Range and Riparian Health Assessment Database

An Overview with Instructions for Data Entry and Analysis

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Table of Contents

1.0 Preamble

Range and Riparian Health Assessment (RRHA) is a standardized biological survey methodology used to assess grassland and surrounding habitats in Alberta. The methodology of these surveys is not described here but can be found in links at the end of this document. This project represents the consolidation of almost 20 years of RRHAs on Nature Conservancy Canada (NCC) lands in Alberta.

The goals of this project are to:

1. Present organized RRHA data in a format useful for referencing, tracking and spatial/statistical analysis,
2. Limit the amount to which large format reports must be referenced, and
3. Facilitate and standardize assessment reporting requirements for contractors/NCC staff.

The tools currently in development for this project include:

I. An Excel database of assessment information,
II. R Statistical Analysis code for outputting summary figures and tables, and
III. A GIS mapping portal/ geodatabase for spatial viewing.

Because analysis methods are being implemented, aspects of historical RRHA data must be entered into the database in certain formats, or it will not be analyzed properly. This is why a clear understanding, problem solving skills, and diligence in entry are all critical when adding information to this project. This document is designed to assist users in data entry, and to keep consistency between different users.

2.0 Range and Riparian Health Assessment Score Sheets

RRHA separates assessments into two *locations*, Terrestrial and Riparian, each with three assessment *types.* The methodologies vary widely between these locations and the assessment questions and weight vary between types within a location. **Riparian assessments** are separated into **lentic** (wetlands, sloughs, and lakes), **lotic** (small rivers and creeks), and **rivers**. The 'rivers' designation is a relatively new addition, so only some newer assessments use this sheet in opposition to lotic sheets. **Terrestrial assessments** are separated into **grassland** (native or modified), **tame pasture** (cultivated, broken, or seeded land dominated by >70% agronomic grasses), and **forest**. There are many examples of sites that change forms between grassland and tame pasture as succession takes place, non-native species increase, or knowledge of site history changes. The appearance and, in some cases, the values on the RRHA score sheets have changed through time, but most aspects of the methodology and the traits assessed have remained

constant, facilitating comparability across years. **Links to blank score sheets are available in the reference section of this document.**

3.0 Excel Database Information

The RRHA_Data_Master excel file generated to house the RRHA data has **10 sheets critical to entry**. For the data itself, there are **6 Assessment Tables** for each of the 6 RRHA assessment types (Grassland, Tame Pasture, Forest, Lentic, Lotic, and River), a **GVI Table** for plant community and range site information, and a **Reports Table** to track entered reports and data entry comments. There are also two data validation sheets. The **Lists Sheet** contains named ranges for each natural area and space to enter the desired break down of projects. This sheet is referenced by all the tables to ensure that projects are named consistently across the database. The **Values Sheet** contains all the possible options for each question in each assessment type. This sheet also contains named lists referenced throughout the assessment tables to flag when incorrect values are entered into the database.

Data validation in excel doesn't work correctly with blanks in the named ranges. However, having blanks was necessary to allow for changes in assessment forms and new properties. Thus, **all the blank cells in the named ranges must be spaces so that they are read by excel.** This will restrict the entry of invalid values. Without these spaces, excel will mark invalid values with a green tab on the cell, but will allow their entry.

This section details the columns in data tables and how they need to be formatted for data analysis, as well as some instructions for entry. Following these instructions and keeping these columns consistent will facilitate analysis and ensure the quality of the output data.

The following describes how to interpret Tables 1, 2, and 3 in Section 4 of this document.

Column Name refers to either a specific column or a group of columns.

- Names not falling into the following categories refer to specific columns.
- Separation with a **"/"** indicates terrestrial and riparian column names, respectively.
- Separation with a **","** indicates groups of columns.
- Entries with a ***"*"*** before the name indicates groups of columns.
- Entries followed by ***"(TO)"*** indicates columns present only for terrestrial assessment types (TO=Terrestrial Only).

Format describes how the R-code analysis treats this column.

- '**Numeric'** refers to entries that *MUST BE ONLY* **numbers** or **blank** (NA) values (characters will cause issues).
- '**Character'** refers to a character string including letters and numbers.
- '**Factor'** refers to columns that are used to filter the data. Factors ***must be consistently treated as variables*** across the database for summary figures and tables to be generated, while character strings can be unique values. Capitals and spaces matter here.

Descriptions include a summary of the information you will find in each column.

Entry Notes provide considerations and instructions of how values need to be entered for analysis to be successful.

3.1 Assessment Tables

TABLE 1: COMMON COLUMNS, FORMATTING, AND ENTRY NOTES FOR ASSESSMENT TABLES. DETAILED TABLE NOTES AVAILABLE IN TEXT.

Column Name	Format	Description	Entry Notes
Natural Area	Factor	*The natural area the property assessed is located in.*	**This value must be selected first.** Dropdowns reference the Lists sheet and are then referenced by the Property column to ensure consistent property naming. Each natural area has its own named range of properties that must be updated with new properties.
Amalgamated Project	Factor	*The amalgamated stewardship project for the property assessed.*	This is only applicable to some projects in some natural areas. This helps to sort through the data by area instead of only by property name. Consult Natural Area Managers for assistance in determining which stewardship projects properties are within.
Observer	Factor	*The organization conducting the assessment.*	Generally, the **contractor** organization, not the individual observer themselves. Exception: "Tracy Rains" (NCC Range Manager). Drop down references named range in the Lists sheet which can be updated with new organizations.
Property	Factor	*The Property or Project name.*	Must **match** between assessment tables, reports table, and GVI table. Keep consistent and do not use variants of the Property name. Some reports will have to be separated by properties to keep naming consistent, but this can be helped by spatially viewing the data. New properties must be entered into the Lists sheet in the appropriately Natural Area range to be selected.
Field	Factor	*An identifier for the field or pasture the assessment was completed in.*	Generally, this doesn't change, but as fences change over years they can. **Use best judgement** to determine when discrepancies between years are the result of reporting errors or changed fences and add a note on the cells. Ensure matching between assessment years as best as possible.
GVI (TO)	Factor	*The unique polygon number from the GVI or stocking rate table.*	**For reports with GVI/stocking rate table data,** must either match with **ONE** GVI polygon with a matching *year and property* or be NA. Multiple matching polygons will cause errors in analysis.
Site Number/ Site/Polygon Number	Factor	*A unique identifier for the assessment plot.*	Generally, kept consistent between assessment years, but in some cases, changes. **If this changes between assessments**, ensure you understand which site is which by viewing them spatially, edit the previous assessments to match the most recent assessment, add a note that the name was changed on the changed cell, and put the old name in the "Comments" column.
Date, Year	Factor	*The date of assessment.*	Year populates from the Date column and is arbitrarily conditionally formatted for colour. Entry trick: "18aug20" autoformats to "8/18/2020". Some entries have dates entered arbitrarily (to give the assessment year) if they were not readily accessible in report. This was not readily tracked previously but should be tracked moving forward. Arbitrary dates are usually Jan 1 or May 1 of the assessment year.

UTM	Factor	*The UTM Projection for the Easting/Northing coordinates.*	Generally, will be a NAD (North American Datum) 27 or NAD 83 zone (ex. 12U). This is important to capture as a difference as they will affect the location of the point. All future points are to be projected in 10TM AEP Forest Resource, which covers all of Alberta in a single projection. **IF coordinates are not available**, copy the coordinates from another assessment at the same location and make a note. If no coordinates are available to be copied, write N/A in this cell and leave the coordinates blank.
Easting, Northing	Numeric	*The coordinates of the point.*	Depends greatly on projection (UTM column). Enter as a **number only**. It is important to spatially view the points to check that the coordinates **make sense** given property boundaries and previous assessments.
Special Observations/Site Description	Character	*Optional box on terrestrial reporting forms, area for ANY additional comments or information from report.*	For plots without score sheets or question summaries available, **input ANY summary comments available here.**
***Dominant Species (TO), Cover (TO)**	Character, Numeric	*Section for dominant species list and percent cover.*	Separated into grasses, forbs, and trees. Only available from score sheets. Input species names as 7 letter codes (4 letters genus, 3 letters species) with a space in between, input cover as a percent. IF species codes for common species are known by the transcriber, they can be used in place of long written species names found in reports (ex. AMEL ALN in spreadsheet for "saskatoon" in report). Nonsensical species codes can be changed to best guesses of species composition (ex. PHLU PAT to PHLE PRA). Many species have extra species written on the score sheets. Indicate either the species in the boxes provided and/or the highest cover species.
Community Code (TO)	Character	*Range Plant Community Code.*	Not always given. Corresponds to community description in range plant community guide for area. Enter multiple codes separated with ";" **If the code is a standard code, (ex. FPB1, A8, CPD13, etc.) you do NOT have to write the community description, as the R-code will match it in analysis.**
Community Type (TO)	Character	*Range Plant Community **or** Plant Community Description.*	Type varies depending on availability in reports. Enter as best as possible. Enter multiple codes separated with ";". Try to ensure that this field is descriptions only, without codes. When entering community types, the "-" and "/" are important to preserve because they represent codominant species within a strata and changes in strata, respectively.
***Questions, Question Comments**	Character, Numeric	*Question values and comments.*	Not always available. Multiple versions of datasheets have been used in assessments, but this section is generally adaptable. **Most critical** is that the Qx_total column has the final value for the question for calculation and summary table output. **If questions are not broken down into the a/b format** (as in some older sheets), **do not** write the answer in the Qx_total column, but force it into the "a" section. This allows easier changes to the database to be made. For riparian assessments, the total the question is worth must also be provided. Drop downs are provided for all values, but some older reports will not correspond to these values. Enter comments as best as possible.
***Invasive Species, Cover, Distributions**	Factor, Character, Numeric	*Invasive species, percent cover, and density distribution.*	Species common name or 7 letter code (4 letters genus, 3 letters species). Cover is given as a percent or as a character (<X%). Density distribution is given as a value of 1 to 13, corresponding to standardized diagrams in field manuals.
Site score/ Overall_Rating	Numeric **(decimal)**	*The final RRHA score for the plot.*	This **must be formatted as a decimal** for analysis. Auto-calculates based on question inputs. If no score sheet or question summary is available, enter manually. When discrepancies are found between score sheets, question summaries, and summary tables, use a 'best guess' based on all available information to determine what the most likely result is and document the rationale as a note on this cell. When score sheets or question summaries are not available, enter the final score directly into this cell as a decimal.
Health Category	Factor	*The health category based on the final score as a percent.*	Autoformats colour based on factor input. Numbers in table below correspond to Trend output table. "Healthy " factor includes 2 spaces for excel conditional formatting purposes. "High Healthy" is an arbitrary distinction with the technical "Healthy" class. Populating these as the correct factor is imperative for analysis.

			Category: 1. "Healthy " — Terrestrial % Range: 75-100 — Riparian % Range: 80-100 2. "Healthy With Problems" — 50-74 — 60-79 3. "Unhealthy" — 0-49 — 0-59
Comments	Character	*Section for data entry comments.*	Area to include any comments about data entry including errors found in report, changes to plot names, non-fitting additional information, uncertainties, etc.

4.0 The Grasslands Vegetation Index (GVI)

The **Grassland Vegetation Index (GVI)** is a dataset created by the Government of Alberta. It uses a variety of biophysical data to create ecosystem polygons based on classes including range site descriptions, wetland features, agriculture, and urban development. It is generally considered the standard for calculating stocking rates in the grassland natural region of Alberta. As such, its 'Rangeland View' data structure forms the basis for the RRHA database in this project. However, it does not cover all the NCC Natural Areas in Alberta (Figure 1), and was not used exclusively in some older reports, so other types of community tables have been presented in reports to calculate stocking rates. These tables must be reformatted slightly for use in this database, but still provide the base information such as plant community descriptions and polygon areas critical for analysis.

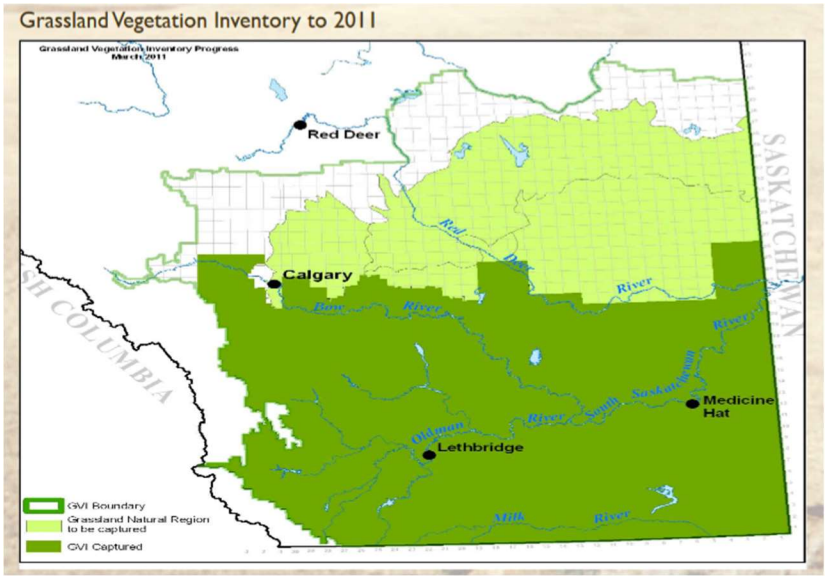


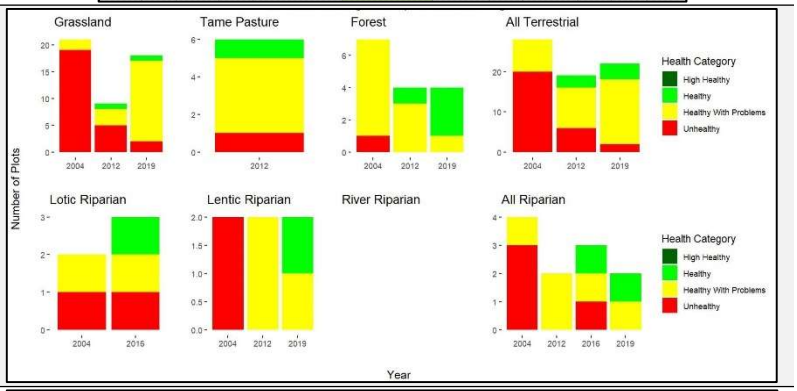
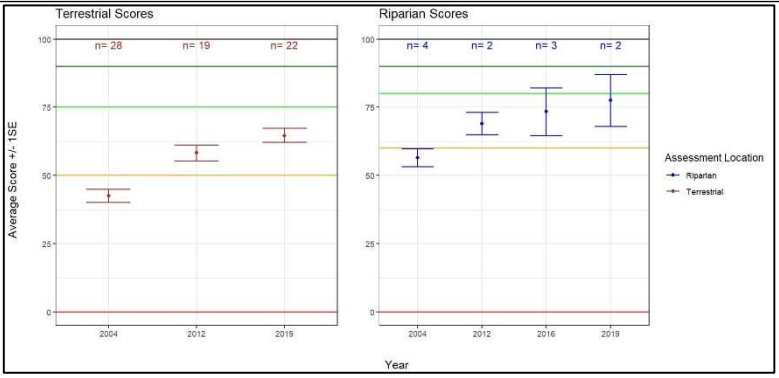
FIGURE 1: EXTENT OF GVI IN SOUTHERN ALBERTA (PCF, YEAR UNAVAILABLE)

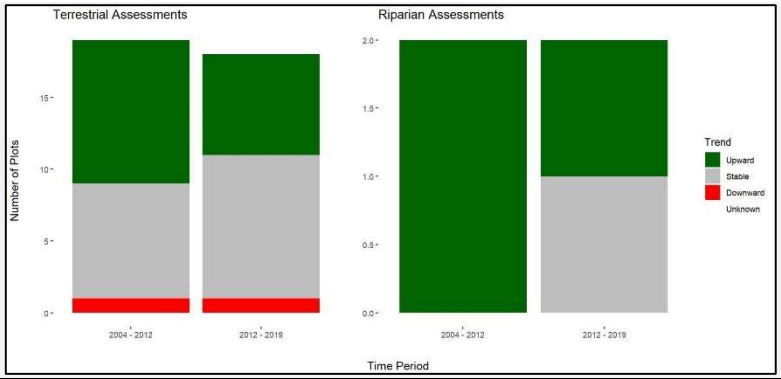
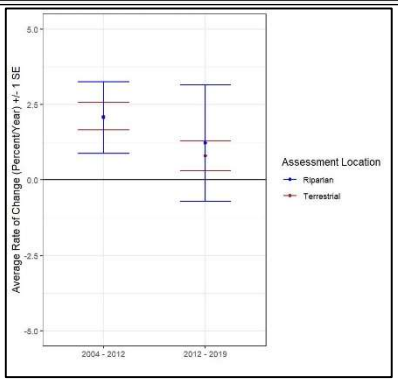
4.1 GVI Table

Two main GVI table formats have been found that were imported as part of the Waterton Natural Area RRHA database. The **Rangeland View GVI** spatial information forms the basis for this table in the database. As some columns were added for the database, the GVI information must be copied and pasted piecewise into the table from modified .SHP files (discussed in section 5.2), but this can be done relatively easily. Tables can be provided easily by the NCC GIS Department. For the Waterton Natural Area, the only other comparable data source in older reports without

spatial GVI information was **Stocking Rate Tables** (Figure 2). Other data sources will likely have to be adapted to the current system, but the wide variety of fields makes it possible to work out how to put all this varied information together. Table 2 details how this table MUST be filled out for the analysis to work properly.

TABLE 4: R OUTPUTS AND EXAMPLES. EXAMPLES FOR TABLES ARE FORMATTED USING EXCEL TEMPLATES AS OUTPUTS ARE IN .CSV FORMAT. FIGURES INCLUDING DATA METRICS, APPEARANCES, OMISSIONS, AND SPECIFICATIONS ARE EDITABLE WITH WORKING R STATISTICAL ANALYSIS KNOWLEDGE.

Description	Output	Example Figure/Table
Terrestrial Question Summary (for TER Summary Template)	Table	*Table X: Summary of terrestrial range health assessments from all years.*
GVI summaries for each year with GVI data (for Stocking Template)	Table	*Table X: Stocking rate calculations*
Stacked bar graph for each assessment type and location showing number of plots in each health category.	Figure	
Average Scores by location with number of observations	Table and Figure	

Trends (changes in health categories) between assessments by location for all reassessed sites	Table and Figure	
Rates of change (in percent per year) between assessments by location for all reassessed sites	Table and Figure	

8.0 References and Links

8.1 Terrestrial Assessments

Grassland, Tame Pasture, and Forest

Adams, B.W., G. Ehlert, C. Stone, M. Alexander, D. Lawrence, M. Willoughby, et al. 2016. **Rangeland Health Assessment for Grassland, Forest and Tame Pasture – Field Workbook**. Alberta Environment and Parks, Rangeland Resource Stewardship Section. 126 pages. Manual and data sheets available from: https://www.alberta.ca/range-health.aspx

8.2 Riparian Assessments

Lentic

Ambrose, N., G. Ehlert, and K. Spicer-Rawe. 2009. **Riparian Health Assessment for Lakes, Sloughs, and Wetlands – Field Workbook.** Second Edition. Modified from Fitch, L., B. W. Adams, and G. Hale, 2001. Riparian Health Assessment for Streams and Small Rivers – Field Workbook. Lethbridge, Alberta. Cows and Fish program. 96 pages. Manual and data sheets available from: http://cowsandfish.org/publications/assessment.html

Cows and Fish. 2018. **Alberta Lentic Wetland Health Assessment User Manual**. Cows and Fish Program. Manual and data sheets available from: http://cowsandfish.org/riparian/health.html

Lotic

Fitch, L., B.W. Adams and G. Hale. 2009. **Riparian Health Assessment for Streams and Small Rivers – Field Workbook.** Second Edition. Lethbridge, Alberta: Cows and Fish Program. 94 pages. Manual and data sheets available from: http://cowsandfish.org/publications/assessment.html

Cows and Fish. 2018. **Alberta Lotic Wetland Health Assessment for Streams and Small Rivers User Manual**. Cows and Fish Program. Manual and data sheets available from: http://cowsandfish.org/riparian/health.html

River

Cows and Fish. 2018. **Alberta Lotic Wetland Health Assessment for Large River Systems User Manual**. Cows and Fish Program. Manual and data sheets available from: http://cowsandfish.org/riparian/health.html

8.3 Grasslands Vegetation Index

Government of Alberta. 2011. **Grassland Vegetation Inventory (GVI) Specifications.** (5th edition). Alberta Sustainable Resource Development. Available in R-drive and from: http://www.albertapcf.org/native-prairie-inventories/gvi

Prairie Conservation Forum (PCF). Year Unavailable. **What is the Grassland Vegetation Inventory (GVI)?** Government of Alberta. Available from: http://www.albertapcf.org/rsu_docs/What_is_GVI_Oct19__2_.pdf (Figure 1)

8.4 R Statistical Analysis

Auguie, B. 2017. **gridExtra: Miscellaneous Functions for "Grid" Graphics**. R package version 2.3.

R Core Team. 2019. **R: A language and environment for statistical computing**. R Foundation for Statistical Computing, Vienna, Austria. Available from: https://www.R-project.org/

Wickham, H. 2016. **ggplot2: Elegant Graphics for Data Analysis**. Springer-Verlag, New York.

Wickham, H., R. François, L. Henry and K. Müller. 2019. **dplyr: A Grammar of Data Manipulation**. R package version 0.8.3.