

Forage Supply Analysis: the Range Vegetation Inventory



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Introduction

Management of the land for rangeland values is challenging because of shifting economic, social, and ecological factors including: forage quality and availability, water supply issues, tenure overlap with other land users and resultant mitigation, and changing relationships with First Nations. These factors can individually and cumulatively impact forage supply allocation and management. Central to effective management is a forage inventory model that provides data-driven estimates (Animal Unit Months (AUMs) and kg/ha) of forage availability under changing conditions. A forage supply review is undertaken to collect, analyze and apply forage inventory data to allow for informed forage allocation and management decisions. Accurate forage supply provides certainty in forage allocation. Results are reported in the Range Vegetation Inventory (RVI) and used in reports and during client meetings. The RVI is an inventory of what is on the ground; thus, it describes the plant community and the current condition of that plant community. It is a snapshot in time that can be enhanced with other data and information to predict potential future scenarios. This document details methodology for undertaking forage supply review to create a RVI.

Background

Under the *Range Act*, the District Manager is responsible for deciding if there is adequate forage for the tenure term, and in practice, range staff guide them in making this determination. Since 2008, Range Branch has directly supported the Chilcotin (DCH, now part of Cariboo-Chilcotin), Thompson Rivers (DTR), 100 Mile House (DMH) and Cascades (DCS) Districts with fieldwork, spatial and tabular analysis, and the formation of management recommendations stemming from the RVI. Branch has also provided information to five other Districts for their forage supply projects.

Available Forage:

That portion of the forage, expressed as weight of forage per unit land area, that is accessible for consumption ...by a grazing animal (Society for Range Management, 1989).

Our primary objective was to develop a consistent, data-grounded approach for determining forage availability, and subsequently, forage allocation. We achieved this objective through forage supply modeling that is sensitive and responsive to multiple challenges. The resulting spatial decision-making approach provides estimates of available forage (AUMs and kg/ha) on Crown land under varying climatic and land management conditions.

Overview

Each RVI offers challenges and opportunities, based on BC's varying topography and ecological properties. Forage supply is difficult to estimate because it is constrained by local climate, (including amount and timing of precipitation

events), available soil moisture, and current plant communities. Uncertainty in predicting forage supply is further complicated by changing weather patterns, impacts of historical use, and disturbance to the range resource (e.g., harvested forests, Mountain Pine Beetle, recreation, feral horses, wildlife, and wildfire). Although some analysis is completed at a broader scale through extrapolation, many areas require application of individual datasets and knowledge at finer scales.

Methods

Creating an RVI is as much an approach as it is a process in collecting and analyzing raw data. A successful RVI requires good knowledge of the land and its condition. Each RVI combines spatial analysis, fieldwork, and relies on the integration of local knowledge. The RVI considers existing forage productivity, rangeland health, limiting factors, and safe use limits. Levels of confidence can be captured. Adjustments have been made to the model based on unpredictable events, such as wildfire. Feral horses and wildlife are unregulated users of forage and, if known, their consumption can be built into the model. Knowledge of local and regional management goals is important for determining how the RVI is applied.

The RVI is transparent and is developed with input and feedback from District Range officers and agrologists. The method described below is both iterative and integrative and is adjusted by new information and interpretations. For example, stratification is frequently adjusted based on knowledge gained during fieldwork.

Forage Production:
The weight of forage that is produced within a designated period of time on a given area. (Society for Range Management, 1989).

Methodology

The following processes are used in creating a RVI:

1. Stratifying Crown range into coarse descriptions of the vegetation community and estimating forage production;
2. Conducting fieldwork to verify the above stratification, to fill in holes where forage production is unknown, and to assess rangeland condition or health;
3. Extrapolating data and accounting for limiting factor deductions, safe use limits, and other relevant data;
4. Calculating total forage availability;
5. Communicating results to Range professionals, natural resource managers, and/or clients.

1. Stratifying Crown range

Geospatial analysis provides a way to visualize where the range descriptions are found and assists in determining limiting factors (access, distance to water) as well as a means to readily calculate area. Use the best spatial data available to stratify the landscape to determine where fieldwork needs to be done. To create the initial RVI descriptive stratification, we have used the *Vegetation Resource Inventory* (VRI) <http://www.for.gov.bc.ca/hts/vridata> as the base layer. The VRI is a composite of timber inventories. We have selected the VRI because it provides contiguous polygon coverage around major vegetation landforms, and thus is a good starting place to create the RVI. Time is saved using the VRI rather than digitizing polygons from scratch, however, to create a usable spatial dataset, significant modification must be undertaken¹.

A short description, elaborated below, of the stratification process:

1. Identify your area of interest
2. Remove appropriate parcels of land (eg. Indian reserves, private land, ecological reserves)
3. Add fields to spatial layer to support RVI analysis (see Data Dictionary, [Appendix 1](#))
4. Stratify polygons into descriptive classes using spatial data, local knowledge, and existing production data

Typically an area, defined by administrative boundaries, subsets the VRI. For example, active and pending tenures, range units, and pastures have all been used as the scale for the RVI. Selecting the smallest scale possible (in other words, the largest land area) is advisable when beginning because spatial data can always be further subset but it is difficult to add data back into the spatial extent once analysis has been done. We do not recommend further adding to the dataset by combining VRI data with, for example, slope and aspect, as this can create many small polygons and an unwieldy dataset. The VRI attribute table includes Biogeoclimatic Ecosystem Classification (BEC) information down to the phase level and you can use this information when defining your descriptive classes. Additional datasets can be used in reference to visually verify the main dataset and to support assumptions from local knowledge and fieldwork.

The RVI contains fields for the plant community description and for recording forage productivity, limiting factors, and safe use levels.

Polygons representing land that is not part of the range tenure system may be removed from the RVI. Typically, this includes private land, Indian Reserves,

¹ We use the VRI as it currently provides the best possible contiguous data. In time, however, it may be replaced by another dataset (eg. LIDAR obtained data).

ecological reserves, urban areas, and parks where grazing does not occur. You may elect to retain portions, for example, Crown land not currently under tenure may be assessed for future tenure under the vacancy system, and you will want to ensure that you keep that portion in your dataset.

An ArcMap script strips away irrelevant fields from the VRI and adds 100 columns to the dataset. With this modification, we begin referring to the dataset as the RVI, although the VRI timber inventory will be mentioned as limitations are identified. The 100 columns are detailed in the RVI Data Dictionary ([Appendix 1](#)). The RVI is designed to maintain transparency and utility for the future by recording forage production, limiting factors, safe use levels, etc. in separate columns in the attribute table.

To begin stratification, general descriptive classes are used to delineate the range forage resources. Knowledge of the landscape is essential. Descriptions can be created where either forage availability is known to be different (from historical studies or field clipping) or suspected to be different by ocular assessment. At this stage, known forage productivity values (kg/ha) can be used to populate the RVI's productivity columns.

The VRI is an inventory of timber, not of the understorey, and thus while timber classes assist in this step do not feel restricted by them. Stratify the polygon cover using your knowledge of how the forage productivity differs. This knowledge may be obtained from ocular surveys or from prior clipping and will be field verified (see Step 2). For example, stratification may result in descriptive classes determined by tree percentage and crown closure of Pine (e.g., class "Pure Pine") or some mixture of tree species (e.g., class "Pine-Douglas-fir") that are selected using the timber values for tree species and percent. Crown closure in particular may assist in delineating polygons into descriptive classes such as "Open Fir" or "Closed Fir". Likewise, BEC data can further subdivide classes, such as "IDF Pure Pine" and "SBPS Pure Pine". Additional spatial data may also assist in descriptive class creation. In particular, logging or wildfire data can be useful in determining which areas have been disturbed and when the disturbance occurred. Similarly, analysis can be supplemented with road networks, Terrain Resource Information Management (TRIM) 1:20k data, and other relevant data. Again, these datasets are used to identify values with which to populate the RVI polygons and rarely to create new polygons, as this can create large datasets.

The field 'Describe' contains a description of the primary plant community. A RVI may have upwards of 40 unique descriptors.

In the past, the timber attribute for 'non-productive' values, including 'OR' (open range), 'S' (swamp), 'R' (rock), 'L' (lake) and 'R' (river), has been widely used in forage analysis. These 'non-productive' classes are gradually being removed from the VRI. Of all these values the OR and S are probably the most relevant. Range

Branch maintains a cover of OR cut from the 1990 timber inventory that can be used to supplement the RVI.

Descriptive classes should focus on the vegetation community that describes unique forage productivity. Avoid using labels that mix in limiting factors or historical activities. A label such as “Primary range” in itself is not a good descriptive classification because to determine primary range one must assess the inclusion of limiting factors. Similarly, the label “Introduced seeding” may not provide an accurate descriptive label because the current plant community will likely include a mixture of introduced and native species; a description like ‘Community Pasture’, ‘Crested Wheatgrass seedings’ or one that captures the existing plant community would be stronger. These labels may reflect management goals with the intent to maintain the plant community with domestic species. Knowledge of where introduced seeding occurred can be of immense value in delineating the landscape into descriptive classes by identifying areas of high productivity.

The scale for timber inventory is broader than what is needed for range inventory and little things are missed in the VRI base. We deal with this by creating the opportunity to subdivide polygons into two land types by weighting each polygon record into two descriptive classes. For example, a single polygon in the timber world may contain only a certain percent and crown closure of aspen; that same polygon, in the range worldview, contains both aspen coppices and grassy openings that provide different amounts of forage (Figure 1). A polygon can be weighted into ‘A’ and ‘B’ descriptive types, where, in this example, ‘A’ would be assigned productivity, limiting factor and safe use values *relating to aspen* and ‘B’ would be assigned values *relating to the openings*. Corresponding forage productivity values, limiting factors, safe use factors, and other attributes are then unique for each of aspen and openings (see [Appendix 1](#) for attribute table details). This approach provides great flexibility to incorporating data across a stratified landscape.

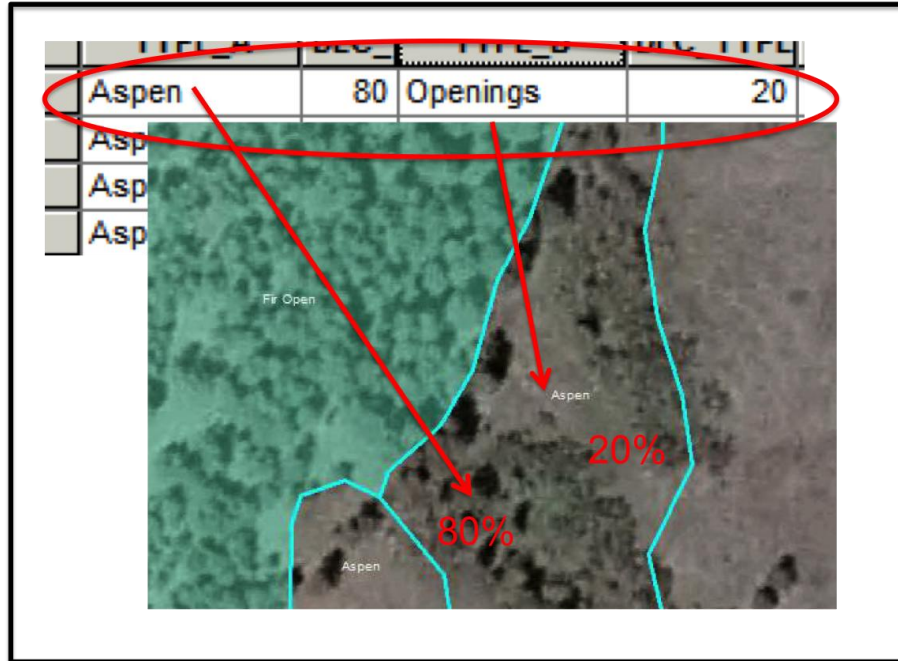


Figure 1: In the above example, the Aspen polygon is sub-divided into Aspen forested (80%) and openings (20%). Subsequent values and calculations treat the two landscape types separately, providing a way to account for heterogeneous range landscapes. When final calculations are done, values are weighted by the appropriate percent.

Sometimes the timber inventory is not very accurate or useful for forage analysis. Variability of plant communities in areas dominated by the same tree species can be high because of disturbance history; for example, an adjacent polygon might be classified the same by foresters but contain different understory plant communities and therefore have a different forage production (see Figure 2). The initial stratification should be done using air photos and/or satellite imagery for reference. Additionally, crown closure classes may have inappropriate breaks for forage production and therefore your selection may be coarser than desired. Logging history may also be inaccurate and these values may need to be updated manually. In particular, grasslands, wetlands, or alpine are not subdivided by type or plant community, and 'OR' is far from being uniform. Any dataset that contributes to delineating descriptive classes should be evaluated for not only how it captures timber classes, but also for how it captures non-forest types. In our experience, approximately 80% of a RVI can be populated through extrapolation using geospatial techniques. The remaining 20% requires 'hand coding'.



Figure 2: The Vegetation Resource Inventory (VRI) records data on timber types and range requires data on the understory. To illustrate some of the challenges with VRI data, in the above example, both areas are designated as 'Yellow Pine' (Py) with the same age and canopy height and cover classes, although the understories are noticeable different because of disturbance history. Thus, in the RVI, we would assign unique descriptive classes. Fieldwork or spatial layers illuminating information on disturbance history may assist when extrapolating the data.

2. Conducting Fieldwork

Once range descriptive types have been identified, fieldwork will supplement missing information on forage productivity and range condition. 'Ground-truthing' is also important to verify classifications. Fieldwork should be done before the cows graze the area. Alternatively, you could put out vegetation cages.

You can start with an ocular assessment but don't rely completely on that method. Air photos or imagery will supplement your understanding of the entire polygon but should not replace fieldwork away from the road. In order to fully assess an area for low, medium and high use you need to walk around and assess where the cattle have been the year before and where wildlife or feral horses graze (Figure 3). If there is a notable difference in productivity in areas with the same descriptive label, as stratified in Step 1, then you may want to further stratify by information about use and condition. Local knowledge about other land use may also supplement considerations of forage availability.



Figure 3: Ocular assessment should be done in a wide area away from roads. Rangeland health assessments will measure impact and contribute to an understanding of range condition and management options.

Select fieldwork sites that represent broad types, based on the timber types, BEC and disturbance history. Do not adopt a sampling regime that is so rigid that you end up sampling 'unlike' areas while assuming they are similar. For example, swales and hills, or 'under tree' cover and 'out of tree' cover are all 'unlike' areas and will produce different production values. In particular, if incorporating clipping values from other studies, ensure their sampling methods provide accurate forage measurements. Also, be conscious that our natural tendency is to sample 'better' areas. Use the weighted percentage approach to divide your polygon into Types A and B if there is a notable and consistent difference.

A short description of the fieldwork procedure is to:

1. Take a photo to capture the representativeness of the area
2. Create a plant species list by walking around the area as clipping may not capture all plant species
3. Conduct an assessment of Rangeland health using the existing forms and guidebooks. The health assessment may provide clues to as to possible management solutions, such as redistributing animals to other parts of the tenure (Figure 4)
4. Pick representative areas to clip for sample production
 - Record percent plant cover in each of the sample clipping plots
 - Clipping is done in $\frac{1}{4}$ or $\frac{1}{2}$ m plots, at least 3 per representative site

- (see: [Determining Available Forage](#) (Fraser, 2004)) (Figure 5)
- Randomly throw your quadrat or hoop in your representative area to determine where to clip
 - Clip the current years growth of species you think the cattle will eat ([Appendix 2](#)), and separate from the litter
 - You may split the clipping into grasses, forbs, litter and shrubs, or record a total of all plants that the cattle are eating
5. Dry the samples in an oven drier or by air-drying. Samples can also be weighed in the field following the procedure described in [Determining Available Forage](#) (Fraser, 2004). Use the same method for all your samples to ensure consistency. Make sure that you tare each individual type of bag that you use as this will impact your overall measurements.



Figure 4: Range health assessments, using the [Rangeland Health Field Guide](#) (Fraser, 2007) and standardized forms, provide information on range health.



Figure 5: Clip using $\frac{1}{4}$ or $\frac{1}{2}$ m plots and separate grass, litter, forbs and shrubs.

After you have obtained clipping measurements, enter values into the appropriate columns in the RVI ([Appendix 1](#)). Slowly we are building a catalogue of range types with descriptions and production that can be used for future reference. [Appendix 3](#) illustrates an example. You may want to develop a catalogue for your District based on your fieldwork.

Consideration of sample size

We typically collect three samples per range descriptive type and increase our sampling effort where we see greater variance. We collect samples in the time we have to do field work. Production values collected for one year don't reflect the variance in weather patterns and therefore clipping should be done over subsequent years to get a more representative estimate.

6. Extrapolating data and entering limiting factor deduction, safe use limit, and other relevant data

Extrapolation of data is done to fill in values in polygons not sampled but sharing a range descriptive type. Local and professional knowledge is used to support findings and to verify estimates and confidence. For some sites there may be supplemental data from site surveys. Exclosure production data may be included in the analysis as a comparison of the productivity of the current community to the ungrazed community. Past reports are consulted for comparison of forage availability.

Limiting factors (terrain, access to water, slope) are assigned based on field observations and local knowledge. New logging roads may increase access or wind throw from new disturbance can reduce access (Figure 6). Safe use factors are assigned based on field observation, professional and local knowledge, and management objectives.



Figure 6: Windfall in this spruce stand makes access for cattle impossible.

7. Calculating total forage availability

Calculate forage availability by summing the forage production and deducting limiting factors, safe use, and other relevant factors. Output is in kg/ha and AUMs and can be converted to other measurements, eg. AUMs/ha or AUMs/acre. ArcMap scripts are available for making these calculations.

8. Communicating results to Range professionals, natural resources managers, and/or clients

Output is provided as spatial and tabular analysis, and can support management recommendations and options (Figure 7). The RVI provides sound foundations for discussing stock rates and addressing capacity issues with clients. Specifically, output from this process has been used to: calculate carry capacity of a vacant tenure; reduce use to better match the forage supply; and implement options, such as modifying animal distribution to access unused forage, that provide additional forage.

Management may request estimates of forage production in a shorter time period than adequate field research can provide and therefore our recommendation is that the RVI approach be used to obtain a coarse estimate. In subsequent years,

more detailed fieldwork and estimates can be done on specific areas. Additionally, the RVI can be further developed by conducting fieldwork over multiple years.

Pasture	Type	Area	Prodction	Limiting F	Safe Use	Available Kg	AUMs	Pasture totals	Planned use	Difference	% planned vs capacity
	Total	5185				671231	1678	1678	3072	1394	183
Pasture 1	Aspen	23	24198	20	35	6775	17				
	closed Fir	0	36	100	35	0	0				
	Openings in closed Fir	0	17	50	35	3	0				
	Grassland	297	208138	0	20	41628	104				
	CWG	28	19642	0	40	7857	20	141	57	-84	41
Pasture 2	Aspen	8	7904	20	35	2213	6				
	Grassland	24	17017	0	20	3403	9				
	CWG	13	9163	0	40	3665	9	23	40	17	172
Pasture 3	Aspen	5	4680	20	35	1310	3				
	Closed Fir	140	27972	100	35	0	0				
	Openings in Fir	25	21524	50	40	4305	11				
	Open Fir	55	25709	50	35	4499	11				
	grasslands in open fir	11	7560	0	20	1512	4				
	Grassland	158	224360	0	20	44872	112				
	Riparian	8	9960	0	35	3486	9	150	114	-36	76
Pasture 4	Aspen	5	4784	20	35	1340	3				
	Grassland	76	52920	0	20	10584	26	30	60	30	201
Pature 5	Grassland	147	102690	0	20	20538	51	51	160	109	312

Figure 7: Sample output table showing results by pasture.

References

Fraser, D. A. 2004. Determining available forage. Forest Practices Branch, British Columbia Ministry of Forests, Victoria, B.C. Rangeland Health Brochure 7.

Fraser, D.A. 2007. Rangeland Health Field Guide. B.C. Min. For. Range, Range Br., Kamloops, B.C.

Society for Range Management. 1989. A Glossary of Terms Used in Range Management, 2nd Edition. Society for Range Management.

Appendices

Appendix 1: RVI Data Dictionary

Attribute Name	Long Name	Description
RVI_ID		Unique and Linking ID - originally equal to Feature_ID, spatial unique for underlying polygons
Describe		Longer text description of over-all community, See: EXAMPLES
Type_A		Description of Primary Plant Community
Dec_Type_A	Decile_Type_A	Decile of Primary Plant Community (percent) (eg. 100, or 80 where Type_B equals 20)
Type_B		Description of Secondary Plant Community per Polygon
Dec_Type_B	Decile_Type_B	With Dec_Type_A, equals 100%
A_Site_Series		Site series information for plant community A, if available.
B_Site_Series		Site series information for plant community B, if available.
A_G_Sp1	A_Grass_Species1	Grass Species 1 for Plant Community A (eg. May be recorded as 'Mixed sp.', POA, etc.)
A_G_Sp1_Pr	A_Grass_Species1_Productivity	Productivity estimates (dried clipping weight) in Kg/Hectare.
B_G_Sp1	B_Grass_Species1	Grass Species 1 for Plant Community B (eg. May be recorded as 'Mixed sp.', POA, etc.)
B_G_Sp1_Pr	B_Grass_Species1_Productivity	Productivity estimates (dried clipping weight) in Kg/Hectare.
A_G_Sp2	A_Grass_Species2	Grass Species 2 for Plant Community A (eg. May be recorded as 'Mixed sp.', POA, etc.)
A_G_Sp2_Pr	A_Grass_Species2_Productivity	Productivity estimates (dried clipping weight) in Kg/Hectare.
B_G_Sp2	B_Grass_Species2	Grass Species 2 for Plant Community B (eg. May be recorded as 'Mixed sp.', POA, etc.)
B_G_Sp2_Pr	B_Grass_Species2_Productivity	Productivity estimates (dried clipping weight) in Kg/Hectare.
A_G_Sp3	A_Grass_Species3	Grass Species 3 for Plant Community A (eg. May be recorded as 'Mixed sp.', POA, etc.)
A_G_Sp3_Pr	A_Grass_Species3_Productivity	Productivity estimates (dried clipping weight) in Kg/Hectare.
B_G_Sp3	B_Grass_Species3	Grass Species 3 for Plant Community B (eg. May be recorded as 'Mixed sp.', POA, etc.)
B_G_Sp3_Pr	B_Grass_Species3_Productivity	Productivity estimates (dried clipping weight) in Kg/Hectare.
A_F_Sp1	A_Forage_Species1	Forb Species 1 for Plant Community A (eg. May be recorded as 'Mixed sp.', POA, etc.)

A_F_Sp1_Pr	A_Forage_Species1_Productivity	Productivity estimates (dried clipping weight) in Kg/Hectare.
B_F_Sp1	B_Forage_Species1	Forb Species 1 for Plant Community B (eg. May be recorded as 'Mixed sp.', POA, etc.)
B_F_Sp1_Pr	B_Forage_Species1_Productivity	Productivity estimates (dried clipping weight) in Kg/Hectare.
A_F_Sp2	A_Forage_Species2	Forb Species 2 for Plant Community A (eg. May be recorded as 'Mixed sp.', POA, etc.)
A_F_Sp2_Pr	A_Forage_Species2_Productivity	Productivity estimates (dried clipping weight) in Kg/Hectare.
B_F_Sp2	B_Forage_Species2	Forb Species 2 for Plant Community B (eg. May be recorded as 'Mixed sp.', POA, etc.)
B_F_Sp2_Pr	B_Forage_Species2_Productivity	Productivity estimates (dried clipping weight) in Kg/Hectare.
A_F_Sp3	A_Forage_Species3	Forb Species 3 for Plant Community A (eg. May be recorded as 'Mixed sp.', POA, etc.)
A_F_Sp3_Pr	A_Forage_Species3_Productivity	Productivity estimates (dried clipping weight) in Kg/Hectare.
B_F_Sp3	B_Forage_Species3	Forb Species 3 for Plant Community B (eg. May be recorded as 'Mixed sp.', POA, etc.)
B_F_Sp3_Pr	B_Forage_Species3_Productivity	Productivity estimates (dried clipping weight) in Kg/Hectare.
A_S_Sp1	A_Shrub_Species1	Shrub Species 1 for Plant Community A (eg. May be recorded as 'Mixed sp.', POA, etc.)
A_S_Sp1_Pr	A_Shrub_Species1_Productivity	Productivity estimates (dried clipping weight) in Kg/Hectare.
B_S_Sp1	B_Shrub_Species1	Shrub Species 1 for Plant Community B (eg. May be recorded as 'Mixed sp.', POA, etc.)
B_S_Sp1_Pr	B_Shrub_Species1_Productivity	Productivity estimates (dried clipping weight) in Kg/Hectare.
A_S_Sp2	A_Shrub_Species2	Shrub Species 2 for Plant Community A (eg. May be recorded as 'Mixed sp.', POA, etc.)
A_S_Sp2_Pr	A_Shrub_Species2_Productivity	Productivity estimates (dried clipping weight) in Kg/Hectare.
B_S_Sp2	B_Shrub_Species2	Shrub Species 2 for Plant Community B (eg. May be recorded as 'Mixed sp.', POA, etc.)
B_S_Sp2_Pr	B_Shrub_Species2_Productivity	Productivity estimates (dried clipping weight) in Kg/Hectare.
A_S_Sp3	A_Shrub_Species3	Shrub Species 3 for Plant Community A (eg. May be recorded as 'Mixed sp.', POA, etc.)
A_S_Sp3_Pr	A_Shrub_Species3_Productivity	Productivity estimates (dried clipping weight) in Kg/Hectare.
B_S_Sp3	B_Shrub_Species3	Shrub Species 3 for Plant Community B (eg. May be recorded as 'Mixed sp.', POA, etc.)
B_S_Sp3_Pr	B_Shrub_Species3_Productivity	Productivity estimates (dried clipping weight) in Kg/Hectare.
A_T_Sp1	A_Total_Species1	Total Species 1 for Plant Community A (eg. May be recorded as 'Mixed sp.', POA, etc.). <u>Use when clippings not separated into grass, forbs, shrubs.</u>
A_T_Sp1_Pr	A_Total_Species1_Productivity	Productivity estimates (dried clipping weight) in Kg/Hectare.
B_T_Sp1	B_Total_Species1	Total Species 1 for Plant Community B (eg. May be recorded as 'Mixed sp.', POA, etc.). <u>Use when clippings not separated into grass, forbs, shrubs.</u>
B_T_Sp1_Pr	B_Total_Species1_Productivity	Productivity estimates (dried clipping weight) in Kg/Hectare.

A_T_Sp2	A_Total_Species2	Total Species 2 for Plant Community A (eg. May be recorded as 'Mixed sp.', POA, etc.). Use when clippings not separated into grass, forbs, shrubs.
A_T_Sp2_Pr	A_Total_Species2_Productivity	Productivity estimates (dried clipping weight) in Kg/Hectare.
B_T_Sp2	B_Total_Species2	Total Species 2 for Plant Community B (eg. May be recorded as 'Mixed sp.', POA, etc.). Use when clippings not separated into grass, forbs, shrubs.
B_T_Sp2_Pr	B_Total_Species2_Productivity	Productivity estimates (dried clipping weight) in Kg/Hectare.
A_T_Sp3	A_Total_Species3	Total Species 3 for Plant Community A (eg. May be recorded as 'Mixed sp.', POA, etc.). Use when clippings not separated into grass, forbs, shrubs.
A_T_Sp3_Pr	A_Total_Species3_Productivity	Productivity estimates (dried clipping weight) in Kg/Hectare.
B_T_Sp3	B_Total_Species3	Total Species 3 for Plant Community B (eg. May be recorded as 'Mixed sp.', POA, etc.). Use when clippings not separated into grass, forbs, shrubs.
B_T_Sp3_Pr	B_Total_Species3_Productivity	Productivity estimates (dried clipping weight) in Kg/Hectare.
Reduc_Pal	Reduction_Palatability	To accommodate an estimate in reduction of clipping (productivity) weights, based on lack of palatability (in percent). Where shrubs are included in the productivity weights, we may have to be careful with the safe use levels. Cows often won't eat all shrubs available. By law (RPPR 20(1)(c)) consumption is limited to 25% and in many RUPs shrub consumption is limited to 10%. So therefore if there is a high shrub component in productivity, and cows either don't eat or you use a high safe use percent (50%) then the actual use of grass and forbs might be higher, which leads to unsafe situation. Use this field to indicate percent that shrub component of productivity should be discounted.
A_Samp_Dat	A_Sample_Date	Date of field sample that productivity numbers based on, Plant Community A
B_Samp_Dat	B_Sample_Date	Date of field sample that productivity numbers based on, Plant Community B
A_Confiden	A_Confidence_Level	Subjective estimate of confidence in productivity numbers (percent), Plant Community A
B_Confiden	B_Confidence_Level	Subjective estimate of confidence in productivity numbers (percent), Plant Community B
A_LF1_CD	A_LimitingFactor1_Code	Limiting Factor Code 1 for Plant Community A - See 'Limiting Factor Codes' Tab
A_LF1	A_LimitingFactor1_Percent	Limiting Factor, match to Code 1, Plant Community A (percent) - expressed as percent limiting EG. 10 represents impact of LF is 10% reduction on productivity.
B_LF1_CD	B_LimitingFactor1_Code	Limiting Factor Code 1 for Plant Community B - See 'Limiting Factor Codes' Tab
B_LF1	B_LimitingFactor1_Percent	Limiting Factor, match to Code 1, Plant Community B (percent) - expressed as percent limiting EG. 10 represents impact of LF is 10% reduction on productivity.

A_LF2_CD	A_LimitingFactor2_Code	Limiting Factor Code 2 for Plant Community A - See 'Limiting Factor Codes' Tab
A_LF2	A_LimitingFactor2_Percent	Limiting Factor, match to Code 2, Plant Community A (percent) - expressed as percent limiting EG. 10 represents impact of LF is 10% reduction on productivity.
B_LF2_CD	B_LimitingFactor2_Code	Limiting Factor Code 2 for Plant Community B - See 'Limiting Factor Codes' Tab
B_LF2	B_LimitingFactor2_Percent	Limiting Factor, match to Code 2, Plant Community B (percent) - expressed as percent limiting EG. 10 represents impact of LF is 10% reduction on productivity.
A_LF3_CD	A_LimitingFactor3_Code	Limiting Factor Code 3 for Plant Community A - See 'Limiting Factor Codes' Tab
A_LF3	A_LimitingFactor3_Percent	Limiting Factor, match to Code 3, Plant Community A (percent) - expressed as percent limiting EG. 10 represents impact of LF is 10% reduction on productivity.
B_LF3_CD	B_LimitingFactor3_Code	Limiting Factor Code 3 for Plant Community B - See 'Limiting Factor Codes' Tab
B_LF3	B_LimitingFactor3_Percent	Limiting Factor, match to Code 3, Plant Community B (percent) - expressed as percent limiting EG. 10 represents impact of LF is 10% reduction on productivity.
A_Safe_use	A_Safe_Use	Safe Use (percent), Plant Community A EG. 35 when 'Safe Use is 35%'
B_Safe_use	B_Safe_Use	Safe Use (percent), Plant Community B EG. 35 when 'Safe Use is 35%'
A_An_CD1	A_Animal_Code1	Animal Code species 1 for Plant Community A (not necessarily largest percent)
A_An_Per_1	A_Animal_Percent_1	Animal Species 1, Plant Community A, percent of productivity consumed/allocated
B_An_CD1	B_Animal_Code1	Animal Code species 1 for Plant Community B (not necessarily largest percent)
B_An_Per_1	B_Animal_Percent_1	Animal Species 1, Plant Community B, percent
A_An_CD2	A_Animal_Code2	Animal Code species 2 for Plant Community A (not necessarily largest percent)
A_An_Per_2	A_Animal_Percent_2	Animal Species 2, Plant Community A, percent
B_An_CD2	B_Animal_Code2	Animal Code species 2 for Plant Community B (not necessarily largest percent)
B_An_Per_2	B_Animal_Percent_2	Animal Species 2, Plant Community B, percent
A_An_CD3	A_Animal_Code3	Animal Code species 3 for Plant Community A (not necessarily largest percent)
A_An_Per_3	A_Animal_Percent_3	Animal Species 3, Plant Community A, percent
B_An_CD3	B_Animal_Code3	Animal Code species 3 for Plant Community B (not necessarily largest percent)
B_An_Per_3	B_Animal_Percent_3	Animal Species 3, Plant Community B, percent
A_An_All_1	A_Animal_Allocation_1	Animal_allocation_1, Plant Community A in AUMs
A_An_All_2	A_Animal_Allocation_2	Animal_allocation_2, Plant Community A in AUMs
A_An_All_3	A_Animal_Allocation_3	Animal_allocation_3, Plant Community A in AUMs

B_An_All_1	B_Animal_Allocation_1	Animal_allocation_1, Plant Community B in AUMs
B_An_All_2	B_Animal_Allocation_2	Animal_allocation_2, Plant Community B in AUMs
B_An_All_3	B_AnimBI_Allocation_3	Animal_allocation_3, Plant Community B in AUMs
Logged	Logged	Has the area been logged, Y/N (Pull data from VRI data and possibly overlay with RESULTS)
Log_Per	Log_Percent	Limiting factor "Access" adjusted by this percent for access because of logging roads.
Adj_Log	Adjustment_Logging	Has the adjustment to LF calculations been made, Y/N. This attribute is included to track whether or not adjustment has been made.
Forage_Hec	Forage_Hectares	Total Polygon Area. Recalculate after changes using Xtools.
Raw_No_Ded	Raw_No_Deductions	Raw (total) Productivity, No Limiting Factor or Safe Use Deductions. In Kg/hectares. Script: Raw-no-deductions.cal
Prod_Avail	Productivity Available	Forage Available = Productivity Minus Limiting Factor and Safe Use Deductions. Potential increase/decrease from logging activity. In Kg/hectares. Script: Prod_Avail.cal
HAXAvail	Hectares times Available	Total area x Productivity Available. In Kg/hectares. Script: HAXAvail.cal
Aums	Animal Unit Months	Conversion of HAXAvailability into AUMs (Base divider is 450 kg, by default). Script:
Comments	Comments	Comments. Suggested: Year of survey, Who surveyed, Source of data, Notes on Limiting Factors, Heavy Use/Historical use, etc. CONCISE but DETAILED.

Appendix 2: Plants – To Clip or Not to Clip

In progress – Coming soon

Please contact:

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Appendix 3: Sample Record of Range Type

James Cattle Company		Date site sampled July 24 2012
Site name BGxw2		UTM
BEC BGxw2 01		Kg/ha 340 % of Normal 150%
Elevation 750		Slope 5 Aspect 180
Soil Texture loam		
Moisture Regime mesic		Site position Macro Middle slope Meso Middle slope
Surface Shape Convex		Microtopography Smooth
Exposure		Humus Form Rhismull
Species	Cover	
Bluebunch wheatgrass	20	
Big Sage	20	
Pussytoes	1	
Geum triflorum	1	
Junegrass	10	
Needle- and- thread grass	1	
Cut- leaved fleabane	1	
Pasture Sage	1	