- age of pasture

Depending on the cover, density and species of plants, woody regrowth may act as complementary forage or compete with seeded forage plants. You may choose to maintain some woody regrowth to support resource goals like timber production, wildlife and riparian area values. In some cases, woody plants may be beneficial to the pasture. For example, they may increase site moisture through snow trapping; they may be important for wildlife or other values; and they might be important to the health and function of the site (e.g. riparian areas).

Riparian areas (those green strips of vegetation that are found around ponds, lakes, sloughs, and along creeks, rivers and streams) are very important to the health and function of the watershed. Please note that it is desirable to have woody cover in riparian areas that may be found in a tame pasture. These woody plants should not be considered or estimated as undesirable woody regrowth. Woody plants in riparian areas should be maintained in balance with the health and function needs of riparian areas, and to that end, pasture managers should proceed with caution in any brush control considerations. Riparian areas should be maintained and managed in their natural state to maximize watershed values and riparian health. For additional information contact the Cows and Fish program (www.cowsandfish.org)

In the Dry Mixedgrass Natural Subregion, sagebrush is an important woody plant for the endangered species Sage-Grouse. For the purposes of protecting the habitat for the Sage-Grouse, sage brush is considered not a woody regrowth problem, and should not be removed from site. Alternatively, if it is being considered as problem that needs control, the manager should make an integrated decision that benefits both livestock and Sage-Grouse. For further information see Beneficial Grazing Management Practices for Sage-Grouse (*Centrocercus urophasianus*) and Ecology of Silver Sagebrush (*Artemisia cana* Pursh subsp. *cana*) in Southeastern Alberta (Adams et al. 2004).

Typically, in northern Alberta tame pastures, poplar species, willow, rose and buckbrush may be a problem if their cover and density distribution is too high. In the Parkland, buckbrush and rose can sometimes become a problem. In the Mixedgrass and Dry Mixedgrass subregions, woody plants are generally not considered a problem. Shrubs are an important source of structure in prairie grasslands with particular value for wildlife species and also enhance site moisture by trapping snow. The removal of woody species from these sites should be carefully weighed against the benefits that woody species provide. In these drier regions, if the integrated benefits of retaining woody species outweigh the potential loss of forage production, you may decide not to score this question. If you do not score the question, remember that you need to adjust the total score so that the % range health is representative of the questions that you answered. For the grassland natural region, additional range health scoring guidelines are provided for woody plant species like silver sagebrush or forbs like prickly pear cactus, that may be considered problem species in some circumstances (Adams et. al 2005).

The health assessment must be repeatable (i.e. answers do not widely vary among observers) and as objective as possible. In order to achieve this, assessment methods must be standardized and observers instructed on how to deal with complicated factors. Woody plants are one of these factors. The observer is advised to record, on the field worksheet, the cover and density distribution of the 3 dominant potentially problematic woody species. For reasons explained previously, exclude all woody plants in riparian areas. If a woody species is to be excluded in the estimation of woody cover and density distribution, comments to that effect must be recorded.

Question 6.1 Woody Regrowth Cover

Estimate the combined cover of included woody plant species (see Figure 21).

Scoring:

4 = less than 5% cover

2 = between 5 and 15% cover

0 = greater than 15% cover

Question 6.2 Density Distribution of Woody Regrowth

Estimate the combined density distribution of included woody plant species (Figure 22).

Scoring:

2 = A low level of woody regrowth is present (density distribution classes 0, 1, 2, 3 or 4)

1 = A moderate level of woody regrowth is present (density distribution classes of 5, 6, 7 or 8)

0 = A heavy level of woody regrowth is present (density distribution classes 9, 10, 11, 12 or 13)

Scoring Notes:

- For the purpose of scoring the following questions, only assess areas that were originally developed for tame pasture. Do not include areas that were left as native vegetation (e.g. riparian areas, knolls and slopes, rocky areas, buffer strips, patches of forested cover, etc). Use the combined cover and density distribution of all included woody species that are not in riparian or other areas of native vegetation. Indicate in the comments any areas that were not included in the assessment.
- In this question, the % cover being estimated is **absolute** cover, not relative cover as was used questions 1 and 2.1. In this case, use your plot, polygon or frame to represent 100% of the sample area – no resizing. Then determine the actual percent of this area that is covered by woody regrowth. Make sure your samples are representative of the entire assessment area (i.e. pasture or polygon). Refer to page 92 for additional information on estimating cover.
- In order to maintain consistency of assessments, do not attempt to compensate for integrated values of woody regrowth when estimating cover. Consider integrated benefits of woody regrowth when evaluating the overall health of the pasture and when making management decisions regarding brush control.

- The density and distribution of dots in Figure 22 represents the density and distribution of woody regrowth in the polygon. The scores for a particular class are on the right margin of the Figure 22. If the pasture has a significant, uneven distribution of woody regrowth, you may want to divide it into different polygons.
- In the comments section, record your observations on the average height of the woody regrowth. This will assist you in assessing the need for brush control measures.
- If woody regrowth is a problem, provide specific comments on the need for control measures like biological, chemical or mechanical treatments.

Determining the Scale of Observation

The field workbook has been designed to assess range health of grassland, forest and tame pasture at a variety of scales (plant community, field or pasture, management unit, or polygon – the observation assessment area). The scale you choose depends on your specific needs and constraints.

- Consider the purpose of the assessment – what do you want to accomplish? Is the sample site an area of concern or is it broadly representative of the pasture as a whole? You may want to know the cover and density of specific weed species in addition to the cumulative measurements for the health indicators. Tame pasture can be assessed on a field basis but woody re-growth is highly variable and will normally require more detailed sampling.

- Determine the amount of time, money and labor you can apply to range health assessment. Once you have started to measure range health, future assessments allow you to establish trend; upward or downward in response to ongoing management practices.

- Sample "like-with-like". This increases the confidence that observations are representative and accurate. For example, always sample within the same fenced management unit, and if you have time, consider sampling within different plant communities. The complexity of the rangeland and the number of intermixed plant communities, will determine the number of samples required.

How Many Points Do I Sample Within a Plant Community, Management Unit or Polygon?

We suggest you pace off a representative distance of the landscape or crisscross the plant community, management unit, or polygon to

get a thorough impression of key health indicators. Consider a minimum of three observation points, making mental notes of variability before you complete the question form. It's a good idea to record information in pencil and refine as you gather more information.

In some cases, you may wish to complete measurements representative of the polygon and break down individual questions into more specific details. In the case of noxious weeds (question 5) or woody regrowth (tame pastures- question 6), the field worksheet allows you to identify specific species in the comments section.

What Sampling Equipment Do I Need?

- Field work book, a pencil and eraser,

- For grassland and tame pasture, a quarter meter frame (50 x 50 cm) for estimating litter amounts. Alternatively you can use a measuring tape and spikes to mark off a quarter meter square or perhaps you can use your feet (boot size),

- For forest, a pencil, knife and/or a shovel and a tape or ruler to measure the LFH.

- Many of the questions ask about vegetation cover. You can use a plotless method, visually estimating canopy characteristics of the sample area, be it a plant community, management unit, or polygon.

- A plot frame can tune your eye to measure vegetation cover. For grasslands and tame pasture, the frame can be a 20 cm by 50 cm (open on one of the 20 cm sides). For forest, the frame can be 50 by 50 cm (open on one of four sides).

Estimating Vegetation Cover and Soil Exposure
The ability to estimate the cover of plant species and the extent of soil exposure is a valuable skill for accurate range health assessment. Usually cover is defined as the vertical projection of the crown or shoot area of a plant species to the ground surface, expressed as a percent of the area of reference (e.g. a plot frame).

Cover can be estimated for an individual plant species, groups of plants, dead vegetation (i.e. litter) or for bare soil. When the cover of all individual plant species are added up, the total cover may exceed 100% because of overlapping foliage from multiple species. Bare soil is the percent of the area of reference where mineral soil is not covered by live or dead vegetation or rocks [greater than 6 in.] and would be vulnerable to erosion from wind, mechanical movement [e.g. as in hoof shear], raindrop impact or overland flow of water.

Estimating vegetation cover requires training and experience to achieve repeatable observations. Most people start out with the basic concept of **canopy** cover as illustrated on the right in figure 23 below, where a line is drawn about the leaf tips of the undisturbed canopies with the this line projected onto the ground, much like an umbrella. However, with experience, the normal progression is to use **foliar** cover as illustrated in figure 23 on the left side. Foliar cover is where vegetation canopy is estimated with a similar projection of the canopy onto the ground below, but the spaces within the vegetation canopy are subtracted from the estimate. In operational range surveys and research studies, Alberta Sustainable Resource Development uses the foliar concept when assessing vegetation cover. Space is provided on the score sheets located on pages 97 to 102 in this workbook to estimate the cover of four grasses and grass-likes, forbs, shrubs and trees to help you establish the major components of the plant community under evaluation. Procedures for conducting detailed quantitative assessment of range vegetation cover can be obtained from the Rangeland Management Branch (see contact information on page 119).

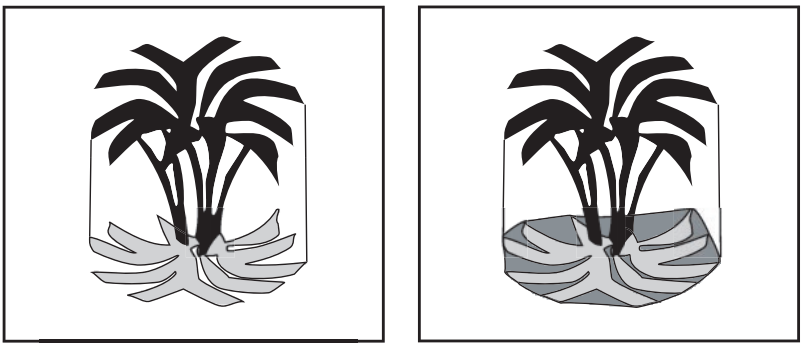


Figure 23. Two different approaches to estimating vegetation cover are the foliar cover (left) and the canopy cover (right) approaches.

Taking Photos

We recommend taking a planned series of photographs that support your written observations. Note the date, direction of view and location of where you took the picture. Here are a few simple steps for taking reference photos:

- Mark the name or number of the sample plot on a piece of paper with felt pen. Place this marker on the ground at your feet along with a plot frame or some other object to provide scale. Take photo 1, looking as close to straight down as possible.
- Turn 180 degrees on your heel, take four paces away from the spot marked on the ground and turn back towards your first photo plot.
- Sit on the ground; a low camera angle will allow you to look into the structure of the plant community. Point your camera back towards photo plot 1, frame the first site so there is only a thin sliver of horizon in the top of your field of view. Take picture number 2.
- These photos can be captured with a digital camera and then transferred to your home computer.
- A simple graphics program can be used to combine photos with the health score and provide a powerful monitoring record.

How to Use the Form?

Samples of field worksheets are provided on the following pages. The abridged range health guide also includes field worksheets that can be photocopied for additional sample sites. Because the range health questions differ slightly depending on type of range, select the appropriate form for grasslands, forest or tame pasture.

Take time to fill out the top of each form. This information (i.e. date, location, plant community, photo information, etc.) will be important when you are summarizing all your observations and deciding on management actions. A good set of records will allow you to look back over many years and determine if the grazing management practices are in balance with a healthy and functioning rangeland. Basic questions can be answered from these records: Has a site with a “healthy with problems” rating recovered to “healthy”? What indicators have responded (litter, species composition, structure, reduced bare soil)?

Note the species table that is found immediately before the health questions. This is a place to record your best estimate of the dominant plant species and the plant community.
Each health question (five each on the grassland and forest forms, six questions on the tame pasture form) requires you to select the best-fit score for that area. We recommend that you select only the scores provided; don't try to score values between the numbers provided.

In addition to the health questions you have the opportunity to estimate other important management factors, such as utilization and trend.

We encourage you to answer all questions. However, in some unique situations you may find one of the questions not applicable. You may want to think it over and ask questions. If you decide to not answer a question, remember that you need to adjust the total score so that the % range health is representative of the questions you answered.

When you have completed the questions, tally up the scores for all the questions and calculate the percentage range health based on the actual score divided by the total possible score.

Is it healthy, healthy with problems or unhealthy? Once you have health scores to look at, go to the following chapter to better understand what the scores mean.

Abridged Range Health Worksheets:

We have also developed a condensed version of the three range and tame pasture health assessment procedures, that we call the abridged range health forms. Copies of these worksheets can be obtained from the local offices of the Rangeland Management Branch, Public Lands Division, Alberta Sustainable Resource Development.
The abridged health forms can also be downloaded from our website at: http://www3.gov.ab.ca/srd/land/publiclands/range.html

Click on the link to: Range and Pasture Health Assessment

Note: Full technical version of this workbook with scientific references also available at the above web link.

NOTES

Grassland Range Health Assessment - SAMPLE SCORE SHEET

Site _____ **Observer** _____ **Date** _____

LSD____ **Quarter**_____ **Section**_____ **Township**_____**Range**_____**Meridian**____ **Photo#**_____

GPS Coord (NAD 83) Lat. _____ **Long.** _____ **Estimated forage production** _____

Special Observations (climate, changes in management) _____

_____

SCORING (circle appropriate values and add their sum to the Score box)

1. What kind of plants are on the site? What is the plant community?

Dominant species

Grasses & Grasslikes	Cover %	Forbs	Cover %	Shrubs	Cover %	Trees	Cover %

Community Type _____

Ecological Status					Comments	Score
1A Native Grassland:	24	16	9	0		
1B Modified Grassland:	9	5	0			

2. Are the expected plant layers present?

					Comments	Score
Community Structure	6	4	2	0		

3. Does the site retain moisture?

					Comments	Score
Litter Cover & Distribution	15	8	0	-		

4. Is there accelerated soil erosion? Site Normally (circle) Stable / Unstable

Site Stability					Comments	Score
4.1 Erosion	6	4	2	0		
4.2 Bare Soil	3	2	1	0	Human caused bare soil (%) _____ Moss & Lichen cover (%) _____	

5. Are noxious weeds present?

Noxious Weeds					Dominant species	% Cover	Density Dist.	Comments	Score
5.1 Cover	3	2	1	0					
5.2 Density Distribution	3	2	1	0					

Grazing Intensity (est. Long Term (circle)): U / U-L / L-M / M / M-H / H

Trend (apparent - circle): Upward / Downward / Stable / Unknown

Site Score (total score) _____

(Site Score ÷ 60 x 100) = Percent Health Rating

(_____ ÷60 x 100) = _____%

Healthy = 75-100%; Healthy with problems = 50-74%; Unhealthy < 50%

Observed Utilization _____ %

PTS	**6**	**12**	**18**	**24**	**30**	**36**	**42**	**45**	**48**	**54**
%	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**75**	**80**	**90**
	← *Unhealthy* →				← *Healthy With Problems* →			← *Healthy* →		

Forest Range Health Assessment - SAMPLE SCORE SHEET

Site _____ **Observer** _____ **Date** _____

LSD___ **Quarter**_____ **Section**_____ **Township**_____**Range**_____**Meridian**____ **Photo#**_____

GPS Coord (NAD 83) Lat. _____ **Long.** _____ **Estimated forage production** _____

Special Observations (climate, changes in management) _____

_____

SCORING (circle appropriate values and add their sum to the Score box)

1. What kind of plants are on the site? What is the plant community?

Dominant species

Grasses & Grasslikes	Cover %	Forbs	Cover %	Shrubs	Cover %	Trees	Cover %

Community Type _____

Ecological Status					Comments	Score
1A Native Forest:	18	12	6	0		
1B Modified Forest:	9	5	0	-		

2. Are the expected plant layers present?

					Comments	Score
Community Structure	18	12	6	0		

3. Thickness of the surface organic layer (LFH)?

					Comments	Score
LFH Thickness	9	6	3	0		

4. Is there accelerated soil erosion? Site Normally (circle) Stable / Unstable

Site Stability					Comments	Score
4.1 Erosion	3	2	1	0	Human caused bare soil (%) _____	
4.2 Bare Soil	6	4	2	0	Moss & Lichen cover (%) _____	

5. Are noxious weeds present?

Noxious Weeds					Dominant species	% Cover	Density Dist.	Comments	Score
5.1 Cover	3	2	1	0					
5.2 Density Distribution	3	2	1	0					

Grazing Intensity (est. Long Term (circle)): U / U-L / L-M / M / M-H / H

Trend (apparent - circle): Upward / Downward / Stable / Unknown

Site Score (total score) _____

(Actual Score ÷60 x 100) = Percent Health Rating

(_____ ÷60 x 100) = _____%

Healthy = 75-100%; Healthy with problems = 50-74%; Unhealthy < 50%

Observed Utilization _____ %

PTS	6	12	18	24	30	36	42	45	48	54
%	10	20	30	40	50	60	70	75	80	90
	← *Unhealthy* →				← *Healthy With Problems* →			← *Healthy* →		

Tame Pasture Health Assessment - SAMPLE SCORE SHEET

Site _____ **Observer** _____ **Date** _____

LSD____ **Quarter**_____ **Section**_____ **Township**_____**Range**_____**Meridian**____ **Photo#**_____

GPS Coord (NAD 83) Lat. _____ **Long.** _____ **Estimated forage production** _____

Special Observations (climate, changes in management) _____

_____

SCORING (circle appropriate values and add their sum to the Score box)

1. Do introduced forage plants dominate the site?

Dominant species

Grasses & Grasslikes	Cover %	Forbs	Cover %	Shrubs	Cover %	Trees	Cover %

Pasture composition				Comments	Score
1A Tame Pasture	8	6	3		
1B Modified Tame Pasture:	6	3	0		

2. What kinds of plants are on the site?

Shift in plant composition:				Comments	Score
2.1 Tame & desirable native species:	8	4	0		
2.2 Weedy & disturbance species:	8	4	0		

3. Is the site covered by litter?

					Comments	Score
Litter Cover & Distribution	15	10	5	0		

4. Is there accelerated soil erosion? Site Normally (circle) Stable / Unstable

Site Stability					Comments	Score
4.1 Evidence of site instability:	6	4	2	0		
4.2 Human-caused bare soil:	3	2	1	0	Human caused bare soil (%) _____ Moss & Lichen cover (%) _____	

5. Are noxious weeds present?

Noxious Weeds					Dominant species	% Cover	Density Dist.	Comments	Score
5.1 Cover	3	2	1	0					
5.2 Density Distribution	3	2	1	0					

6. Does the site have woody regrowth?

Woody Regrowth				Dominant species	% Cover	Density Dist.	Comments	Score
6.1 Cover	4	2	0					
6.2 Density Distribution	2	1	0					

Grazing Intensity (est. Long Term (circle)): U / U-L / L-M / M / M-H / H

Trend (apparent - circle): Upward / Downward / Stable / Unknown

Site Score (total score) _____

(Site Score ÷ 60 x 100) = Percent Health Rating

(_____ ÷60 x 100) = _____%

Healthy = 75-100%; Healthy with problems = 50-74%; Unhealthy < 50%

Vegetative Height (Avg.):_____cm./in.

Observed Utilization _____%

PTS	6	12	18	24	30	36	42	45	48	54
%	10	20	30	40	50	60	70	75	80	90
	← *Unhealthy* →				← *Healthy With Problems* →			← *Healthy* →		

Range Health Categories

The range health score is a cumulative measure of the health and function observed and measured in your sample area. It is a rapid assessment tool and provides a snapshot of the health of the site and possible impacts of management. Range health monitoring alerts livestock producers to potential issues and problems on rangelands so that management changes can be made. First, consider the health categories and what they mean.

Health Categories

***Healthy*:**
A health score between 75 to 100 %. All of the key functions of health rangeland are being performed. This rating provides a positive message about your current management practices. It may tell you that current stocking levels, distribution and grazing practices are maintaining range health. Optimum grazing opportunities for livestock are possible.

Healthy with Problems:
A health score of 50 to 74%. Most, but not all of the key functions of healthy range are being performed. Sites in this category should be on the "watch list" requiring further monitoring. This score is an early warning of the need for minor to major adjustments to management. May be a reduction in livestock grazing opportunities. Recovery to a healthy class can normally be accomplished within a few years.

Unhealthy:
A health score of less than 50%. Few of the functions of health range are being performed. An unhealthy rating means urgent action is required. Significant management changes are essential and it may take years to regain a healthy class. Livestock grazing opportunities are seriously reduced.

RANGE HEALTH HINTS

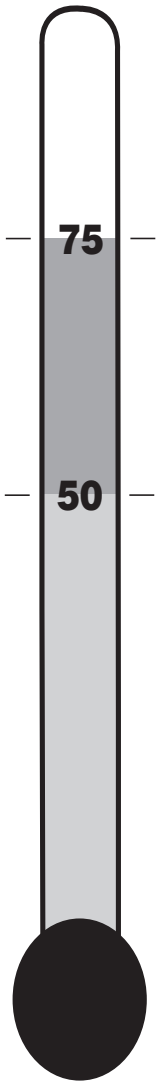
What do the health scores mean?

Range Health Categories

Healthy
A health score of 75 to 100%. All of the key functions of health rangeland are being performed.

Healthy with Problems:
A health score of 50 to 74%. Most but not all key functions of healthy range are being performed.

Unhealthy:
A healthy score of less than 50%. Few of the functions of healthy range are being performed.



Healthy
Good job!

Healthy with problems
Minor to major change in grazing practices required

Unhealthy
Major change in grazing practices required

What Do the Scores of Individual Health Questions Tell You?

Individual health question scores allow you to take a closer look at the specific indicators of range health. The scores for individual health questions or combinations of questions can help you formulate management objectives. Consider the possible score for each question; this tells you the relative importance of the question to the overall rating.

Evaluation of Individual Questions:

- In grasslands - ecological status and in forests - plant community structure, are most important. High scores here will contribute most to establishing a healthy rating. Low scores indicate a large negative impact on the function of the plant community.

- In tame pastures, species shifts to disturbance induced or weedy species will be of greatest concern as they replace the more productive forage plants.

- In modified grassland, forest and tame pastures, the presence of erosion, bare soil and noxious weeds will be of greatest concern and indicate a large negative impact on the function of the plant community.

Litter and LFH

In grasslands and tame pasture, litter scores provide insight into moisture retention functions of the site. High scores mean moisture is being retained and that conditions are favorable for water to infiltrate into the soil. Medium scores mean that moisture retention is being measurably reduced. Lighter stocking, longer and more effective rest periods and improved rotational grazing can usually restore litter levels in a number of years. Low litter ratings mean that little moisture is being retained and the stage may be set for increased soil erosion from the site. Other impacts may come into play, for example the invasion of weeds.

In forests, a combination of reduced LFH thickness and compaction will reduce moisture retention functions and can lead to drying of

the site. A secondary impact may be a decline in the plant community composition and structure. Many years of effective rest may be required to restore plant community structure and LFH thickness and sponginess.

Bare Soil and Soil Erosion

Any human-caused erosion and bare soil puts management on "high alert" status and requires immediate attention and correction. Similar to a domino effect, allowing erosion processes to accelerate will have drastic impacts to the health and function of the plant community and site.

Noxious Weeds

Noxious weed species are another one of those key early warning signs that the system may be under stress and that both weed control measures and management changes are required. Better management to reduce weed levels, like lighter grazing and more rest, will set off a beneficial chain of events. Plant vigor will increase, improving the reproduction of desirable plants and leading to more vegetation cover which in turn adds more litter to the site and reduces bare soil. The outcome will be less space for weeds to establish.

Woody Regrowth In Tame Pastures

Woody regrowth levels are often a function of a combination of site, tame pasture development method, and grazing management practices. Forest regeneration after pasture development is a natural occurence just like after a wildfire. At low densities woody regrowth may serve as a complementary forage as livestock browse woody plants. As tame pasture regenerates back to secondary forest, woody regrowth competes with tame forages as the density, height and stem diameter of shrubs and trees increase, reducing light and increasing shade over the seeded forages. Measuring the cover and density of woody species can help determine if control measures are required.

Rotational grazing systems that maintain healthy and productive stands of seeded grasses and legumes often do not have serious

woody regrowth problems since control is provided by livestock. In contrast, ineffective grazing systems may stimulate woody regrowth and also have negative impacts on surrounding native rangeland health.

Evaluation of Combined Questions:

When the health assessment indicates problems, think about the questions as they relate to each other. This reduces chances of practice changes dealing with the symptoms instead of correcting the problem. For example, the tame pasture health score may indicate woody regrowth, disturbance-induced and weedy species problems as well as low litter reserves. It won't be possible to heal one problem without addressing the others.

Natural, Human-Caused or Both?

A number of natural events and processes may affect a health rating. Events such as drought, wildfire, insect damage, flood, disease and extreme wind events can also effect range health. Maintaining historical records, particularly on moisture, disturbance and disease, and carrying out range health assessments, can help you determine which impacts are natural and which are human-caused. We want to focus on any grazing management problems and correct them.

Sample Range Health Ratings

Example 1-Healthy Category

A native grassland site rates as healthy but the score of 76% falls at the low end of the range. The reduced health score is due to low litter values. A review of management practices suggests that stocking rates may not have been reduced sufficiently during recent dry years. A recent increase in cow size also contributed to increased forage demands on the pasture. Plans are made to reduce stocking slightly and defer grazing in spring.

Example 2 - Healthy with Problems

A forest health assessment has scored 56% and has plant

community and structure problems. Corrective management includes deferred entry until mid June and only one grazing period per growing season. The stocking rate is further adjusted by recognizing that unpalatable shrubs (e.g. alder) should not be included as forage.

Example 3 - Unhealthy:

A tame pasture has a range health score of 28% indicating species, litter, erosion, noxious weed and woody regrowth problems. Years of overgrazing has reduced forage production and limited the ability of the pasture to withstand the recent dry conditions. A review of management practices suggests that the stocking rate should be reduced and extended rest periods are required to rebuild litter levels. Weed control and/or pasture rejuvenation may be required depending on cost/benefit analysis.

Range Health Assessment – A Tool for Adaptive Range Management

Repeated range health assessments can ensure livestock stocking rates are sustainable. Range plant community guides give you recommended or initial stocking rates for each plant community. Range health assessment allows you to fine tune your management. These tools along with livestock grazing records, weather records and photographs, can help you manage through drought cycles and identify early signs of declining pasture health.

Grassland Range Health Assessment - SAMPLE SCORE SHEET

Site Border Field **Observer** Cal Minner **Date** June 24/02

LSD ___ **Quarter** SE **Section** 27 **Township** 17 **Range** 18 **Meridian** 4 **Photo#** 10

GPS Coord (NAD 83) Lat. _____ **Long.** _____ **Estimated forage production** _____

Special Observations (climate, changes in management) _____

SCORING (circle appropriate values and add their sum to the Score box)

1. What kind of plants are on the site? What is the plant community?

Dominant species

Grasses & Grasslikes	Cover %	Forbs	Cover %	Shrubs	Cover %	Trees	Cover %
Sedge	16	Scarlet mallow	6	Silver Sagebrush	2		
Western Wheat Grass	15	Fringed Sage	2	Buckbrush	1		
Northern Wheat Grass	7	Golden Aster	1				
Needle and Thread	5	Prairie Onion	1				

Community Type _____

Ecological Status					Comments	Score
1A Native Grassland:	24	(16)	9	0		16
1B Modified Grassland:	9	5	0			

2. Are the expected plant layers present?

					Comments	Score
Community Structure	6	(4)	2	0		4

3. Does the site retain moisture?

					Comments	Score
Litter Cover & Distribution	15	(8)	0	-	Litter estimation 310 lbs/ac	8

4. Is there accelerated soil erosion? Site Normally (circle) (Stable) / Unstable

Site Stability					Comments	Score
4.1 Erosion	(6)	4	2	0	Human caused bare soil (%) 5	9
4.2 Bare Soil	(3)	2	1	0	Moss & Lichen cover (%) 80	

5. Are noxious weeds present?

Noxious Weeds					Dominant species	% Cover	Density Dist.	Comments	Score
5.1 Cover	(3)	2	1	0				Annual weeds common	6
5.2 Density Distribution	(3)	2	1	0					

Grazing Intensity (est. Long Term (circle)): U / U-L / L-M (M) M-H / H

Trend (apparent - circle): Upward / Downward (Stable) / Unknown

Site Score (total score) 43

(Site Score ÷ 60 x 100) = Percent Health Rating

(43 ÷60 x 100) = 72 %

Healthy = 75-100%; (Healthy with problems) = 50-74%; Unhealthy < 50%

Observed Utilization _____ %

The Reference Plant Community is Wheatgrass/Needle and Thread. Wheat grass cover is reduced.

In more heavily grazed areas, vigour and stature of tall grasses is significantly reduced.

Approximately 310 lbs/ac estimated by raking litter from a 1/4m² frame. Threshold level for healthy range is 390 lbs/ac.

Site is stable, some increase in human-caused bare soil due to livestock trailing but less than 10%. Ant activity has created small patches of exposed soil.

No noxious weeds found on site. Note an increase in annual weeds due to increased moisture in current year.

72%, healthy with problems. Utilization is moderate, and the trend is stable. This score indicates that some management changes should be made to encourage healthier range.

Due to drought conditions in the previous 3 years, production was reduced, decreasing the amount of carryover to the following years. Cumulative effects have dropped litter to half of normal. Consider delaying entry of livestock until late June/July and a slight reduction in cattle numbers.

PTS	6	12	18	24	30	36	42	45	48	54
%	10	20	30	40	50	60	70	75	80	90
	← *Unhealthy* →				← *Healthy With Problems* →			← *Healthy* →		

Forest Range Health Assessment - SAMPLE SCORE SHEET

Site Tower Field **Observer** Barb Smith **Date** July 5/03

LSD ___ **Quarter** SW **Section** 32 **Township** 55 **Range** 11 **Meridian** 4 **Photo#** 7

GPS Coord (NAD 83) Lat. _____ **Long.** _____ **Estimated forage production** 650 lbs/ac

Special Observations (climate, changes in management) _____

Keyed to a native forest Aspen-Rose-Tall Forb

SCORING (circle appropriate values and add their sum to the Score box)

1. What kind of plants are on the site? What is the plant community?

Dominant species

Grasses & Grasslikes	Cover %	Forbs	Cover %	Shrubs	Cover %	Trees	Cover %
Hairy Wild Rye	7	Bunchberry	10	Rose	5	Aspen	50
Purple Oat Grass	3	Aster	5	Snowberry	10	Balsam Poplar	15
Rice Grass	1	Fireweed	1	Cranberry	2	White Spruce	1
Awned Wheat Grass	1	Peavine	2	Dogwood	2	Birch	1

Community Type _____

Ecological Status					Comments	Score
1A Native Forest:	18	12	(6)	0	Clovers present and greater percent low forbs	6
1B Modified Forest:	9	5	0	-		

Shrub > 3m and the tall forb layers are much reduced. Palatable shrubs are heavily browsed and peavine is uncommon

2. Are the expected plant layers present?

					Comments	Score
Community Structure	18	12	(6)	0	Layers reduced	6

3. Thickness of the surface organic layer (LFH)?

					Comments	Score
LFH Thickness	(9)	6	3	0	Spongy, okay thickness	9

Moist site. LFH is spongy and not compressed. Less than 10% difference in LFH thickness.

4. Is there accelerated soil erosion? Site Normally (circle) (Stable) **/ Unstable**

Site Stability					Comments	Score
4.1 Erosion	(3)	2	1	0	Human caused bare soil (%) <1%	9
4.2 Bare Soil	(6)	4	2	0	Moss & Lichen cover (%) 30%	

5. Are noxious weeds present?

Noxious Weeds					Dominant species	% Cover	Density Dist.	Comments	Score
5.1 Canopy Cover	3	(2)	1	0	Canada Thistle	1	2		4
5.2 Density Distribution	3	(2)	1	0					

Grazing Intensity (est. Long Term (circle)): U / U-L / L-M / M / M-H (H)

Trend (apparent - circle): Upward (Downward) Stable / Unknown

Site Score (total score) 34

(Actual Score ÷60 x 100) = Percent Health Rating

(34 ÷60 x 100) = 57 %

(Healthy = 75-100%) Healthy with problems = 50-74%; Unhealthy < 50%

Observed Utilization 57% %

Stable. No evidence of erosion. Some natural wind-throw. human-caused bare soil cattle trail < 1% bare soil.

57% = healthy with problems. Heavy grazing regime removing two layers.

Management changes required to prevent further decline. Consider later entry to mid-June and remove cattle when understory remains waist high. Fence separate from tame pasture and graze only once each year. Control thistles. Take picture at trail junction north and monitor for improved range health.

Canada thistle present in low numbers. Spreading from drove trail? Spot control.

PTS	6	12	18	24	30	36	42	45	48	54
%	10	20	30	40	50	60	70	75	80	90
	← *Unhealthy* →				← *Healthy With Problems* →			← *Healthy* →		

Tame Pasture Health Assessment - SAMPLE SCORE SHEET

Site Riverbank Field **Observer** Doug Jones **Date** Aug. 4/03

LSD ___ **Quarter** SE **Section** 15 **Township** 56 **Range** 9 **Meridian** 4 **Photo#** 14

GPS Coord (NAD 83) Lat. _____ **Long.** _____ **Estimated forage production** 1000 lb/ac

Special Observations (climate, changes in management) drought

SCORING (circle appropriate values and add their sum to the Score box)

1. Do introduced forage plants dominate the site?

Dominant species

Grasses & Grasslikes	Cover %	Forbs	Cover %	Shrubs	Cover %	Trees	Cover %
Kentucky Bluegrass	45	Dandelion	7	Rose	3	Aspen	1
Quack Grass	20	Strawberry	5	Balsam	1		
Smooth Brome	15	Pussy-toes	5				
Hairy Wild Rye	10	Yarrow	3				

Pasture composition				Comments	Score
1A Tame Pasture	8	(6)	3	decrease in percent of seeded grasses	6
1B Modified Tame Pasture:	6	3	0		

> 50% cover from introduced forage plants

80% cover from introduced forage

Grazing resistant forage plants dominate pasture. Seeded alfalfa not seen.

2. What kinds of plants are on the site?

Shift in plant composition:				Comments	Score
2.1 Tame & desirable native species:	8	4	(0)	Increase in weedy and increaser species	8
2.2 Weedy & disturbance species:	(8)	4	0		

Litter < 1/2 handful, thin and sparsely distributed.

3. Is the site covered by litter?

Litter cover & Distribution	15	10	(5)	0	Comments	Score
						5

Plant pedastalling/ hoof shear. Creeping rooted pasture 7% of bare soil.

4. Is there accelerated soil erosion? Site Normally (circle) (Stable) / Unstable

Site Stability					Comments	Score
4.1 Evidence of site instability:	6	(4)	2	0	Human caused bare soil (%) 7	6
4.2 Human-caused bare soil:	3	(2)	1	0	Moss & Lichen cover (%) 1	

Canada thistle cover 2% near north repiles and class 3 density. Spot control.

5. Are noxious weeds present?

Noxious Weeds					Dominant species	% Cover	Density Dist.	Comments	Score
5.1 Canopy Cover	3	2	(1)	0	Canada Thistle	3	3	Spot Control	3
5.2 Density Distribution	3	(2)	1	0					

6. Does the site have woody regrowth?

Woody Regrowth				Dominant species	% Cover	Density Dist.	Comments	Score
6.1 Canopy Cover	(4)	2	0	Balsam	1	2	No Control needed	6
6.2 Density Distribution	(2)	1	0	Rose	3	2		

A few balsam poplars and shrub-form aspen near northeast repiles. Woody regrowth is complementary forage.

Grazing Intensity (est. Long Term (circle)): U / U-L / L-M / M / (M-H) / H

Trend (apparent - circle): Upward (Downward) / Stable / Unknown

Site Score (total score) 34

(Site Score ÷ 60 x 100) = Percent Health Rating

(34 ÷60 x 100) = 57 %

Healthy = 75-100% (Healthy with problems = 50-74%) **Unhealthy < 50%**

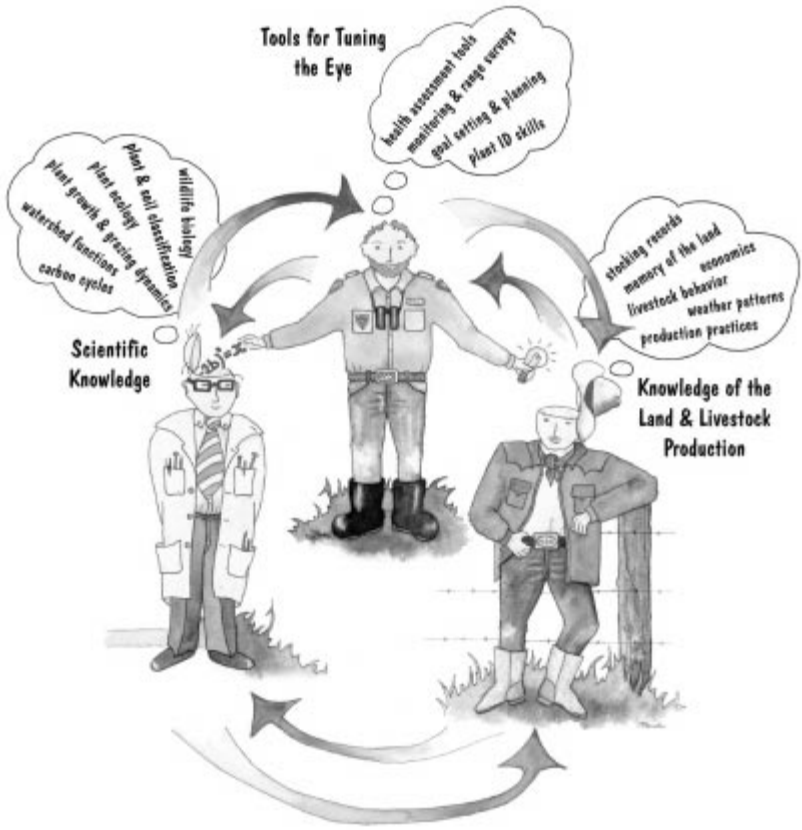
Vegetative Height (Avg.): 1-2 (cm)/in.

Observed Utilization 80 %

57% healthy with problems: loss of productive forage species and >% grazing resistant species. Disturbance induced and weedy species close to score of 4. Present management practices not conducive to tall, productive forage species and adequate litter reserves. "human-caused" drought at play. Pasture should be producing about 30% in these conditions and more when the rains come.

Management change required. Implement deferred spring entry, rotational grazing with effective rest, and leave more residual cover to provide carryover and litter. Monitor for improvements. May require reduced stocking rate if the above changes do not work? Take picture at 3rd fence post from gate looking east. Compare to future pictures taken same place.

PTS	6	12	18	24	30	36	42	45	48	54
%	10	20	30	40	50	60	70	75	80	90
	← *Unhealthy* →				← *Healthy With Problems* →			← *Healthy* →		



A wise person once said, *"No one is as smart as all of us"*. That's the philosophy we like to foster with range health tools. Livestock producers possess tremendous wisdom, knowledge and experience on the land. Science can provide valuable insight into how ecosystems function. Range health tools help to link science and wisdom to improve range management, to make livestock production more sustainable and to help resolve or head off resource conflicts among resource users.

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How to Read the Species Table

Species Code (in the species table) refers to the seven letter code used to record the Latin (scientific) name of a species during range health assessments and inventories. The first four letters are usually 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. If only the genus is known, then the code is derived from the first six letters of the genus name. 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.

This is a generic species list that is also used for riparian health assessment. Not all plants will be found in all environments.

Regulated Category refers to the designation given weeds (restricted, noxious, or nuisance) under the Weed Designation Regulations.

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

- Restricted weed species are indicated by '1'. Because of the serious management implications these species pose, they are indicated by bold;
- Noxious weeds are indicated by '2'
- Nuisance weeds are indicated by '3'
- Species that are not regulated are indicated by '0'

Range Health Plant Category refers to the suggested categorization of these plants for range health assessment and inventory purposes. Two plant categories are important in range health assessments and inventories:

- Invasive species are indicated by 'I'. Invasive species include all restricted, most noxious species, and a few nuisance species
- Disturbance-caused undesirable herbaceous species are indicated by 'D'. They include mostly nuisance weed species and some noxious weed species, as well as native species that increase with disturbance on rangelands.

Species	Latin Name	Common Name	Regulated	Range Health
BROMTEC	*Bromus tectorum*	downy chess/brome	3	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
SILECUC	*Silene cucubalus*	bladder campion	2	I
SONCARV	*Sonchus arvensis*	perennial sow thistle	2	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
ANTENN	*Antennaria species*	pussy-toes and 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	(*Sinapis arvensis)* *Brassica kaber*	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	0	D
CAPSBUR	*Capsella bursa-pastoris*	shepherd's purse	3	D

Species	Latin Name	Common Name	Regulated	Range Health
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	3	D
ERUCGAL	*Erucastrum gallicum*	dog mustard	3	D
ERYSCHE	*Erysimum cheiranthoides*	wormseed mustard	3	D
FAGOTAR	*Fagopyrum tartaricum*	tartary buckwheat	3	D
FRAGAR	*Fragaria species*	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
MELILO	*Melilotus officinalis and alba*	sweet clovers	0	D
NESLPAN	*Neslia paniculata*	ball mustard	3	D
PHLEPRA	*Phleum pratense*	timothy	0	D
PISUSAT	*Pisum sativum*	peas (field)	0	D
PLANTA	*Plantago species*	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
TRIFOL	*Trifolium species*	clovers	0	D
TRITAES	*Triticum aestivum*	wheat	0	D
VACCPYR	*Vaccaria pyramidata*	cow cockle	3	D
XTRITIC	*X Triticosecale*	triticale	0	D

Contacts For Further Information on Rangeland Health Assessment

SE Region

Range Resource Management Program
Rangeland Management Branch
Public Lands and Forests Division,
Alberta Sustainable Resource Development
Agriculture Centre,
#100, 5401 - 1st Ave. South
Lethbridge, Alberta, T1J 4V6.
(403) 382-4299

Range Resource Management Program
Rangeland Management Branch
Public Lands and Forests Division,
Alberta Sustainable Resource Development
211, 4920 - 51 St.
Provincial Bldg.
Red Deer, Alberta, T4N 6K8.
(403) 783-7075

SW Region

Range Resource Management Program
Rangeland Management Branch
Public Lands and Forests Division,
Alberta Sustainable Resource Development
6203 - 49 St., Box 4534
Barrhead, Alberta, T7N 1A4
(780) 674-8231

Range Resource Management Program
Rangeland Management Branch
Public Lands and Forests Division,
Alberta Sustainable Resource Development
2nd Floor, Provincial Bldg.
782 Main St.
Pincher Creek, Alberta, T0K 1W0
(403) 627-1131

NE Region

Range Resource Management Program
Rangeland Management Branch
Public Lands and Forests Division,
Alberta Sustainable Resource Development
417 Provincial Bldg., 5025 - 49 Ave.
St. Paul, Alberta T0A 3A4
(780) 645-6336

NW Region

Range Resource Management Program
Rangeland Management Branch
Public Lands and Forests Division,
Alberta Sustainable Resource Development
Rm 1001, Provincial Bldg.
10320 - 99 St.
Grande Prairie, Alberta T8S 1T4
(780) 538-5260

Range Resource Management Program
Rangeland Management Branch
Public Lands and Forests Division,
Alberta Sustainable Resource Development
Bag 900-35, Room 115, Provincial Bldg.,
9621 - 96 Ave.
Peace River, Alberta T8S 1T4
(780) 624-6116

Edmonton
Range Resource Management Program
Rangeland Management Branch
Public Lands and Forests Division,
Alberta Sustainable Resource Development
4th Floor, Great West Life Bldg.
9920 - 108 St.
Edmonton, AB T5K 2M4
(780) 422-4598

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