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Alberta Grasslands Scan: A review of current datasets and approaches to monitor state of grasslands

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Document prepared for Alberta North American Waterfowl Management Plan Partnership

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datasets and approaches to monitor state of
grasslands

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Report Summary

Grasslands play a pivotal role in the ecological balance of our planet, serving as crucial ecosystems with diverse benefits for both the environment and society by contributing many ecosystem services such as biodiversity and carbon storage. Recent increases in interest in grasslands and concern for this threatened, largely unprotected ecosystem, coupled with advances in remote sensing technologies has resulted in a surge in datasets, resources and initiatives related to characterizing grassland extent and condition. This surge in information has also led to an increase in confusion about the differences amongst these resources and which resources to rely on.

We conducted 24 interviews with key organizations and individuals who either develop spatial datasets or use spatial datasets to understand grassland extent and condition. We asked them questions to help us gain an understanding of the range of resources available, their strengths and limitations, and how they are being applied.

From our conversations we learned about the large number of relevant spatial datasets available for Canada or parts of Canada and the importance of considering the purpose of the dataset when determining whether it is appropriate to answer your question. We also learned there are a number of initiatives underway attempting to clarify work in this space. We learned there are some fundamental differences in definitions of grasslands that are at the root of the diversity of datasets available.

We compiled a large list of initiatives and resources that we categorized into: 1. large-scale data, 2. small-scale or field data, 3. evaluation/aggregation projects or 4. models. We provide a short list of initiatives to continue to watch for the purposes of understanding grassland extent and change in Canada, and in Alberta in particular.

Acknowledgement

We would like to thank the many individuals and organizations that provided their time, expertise and access to data and summary information that helped inform this report.

Background

Importance of Grasslands

Grasslands play a pivotal role in the ecological balance of our planet, serving as crucial ecosystems with diverse benefits for both the environment and society (Liu et al., 2022). These expansive areas contribute significantly to biodiversity by providing habitats for numerous species, and in Alberta these habitats contain over 75 percent of Alberta’s species at risk (MULTISAR, 2012). Grasslands also provide valuable resources to mitigate climate change with significant capacity for carbon storage (Bengtsson et al., 2019).

Cause for Concern

Despite their value in ecosystem services, native grasslands are under increasing threat in North America and around the world. Figure 1 shows the Central Grassland Roadmap’s Risk Assessment map (WWF, 2023) illustrating the large areas of the Great Plains that have already been converted for other land uses.

With many sources reporting that native grasslands are amongst the most at-risk and the least protected ecosystems globally, native grasslands are now receiving increasing calls for conservation (Bardgett et al., 2021). A vital first step is to understand where this ecosystem remains and how much remains intact. Alberta is home to some of the Canada’s healthiest and connected remaining grassland (ABMI, 2015).

The Challenge

With a surge in concern and interest in grasslands, and improvements in mapping and remote sensing capabilities and tools, the number of spatial data resources have also increased. These different mapping initiatives often have different purposes and may result in different outcomes. This has caused confusion for end users that are interested in understanding loss of grasslands and remaining grassland extents.

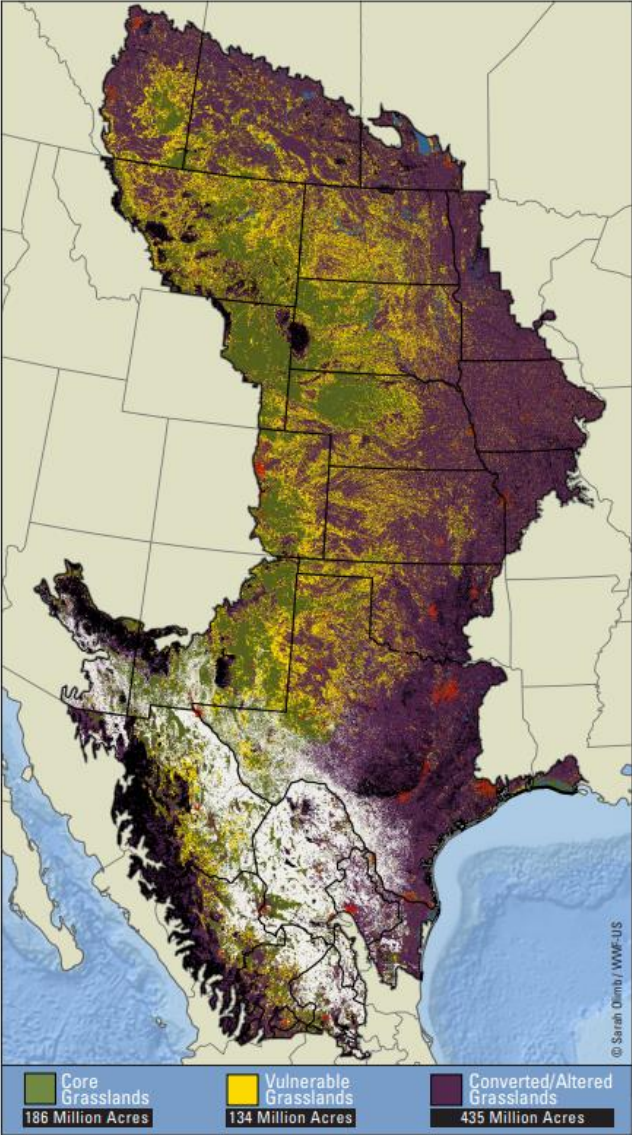


Figure 1. Map illustrating core remaining “intact” grasslands, vulnerable grasslands and converted or altered grasslands from (WWF, 2023)

Project Objectives

This report was prepared for the Alberta North American Waterfowl Management Plan (NAWMP) Partnership, to fulfill the following objectives:

1. Conduct a comparison analysis of existing data and methods being used to monitor and assess the state of native grasslands in Alberta, ownership of those data sets, with a clear discussion on technical aspects.
2. A review and assessment of deficiencies that are relevant to understand including barriers and challenges.
3. A brief review and recommendations on addressing the needs and gaps specific to Alberta, with discussion on the role and responsibilities of various agencies and organizations that have the mandate and interest to do so.

Methods

Scan Method

To conduct a scan of key organizations and individuals involved in grassland work, we compiled a list of potential contacts to interview with input from AB NAWMP Partnership project leads and from suggested contacts from other Miistakis Institute staff. We reached out to members of this initial list to set up interviews where we asked them the following questions:

1. Can you please tell me about the grasslands work you are doing?
2. What grassland datasets do you use in your work? Why?
 - Where can I find this dataset?
 - Is there a technical report associated with the dataset?
 - When was it produced?
 - How often is it updated?
 - What is the scale / dataset area?
3. Are you currently developing (or have you developed) a dataset or resource relevant to assessing the state of the grasslands in Alberta?
4. Is there anyone else you feel we should talk to?

As our interviews progressed, we tailored our questions to each interviewee where possible to follow information paths from previous interviews. We expanded our list throughout this process by adding suggested contacts from each interview. We compiled information and resources from each interview as we went.

In total we conducted 24 interviews at 16 organizations, with several interviews including multiple interviewees within a single organization. Also, we received correspondence through email with six people on our list. Four others did not respond to email requests for meetings, however, we did not pursue those meetings further because the organization was either quite removed from our main focus, or we were able to connect with other individuals from the same organization. Please see the People_Orgs worksheet for more detailed information.

Resource and Initiative Evaluation

Although we compiled a large amount of information related to grasslands, we mainly focused on reviewing the grassland datasets and related models that we learnt about. In this process, where possible, we determined the focus/purpose for the dataset or model, the spatial resolution, data source, timeline (e.g., date of completion) and expectation for repetition. We also tried to capture the definitions for grasslands where possible and other information such as whether or not ground truthing was a large component of the initiative.

Results

The information from our interviews is summarized in Table 1 in this report and Appendices A and B. We found that the types of initiatives could be categorized into large-scale data, models, evaluations/aggregations, and small-scale and field data. The initiatives we included are largely related to the ones that came up frequently during our interviews, however, it is likely that the large-scale datasets are reviewed most thoroughly, whereas the small-scale datasets are presented opportunistically and do not represent the full ranges of these works.

Key Organizations, Initiatives & Datasets

Particularly with respect to large-scale grassland datasets, a small handful of organizations came up frequently in our discussions. A full summary of all the organizations can be found in Appendices A and B, but we provide a summary of the key organizations below.

Agriculture and Agri-Food Canada (AAFC)

AAFC, specifically the Earth Observation research group, is the primary source for datasets covering the extent of grassland related land cover types on a national scale. This group produces the Annual Crop Inventory (ACI) and the Land Use Time Series (LUTS) datasets. The ACI is produced annually from Landsat optical satellite imagery and radar imagery producing 30 m resolution representation of crop inventory with an accuracy of >85%. This dataset provides information in several relevant classes: grassland, agriculture (undifferentiated, pasture/forages, too wet to be seeded, fallow, specific grain types). However, the focus is to provide crop information and this dataset does not differentiate between native and tame pasture. Further, this dataset does not set out to provide information on grassland change and as such does not resolve pixel errors associated with remote sensing methods. Changes observed by comparing year-to-year variation at the pixel level can be due to errors/noise in the data as opposed to real change.

The LUTS dataset (also called semi-decadal) is a time-series of maps produced every five years resulting from a meta-analysis of several spatial datasets developed to provide explicit, high-accuracy, high-resolution land use maps. This dataset provides a better view of change because of the high level of review and consideration of multiple datasets involved in its creation. However, the drawbacks to this dataset are that it is only produced semi-decadally (every 5 years), has a resolution of 30 m, and does not differentiate between native and tame grasslands. On the national scale, and to assess change, this dataset appears to be the most considered.

Canadian Forage and Grasslands Association (CFGGA)

Since 2020, an initiative by the CFGA, called the National Grassland Inventory (NGI) has set out to develop a dataset with a grassland focus. This initiative brought together participants working in the grassland dataset space from each province as well as those working on this question nationally. This included the Prairie Land Inventory (PLI) and the Manitoba Grassland Inventory (MGI), the remotely sensed grassland datasets by the Governments of Saskatchewan and Manitoba, respectively. These datasets both use the same methods. Dr. Nasem Badreldin, Faculty of Agricultural and Food Sciences at the University of Manitoba, is involved in this initiative and has recently completed a similar dataset for Alberta. These datasets all use Sentinel-2 imagery as the source imagery and results in 10 m accuracy. They are also able to differentiate between native and tame grasslands with an approximate 70% accuracy (this value is not yet finalized). However, at the moment, there is no plan for when and how these datasets may be updated and at what frequency. The current methods are heavily reliant on a ground-truthing step that is costly and time consuming. Similar to the ACI that does not attempt to correct pixel error associated with remote sensing, Dr. Badreldin also expressed that using the remotely sensed data included in the NGI to detect change would be affected by the same limitations associated with potential error.

Statistics Canada

Statistics Canada provides a unique set of datasets since these are based on census data rather than the remotely sensed data that are increasingly common. Census data has been collected (in some form) every five years since the 1920s, and in a similar format to current day since 1956. This sort of data presents some challenges since it relies on self-reporting by producers but can add a valuable perspective when combined with remotely sensed data. However, like the AAFC datasets, these are focused on crops rather than native or tame pasture and therefore only have limited relevance to understanding remaining native grasslands.

Environment and Climate Change Canada (ECCC)

A group within ECCC is working on a new dataset (see Change Monitoring in the Canadian Prairies in the Datasets_Resources spreadsheet) that uses machine learning and Landsat imagery to assess land cover change (Pouliot et al., 2021). The dataset uses data from 1984 to present to determine annual change and explores how the change can impact other species. This dataset is currently in a prototype stage but is expected to be completed in spring 2024 and will eventually be an open access product.

Alberta Environment and Protected Areas

The Government of Alberta does not currently have its own province-wide or biome-wide initiative to provide remotely sensed data on grasslands. There are a few datasets that the Government of Alberta has produced in the past. This includes the Native Prairie Vegetation Index (NPVI), the Central Parkland Vegetation Index (CPVI), and the Grassland Vegetation Index (GVI). The GVI, in particular, was touted by users we spoke to in Alberta and some from ECCC, for its high accuracy. Several interviewees expressed the value of keeping the GVI up to date. However, this dataset is based on optical photos and uses vastly different methods than most of the current datasets in development. It is highly accurate but time-consuming and therefore costly to update.

Example Applications

There are some interesting examples of initiatives where researchers are working with existing spatial datasets to understand interactions with wildlife. For example, ECCC, specifically the Canadian Wildlife Service (CWS), used remotely sensed datasets released by

AAFC (the ACI) to produce a conversion risk model (see Agricultural Conversion Risk Model in spreadsheet; Olimb & Robinson, 2019). They then interpreted that information further by combining it with species distribution models to create a landbird model for twenty bird species (see Landbird Conservation Model in spreadsheet Prairie Habitat Joint Venture (PHJV), 2021). A research group within AAFC similarly inferred a wildlife habitat capacity index on agricultural land by combining AAFC's LUTS model with habitat needs by 500+ species (see Wildlife Habitat Capacity on Agricultural Land in spreadsheet).

What We Learned

Likely linked to the recent interest and growing concern about the grassland ecosystem, there are many datasets that attempt to capture grassland extent or are being used as such, even if this was not their primary intent. In Canada, we have thirteen such datasets (John Pattison-Williams, personal communication). In comparison, Mexico has eight and the USA has six. The large number of datasets in Canada reflect a need for consolidation of methods and efforts to provide a single resource or group of resources to meet the needs of end-users.

A review of the existing datasets indicated that they all have benefits and limitations. How these datasets are used should depend on the objective of each initiative, the purpose for which the datasets were built and the source data they are built on.

In our review of this space, we learned that a fundamental issue that may be part of the cause of discrepancy among datasets is a lack of agreement on key definitions. The NGI project is attempting to consolidate some of these differences, and at least some of the datasets included in this initiative (e.g., Manitoba Grassland Inventory (MGI), Prairie Landscape Inventory (PLI) and the Alberta inventory that was developed as part of the NGI) all use the same definitions. These definitions vary in what proportions of area are made up by specific vegetation species or whether or not the land was previously broken. We did not fully capture the variation of definitions being used but note it here as a factor to look for in further work.

There is a keen interest in understanding native grassland loss but caution should be applied to how remotely sensed datasets are used. Users should make sure the tool is suited to their question.

Understanding the State of Grasslands in Alberta

Our assessment suggests that the current best approach to understanding the state of grasslands is the AAFC's semi-decadal LUTS dataset, which is in line with the conclusion made by the Prairie Conservation Forum's assessment in their first State of the Prairie report (2019). Arguably, there are currently no freely available, frequently updated datasets that will allow accurate representation of native and tame grasslands on a fine enough scale to detect change. Despite growing interest and recent initiatives (see the Initiatives to Watch section), this gap remains. One discussion we had during this scan suggested that a more appropriate, cost-effective way to understand grassland loss (native and/or tame) may be to subtract areas where loss is known (e.g., conversion to crop or human development). However, this would only be effective where loss is a result of land use changes and would likely not capture losses that result from woody encroachment and losses through other similar processes.

When working with existing datasets to understand the state of grasslands, Alberta NAWMP should consider:

1. What was the primary goal of the dataset? If the dataset was created to monitor cropland, their application to understand grasslands at the scale and detail needed will be limited.
2. Is the dataset ground-truthed and how? Datasets with ground truthing using grassland types will provide higher accuracy than datasets ground-truthed focusing on crops. But any ground truthing is better than none at all.
3. Because of the pixel-based error inherent in remotely sensed data it is not appropriate to directly compare how pixels change from one year to the next to measure change. This caveat applies to all similar pixel-based identifications and is not limited to the AFFC's Annual Crop Inventory (ACI).

Initiatives to Watch

The reviews that are currently underway by the CFGA and the Commission for Environmental Cooperation (CEC) and are likely to provide in-depth, thorough reviews of this space from the Canadian and tri-national (North American) perspectives. Reviews from both initiatives are expected to be released in 2024 and available to the public. In addition to the review work by the CFGA, the related NGI initiative is certainly one to watch given its national span, 10 m resolution, ability to differentiate between native and tame grasslands, and reliance on ground-truthing. Although several next steps are not certain such as when and how this resource will be shared, and how and how often this inventory will be updated, this initiative has taken large strides forward in increasing discussion and cooperation toward a national grassland inventory. This project also puts a strong emphasis on ground-truthing methods and importantly, shows high accuracy in being able to differentiate between native and tame grasslands.

Environment and Climate Change Canada's from-to change monitoring (called Change Monitoring in the Canadian Prairies in the spreadsheet) is currently in a prototype stage but shows promise in filling a need to understand grassland loss.

The AAFC continues to provide the most frequently updated and reliable datasets. They are continually exploring how best to improve their products.

Next Steps & Future Considerations

The world of people and organizations studying grassland extent or participating in grassland conservation is a vibrant and dynamic place. This area of study has seen rapid change over the last few decades with significant advances in technology. The relative newness of these technologies coupled with the urgent need to understand state of grasslands and risks of loss has resulted in some inconsistencies between what datasets are available and how they are being used.

Given Alberta NAWMP's interest in the state of Grasslands in Alberta, we recommend that any further work to understand and monitor this research area focus on the following areas:

1. Keep an eye on the National Grassland Initiative: We recommend remaining aware of the work being done on this initiative to determine when and how this dataset

will be available to the public. It will also be important to know if an organization is able to take on the role of maintaining this dataset and at what frequency it will be updated.

2. In Canada, current mapping shows Alberta as being home to the largest swath of intact native prairie. Despite this, there seems to be a lack of provincial participation in maintaining a province-scale dataset. It would be a benefit to many organizations working in Alberta if there was logistical and financial support for updating the GVI and taking on the role of updating the Alberta portion of the National Grassland Inventory dataset created during the CFGA initiative.
3. Similarly, could an Alberta-specific conversion risk map be developed that may be more accurate than the current North American one in existence (Olimb & Robinson, 2019)?
4. Grassland habitat in the Peace Region is often overlooked and several datasets we reviewed did not cover this area. As well, with climate change, grassland areas outside of the Grassland and Parkland natural regions (e.g., Peace region) may become more important for agriculture and therefore more at risk to conversion. Future grassland assessments should include this area.
5. While it is tempting to want to wait until the gaps in existing datasets are filled, pressures on grasslands for conversion to other land uses are too high for action to stagnate. As such, end users including Alberta NAWMP Partnership should continue to convey key messages about the importance of grasslands and concerns about potential loss to their target audiences. However, caution and best judgement should be exercised when selecting datasets for this task.
6. During our interviews, we heard about different grassland definitions used when creating different datasets and the role this plays in the dataset outcomes, however, we did not exhaustively compile this information. This is a topic that should be kept in mind as more summaries emerge on grasslands.

Table 1. Summary of key initiatives in grassland mapping and understanding grassland health in North America.

Initiative Type	Name	Lead Organization	Geographic Extent	Description
Large-scale Data	Annual Crop Inventory (ACI)	Agriculture and Agri-Food Canada (AAFC)	All provinces and Yukon Territory	An annual map of crop type based on optical and radar-based satellite images to support a national crop inventory. Resolution, geographic extent and data sources all vary among years. Data presented in this table reflects the most recent year.
Large-scale Data	Land Use Time Series (LUTS)	Agriculture and Agri-Food Canada (AAFC)	Canada, south of 60N	A time-series of maps resulting from a meta-analysis of several spatial datasets developed to provide explicit, high-accuracy, high-resolution land use maps. Data sources all vary among years and information presented in this table reflects the most recent year. AAFC uses this for national reporting and aligned to Intergovernmental Panel on Climate Change (IPCC) definitions.
Large-scale Data	Wall-to-wall Landcover	Alberta Biodiversity Monitoring Institute (ABMI)	Alberta	Polygon-based representation of types and extent of broad land cover classes in Alberta
Large-scale Data	Central Parkland Vegetation Inventory (CPVI)	Alberta Environment and Protected Areas (AEPA)	Central (Aspen) Parkland Natural Subregion of Alberta	The purpose of the Central Parkland Vegetation Inventory was to develop a comprehensive current vegetation / land use database for the Central Parkland Natural Subregion indicating native vegetation versus agricultural land, the number and size of wetlands, public versus private ownership and details of the native vegetation land base. This information was required to address the need for immediate

Initiative Type	Name	Lead Organization	Geographic Extent	Description
				conservation in the Central Parkland Natural Subregion.
Large-scale Data	Primary Land Vegetation Inventory (PLVI)	Alberta Environment and Protected Areas (AEPA)	Only covers eastern Central Parkland	Developed to identify type, extent, and condition of vegetation in the forested and parkland areas of Alberta.
Large-scale Data	Native Prairie Vegetation Inventory (NPVI)	Alberta Environment and Protected Areas (AEPA)	Grasslands Natural Region, Alberta plus some adjacent areas in different Natural Regions	A quarter section-based vegetation inventory. The Native Prairie Vegetation Inventory extends beyond the Grasslands Natural Region to include data for adjacent areas, such as the Cypress Hills. In addition to the Grassland Natural Region, the Native Prairie Vegetation Inventory (NPVI) Polygons include areas that belong to the Foothills Parkland, Central Parkland, Montane, Dry Mixedwood Boreal and Lower Foothills Natural Subregions.
Large-scale Data	National Grassland Inventory (NGI)	Canadian Forage and Growers Association (CFGGA)	Canada	Initiative to create a national grassland inventory being spearheaded by CFGGA but involving many partners. Nasem Badreldin (UofM) has created an Alberta grassland inventory to feed into this project. It does not cover grasslands in the Peace River region. Existing datasets from Manitoba (MGI) and Saskatchewan (PLI) created with the same methods feed into this too.

Initiative Type	Name	Lead Organization	Geographic Extent	Description
Large-scale Data	North American Land Cover and Land Change Monitoring System (NALCMS)	Commission for Environmental Cooperation (CEC)	North America	A North America-wide land cover dataset that uses 19 land cover classes based on the Land Cover Classification System (LCCS) standard developed by the Food and Agriculture Organization (FAO) of the United Nations.
Large-scale Data	Prairie Landscape Inventory (PLI) - Mixed Grassland Classification and Moist Mixed Grassland Classification	Government of Saskatchewan	Saskatchewan	Land cover imagery for the mixed grassland ecoregion of Saskatchewan with a resolution of 10 m. Classification was based on machine learning analysis and remote sensing data of Sentinel-1 and Sentinel-2 imagery. The goal of this land cover was to distinguish native from tame grasslands, and is classified into several classes: cropland, native grassland, mixed grassland, tame grassland, water, shrubs and trees. Please also refer to the Prairie Landscape Inventory (PLI) - Mixed Grassland Accuracy raster file, which depicts the estimated level of accuracy for this this classification. There is a separate dataset for the moist mixed grassland ecoregion.
Large-scale Data	Land Cover Data	Natural Resources Canada (NRCan)	Canada	The Canada Centre for Remote Sensing (CCRS) at Natural Resources Canada uses data collected by Earth observation satellites to produce accurate, efficient and cost-effective data and images of Canada's land cover.
Large-scale Data	Grassland Vegetation Index (GVI)	Alberta Environment and Protected Areas (AEPA)	Grasslands Natural Region, Alberta	Government of Alberta's comprehensive biophysical, anthropogenic and land-use inventory of the southernmost portion of the province's White Area. An update to the NPVI from 1993.

Initiative Type	Name	Lead Organization	Geographic Extent	Description
Large-scale Data	Statistics Canada Census of Agriculture	Statistics Canada	National	Agriculture statistics obtained directly from producers through census. Includes physical, economic, social and environmental information. Crop focused. Closest statistic to native prairie is "unimproved pasture."
Large-scale Data	Statistics Canada Census of Agriculture: Agri-Environmental Spatial Data (AESD)	Statistics Canada	National	Provides estimates for ecological and hydrological watershed geographies based on AAFC's ACI and crop insurance data.
Model	Wildlife Habitat Capacity on Agricultural Land	Agriculture and Agri-Food Canada (AAFC)	Canada	Index of wildlife habitat capacity based on a habitat availability and a habitat association matrix for 500+ species. Agricultural land includes not only fields for food production but also wooded areas, wetlands, shoreline areas and natural pastures on agricultural land, which are also important habitats for wildlife. This model captures how managed agriculture can support wildlife.
Model	Agricultural Conversion Risk Model	Canadian Wildlife Service (CWS)	North American Great Plains (Canada and USA)	A probabilistic ecoregion-wide model using soil, topography, and climate variables to simulate future conversion.
Model	Landbird Conservation Model	Canadian Wildlife Service (CWS)	North American Great Plains (Canada and USA)	A model produced by combining bird species predictive models (CWS) with the agricultural conservation risk model.

Initiative Type	Name	Lead Organization	Geographic Extent	Description
Model	Change Monitoring in the Canadian Prairies	Environment and Climate Change Canada (ECCC)	Canadian Prairies	Assessing change in land cover classes from 1984 to present using machine learning and Landsat imagery.
Model	Isolated Native Prairie Habitats	Prairie Conservation Forum (PCF)	Alberta	Modelled estimation of remaining isolated native prairie habitat.
Evaluation/Aggregation	Summaries of Canadian Prairie Land Conversion and Rangeland Distribution	Canadian Cattle Association (CCA)	Canadian Prairies	Two reviews looking at land conversion and range and distribution.
Evaluation/Aggregation	Review of Canadian Grassland Datasets	Canadian Forage and Growers Association (CFGGA)	Canada	A review of grassland inventories across Canada to support efforts to create a national grassland inventory. The review includes an assessment of accuracy, resolution, data sources and update frequency. A report of findings will be available in Spring 2024.
Evaluation/Aggregation	Central Grasslands Roadmap	Central Grasslands Roadmap	North America	The Central Grasslands Roadmap is a continental initiative to increase conservation of North America's Central Grasslands. Central Grasslands Assessment Map shows core grasslands, vulnerable grasslands and converted/altered grasslands based on AAFC's ACI data.
Evaluation/Aggregation	Grassland Inventory Initiative	Commission for Environmental	North America	Tri-National (Canada-USA-Mexico) work assessing data and methods of grassland inventories.

Initiative Type	Name	Lead Organization	Geographic Extent	Description
		Cooperation (CEC)		
Evaluation/Aggregation	North American Ranching Industries, Beef Cattle Trade, and Grasslands: Status and Trends	Commission for Environmental Cooperation (CEC)	North America	A nice example of a communication piece on grasslands.
Evaluation/Aggregation	Grassland Extent and Loss Datasets Evaluation	Nature Conservancy Canada (NCC)	Canadian Prairies	An unpublished working document evaluating existing grasslands datasets available throughout the Canadian prairies. The goal was to look at datasets for accuracy in recording grassland loss.
Evaluation/Aggregation	Analysis of Grassland Inventories	Nature United	North America	A quantitative comparison and review of existing inventories and development of a land use change model. A tentative timeline for completion is Spring 2025.
Evaluation/Aggregation	State of the Prairie	Prairie Conservation Forum	Grassland and Parkland Natural Regions, Alberta	A report evaluating the state of the prairie. The first report in 2019 evaluated the best/most appropriate datasets to use for this comparison. An update is planned to be released in Spring 2024.
Evaluation/Aggregation	Prairie Habitat Monitoring Program	Prairie Habitat Joint Venture (PHJV)	Canadian Prairies	Status of wetlands and uplands based on a transect monitoring program.
Evaluation/Aggregation	Agriculture Web Mapping Application Tool	The Canadian Agri-Food Policy Institute	North America	A mapping tool that displays datasets e.g., ACI and LUTS.

Initiative Type	Name	Lead Organization	Geographic Extent	Description
Evaluation/ Aggregation	Global Pasture Watch: Mapping & Monitoring Global Grasslands and Livestock	World Resources Institute (WRI)	International	A research consortium with a goal to produce recurrent and high-resolution maps for pasture areas and productivity.
Evaluation/ Aggregation	Plowprint Report	World Wildlife Fund (WWF)	Great Plains (Canada and USA)	An annual report presenting an analysis of grassland loss across the US and Canadian Great Plains.
Small-scale or Field Data	Ecosystem Health Field Monitoring	Alberta Biodiversity Monitoring Institute (ABMI)	Alberta	Data collected at 1,656 randomly selected sites spaced every 20 km across the entire province including remote boreal forests, alpine meadows, and agricultural fields.
Small-scale or Field Data	ACA - Various	Alberta Conservation Association	Grassland/ Parkland regions of Alberta	Collect smaller scale data on wildlife surveys, riparian health assessments, range health inventories, vegetation assessments, bird surveys. Includes work on the MultiSAR project (multisar.ca/learn-more/) and restoration work restoring previously cropped areas to native grasslands.
Small-scale or Field Data	Ecological Information systems Data (ECOSYS)	Alberta Environment and Protected Areas (AEPA)	Alberta	Provincial database that stores data on 26,000+ vegetation and soil plots. This information is used to develop management tools to ensure that public lands are being managed sustainably.
Small-scale or Field Data	Bird Point Data	Canadian Wildlife Service (CWS)	Canadian Prairies	The number of a specific type or types of birds identified during a timed survey.

Initiative Type	Name	Lead Organization	Geographic Extent	Description
Small-scale or Field Data	NCC-Range Health Assessments	Nature Conservancy Canada (NCC)		NCC conducts range health assessments on some properties.
Small-scale or Field Data	Various data collection on Kainai Reserve grasslands	Blood Tribe Land Management (BTLM)	Kainai Reserve	Bison reintroduction, fire reintroduction, native seed collection, data collection on invasive species, range health assessments, traditional plant identification.

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Summary of Initiatives

Initiative Type	Name	Lead Organization	Partner Organization	Geographic Extent	Description	Accessibility	Link	Method	Timeline	Update Frequency	Output Type	Resolution
Large-scale Data	Annual Crop Inventory (ACI)	Agriculture and Agri-Food Canada (AAFC)		All provinces and Yukon Territory	An annual map of crop type based on optical and radar based satellite images to support a national crop inventory. Resolution, geographic extent and data sources all vary among years. Data presented in this table reflects the most recent year.	Open-access. Government of Canada	https://open.canada.ca/data/en/dataset/ba2645d5-4458-414d-b196-6303ac06c1c9	Satellite based inventory. Optical (Landsat-8, Landsat-9, Sentinel-2) and radar (RCM) based satellite images	2009-present	annual	raster	30 m
Large-scale Data	Land Use Time Series (LUTS)	Agriculture and Agri-Food Canada (AAFC)		Canada, south of 60N	A time-series of maps resulting from a meta-analysis of several spatial datasets developed to provide explicit, high-accuracy, high-resolution land use maps. Data sources all vary among years and information presented in this table reflects the most recent year. AAFC uses this for national reporting and aligned to Intergovernmental Panel on Climate Change (IPCC) definitions.	Open Access. Government of Canada Open Data Licence.	https://open.canada.ca/data/en/dataset/fa84a70f-03ad-4946-b0f8-a3b481dd5248	Mixed data inventory. Combines various data sources (e.g., ACI, ABMI's Human footprint, visual observation of imagery in Google Earth) to develop a "best current understanding of what happened in each pixel through the time series"	2000, 2005, 2010, 2015, 2020, ongoing	semi-decadal	raster	30 m
Large-scale Data	Wall-to-wall Landcover	Alberta Biodiversity Monitoring Institute (ABMI)		Alberta	Polygon-based representation of types and extent of broad land cover classes in Alberta	Open Access.	https://abmi.ca/home/data-analytics/da-top/da-product-overview/Data-Archive/Land-Cover.html	Digital classification of Landsat satellite images and enhanced using GIS datasets from the Government of Alberta. Includes 11 classes: water, shrubland, grassland, agriculture, exposed land and different forest types.	2000, 2010, now archived	unknown if this will be updated or replaced	polygon	
Large-scale Data	Central Parkland Vegetation Inventory (CPVI)	Alberta Environment and Protected Areas (AEPA)		Central (Aspen) Parkland Natural Subregion of Alberta	The purpose of the Central Parkland Vegetation Inventory was to develop a comprehensive current vegetation / land use database for the Central Parkland Natural Subregion indicating native vegetation versus agricultural land, the number and size of wetlands, public versus private ownership and details of the native vegetation land base. This information was required to address the need for immediate conservation in the Central Parkland Natural Subregion.	Open Access. Government of Alberta Open Data Licence.	https://geodiscover.alberta.ca/geoportals/rest/metadata/item/865b8ba92665411c87833d1bf1af8914/html	Combination of satellite, air photos and base features derived information.	2012	none planned	polygon	10 m
Large-scale Data	Primary Land Vegetation Inventory (PLVI)	Alberta Environment and Protected Areas (AEPA)		Covers portions of the green and white areas of Alberta. Extends from the north extent of the GVI. Only covers eastern Central Parkland	Developed to identify type, extent and condition of vegetation in the forested and parkland areas of Alberta.	Open Access. Government of Alberta Open Data Licence.	https://geodiscover.alberta.ca/geoportals/rest/metadata/item/2d41d0e64a844a2fbf4485525e17178f/html#dataQualityInfo	Air photo based inventory	Created 2020, data from 2008-2015	irregular	raster	5 m
Large-scale Data	Native Prairie Vegetation Inventory (NPVI)	Alberta Environment and Protected Areas (AEPA)		Grasslands Natural Region, Alberta and some adjacent areas in other Natural Regions	A quarter section-based vegetation inventory intended to provide native prairie vegetation percent cover information at a quarter section resolution. Replaced by the GVI.	Open Access. Government of Alberta Open Data Licence.	https://geodiscover.alberta.ca/geoportals/rest/metadata/item/6c5bbf356eee41f696dd02a70fd5c076/html	Air photo based inventory	1991/1993	none planned	polygon	30 m
Large-scale Data	Grassland Vegetation Index (GVI)	Alberta Environment and Protected Areas (AEPA)	Prairie Conservation Forum (PCF)	Grasslands Natural Region, Alberta	Government of Alberta's comprehensive biophysical, anthropogenic and land-use inventory of the southernmost portion of the province's White Area. An update to the NPVI from 1993.	Open Access. Government of Alberta Open Data Licence.	https://geodiscover.alberta.ca/geoportals/rest/metadata/item/9dea946a24314ca399b89723fcd857fc/html	Air photo based inventory	2006-2016 averaged	none planned	polygon	5 m
Large-scale Data	National Grassland Inventory (NGI)	Canadian Forage and Growers Association (CFGGA)		Canada	Initiative to create a national grassland inventory being spearheaded by CFGGA but involving many partners. Nasem Badreldin (UoM) has created an Alberta grassland inventory to feed into this project. It does not cover grasslands in the Peace River region. Existing datasets from Manitoba (MGI) and Saskatchewan (PLI) created with the same methods feed into this too.	Will be open access. Dataset is not yet complete. Mechanism to host data have not yet been determined.	https://www.canadianfga.ca/en/projects/grassland-inventory/	Sentinel 2 data and machine learning based predictive modelling that relies heavily on ground control data. Ability to update this dataset in the future relies heavily on ability to keep up with ground truthing.	Unknown (first round is nearly complete)	unknown	raster	10 m
Large-scale Data	North American Land Cover and Land Change Monitoring System (NALCMS)	Commission for Environmental Cooperation (CEC)		North America	A North America-wide land cover dataset that uses 19 land cover classes based on the Land Cover Classification System (LCCS) standard developed by the Food and Agriculture Organization (FAO) of the United Nations.	Open Access.	http://www.cec.org/north-american-land-change-monitoring-system/	Based on either Moderate Resolution Imaging Spectroradiometer (MODIS) satellite imagery monthly composites; Landsat 7-8; or RapidEye satellite imagery. Uses NRCAN's Landcover data for Canadian portion.	2005, 2010, 2015, 2020			MODIS: 250 m Landsat: 30 m RapidEye: 30 m
Large-scale Data	Change Monitoring in the Canadian Prairies	Environment and Climate Change Canada (ECCC)		Canadian Prairies	Assessing change in land cover classes from 1984 to present using machine learning and Landsat imagery.	Will be open access once complete	https://www.mdpi.com/2072-4292/13/4/634		Currently at prototype stage; Completion is expected in spring 2024, but may take longer to get online.	Unknown, ideally annual	unknown	30 m

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Large-scale Data	Prairie Landscape Inventory (PLI) - Mixed Grassland Classification and Moist Mixed Grassland Classification	Government of Saskatchewan		Saskatchewan	Land cover imagery for the mixed grassland ecoregion of Saskatchewan with a resolution of 10m. Classification was based on machine learning analysis and remote sensing data of Sentinel-1 and Sentinel-2 imagery. The goal of this land cover was to distinguish native from tame grasslands, and is classified into several classes: cropland, native grassland, mixed grassland, tame grassland, water, shrubs and trees. Please also refer to the Prairie Landscape Inventory (PLI) - Mixed Grassland Accuracy raster file, which depicts the estimated level of accuracy for this this classification. There is a separate dataset for the moist mixed grassland ecoregion.	Open Access. Government of Saskatchewan.	https://geohub.saskatchewan.ca/maps/96741383666c4ba994a40216e7f2460/about	Uses machine learning methods to predict class based on Sentinel-1 and Sentinel-2 data related to ground control points.	2021	unknown, currently acquiring funding to explore updates	raster	10 m
Large-scale Data	Land Cover Data	Natural Resources Canada (NRCan)		Canada	The Canada Centre for Remote Sensing (CCRS) at Natural Resources Canada uses data collected by Earth observation satellites to produce accurate, efficient and cost-effective data and images of Canada's land cover. This is the Canadian contribution to the NALCMS.	Open Access. Government of Canada.	https://open.canada.ca/data/en/dataset/ee1580ab-a23d-4f86-a09b-79763677eb47	Produced using observation from Operational Land Imager (OLI) Landsat sensor	2010, 2015, 2020	semi-decadal	raster	30 m
Large-scale Data	Statistics Canada Census of Agriculture	Statistics Canada		National	Agriculture statistics obtained directly from producers through census. Includes physical, economic, social and environmental information. Crop focused. Closest statistic to native prairie is "unimproved pasture."	Open Access. Government of Canada.	https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3210015301	Census.	1956-2021, ongoing	semi-decadal	csv files	
Large-scale Data	Statistics Canada Census of Agriculture: Agri-Environmental Spatial Data (AESD)	Statistics Canada		National	Provides estimates for ecological and hydrological watershed geographies based on AAFC's ACI and crop insurance data.	Open Access. Government of Canada.	https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3810016501	Combines census information with ACI (more details here: https://www150.statcan.gc.ca/n1/en/pub/16-001-m/16-001-m2023001-ene.odf?st=IBsCBuval)	1986-2021, ongoing	semi-decadal	csv files	
Model	Wildlife Habitat Capacity on Agricultural Land	Agriculture and Agri-Food Canada (AAFC)		National	Index of wildlife habitat capacity based on a habitat availability and a habitat association matrix for 500+ species. Agricultural land includes not only fields for food production but also wooded areas, wetlands, shoreline areas and natural pastures on agricultural land are important habitats for wildlife. This model captures how managed agriculture is able to support wildlife.	Open Access. Government of Canada.	https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/wildlife-habitat-capacity-agricultural-land.html	Uses the AAFC LUTS data primarily, but uses ACI to remove crop footprint. Combines this with information about species-specific habitat requirements.	2016	semi-decadal	image	30 m
Model	Agricultural Conversion Risk Model	Canadian Wildlife Service (CWS)	World Wildlife Fund (WWF)	North American Great Plains (Canada and USA)	A probabilistic ecoregion-wide model using soil, topography, and climate variables to simulate future conversion. Published paper: www.sciencedirect.com/science/article/abs/pii/S15470160X19301517 .	Open Access.	Data: https://osf.io/ffega/	Used AAFC's ACI data from 2009-2016 for the Canadian portion of the dependent variable in the model. More information on the method including covariates included in the model can be found in the published paper.			raster	
Model	Landbird Conservation Model	Canadian Wildlife Service (CWS)	Prairie Habitat Joint Ventures (PHJV)	North American Great Plains (Canada and USA)	A model produced by combining bird species predictive models (CWS) with the agricultural conservation risk model. Current species include Baird's Sparrow, Bobolink, Brewer's Sparrow, Chestnut-collared Longspur, Clay-colored Sparrow, Eastern Kingbird, Grasshopper Sparrow, Horned Lark, Lark Bunting, Le Conte's Sparrow, Loggerhead Shrike, Long-billed Curlew, Marbled Godwit, Savannah Sparrow, Sedge Wren, Sprague's Pipit, Upland Sandpiper, Vesper Sparrow, Western Kingbird, Western Meadowlark and Willet.	Model can be requested from Barry Robinson		Developed for 20 landbird species and four shorebird species using controlled-effort point count surveys from 2009-2018.	2018	irregular; every 2-3 years	raster	
Model	Isolated Native Prairie Habitats	Prairie Conservation Forum (PCF)		Alberta	Modelled estimation of remaining isolated native prairie habitat.	Open Access.	https://www.albertapcf.org/connectivity	Combines species ecology and various available input data sources to determine likely areas of isolated prairie habitat.		unknown		
Evaluation/Aggregation	Summaries of Canadian Prairie Land Conversion and Rangeland Distribution	Canadian Cattle Association (CCA)	Nature Conservancy Canada (NCC)	Canadian Prairies	Two reviews looking at land conversion and rangeland distribution.	Internal document.		Review	Rangeland: 1921-2016. Conversion: 2011-2021			
Evaluation/Aggregation	Review of Canadian Grassland Datasets	Canadian Forage and Growers Association (CFGGA)	Pattison Resource Consulting	Canada	A review of grassland inventories across Canada to support efforts to create a national grassland inventory. The review includes an assessment of accuracy, resolution, data sources and update frequency. A report of findings will be available in Spring 2024.	Will be open access. Not available yet.		Review	2023-2024; completion Mar 2024			
Evaluation/Aggregation	Central Grasslands Roadmap	Central Grasslands Roadmap		North America	The Central Grasslands Roadmap is a continental initiative to increase conservation of North America's Central Grasslands. Central Grasslands Assessment Map shows core grasslands, vulnerable grasslands and converted/alterer grasslands based on AAFC's ACI data.	Spatial resources can be found here: https://www.grasslandsroadmap.org/spatial-resources	https://www.grasslandsroadmap.org/	An aggregation of tools and resources.				
Evaluation/Aggregation	Grassland Inventory Initiative	Commission for Environmental Cooperation (CEC)		North America	Tri-National (Canada-USA-Mexico) work assessing data and methods of grassland inventories.	Will be open access. Not available yet.		Review	Estimated completion: September 2024			

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Evaluation/Aggregation	North American Ranching Industries, Beef Cattle Trade, and Grasslands: Status and Trends	Commission for Environmental Cooperation (CEC)		North America	A nice example of a communication piece on grasslands.	Available Online.	http://www.cec.org/files/documents/publications/11634-north-american-ranching-industries-beef-cattle-trade-and-grasslands-status-and-en.pdf	Summary	published 2015: incorporates data from a range of dates			
Evaluation/Aggregation	Grassland Extent and Loss Datasets Evaluation	Nature Conservancy Canada (NCC)	n/a	Canadian Prairies	An unpublished working document evaluating existing grasslands datasets available throughout the Canadian prairies. The goal was to look at datasets for accuracy in recording grassland loss.	Not open access; shared by request		Review and analysis	2023-ongoing			
Evaluation/Aggregation	Analysis of Grassland Inventories	Nature United	WWF and others	North America	An quantitative comparison and review of existing inventories and development of a land use change model.	Project has not yet started.		Review and analysis	Beginning May 2024; Tentative completion of review is spring 2025		review and model	
Evaluation/Aggregation	State of the Prairie	Prairie Conservation Forum		Grassland and Parkland Natural Regions, Alberta	A report evaluating the state of the prairie. The first report in 2019 evaluated the best/most appropriate datasets to use to compare state of the grassland over time.	Available online.	https://www.albertapcf.org/rsu_docs/state-of-the-prairie-technical-report-final-including-summary.pdf https://www.pnjv.ca/wp-content/uploads/2020/11/ECCC-PHJV_HabitatMonitoringReport_LowRes.pdf	Review and analysis	2019, update: 2024	irregular	report	
Evaluation/Aggregation	Prairie Habitat Monitoring Program	Prairie Habitat Joint Venture (PHJV)		Canadian Prairies	Status of wetlands and uplands based on a transect monitoring program.	Available online.			published 2017 (2001-2011 data)	update expected soon		
Evaluation/Aggregation	Agriculture Web Mapping Application Tool	The Canadian Agri-Food Policy Institute		North America	A mapping tool that displays datasets e.g., ACI and LUTS.	Available online.	https://capi-icpa.ca/land-use-hub/					
Evaluation/Aggregation	Global Pasture Watch: Mapping & Monitoring Global Grasslands and Livestock	World Resources Institute (WRI)		International	A research consortium with a goal to produce recurrent and high-resolution maps for pasture areas and productivity.	Available online.	https://www.wri.org/events/2023/4/global-pasture-watch-mapping-monitoring-global-grasslands-livestock	"The project uses ensemble machine learning algorithms, visual interpretations, crowdsourcing, and earth observation data fusion to produce per-pixel probabilities of land use and land cover, livestock density, short vegetation height, and gross primary productivity (GPP)."	New initiative (2024); data from 2000 onward			
Evaluation/Aggregation	Plowprint Report	World Wildlife Fund (WWF)		Great Plains (Canada and USA)	An annual report presenting an analysis of grassland loss across the US and Canadian Great Plains.	Open Access.	https://www.worldwildlife.org/projects/plowprint-report	Uses AAFC's ACI data for the Canadian extent of this work.	annual			
Small-scale or Field Data	Ecosystem Health Field Monitoring	Alberta Biodiversity Monitoring Institute (ABMI)		Alberta	Data collected at 1,656 randomly selected sites spaced every 20 km across the entire province including remote boreal forests, alpine meadows, and agricultural fields.	Available online.	https://abmi.ca/home/data-analytics/data-top/da-product-overview.html	Various.	frequent (exact timing was not determined)			
Small-scale or Field Data	ACA - Various	Alberta Conservation Association	various	Grassland/ Parkland regions of Alberta	Collect smaller scale data on wildlife surveys, riparian health assessments, range health inventories, vegetation assessments, bird surveys. Includes work on the MultiSAR project (multisar.ca/learn-more/) and restoration work restoring previously cropped areas to native grasslands	Not open access; Summary information can be requested.		Various.	approximately 20 years of data	annual	n/a	n/a
Small-scale or Field Data	Ecological Information systems Data (ECOSYS)	Alberta Environment and Protected Areas (AEPA)		Alberta	Provincial database that stores data on 26,000+ vegetation and soil plots. This information is used to develop management tools to ensure that public lands are being managed sustainably.	Open Access. Government of Alberta.	https://open.alberta.ca/opendata/ecological-information-systems-data#summary		2016	unknown	csv files	
Small-scale or Field Data	Various data collection on Kainai Reserve grasslands	Blood Tribe Land Management (BTLM)		Kainai Reserve	Bison reintroduction, fire reintroduction, native seed collection, data collection on invasive species, range health assessments, traditional plant identification	Not open access.		Various.				
Small-scale or Field Data	Bird Point Data	Canadian Wildlife Service (CWS)		Canadian Prairies	The number of a specific type or types of birds identified during a timed survey.	Data can be requested.		Field point survey methods.	2009-present	annual		
Small-scale or Field Data	NCC-Range Health Assessments	Nature Conservancy Canada (NCC)			NCC conducts range health assessments on some properties.	Not open access. A portal is in the works to share some data.					raw data	