# GRAZING RESPONSE INDEX (GRI)

## A SIMPLE AND EFFECTIVE ASSESSMENT OF GRAZING MANAGEMENT

Healthy rangelands provide sustainable grazing for domestic livestock and supply many environmental, economic and social benefits. Rangeland managers make landscape-level decisions daily that affect rangeland health and productivity. For example, they must estimate how much forage can be removed, how often to graze the rangeland and how much recovery time it receives. But are these decisions improving or maintaining the resource? To answer this question, land managers need monitoring tools that offer a better understanding about the plants and how the rangeland system responds to grazing. Provided in a timely fashion, this information can lead to management decisions that positively *and* proactively influence forage production and range health.

Rangeland assessment

### THE GRAZING RESPONSE INDEX

The intent of any monitoring system is to maintain or improve the resource. While there are several monitoring methods available, the Grazing Response Index (GRI) is a beneficial short-term monitoring tool that offers a simple and effective means of evaluating the impacts of livestock grazing. The GRI provides a comprehensive evaluation of the effects of the ***current season's*** grazing management and can be used to make rangeland management decisions for the following year. A key outcome of the GRI is that the information is immediately available to producers and land managers because they are the ones making the observations – there is no need to wait for someone else to gather, interpret and report the data. This timely assessment information allows livestock producers and land managers to make adjustments that are relatively small, but are economically productive and highly beneficial.

Due in large part to its simplicity of use and easily understood underlying science-based concepts, GRI has been widely adopted by ranching communities in western USA and British Columbia. Agriculture and Agri-Food Canada (AAFC) has been an integral partner in bringing the GRI to Western Canadian ranchers and forage/pasture extension specialists. From 2010 to 2014, AAFC funded and partnered in studies undertaken in British Columbia, Saskatchewan and Manitoba.[1] The preliminary findings from these studies concluded that GRI can be a valid monitoring tool for native rangelands on the Prairies. AAFC has also led workshops in the Prairies to introduce rangeland professionals to the concept and practice of applying GRI, and continues to work with partners to provide this tool to livestock producers. In combination with other rangeland assessment tools, GRI can enhance opportunities for adaptive rangeland and pasture management and improve long-term forage and livestock productivity.

[1] Gardner, W., M. Khadka and V. Volpatti. 2013. The Grazing Response Index Project. Agriculture and Agri-Food Canada. Kelowna, BC: Thompson Rivers University, 39 pp. (English only. For a copy contact cameron.kayter@agr.gc.ca)

## How GRI Works

The GRI is based on a general assessment of the current grazing use. It involves three factors to evaluate grazing management impacts on plant health: grazing frequency, grazing intensity and opportunity for plant recovery.

### Frequency

Frequency refers to the number of times forage plants are defoliated during a grazing period. This portion of the index is based on research that shows native plants take approximately 7 to 10 days after each defoliation to grow tall enough to be grazed again, and 3 or more successive defoliations during a growing period negatively impacts plants. In short, each time a plant is grazed, its energy bank is drawn down. If drawn down too much and too quickly, the plant loses vigour, regrowth capacity and stress tolerance.

Frequency is evaluated based only on grazing within the growing season; it does not include grazing that occurs before spring green-up or after a killing frost in the fall. To estimate the number of times the plants could be grazed, divide the number of grazing days during the growing season by the 7- or 10-day regrowth period. Use local knowledge of plant growth rate as affected by time of year and weather conditions to determine whether to use 7- or 10-day regrowth period in your calculation.

Frequency Index

| Number of Times grazed | Index value |
|---|---|
| 1 | 1 |
| 2 | 0 |
| 3 or more | -1 |

Grazing only once (index value = 1) will positively affect plants. Grazing twice in sequence (index value = 0) would have relatively little effect. Continuing to graze 3 or more times in sequence (index value = -1) will negatively impact plants. For example, if your livestock are in a field for a total of 13 days during the growing season, then plants could have been grazed up to 2 times, generating a frequency index value of 0.

Grazing exclusion cage

### Intensity

Intensity is a measure of how much leaf material has been removed during the grazing period. The primary concern is the amount of photosynthetically active material (e.g. leaf area) remaining for the plant to recover from defoliation. Amount and speed of regrowth after grazing depends on the energy being produced either by the remaining leaf area or from the plant's carbohydrate (i.e. stored energy) reserves. The more leaf area remaining after grazing, the more photosynthetic capacity there is to replenish carbohydrates and recharge root systems. Removing no more than half of the leaf material in a grazing period ensures there is adequate leaf area to capture light energy and allows for plants to regrow or recover.

Measured at the end of the grazing period, intensity is described using three levels of defoliation – light, moderate and heavy. Grazing exclusion cages placed in representative areas provides a clear visual reference to help determine percent utilization during the grazing period. Cages must be moved to a different location within the field each spring to capture the current year's forage growth.

Intensity Index

| Grazing Intensity | Utilization (%) | Index value |
|---|---|---|
| Light | < 40% | 1 |
| Moderate | 41 - 55 | 0 |
| Heavy | > 56 | -1 |

**Opportunity**

Opportunity relates to how much time plants have for growth prior to grazing or for regrowth after grazing. Full growth or recovery enables plants to meet their nutrient and growth requirements during the growing season and allows them to mitigate the impacts of relatively high grazing intensity or frequency. The opportunity for plants to grow or regrow is dependent on soil moisture, air temperature and leaf area. Therefore, it is important to consider the quality of the rest period. Because opportunity for rest is most strongly correlated to long-term health and vigour of the vegetation, the index values are doubled

Opportunity should be assessed at the end of the growing season based on two aspects: the apparent level of recovery of the vegetation and the knowledge of whether the plants had a full opportunity for growth before grazing. Generating an index value for this factor can be subjective; it relies on knowledge of how environmental conditions might have affected plant growth. For example, if plants appear ungrazed at the end of the season or if plants reached full growth before grazing, then the site would score 2. Under continual grazing, the site would score -2. If there was a chance for growth or regrowth it could rate as a 0 or -1.

| Opportunity Index | |
|---|---|
| Opportunity to Grow or Regrow | Index value |
| Full Season | 2 |
| Most of the Season | 1 |
| Some Chance | 0 |
| Little Chance | -1 |
| No Chance | -2 |

**Total GRI Score**

The overall GRI rating of an individual pasture is the sum of the frequency, intensity and opportunity index values. This value represents the expected response of the plants to the current grazing management. A positive overall value indicates the management is beneficial to plant health, structure and vigour. A negative value indicates that management is detrimental to plant health if continued over the long term. A zero rating is neutral.

Looking at the overall GRI value for each pasture may provide direction on where and when to adjust grazing management to achieve a more sustainable operation. By further considering the individual GRI components (i.e. frequency, intensity, opportunity), the producer can begin to determine what management or infrastructure adjustments are needed to yield a positive GRI score. In combination with other rangeland assessment tools, GRI can enhance opportunities for adaptive rangeland and pasture management, which in turn, can improve long-term forage and livestock productivity.

### GRI DOES NOT MONITOR RANGELAND HEALTH

GRI provides a comprehensive evaluation of the effects of the current season's grazing management and can be used to make rangeland management decisions for the following year. However, GRI is not intended to monitor rangeland health as it does not measure long-term changes on the landscape in respect to plant community structure, plant species composition and physical aspects such as soil exposure. Therefore, GRI cannot be used to monitor or assess rangeland plant communities or as a replacement for vegetation monitoring and assessment.

## ONGOING EVALUATION OF GRI UNDER PRAIRIE CONDITIONS AND TAME PASTURES

GRI was introduced in Colorado, USA by Dr. Roy Roath (Colorado State University, Integrated Resource Program) as a tool to evaluate grazing impacts on native grasslands. However there is significant interest in the GRI's applicability for evaluating tame pastures. While the overall GRI principles remain similar, tame forages are expected to be tolerant of shorter regrowth periods after defoliation, higher grazing intensities and shorter opportunity requirements for growth or regrowth. AAFC, the Saskatchewan Forage Council, Ducks Unlimited Canada and the Saskatchewan Ministry of Agriculture are working together to assess the value of using the GRI assessment tool on tame pastures in a three-year (2014-2017) Agricultural Demonstration of Practices and Technologies (ADOPT) Project: *Use of the Grazing Response Index (GRI) on Saskatchewan Pastures to Facilitate Forage Management Decisions.* Funding for this project comes through Growing Forward 2, a federal-provincial-territorial cost-shared initiative.

Grazing cattle in GRI evaluation and demonstration project

Grazing Response Index: A simple and effective assessment of grazing management



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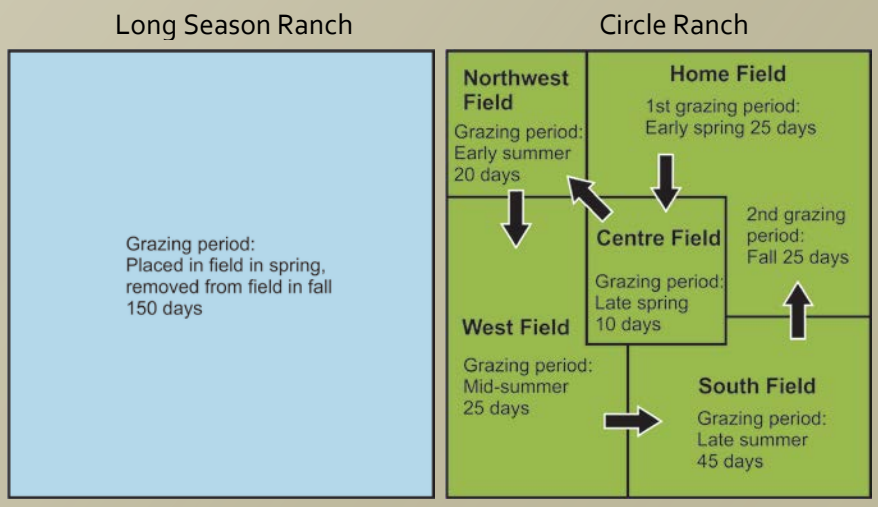
## GRI Assessment Example: Long Season Ranch vs. Circle Ranch

Long Season Ranch and Circle Ranch are similar in many respects: similar size, similar native rangeland type, same sized herd (100 cow/calf pairs), same grazing period (May 24 – October 20 = 150 days). However, they are managed very differently. Long Season Ranch is managed as a single very large field (continuous grazing system); whereas the pasture at Circle Ranch has been divided into five fields of varying size utilizing a rotational grazing system.

### GRI Assessment

*Long Season Ranch*

On the single, very large field at Long Season Ranch, frequency was scored as -1 as plants were exposed to grazing all season long. Intensity was judged as moderate (0), in part due to the large field size. But there was no opportunity for regrowth, resulting in -2 rating. Overall GRI score for Long Season Ranch was very low: -3. If the ranch continues this style of grazing management over the long term, forage production will diminish, resulting in a decrease in the number of cattle that it can support. Unfortunately, without significant management and/or infrastructure changes this ranch has little flexibility to change the GRI scores.




| Pasture/Field Name | Date In - Date Out | Grazing Days | Frequency | Intensity | Opportunity | GRI (Total) |
|---|---|---|---|---|---|---|
| Long Season Ranch | May 24 - Oct. 20 | 150 | -1 | 0 | -2 | -3 |
| Circle Ranch: Home field | May 24 - June 17<br>Sep 26 - Oct 20 | 50 | -1 | 0 | 1 | 0 |
| Circle Ranch: Center field | June 18 - June 27 | 10 | 0 | 1 | 2 | 3 |
| Circle Ranch: Northwest field | June 28 - July 17 | 20 | -1 | -1 | 1 | -1 |
| Circle Ranch: West field | July 18 - Aug 11 | 25 | -1 | 1 | 2 | 2 |
| Circle Ranch: South field | Aug 12 - Sept 25 | 45 | -1 | -1 | 2 | 0 |

*Circle Ranch*

At Circle Ranch, each field was evaluated individually. With one exception, GRI scores suggest that grazing had either a neutral or positive impact; the exception (Northwest) scored -1 due primarily to high frequency and heavy intensity. The variability is due primarily to different levels of grazing intensity and amount of opportunity available for growth and recovery. For example, in the Centre field, intensity was rated as light (1) whereas in the similar sized Norwest field with double the grazing days, intensity was rated as heavy (-1). Because of the long periods before, after or between grazing periods on all fields, opportunity for growth or regrowth was deemed to have been most of the season (1) or full season (2).

Continuing the same pattern of grazing at Circle Ranch is expected to have the following long-term impacts: (1) Centre and West fields: increase forage production and rangeland health; (2) Home and South fields: have no effect on production and rangeland health; and (3) Northwest field: decrease forage production and rangeland health. With multiple fields in the system, there is flexibility at Circle Ranch to change how GRI could be scored next year. For example, to improve the GRI score in the Northwest field (-1), there are at least two options: (1) have cattle spend less time in the Northwest field to increase the number of days available for regrowth; or (2) use more forage in some of the other fields to lower the grazing intensity in the Northwest Field.

## GRAZING RESPONSE INDEX (GRI) – WORKSHEET

Use the GRI method to evaluate each pasture or multiple sites within a pasture. Select representative sites based on your management objectives. Add values for frequency, intensity, and opportunity to determine the total GRI score.

**Property or Operation Name** _____

**Observation Date** _____ **Name of Observer** _____

| Frequency Index | |
|---|---|
| Number of Times grazed | Index value |
| 1 | 1 |
| 2 | 0 |
| 3 or more | -1 |

| Intensity Index | | |
|---|---|---|
| Grazing Intensity | Utilization (%) | Index value |
| Light | < 40% | 1 |
| Moderate | 41 - 55 | 0 |
| Heavy | > 56 | -1 |

| Opportunity Index | |
|---|---|
| Opportunity to Grow or Regrow | Index value |
| Full Season | 2 |
| Most of the Season | 1 |
| Some Chance | 0 |
| Little Chance | -1 |
| No Chance | -2 |

| Pasture/Field Name | Date In - Date Out | Grazing Days | Frequency | Intensity | Opportunity | GRI (Total) |
|---|---|---|---|---|---|---|
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