

A methodology for monitoring Crown range



RANGELAND HEALTH BROCHURE [10] draft



BRITISH
COLUMBIA

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* This material has been developed for discussion and testing by clients.

1 What is Monitoring?

Monitoring is the collection and analysis of repeated measurements or observations to assess changes in condition, to assess progress towards a management objective, or to support management change or continuation.¹ On rangelands, monitoring is a management tool that assists in assessing the effects of management practices and/or environmental variation over time.

2 Why Monitor?

Monitoring identifies management impacts on rangeland communities. Results from monitoring can promote awareness, facilitate assessment, indicate trends, and support decision-making.

On Crown range, monitoring will focus on plant community structure and composition (seral stage), utilization zone determination, and permanent photo-points.

All range agreement holders are encouraged, and Range Stewardship Plan (RSP) holders are required, to monitor impacts of their management activities on Crown range. Although agreement holders will carry out monitoring, the Ministry of Forests and Range (MOFR) will provide training.

3 Monitoring Frequency

Range Use Plans (RUPs) and Range Stewardship Plans (RSPs) have a 5-year term. To assess management effects within the term of a plan, agreement holders are encouraged to monitor during the first and fourth year of a plan. Results from the first year provide baseline information on which to assess the management effects on the fourth year. Stubble heights, however, should be measured each year to assist in determining when to move livestock from a pasture or other area.

¹ Elzinga, C.L., D.W. Salzer, and J.W. Willoughby. 1998. Measuring and monitoring plant populations. USDI Bureau of Land Management, National Applied Resource Sciences Center, Denver, Colo. BLM Technical Reference 1730-1.

4 Getting Started—Gathering Background Information

Before monitoring, collect the following information:

- Historical plant community information (e.g., past monitoring records).
- Lists of dominant species, invader species, and invasive alien plants.
- Maps and aerial photographs.
- Soils and geography.
- Records of past livestock use and management activities (e.g., seeding, clearing, and invasive alien plant control).
- Disturbances (e.g., fire, drought, pestilence, logging, and flood events).

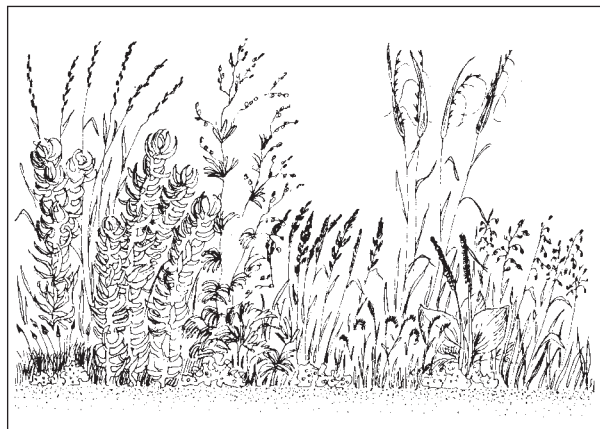
5 Site Selection

Agreement areas are often comprised of several plant communities representing primary, secondary, and tertiary range. Select monitoring sites to represent distinct plant communities within primary and secondary range types.

6 Current Plant Community

Collecting plant community information allows the description of the structural layers, the description of the species composition, and the determination of the seral stage. Layers may include lichens/mosses, litter, grasses, forbs, shrubs, and trees. Rangeland communities may not have all layers present. For example, some grassland communities lack trees and shrubs. Plant community composition is described by listing dominant species within each structural layer. Seral stage is

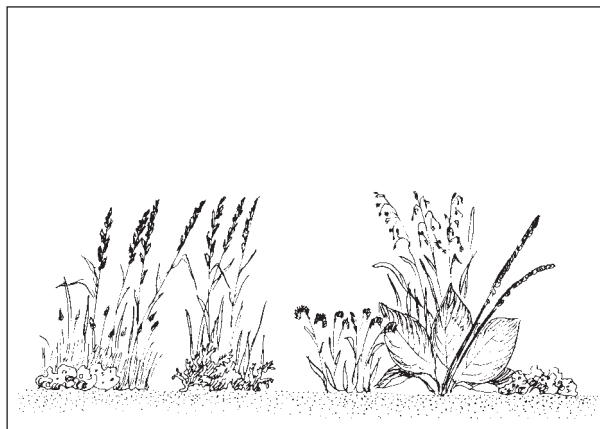
determined by comparing current plant community composition to a site's potential or reference community. There is a close correlation between seral stage and measures of rangeland health. Results of recent effectiveness evaluations of range practices indicate that mid- to late-seral stages have higher range health scores than early-seral stages.²



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.

Figure 1 Changes in grassland plant community structure as disturbance levels increase.³

² Fraser, D. 2005. Range effectiveness evaluations 2004. British Columbia Ministry of Forests and Range, Victoria, B.C. Unpublished report.

³ Adapted from: Adams, B.W., G. Ehlert, C. Stone, M. Alexander, D. Lawrence, M. Willoughby, D. Moisey, C. Hincz, and A. Bogen. 2003. Range assessment for grassland, forest and tame pasture. Public Lands Division, Alberta Sustainable Resource Development, [Edmonton], Alta. Publ. T/044.

6.1 Why is community composition and structure important?

- Structural layers represent a community's ability to capture and utilize resources (i.e., sunlight, water, and nutrients) from different positions in the canopy and soil profile.
- Grazing—particularly when it is poorly timed, at high intensity, or without adequate rest—can alter plant community structure and composition.
- Changes in composition and structure influence forage production, habitat values, and, ultimately, sustainability of current grazing practices.

6.2 How to assess the current plant community

- Determine what plants dominate the site. Mostly grasses? Mix of grasses/forbs/shrubs? Are trees present? If so, how are they distributed and what species are present? Are species within the plant community native or seeded (e.g., crested wheatgrass and meadow brome)? Are invasive alien plants present (e.g., knapweed and Canada thistle)? From this information, determine the plant community (e.g., Fescue Grassland, Open Aspen Forest, Mountain Meadow).
- List dominant species for each of the following: grasses, forbs, shrubs, and trees. Note if one or more of these layers is absent.
- Seral stage is determined by comparing dominant plants of the current community to that of a reference site, where known. When reference conditions are unknown, you are encouraged to create a small reference site or locate a relic (ungrazed) community. (For further information on seral stage determination, see Appendices 1 and 2.)

7 Utilization Zone Determination

Due to grazing preferences, certain species are more susceptible to grazing. Stubble height is a physical measure of remaining leaf area

following grazing. Measure stubble height, excluding seed stalks, of dominant and indicator grasses.

Once the recommended stubble height is reached (Table 1), livestock should be removed from the pasture or other area. If, at the end of the grazing period, average stubble height is below the recommended

Table 1 Recommended average minimum stubble heights for common forage species

Riparian species		
Common name	Scientific name	Stubble height (cm)
Bluegrasses	<i>Poa</i> spp.	10
Canada reedgrass (bluejoint)	<i>Calamagrostis canadensis</i>	12
Desert saltgrass	<i>Distichlis spicata</i>	8
Foxtail barley	<i>Hordeum jubatum</i>	10
Kobresia	<i>Kobresia</i> spp.	8
Sedges (large)	<i>Carex</i> spp.	20
Spikerush	<i>Eleocharis</i> spp.	15
Tufted Hairgrass	<i>Deschampsia caespitosa</i>	12
Upland species		
Alpine timothy	<i>Phleum alpinum</i>	10
Altai fescue	<i>Festuca altaica</i>	18
Blue wildrye	<i>Elymus glaucus</i>	15
Bluebunch wheatgrass	<i>Agropyron spicatum</i>	17
Bluegrasses	<i>Poa</i> spp.	10
Brome (introduced forages)	<i>Bromus</i> spp.	10
Creeping red fescue	<i>Festuca rubra</i>	8
Crested wheatgrass	<i>Agropyron cristatum</i>	8
Domestic timothy	<i>Phleum pratense</i>	10
Idaho fescue	<i>Festuca idahoensis</i>	15
Needlegrasses	<i>Stipa</i> spp.	12
Northern wheatgrass	<i>Agropyron dasystachum</i>	15
Orchardgrass	<i>Dactylis glomerata</i>	10
Pinegrass	<i>Calamagrostis rubescens</i>	18
Rough fescue	<i>Festuca scabrella</i>	18
Rough-leaved ricegrass	<i>Oryzopsis asperifolia</i>	8
Slender wheatgrass	<i>Agropyron subsecundum</i>	15
Western wheatgrass	<i>Agropyron smithii</i>	12

value, the plant community may be at risk. However, occasional over-use followed by appropriate recovery is not necessarily harmful.

Once stubble heights of dominant grasses and utilization classes are determined, this information is used to map zones of utilization (Figure 2). Since utilization is mapped repeatedly, change in use can be mapped and correlated to changes in management, disturbance regime, or climate, or to a combination of these factors.

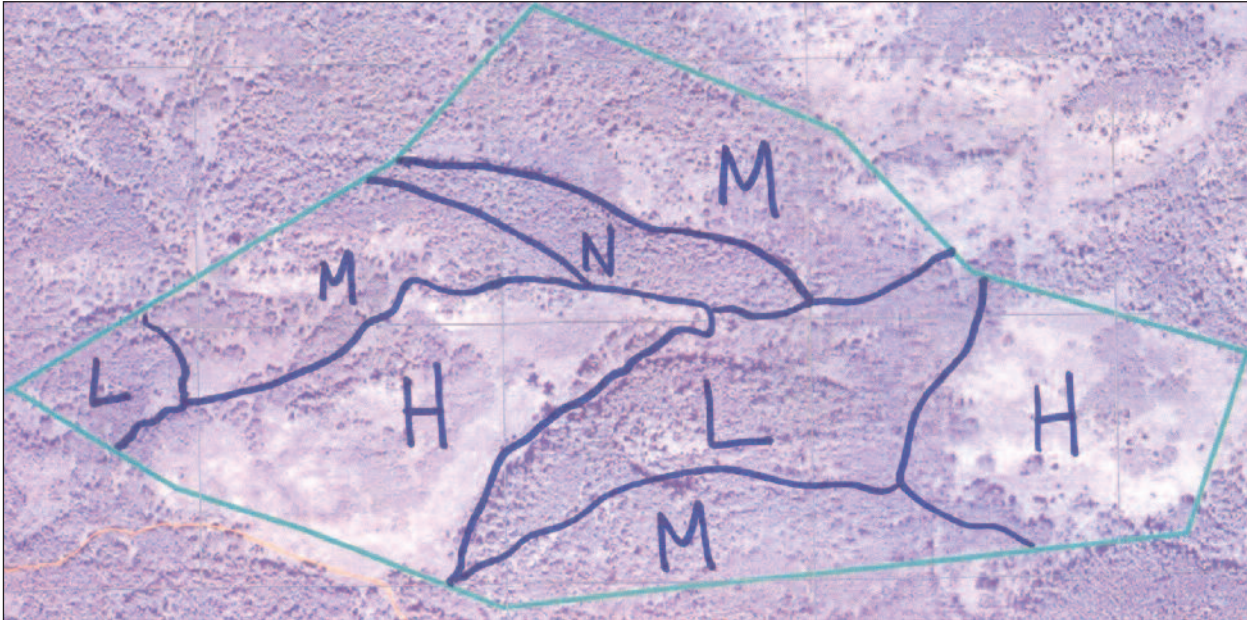


Figure 2 Map showing zones of utilization.

7.1 Why measure stubble heights and map zones of utilization?

- Stubble heights indicate current season’s use, and their comparison to the recommended stubble heights indicate level and suitability of use.
- Mapping broad utilization zones across plant communities allows assessment of landscape-level grazing patterns.
- Such measurement and mapping allows managers to examine the appropriateness of current management practices and to implement changes as needed.

7.2 How to determine utilization zones

- Identify dominant and indicator grass species.
- Look up the stubble height threshold for these species (see Table 1).
- Measure stubble heights on individual plants (minimum of 10 per species recommended).
- Calculate average stubble height.
- Compare average stubble height to the recommended threshold stubble height for each species.
- Assign utilization class according to Table 2.
- Delineate the utilization classes on a map (see Figure 2).

Table 2 Utilization classes

Class	Description
None–Slight (N)	Average stubble height is about equal to the height of the ungrazed plants.
Light (L)	Average stubble height is about mid-way between the threshold height and the ungrazed height.
Moderate (M)	Average stubble height is about the same as the threshold height.
Heavy (H)	Average stubble height is about one half of the threshold height.
Extreme (E)	Average stubble height is one quarter of the threshold height or less.

8 Shrub Use (Browse) Determination

Shrubs form an important component of many rangeland communities. The *Forest and Range Practices Act* (FRPA) allows browse use to a maximum of 25% of current year’s growth. On ungulate winter range, livestock utilization allowances may be lower (e.g., 10%).

On sites with a shrub layer, determine browse utilization of dominant and indicator species. This is in addition to utilization zone determinations completed for dominant and indicator grass species. On some sites, shrubs are the main forage (e.g., some riparian communities) and, therefore, utilization percentages for these areas should be

mapped along with grass utilization codes (e.g., where N/40 means none–slight grass use and 40% shrub use).

It is also important to assess historical use by observing and recording shrub form class for dominant shrub species (see Figure 3).

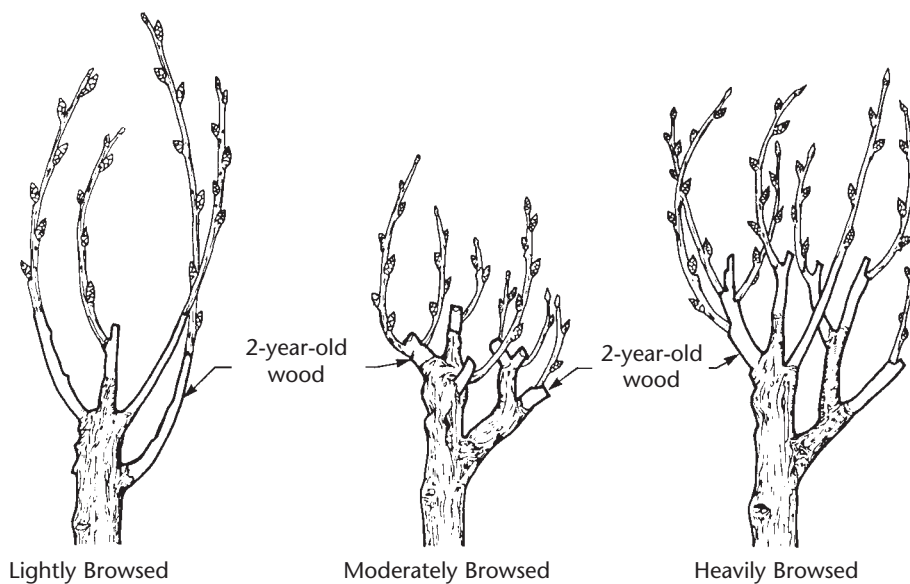


Figure 3 Browse use form classes.⁴

8.1 Why measure shrub use?

- Percent shrub use indicates current season’s use, and comparison of this to threshold values indicates level and suitability of use.
- Shrub form class indicates historical use pattern.
- Over-use of the shrub component can result in reduced vigour, decreased recruitment, and marginalized habitat values for wildlife.
- Such measurement helps identify consequences of livestock management on shrubs and may prompt shifts in management.

⁴ From: Luttmerding, H.A., D.A. Demarchi, E.C. Lea, D.V. Meidinger, and T. Vold. 1990. Describing ecosystems in the field. British Columbia Ministry of Environment and British Columbia Ministry of Forests, Victoria, B.C. MOE Manual 11.

8.2 How to determine shrub use

- Identify dominant and indicator shrub species within the plant community.
- Randomly select a branch of a shrub. On this branch, examine 10 twigs and determine how many of these show use. Convert this number to percent (i.e., two twigs equals 20%, six twigs equals 60%, and so forth). Sample one branch on 10 shrubs and calculate average percent use. Repeat the process for each species.
- Assess and record browse form class for each plant sampled. Do this by relating the form class to the images in Figure 3.

9 Permanent Photo-points

Establish photo-points to supplement descriptions of plant communities and measurements of utilization. Photo-points are not a substitute for monitoring. Photo-points are locations from which photographs are taken periodically to allow comparisons.

9.1 Why establish permanent photo-points?

- To support monitoring by providing a current and historical visual record.
- To provide a point of reference for further evaluation.

9.2 How to establish and use permanent photo-points

- Establish a permanent photo-point marker (e.g., rebar, wooden stake, painted rock).
- For new photo-points, fill out a photo-point record sheet. On the site sketch show a type point and the bearing and distance to the photo-point.
- When re-taking pictures, take the photo from the same bearing and distances as the first pictures, and record the photo number on the site monitoring form.
- Place a metre board, (e.g., 1-m metal ruler, or painted and marked stick) at the permanent point and walk 10 m away in the desired direction.

- Take a picture centred on the top of the metre board using a 50-mm lens or equivalent zoom setting.
- Move to within 2 m of the board and take two pictures (one on the left and one on the right) showing the metre board on the edge of the frame.
- Record the date, the picture number, and the compass reading.

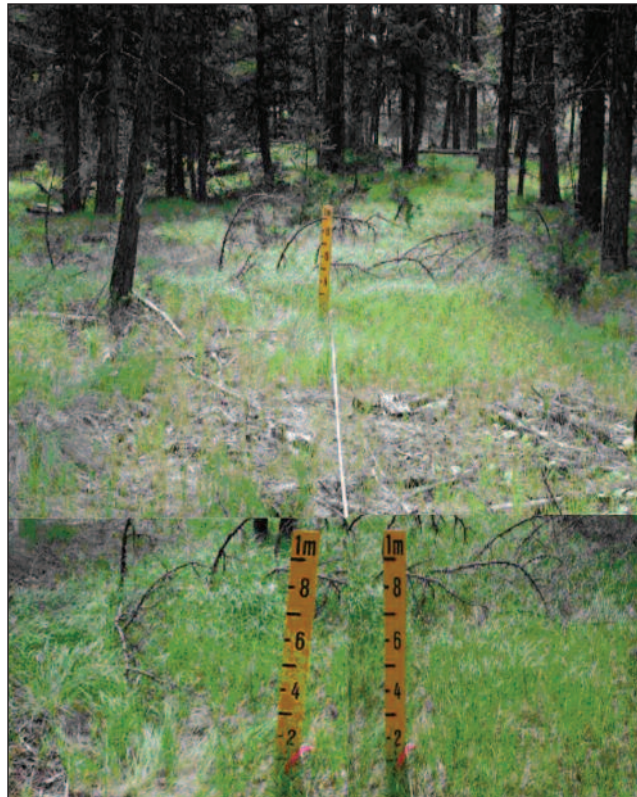


Figure 4 Example of a photo-point.

- A) A name or map number is needed to match the monitoring form to the map.
- B) If the site is used for a photo-point, record the photo number here. Record the details of the photo-point on a photo-point record sheet.
- C) The dominant species are those that make up the highest cover for each layer.
- D) An indicator species is not dominant but is important to note. This may be an increaser or invader, or a late-seral species that you want to remember to look at the next time you monitor.
- E) Record if a layer that occurs in the reference condition is missing from the site.
- F) Record if a species that occurs in the reference area is missing from the site. (Note: a layer may be present but contain different species.)
- G) Record the amount of litter on the site compared to the reference condition. Broad classes are: about the same, slightly less, moderately less, greatly less. If the litter is greater than the reference condition, try to explain why.
- H) Record the seral stage if known. Alternatively, describe differences between the site and the reference condition that can be attributed to livestock grazing.
- I) For each dominant and indicator species, record stubble heights on enough plants to get a good estimate of use. Mark measured heights of ungrazed plants with an *. If you have good ability to estimate stubble heights, skip this and record an estimate in *J*.
- J) If you measured stubble heights, enter the average for each species.
- K) If you measured one or more ungrazed plants, enter the average height. If no ungrazed plants were encountered, wander around and find one to measure or enter an estimate based on memory.
- L) Mark ungrazed stubble heights with an *.
- M) Record percent use form class in each cell; for example, 30%-2 means that the twig was used 30% and the whole shrub is form class M.

- N) Average the percent use recorded for each species.
- O) Under L, M, and H, enter the number of measured shrubs that fell into form classes L, M, or H. For example,

Form		
L	M	H
2	5	3

means that two plants of the species were form class light, five were form class moderate, and three were form class heavy.

Plant community description form

Site name or map sheet # _____ Date _____

Observer _____ Photo # _____

Plant community

Dominant grass species	Dominant forb species	Dominant shrub species	Dominant tree species
Indicator grasses	Indicator flowers	Indicator shrubs	

Missing layers	Missing species

Litter

Comments on impact of livestock grazing on the plant community

Stubble height (circle high and low for each species. * = ungrazed)

Species	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	Mean	Ungrazed height

Shrub use (record percent use and form class for 10 twigs)

Species	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	% use	Form		
												L	M	H

Notes:

Appendix 2 Seral stage descriptions and examples

Early-seral plant communities (0–25% of PNC)*

- Perennial native grass plants and decreaser forb species scarce.
- Plant community comprised of shallow-rooted grasses and forbs.
- Annual and/or perennial invaders or invasive alien plants prevalent.
- Uplands may exhibit excessive shrub cover.

In addition, early-seral plant communities may exhibit some or all of the following:



Figure 5 Early-seral community, short stubble.

- Reduced surface litter and lichen cover.
- Bare soil, pedestalling, and erosion.

Mid-seral plant communities (25–50% of PNC)

- Native perennial grasses account for 35–50% of annual production. Increaser species more prevalent than decreaser species.
- Forbs contribute <30% of annual production.
- Some annual and perennial weeds may be present.
- Uplands may exhibit excessive shrub cover.
- Early successional lichen cover may be present (depending on the type of plant community).

In addition, mid-seral plant communities may exhibit some or all of the following:

- Surface litter.
- Patches of exposed soil.
- Pockets of erosion; pedestals have generally stabilized



Figure 6 Visual obscuration measurement.

* PNC (Potential Natural Community) is defined as the community that would become established on an ecological site if all successional sequences were completed without interference by humans under present environmental conditions.



Figure 7 Late-seral community.



Figure 8 PNC-community, fence line contrast.

Late-seral plant communities (50–75% of PNC)

- Decreaser perennial grasses exhibit good vigour (health) and contribute >50% of annual production. Increaser species present to a moderate degree.
- Forbs contribute <20% of annual production.
- Non-native perennial grasses and forbs may be present; however, they do not dominate the site.
- Presence of annual weeds is scarce to negligible.
- Upland shrub cover is within normal range of variation.
- Later-successional lichens may be present.

In addition, late-seral plant communities may exhibit some or all of the following:

- Surface litter in various stages of decomposition (breakdown).
- Bare ground, if present, within the normal range for a healthy site.

PNC-climax plant communities (>75% of PNC)

- Non-native grasses and perennial forbs may be present but do not dominate the site.
- Presence of annual weeds is negligible to non-existent.
- Forbs contribute <10% of annual production.
- Healthy and vigorous perennial plants dominated by decreaser species contribute >75% of annual production.
- Late-successional lichens may be present.

In addition, PNC-climax plant communities may exhibit the following:

- Surface litter in various stages of decomposition (breakdown).



Figure 9 Aspen communities in late-seral (left), mid-seral (middle), and early-seral (right) stages.