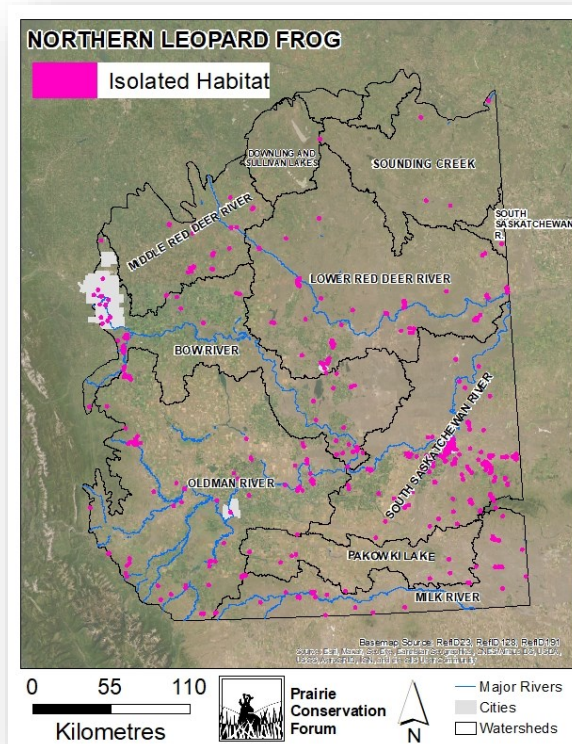




Framework for Grassland Species-at-risk Isolated Habitat Mapping in Alberta



VERSION 1.1

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Acronyms

Abbreviation	Description
ABMI	Alberta Biodiversity Monitoring Institute
ACIMS	Alberta Conservation Information Management System
ATS	Alberta Township System
CV	Conservation Value
EID	Eastern Irrigation District
FWMIS	Fish and Wildlife Information Management System
GIS	geographic information system
GoA	Government of Alberta
GVI	Grassland Vegetation Inventory
KBA	Key Biodiversity Areas
LAT	Landscape Analysis Tool
LSD	Legal Subdivision
LUT	Look Up Table
MULTISAR	Multiple Species at Risk
NR	Natural Region
PCF	Prairie Conservation Forum
SAR	Species-at-risk

Introduction

The 2021-2025 *Prairie Conservation Action Plan* (PCAP 2020) identified three strategic outcomes: 1) maintain large native landscapes, 2) conserve connecting corridors, and 3) protect isolated native habitats. In support of the third outcome in the Action Plan, three main ‘action items’ were identified:

- ✓ Define ‘isolated habitats/fragments’,
- Map isolated native prairie habitats, and
- Identify/categorize value(s) to isolated habitats/fragments.

In 2022, the Prairie Conservation Forum (PCF) conducted a literature review entitled *Isolated Habitats – Assessment of Native Grasslands in Alberta for Isolation, Values, and Management Implications* (Taylor 2022), where the term ‘isolated habitat’ was conceptually defined as the degradation or loss of connections between resource patches. The literature review provided a focus for the second action item: mapping isolated native prairie habitat, by defining a suite of concepts and tools upon which to conceptualize isolated habitat, including focussing on isolated habitats for endemic grassland species-at-risk (SAR), for use when prioritizing future isolated habitat mapping Projects.

To continue the implementation of the isolated habitat mapping initiative, PCF retained a Biologist and Geomatics Specialist to develop a framework for the overall management of the isolated habitat initiative, as well as detailed requirements for future Mappers on how to approach Project design, data analysis, map output, and deliverable specifications. This *Framework* can be used by PCF when issuing future ‘requests for proposals’ to ensure that all candidates understand the scope and expectations. It is assumed that any Mapper using this *Framework* has specialized knowledge of habitat models, mapping, and/or geomatics, as well as a working knowledge of species ecology.

The *Framework* is simple, robust, flexible, and standardized, and ensures each Project is repeatable. The *Framework* provides an ‘action item’ management process where the PCF Organization can track Projects, track and store proprietary data, and incorporate Project-specific additions to the ongoing improvement of the *Framework* and its associated tools. A primary focus of the *Framework* was to define data management requirements so that deliverables from different Mappers are standardized scientifically-defensible and mitigate PCF’s risks associated with using or sharing proprietary spatial data (particularly related to SAR locations).

Scope of Isolated Habitat Mapping Framework

The Isolated Habitat Mapping *Framework* consists of this Word document (further referred to as *Framework*), which provides detailed specifications, instructions and considerations for Mappers retained by PCF on a per Project basis, plus a suite of supportive tools that include:

- The **Framework Tool**, an Excel spreadsheet, with a suite of tabs that are used to document Project design and methods, as well as track Isolated Habitat Projects ([Appendix A](#)),
- The **SpeciesDB**, an Excel spreadsheet, where each row represents one grassland SAR, and the species record is populated with a variety of species attributes (columns), such as rarity designation and habitat requirements ([Appendix B](#)), and
- The **Report** template, a Word document, provides an example of a species *Report*, with specifications for content and graphics detailed in [Appendix C](#).

This framework does not address contract management or coordinating the end use of the data.

Project Development

The outcome of the initiative is to encourage land stewardship by identifying areas where landowners and land users can focus stewardship efforts that result in a reduction of isolating conditions. The objectives of each Project are to map isolated habitat for the selected SAR and produce a *Report* that provides an overview of the SAR's ecology, habitat requirements and rarity, followed with a brief description of isolating conditions, where that SAR's isolated habitat is found in Alberta, and 'calls to action' that can be taken to reduce isolating conditions.

Designing an isolated habitat mapping Project involves four main steps: define analysis objectives; prepare input data; model/map isolated habitat; process map output, document methods and results, and draft a *Report*.

Step 1: Define Analysis Objectives

When designing an isolated habitat mapping Project, there are several decisions that Mappers will need to make, based on species' ecological needs, knowledge of species movement behaviour, availability and relevant and available habitat data, relevant data that represents barriers or isolating factors, and the approach for identifying isolated habitats. The first decision involves species selection, and from this the Mapper can then define what constitutes a habitat/resource patch for that SAR, as well as how to geospatially represent it. Next, the Mapper must define what constitutes an isolating factor or condition. Defining and mapping isolating factors are the main focus of the analysis, and may include land features, land cover types, or land use activities that change the species movement behavior, including those that degrade existing habitat so that it is avoided.

To focus Project study design, a list of 65 priority endemic grassland SAR was created (Taylor 2022), from which Project SAR species will be selected. These priority species include 32 vertebrate animals (i.e., birds, amphibians, reptiles, and mammals), 10 invertebrate animals (i.e., insects) and 23 vascular plants. The concept of isolation is different for each species and must be explored and defined on a per Project basis.

Species Selection

- Priority Endemic Grassland SAR
- Rarity
- Occurrence/habitat data available

The list of priority species identified in the Literature Review (Taylor 2022), provided the basis of the *SpeciesDB*, with attribute fields and species-specific information added for habitat descriptions, potential data source information (such as number of FWMIS observation records available (L. Biylk pers. comm., 2023) and availability of predicted habitat data (P. Wesveen, pers. comm., 2023)), and rarity information (such as rarity designation, including: conservation status rank, general status, Alberta *Wildlife Act Regulations* Schedule 6 listing, Canada *Species-at-risk Act Regulations* Schedule 1 listing, or the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designation). PCF will provide Mappers with directions for species selection on a per Project basis.

Once a species is selected, the next step in defining the analysis objective, is describing the species ecology and habitat requirements. This information should be populated in the *SpeciesDB* by the Mapper and used as content for the *Report*. Often different phases in a species' life cycle may occur in a

different habitat; therefore, it helps to describe habitat requirements for each life phase. Once species and habitat ecology are known, Mappers must then find ecologically relevant geospatial datasets that can be used to represent mapped habitat. Once the Mapper has identified habitat for a SAR, the next step is to identify how a SAR travels/disperses/moves in a day, in a season, in a year, or throughout its lifespan within and between its mapped habitats. By understanding species movement behavior, the Mapper can define isolating factors and conditions that affect natural movement behavior within and between habitat patches/areas selected for analysis and acquire and process available datasets that can be used to represent them.

Isolated Habitat

- Habitat Matrix/Patch
- Isolating Factors
- Barriers

The term 'Isolated Habitat' will be defined on a per Project basis, as it is species-specific. In general, it refers to any land use activity or land cover feature that blocks, deters, or changes the species movement behavior. Pragmatically, isolated habitat is a subset of habitat; therefore, Mappers must first map habitat and then determine if the habitat is isolated.

Defining Habitat

Mappers must conceptually define habitat for their SAR and then map it. Defining habitat starts with an understanding of species ecology. In general, any species' life cycle can be represented as seed/egg/spore → origin → growth → maturation → reproduction → seed/egg/spore. Defining the SAR's life cycle provides a tool for understanding movement behavior, by connecting the different activities that occur at different phases.

For their SAR, Mappers should describe:

- Stationary life phases/activities,
- Mobile life phases/activities,
- Travel/dispersal behavior between stationary activities and during mobile activities (e.g., route, dispersal vector, duration, time of day), and
- Where do these different activities occur in Alberta's grassland landscape.

There are different types of habitats to consider when conducting this analysis, particularly in the grassland landscape, where habitat patches are often large landscape features, or large areas that contain multiple, interspersed, or complexed habitat types. It is helpful to analyze the Grassland Vegetation Inventory (GVI) (GoA 2019) to summarize the various site types and their distribution in the polygons spatially associated with observation locations. In Alberta's grasslands, complex habitats are extensive, and examining GVI can help to provide a more detailed description of SAR habitats. Several complex habitats (NatureServe 2020) should also be considered when Mappers describe habitats, such as: islands/patch habitat, continuous stable habitats, riparian/river features, dynamic landscape mosaic habitats, such as Badlands, Choppy Sandhills and wetlands.

Defining Isolating Conditions

Isolating conditions depend on the SAR, but generally relate to:

- Barriers or features on the land that affect the species' movement behavior/impediments,
- Changes in corridor connectivity, that change movement behavior,
- Changes in external environmental conditions that change habitat, and
- Changes to movement/dispersal mechanisms.

When examining isolating conditions, cause and effect are dependent on the species ecology and methods of movement/dispersal. Mappers should consider the following:

- Isolating conditions for water dispersal species can include:
 - Drought can prevent dispersal for sensitive annual species but is a hard impact to map,
 - Distance from water is often used when describing connectivity and home range, and
 - Stabilization can prevent erosion and sedimentation process required for some seed dispersal in some plants.
- Isolating conditions for wind dispersal species can include:
 - Stabilization can prevent erosion and sedimentation processes required from seed dispersal in some plants,
 - Presence of wind turbines and large structures, and
 - Presence of woody vegetation.
- Isolating conditions for aerial migration species can include:
 - Distance between suitable landing patches,
 - Aerial structures interrupt bird and bat flight patterns and some types can be mortality hotspots,
 - Above-ground wires are high mortality hotspots,
 - Airports can interrupt bird flight patterns and are mortality hotspots, and
 - Roads are mortality hotspots for many types of insects.
- Isolating conditions for terrestrial migration/movement/dispersal species can include:
 - Natural land cover that are impassable, such as lakes, badlands, and wide rivers,
 - Roads and railways, which are mortality hotspots for many terrestrial mammals, and vectors of weed seeds, noise-, air- and light-pollution,
 - Anthropogenic uses that remove habitat and create inhospitable environments, which often increase risk of mortality or decrease survivorship, and
 - Sensitivities of species to various land uses/intensities of activities.

Map/Model Approach

- Input Data
- Mapping/Modelling Isolating Conditions
- Output Attributes

Taylor (2022) explored some ways in which to define and map habitat patches by describing different types of habitat extents or ranges of many of the priority SAR, such as home range, foraging range, breeding territory and brood territory. This concept of a habitat patch can also be applied to plants, such as a stand of trees, extent of occurrence or dispersal range. These concepts help Mappers to build a methodology for spatially representing habitat for their SAR. When creating a methodology for spatially representing isolating conditions, reviewing the threats to a species can help inform how land use and land cover features impact species movement. Using the Grassland Vegetation Inventory (GVI) (GoA

2019) and the Alberta Biodiversity Monitoring Institute's (ABMI's) Human Footprint Inventory (ABMI 2019) are anticipated for each Project, but the isolating effect of each site type or feature type will differ depending on the SAR. Additionally, the provincial hydrology and wetland inventories and other open-source datasets listed in the *Framework Tool*/References tab may prove useful for mapping habitat and isolating conditions.

Mappers must document how they mapped the habitat of their species and how they determined whether or not it was deemed isolated in the Project *Framework Tool*.

End Users

- PCF Connectivity Portal
- Land Users

During the development of this *Framework*, PCF identified two primary outcomes for each SAR Isolated Habitat Mapping Project:

1. Maps that can be accessed by the public through the PCF Connectivity Portal, and which indicate areas where habitat for a given species was deemed isolated, and
2. Educational materials for landowners and land users, which contain a synopsis of the SAR, its rarity, habitat, threats, and isolating conditions. This information should include ways in which small considerations and changes in land use activities can support conservation of a given SAR.

The technical specifications of the output spatial dataset are important to define for any study and depend on the intended end user. Understanding how map output is going to be used is essential when defining spatial parameters, attributes, and analysis method. For this initiative, the general public is the primary end user; therefore, it is important to have any representations of existing or known observation locations, per data sharing agreements. Mappers must ensure that output spatial files meet specifications in the *Framework Tool*/Global tab.

Other end users may be considered by Mappers early in Project planning. Other potential users are listed in the *Framework Tool*/EndUser tab. Potential end users and useable output parameters are discussed in [Appendix D](#).

Step 2: Model/Map Inputs

Model/mapping inputs are spatial datasets or imagery that are used to spatially identify habitat and isolating conditions.

Data Sources

Both open-source and proprietary data can be used as input or reference data; however, they must be treated differently. Open-data can be obtained without a data sharing agreement in place, with general use principles applied. Proprietary data, such as occurrence data and habitat suitability mapping may be acquired through a data sharing agreement, where specifications of use are detailed. Proprietary data may also be sensitive, particularly SAR observation/occurrence data; therefore, additional management and use of these datasets is required. It is up to the Mapper to determine what types of data will be used, acquired, processed, output and stored.

Species Occurrence/Observation Data Sources

This framework focusses on SAR, therefore, any SAR location information acquired through a data sharing agreement, or derived from this data must never be made available to the public, and if displayed on publicly available platforms, must be sufficiently hazed to mask the exact location.

Species observation data may be acquired through data requests to the following sources:

- ACIMS for vascular plant and invertebrate animal SAR
- FWMIS for vertebrate animal SAR
- EID for any SAR observations that overlap the district
- Provincial SAR for a given species (if listed on *Wildlife Act Regulations* Schedule 6)

Acquisition of Occurrence Data

Mappers must request observation data from the appropriate source and will be required to initiate a data sharing agreement request. Requests and observation data sharing agreement and data transmittal correspondence shall cc the PCF Executive Director, who will ultimately need to agree to the data sharing agreements. Data sharing agreements and the original observation data received must be stored in **IH#/Data/Original/DataSharingAgreement**, with the following information added in the Mapper's Project *Framework Tool*/Reference tab:

- Filename
- Date received
- Data sharing agreement status
- Number of records
- Data type
- Projection

When Mappers initiate requests from these sources, they must ensure that e-mails and data sharing agreement communications include the PCF Executive Director at info@albertapcf.org.

Occurrence/observation sources (e.g., ACIMS vs FWMIS) collect and store different information for each species observation, as well as store data in different formats. The following provides an overview of the data, how it is stored, and limitations associated with each source. In general, the SAR observation location information must not be released publicly or to any organization; any maps or figures created using the observation location information, which are intended to be released publicly, must be sufficiently "hazed" to prevent identification of exact locations; and the SAR location information is only

used for the given Project, for which it was requested. It is up to the Mapper to determine how to use or stratify occurrence data so that it is ecologically relevant. This includes considering how current the data is, how data was processed for storage, how accurate the location information is, etc. Treatment of this data must be described in the Mapper's Project *Framework Tool/Methods tab*.

Alberta Conservation Information Management System (ACIMS)

ACIMS provides two types of data to the public: sensitive element occurrence data, which is hazed to township, and non-sensitive species occurrence, which includes a buffered representation of original observation locations. To obtain more specific data for sensitive element occurrences, data must be requested from ACIMS and then a permission process is initiated to request release of data, including requesting permission from associated stakeholders. A detailed project description along with details as to how the data will be used is requested on the external guidelines form. The guidelines form indicates the conditions and restrictions associated with using and releasing the data. Occurrence data (both sensitive and non-sensitive) represents polygonal buffers of original observation locations using an uncertainty buffer radius, whose length is based on the confidence in location information.

Fish and Wildlife Management Information System (FWMIS)

Counts of observation records for many vertebrate SAR were acquired from FWMIS and are stored in the *SpeciesDB*. These counts reflect the number of reported observations in FWMIS to provide Mappers with a relative number of occurrences per SAR; however, there are many records that may reflect multiple years' data at a single location. Species observation data are provided as point locations in an Excel spreadsheet.

The Grassland Natural Region overlaps with the Eastern Irrigation District (EID) in southern Alberta. Due to a 3rd party agreement between the EID and the Government of Alberta (GoA), FWMIS records can only be released for this area if permission is granted from EID. To gain permission to access any possible data from within the EID contact Daniel.buell@eid.ca.

Environmental/Land Use Data Sources

To provide a spatial analogue of habitats and isolating factors, spatial datasets and imagery can be obtained from a variety of sources. Different types of data that reflect a variety of themes are acquired in a variety of ways. Mappers must understand limitations and bias for each dataset used and determine if the input bias affects the output results.

When conducting geospatial analyses, there are differences depending on the type of data that is being used: vector versus raster. Observation data, GVI and the Human Footprint are provided in vector format, as this allows for multiple attributes to be captured per point or polygon. Other environmental data, such as streams, wetlands and other types of land cover or land use mapping are usually provided as vector data. Some environmental data are available in raster format, such as imagery-derived data like Wet Areas Mapping and Normalized Differential Vegetation Indices.

For analyses using mapping/modelling algorithms or software, input datasets must be standardized and in the same format. Preparing source data for these applications often requires generalizing vector data by converting it to raster format for input. Converting vector data to raster data usually results in loss of attributes and spatial accuracy, as a raster can only have a single value, and when converting polygons to rasters, the resulting raster dataset is either huge to maintain the details, or the details are lost in

larger output rasters needed to make the overall dataset smaller. Large datasets can create issues when using mapping/modelling algorithms or software and may create issues. Generally, vector data can hold more information than raster data and are easier to edit, but sometimes the irregular shapes of vector data (versus raster squares) cause files to corrupt during spatial analysis. In the case of GVI and the Human Footprint, troublesome polygons include watercourses, small wetlands, and narrow, linear features, such as badlands and roads that cause issues during processing.

A list of open source and proprietary spatial datasets was provided in the *Framework Tool/References* tab. For each Project, Mappers must add new records for any new or updated spatial datasets used, including environmental datasets, occurrence datasets, and new 'input' datasets created for the Project. Original open-source data does not need to be stored or saved for this initiative; however, any processed version of open data used as an input in the model/mapping must be included in the deliverable as specified in [Appendix E](#).

Resource Selection Function (RSF) models and Habitat Suitability Index (HSI) surfaces were obtained from MULTISAR and are stored in **IsolatedHabitats/Data/Originals/MULTISAR** on the PCF server for use by future Mappers upon request. In the *SpeciesDB*, priority species with a corresponding RSF/HSI dataset have been identified. There are some limitations associated with these datasets, including the limited extent, and other limitations (P. Wesveen, pers. comm. 2023):

- These are not considered corporate geospatial datasets so they do not fall under typical licensing conditions with GOA; however, these must only be used for Isolated Habitat mapping projects.
- Acquisition of these datasets were approved from the GoA's business unit data owner.
- For the majority of models, there is a raw HSI/RSF and a normalized version (denoted by “_n” in the name). The normalized models were used as input into the MCV model.
- Some model outputs did not need to be normalized as they were already within a range of values between 0-1. These include FEHA, LBCU, PRRA, RGSQ.

Step 3: Isolated Habitat Mapping/Modelling Approach

Once the Project's analysis objectives have been identified through a review of species ecology and available input data sources, habitat maps and spatial datasets that represent isolating conditions are analyzed by the Mapper to determine whether a habitat is deemed isolated. To derive ecologically-relevant model input data, the dataset may require transformation or pre-processing to extract information and present it in the desired way. This involves transforming attributes, as well as spatial processing, which may include clipping the extent of source data to the extent of analysis, converting vector data to raster data, and projecting into the analysis coordinate system. Depending on the modelling/mapping approach, some connectivity models may also require some specific parameter settings, particularly to specify the desired output. Mappers must document input data processing and model parameterization or mapping specifications in the Mapper's Project *Framework Tool/Checklist* tab.

In its simplest form, known SAR habitat can be defined as the area of land upon which an individual or population has been observed. In Alberta, observation data also includes some observation specifics, such as the life cycle phase observed (e.g., adult, nest, seed pod), thus allowing Mappers to filter observations as needed. Connecting individual observations with habitat can then be accomplished by using observation locations with mapped environmental datasets. In the Alberta grasslands, the Grassland Vegetation Inventory (GVI) (GoA 2019) provides a fine-scale land cover inventory and as a

multi-relational complexed spatial dataset that can be processed in a variety of ways to represent different environmental conditions and isolating conditions associated with anthropogenic land cover types. Furthermore, the Human Footprint Inventory (ABMI 2019) provides fine-scale land use mapping. Although these are fine-scale and detailed inventories, it should be noted that they were published in 2019 and were based on imagery that was acquired prior to publication. Regardless, these datasets are of sufficient currentness for the purposes of map output.

When selecting the mapping approach, Mappers need to balance the amount of time required to create different input datasets, based on the issues associated with vector source data formats and the raster input data format required by modelling/mapping algorithms and software. For example, if a Mapper is modelling watercourses to create a corridor layer using the provincially mapped stream network, then Mappers would need to make sure that no gaps in connectivity of watercourses were created when converting the source dataset. If spatial connectivity is not maintained when converting vector watercourses to a raster dataset, the results may show a false gap in connection.

In many cases, the time and effort to automate connectivity may outweigh the accuracy of the results, creating a trade off on effort versus accuracy. In some cases, the source data for habitat and isolating factor mapping may prohibit some mapping/modelling approaches. In some cases this can be ameliorated by manually analyzing habitats to determine whether or not they are deemed isolated based on the same data and assumptions that would be used in the model algorithm or software. For both approaches, and in the simplest sense, input data, such as mapped habitat polygons/areas plus mapped features that represent isolating factors for a given species, as defined by the Mapper, are combined in some way to determine where isolating conditions exist in relation to the habitat patches (i.e., within a patch or between patches).

Step 4: Map Output, Reporting and Deliverables

There are two spatial dataset outputs: SAR habitat and SAR isolated habitat, where isolated habitat polygons are a subset of all habitat polygons. The primary use of the output is display general areas that could benefit from grassland SAR-specific stewardship or management efforts. The isolated habitat map will be available through the PCF's Connectivity Portal, and will contain isolated habitat patches plus the rationale for isolation included as a Comment (refer to [Appendix F](#) for map deliverable specifications). Metadata must be applied to the final spatial dataset deliverables, as well as any input datasets created for the analysis (e.g., resistance layer), with detailed specifications for input data deliverables provided in [Appendix E](#).

Mappers will create a 2- to 3-page 'infographic-style' report, based on information they used to populate the *SpeciesDB* and rationalize their approach detailed in the Mapper's Project *Framework Tool*. The goal of the report is to provide a concise summary of the SAR and results of the isolated habitat mapping and ending with a 'call to action'. Using PCF's "SAR_Isolated Habitat Report Template.docx", which provides an example of required content components ([Appendix C](#)). Mappers will create content based on information they used to populate/update required tabs in the Mapper's Project *SpeciesDB* and *Framework Tool*.

Report contents of the *Report* include:

- Species & habitat ecology,
- Rarity status,
- Life cycle graphic,
- Movement behaviour,
- Mapping definitions,
- Map figure ([Appendix C](#) Specifications), and
- Images/Photos to represent:
 - species form, habitat and a barrier/threat,
 - Mapper's must insert stock images/icons, or Mapper's image, and/or recommendations for graphics/photos, and
 - For each image inserted (not needed for icons), Mapper must insert a Comment, via the Review tab in Word, which indicates:
 - "Appropriate stock image",
 - "Needs an appropriate image", or
 - Mapper's copyright credit (and 'stamped' into the image or added as text).

Each Project involves habitat mapping and isolation analyses, which are documented in a way in which they can be repeated. This makes them scientifically-defensible, even though the output is not designed for the scientific community. As such, PCF has drafted a User Notice for the *Report* that explains the limitations of use.

User Notice

Isolated habitat maps represent general areas that might benefit from SAR-specific habitat conservation efforts. PCF makes no representation or warranty, either expressed or implied, in fact or in law, with respect to the accuracy.

Internal discussion on the contents of the *Report* identified the potential for conflicts in species-specific recommendations or actions between two species whose habitats overlapped. For example, a suggested action for ferruginous hawks might suggest adding nesting perches, but hypothetically an added perch may be installed near a swift fox den, which then conflicts with conservation management of swift fox, upon whom the hawks prey. As such, PCF has identified the following approach for promoting stewardship or land management opportunities associated with isolated habitat maps by:

- Connecting landowners with member organizations,
- Connecting land managers with information, and
- Promoting additional research.

To connect landowners with member organizations the following text will be included in each *Report*: *Species-specific habitat management activities are meant to reduce isolating conditions and re-connect isolated habitat patches for a given SAR; however, there is no one-size-fits-all approach. In the grasslands, it is often the case where habitat patches of one SAR overlap habitat patches of another. In some cases, the presence of one SAR, like a Ferruginous Hawk nest, may be a barrier to another SAR, like a Swift Fox den.*

Visit PCF's [Isolated Habitat Webpage](#), to find organizations who can:

- provide specific opportunities for habitat enhancement, development, and restoration of prairie habitats, and/or
- help you to establish your legacy through SAR habitat conservation on your land.

A curated list of member groups will be added to PCF's [Isolated Habitat](#) webpage (Appendix G).

To connect land managers with information, PCF will explore the possibility of providing limited use of output spatial datasets to regulatory bodies, member groups, and land use planning practitioners. It is anticipated that isolated habitat maps would be consulted prior to any land use changes in southern Alberta, and that if present, it may trigger the need for a pre-purchase or pre-disturbance assessment, depending on the activity and type of habitat.

To promote additional research, PCF will consider pursuing projects that explore additional types of isolated habitat analyses, such as those to identify priority areas that represent overlapping isolated habitat polygons of multiple SAR.

To ensure due diligence, draft reports will be approved by the Board, prior to publication; therefore, the 'draft' Watermark should be left in the Mapper's Deliverable and removed when published on PCF's website.

Mappers are responsible for ensuring that:

- The *SpeciesDB* is updated, and information matches that used in the *Report*,
- The *Framework Tool*/Checklist, /Methods, and /Results tabs are consistent with information presented in the *Report*, and
- The output geospatial datasets mask known SAR locations, yet still identify lands within which stewardship and management efforts should focus.

For each Project, Mappers will transmit digital deliverables electronically:

- To PCF's Executive Director, at info@albertapcf.org (via e-mail or a file transfer protocol, depending on the size), and
- As a zipped file (named: IH#_IsolatedHabitatfor_[SpeciesCode]_[date].zip), which contains all Project, as detailed in Table 1.

Isolated Habitat Initiative Management

Project Management

To start a Project, PCF will create a new record in the MASTER *Framework Tool*/ProjTracking tab, which tracks the Project and provides the Project ID (IH#) and select a species. PCF will provide the Mapper with a Project *Framework Tool*, *SpeciesDB* and *Report* template. Once started, PCF will provide input to study design, as well as support data management and file management requirements. At the close of the Project, PCF will ensure all MASTER documents are updated, deliverable files stored, and the project record in the Framework Tool/Projtracking tab updated ([Figure 1](#)).

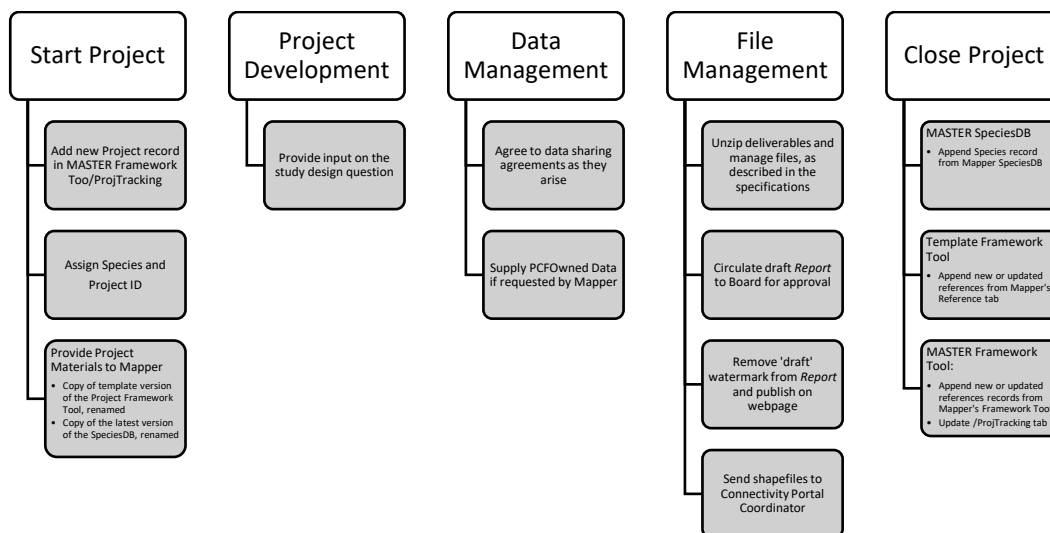


Figure 1 Overview of Initiative Management Tasks

File Management

The file management protocol standardizes file naming conventions and storage pathways and ensures version control of MASTER and template files. Mappers and PCF file management specifications are summarized in Table 1 and Table 2 and found in the MASTER and Project *Framework Tools*/FileMgmt tab.

The following file management and file naming conventions for Mappers and PCF will ensure consistency across Projects. Folder names and pathways are in bold. For file naming conventions below, note that there are no spaces in folder names on purpose, folder names are bolded, and a file pathway is denoted with '/'. Square brackets '[' indicate that the content requires updating to the actual value for implementation. ProjectIDs (i.e., IH#), provided by PCF, and Species Codes must be referenced in the filename of all deliverable files.

Table 1 Mapper File Management Overview

Root Directory	Folders	Sub-folders	Filename & File Type	Description
IH#/ 	Data/	-	IH#_[SpeciesCode]_IsolatedHabitatMap_[date] Acceptable types: .jpg, .png, .tif	High-resolution Map of Isolated Habitats
			IH#_[SpeciesCode]_HabitatThumbnail_[date] AND IH#_[SpeciesCode]_IsolatedHabitatThumbnail_[date] Acceptable types: .jpg, .png, .tif	Two thumbnail images: 1) habitat and 2) isolated habitat
		Deliverables/	Filenames: 1) [Project Code]“_Habitatfor” [_Species Code][_date] AND 2) [Project Code]“_IsolatedHabitatfor” [_Species Common Name][_date] Minimum format requirements in Global tab File type: either as a shapefile (.shp plus at least 5 other associated files), or .gdb	Two (2) spatial datasets/shapefiles: Habitats and Isolated Habitats, where 'Isolated Habitat' polygons are a subset of 'Habitat' polygons (which can also be the same #)
			Filename: [Project Code]“_ModelInput_[RefID][_date] File type: either as a shapefile (.shp plus at least 5 other associated files), or .gdb	Input spatial datasets modified for input for the Project
			Originals/	As received (often an excel spreadsheet)
		Originals/ DataSharingAgreement	As received (often as a .pdf and/or within the body of an e-mail (save to .txt)	Data sharing agreement and associated correspondence
	Documentation/		PCF_IsolatedHabitatMappingTool_[Project Code]_[Species Code]_[date].xlsx	Project version of <i>Framework Tool</i> spreadsheet
			GrasslandSARSpeciesDB_IsolatedHabitats_[Project Code] _[Species Code]_[date].xlsx	Project version of the <i>SpeciesDB</i> spreadsheet
			SAR_Isolated Habitat Report_IH#_[SpeciesCode]_Draft_[date].docx and .pdf	Content for a 2- to 3-page <i>Report</i> in edited document template

Table 2 PCF File Management Overview

PCF File Management					
Root Directory	Folders	Sub-folders	Filename & File Type	Description	Action
IsolatedHabitats/	DataLibrary/	Originals/	various (sometimes in an Excel file)	Proprietary or sensitive data provided by 3rd parties, such as occurrence data from ACIMS or FWMIS should be stored here	Copy all files from Mapper's /Data/Originals/ folder to Originals/
		PCFOwned/	Filenames: 1) [Project Code]“_Habitatfor” [_Species Code][_date] AND 2) [Project Code]“_IsolatedHabitatfor” [_Species Common Name][_date] File type: either as a shapefile (.shp plus at least 5 other associated files), or .gdb	Map output deliverables: 1) Habitat and 2) Isolated Habitat (a subset of Habitat)	1. Copy all files from Mapper's /Data/Deliverables/ folder to PCFOwned/ 2. Ensure Comment Field is populated for all Isolated Habitat Polygons
			Filename: [Project Code]“_ModelInput_[RefID][_date] File type: either as a shapefile (.shp plus at least 5 other associated files), or .gdb	Processed input datasets used for model/mapping (e.g., resistance layer) from each completed project, copied from Mapper’s Data/Deliverables/ pathway	Copy from Mapper's /Data/Deliverable/ folder to PCFOwned/
	Management/	Documentation/	1. PCF_IsolatedHabitatMappingTool_MASTER_[date].xlsx 2. PCF_IsolatedHabitatMapping_Tool_Template_[date].xlsx 3. PCF_IsolatedHabitatMappingTool_[Project Code]_[Species Code]_[date].xlsx	Framework Tool spreadsheet Management - MASTER version is CONFIDENTIAL	1. At the end of each Project, update existing MASTER version of the Framework Tool by first saving using that day's date in the filename, and updating the References tab from Mapper's Project Framework Tool deliverable with added or amended records; and update the ProjTracking tab with Project details 2. At the start of each Project, update the References tab in the Template version of the Framework Tool with the References tab in the MASTER version of the Framework Tool 3. At the start of each Project, provide a Mapper's version of the Project Framework Tool Template with updated Reference tab by saving it using that day's date and the Species Code in the filename of the Mapper's Framework Tool
			1. GrasslandSARSpeciesDB_IsolatedHabitats_MASTER_[date].xlsx 2. GrasslandSARSpeciesDB_IsolatedHabitats_[Project Code]_[Species Code]_[date].xlsx	MASTER version of the <i>SpeciesDB</i> spreadsheet	1. At the end of each project, update the MASTER version with new species records from the Mapper's Project SpeciesDB deliverable and save using that day's date in the filename 2. At the start of each project, provide Mapper with a 'renamed' version of the MASTER SpeciesDB using Project Code, created in the Framework Tool MASTER
			1. SAR_Isolated Habitat Report_Template_[date].docx 2. SAR_Isolated Habitat Report_IH#_[SpeciesCode]_Draft_[date].docx and .pdf	Report template, with reporting requirements and examples of content for a 2- to 3-page <i>Species</i> Report.	1. Update Template as needed 2. At the start of each Project, provide Mapper with their version of the Report_Template saved using Species Code and date of issue in the filename

Framework for Mapping Grassland Species-at-risk Isolated Habitat in Alberta

		Documentation/Archive/	n/a	Older versions of MASTER files should be stored here	Move old versions of the MASTER Framework Tool and Species DB after copying and updating.
	Project/	IH1/, IH2/, IH3/,...	n/a	All data deliverables will be stored here, per the Mapper's file management pathway specifications	<div><div>3.</div><div>Copy zipped deliverable to Project/ folder and 'Extract All' (zipped file can then be deleted or moved to the corresponding Project folder)</div><div>4.</div><div>From the extracted files, several file and version management actions are required (see above)</div><div>5.</div><div>Distribute report and map to Board of Directors, committee, etc. for review/approval/finalization (Note: PCF should remove the draft watermark prior to publication)</div><div>6.</div><div>Distribute to website and Connectivity portal once finalized</div></div>

Gaps in Framework

As a first draft of this Framework, there are some gaps that may need to be addressed in future updates of this framework, or at least considered for each project and the initiative as a whole, including:

- What is PCF's ethical obligation for sensitive SAR habitat data?
 - a. Use of home range or similar allow for a sufficient hazing of point location data provided.
 - b. The scale of analysis dictates the amount, if any, of hazing required for public viewing, upon recommendations from the Mapper.
- What is the best processing for public viewing of isolated habitat maps through the Connectivity Portal?
- Some species prefer isolation of habitats, or there are no known corridor data available (such as wind stream data), or some species are abundant on the landscape and connect into a single habitat patch, or some species densities are changing, and are creating isolating conditions. These should be examined when determining a study objective, while keeping in mind the purpose of the mapping, which is to identify areas that may have more predicted conservation value than other areas. Mappers must provide enough information to rationalize why.

Adaptive Management

This *Framework* provides detailed mapping guidance and specifications, addressing potential liabilities, standardizing file management, implementing a tracking system, and creating a wholesome and adaptive documentation system, resulting in greater confidence that Projects are consistently completed, and the information is responsibly managed. Inherent in the process are regular updates to the *Framework Tool* and the *SpeciesDB*; however, as Project are completed, some aspects of this *Framework* may require updating. Limitations identified by Mappers in the Mapper's Project *Framework Tool*/Checklist and Methods tabs may provide guidance on issues with implementing the *Framework* that may need to be addressed.

Closure

- This is an organic document, and it is anticipated that it will be updated as the initiative progresses.
- This document must be used in with the other tools created for this project (Figure 2).
- This document is intended for internal use only and does not purport to be a comprehensive guideline for isolated habitat mapping.
- References associated with this *Framework* are found in the *MASTER Framework Tool/References tab*
- This initiative is not an assessment of habitat presence or quality but studies a very specific interpretation of isolation of a habitat patch for selected species.
- Information provided through this initiative is meant to support land stewardship for all Albertans by making it easier to see how any given tract of land is connected to another.

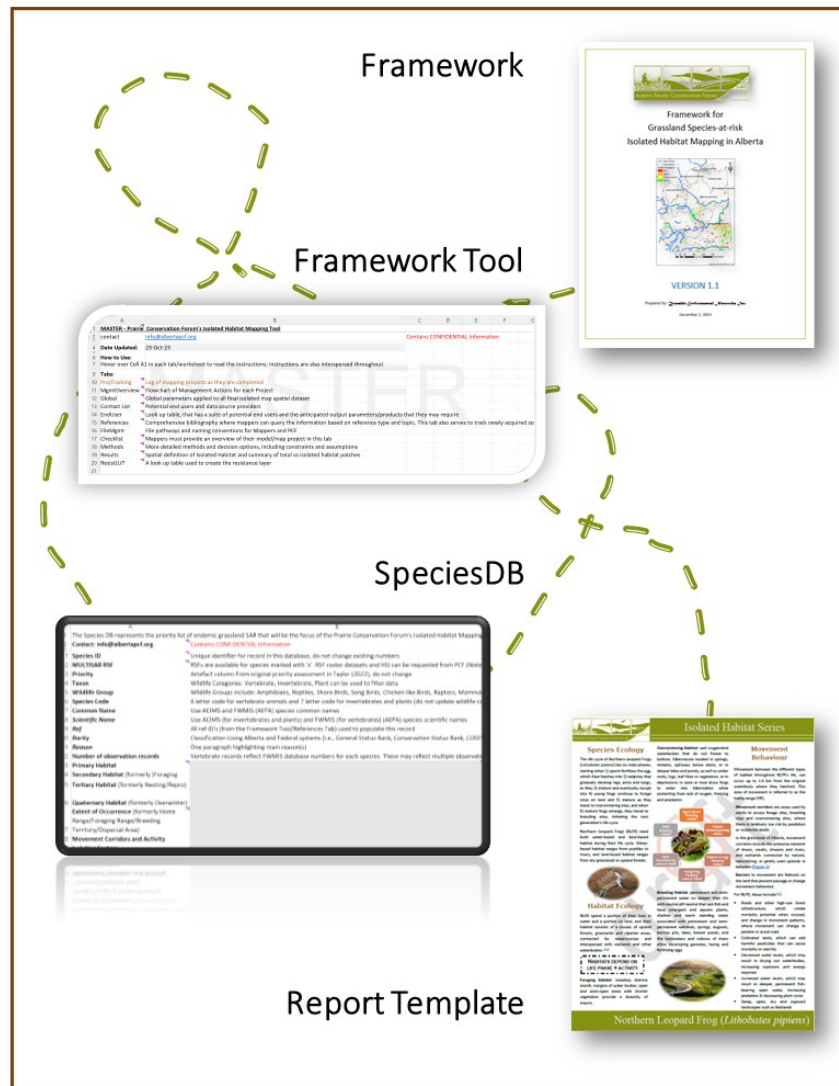


Figure 2 PCF's Isolated Habitat Mapping Framework Toolkit

Appendix A – Framework Tool Specifications

There are two (2) versions of the *Framework Tool*, MASTER and Project, where the MASTER version contains all of the tabs (i.e., worksheets) found in the *Project* version plus additional tabs that are to be used only by PCF to track the status of the Isolated Habitat Mapping Projects. Mapper instructions are included as Comments in the Info tab and in column heading cells in each tab.

Mapper's Project *Framework Tool* will be updated by each Mapper so that design considerations, input data, processing, limitations, attribution, and results are documented. In addition to these Project-specific tabs, a growing reference library tab will be maintained in both versions, as Projects are completed.

Tabs*	Description
Info	Contains information on all the tabs. Some cells need to be updated by the Mapper, such as the date it was last updated, and the SAR Species Code.
Global	Global parameters applied to all final isolated map spatial dataset
Contact List	Potential end users and data source providers
EndUser	Look up table, that has a suite of potential end users and the anticipated output parameters/products that they may require
References	Comprehensive bibliography where Mappers can query the information based on reference type and topic. This tab also serves to track newly acquired source datasets, and newly created datasets. This worksheet should be updated in the Master after each project is completed. Mappers should add any new spatial datasets or references that they use into this tab. RefIDs from this tab must be used in the Checklist and Methods tabs.
FileMgmt	A list of file pathways, filename, file type and description of Mapper deliverables, and PCF file management specifications
Checklist	Overview of Project
Methods	Details Methods of data processing and analysis, including rationale
Results	Summarize the results so that habitats and isolating conditions are described
ResistLUT	Resistance Look Up Table or similar that provides the quantitative connection between the isolating factors and isolating conditions.

*MASTER version of the *Framework Tool* also includes ProjTracking and MgmtOverview tabs.

Appendix B – SpeciesDB Specifications

The *SpeciesDB* is an Excel workbook that contains a list of all species prioritized for this initiative, along with a variety of habitat and rarity attributes. Mapper instructions were included as Comments in the Info tab and in column heading cells. Mappers must review and update their SAR information on a per Project basis. Mappers are required to add information for their assigned species, but only change existing information if rationale is provided and references added in the *Framework Tool*/References tab and the resulting RefID(s) added to the species record.

Field Name	Description
Species ID	Provides a unique identifier for each species record
MULTISAR Mapping Available*	'x' appears if RSF was received for a given species. Raster datasets for resource selection function and HSI can be requested from PCF, where it will be stored in IsolatedHabitats/Data/Originals/RSF_HSI_2017/[SpCode]
Priority	Mappers should highlight their species record. PCF should remove the highlighting when copying it to the MASTER version.
Taxon	Vertebrate, Invertebrate, Plant
Wildlife Group	Amphibians, Reptiles, Shore Birds, Song Birds, Chicken-like Birds, Raptors, Mammals, Insects, Vascular, Non-vascular, Waterfowl
SpCodes	4 letter code for vertebrate animals and 7 letter code for invertebrates and plants (do not update wildlife codes, per FWMIS)
Common Name	Try using ACIMS and FWMIS (EPA) species common names
Scientific Name	Try using ACIMS (for invertebrates and plants) and FWMIS (for vertebrates) (EPA) species scientific names
Ref	List all the RefIDs (from the <i>Framework Tool</i> /Reference tab) that were used to populate the record
Rarity	Compilation of various rarity categories applied in Alberta and Canada: conservation status ranks, general status ranks, AB <i>Wildlife Act Regulations</i> Schedule 6 listing, Canada <i>Species-at-risk Act Regulations</i> Schedule 1 listing
Reason	Provide the reason for rarity
Number of observation records	Vertebrate records reflect FWMIS database numbers for each species. These may reflect multiple observations/records of the same individual at the same location
Primary Habitat	Describe the different types of habitat/resource patches for each life cycle phase, and/or found in different jurisdictions. Primary habitat should be the one that was analyzed in the Project.
Secondary Habitat	See above
Tertiary Habitat	See above
Quaternary Habitat	See above
Extent of Occurrence	Approximate the area within which the Project analysis will occur
Movement Corridors and Activity	Describe movement behaviour and identify corridors that may not represent resource patches, but provide safe passage to habitat patches
Isolating Factors	Describe the types of land uses and land cover that create barriers to movement or create conditions that cause the SAR to change movement behaviour

*MULTISAR mapping extent may not be the full extent required for each project

Appendix C – Report Specifications

Report Components

Formatted per specifications below, *Report* components include:

- Page 1, which provides species ecology information that was used to rationalize the mapping approach, and connects species life phases with their daily, yearly and lifelong activities and locations where these occur. This sets up the discussion on movement behaviours, which introduces corridors and barriers. Required components:
 - an overview of the species ecology, focussing on life cycle phases,
 - life cycle graphic,
 - definition of habitats,
 - habitat ecology, focussing on activities and habitat for each life phase,
 - rarity status and reason, including threats
 - movement behaviour, including species-specific corridor, patch and matrix use
- Page 2 & 3 provides the connection between species ecology, movement behaviour and isolating conditions, as well as provides an overview of how the mapping project was conducted. Required components:
 - definitions of isolated habitat,
 - description of how habitat was mapped,
 - description of isolating factors and conditions (e.g., threats or land use types),
 - a map figure, per specifications below,
 - summary of isolated mapping results,
 - reference to actions, and
 - User Notice
 - *Isolated habitat maps represent general areas that might benefit from SAR-specific habitat conservation efforts. PCF makes no representation or warranty, either expressed or implied, in fact or in law, with respect to the accuracy.*

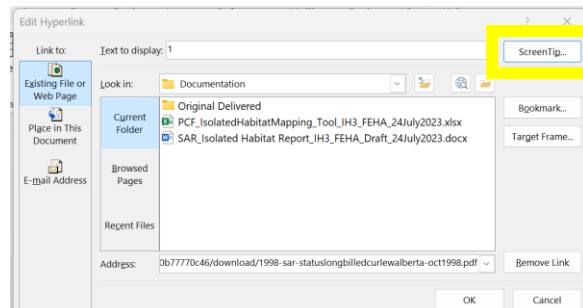
Map Figure Specifications:

- Scale Bar:
 - With black font and 25pt font and number size. Placed in bottom legend/scale block
- PCF Logo
 - Add along bottom block
- North Arrow:
 - Placed where there is space, nothing is overwritten, and with/without a white background
- Title:
 - Text: [Species Common Name]
 - Placement: upper left-hand corner of the map
 - Font: Bold Arial 24.0, White Halo 1.0
- Add Basemap Sources in a text box in the lower right-hand corner, above the bottom block
 - Text: “Basemap Source: RefID23, RefID128, RefID191”
 - Font: Black, Arial 10pt, White 1pt Halo
- HUC4 Watersheds will be labelled as follows:
 - Text: NAME field
 - Font: Black Bold Arial 20.0; White Halo 1.0
 - Exceptions: the three labels on the north edge [font 10pt to fit]
 - Placement: one label per feature, placed level or angled to fit
- Two legends, one in the bottom bar and one used as the figure sub-title:
 1. Bottom Bar Legend Basemaps:
 - a. Major Rivers (primary & secondary) and perennial streams symbol: 1pt Cretan blue
 - b. HUC4 Watersheds symbol: 0.4pt black line, no fill
 - c. Cities: Grey Outline and Fill
 2. Figure Sub-title Legend:
 - a. Format: White background
 - b. Font: black Arial 25pt size
 - c. Symbol: Prominent symbol colour and size, Habitat and Isolated Habitat must be different colours or symbology
 - d. Placement: upper right of figure, or in a prominent position
 - i. Text: remove ‘Legend’ from Title; “Isolated Habitat” or “Habitat”
- Imagery may also be used as a base map, but ensure that the habitats are visible, and the Basemap Source text isn’t overwritten
- Output Resolution: Thumbnail (72dpi) and High-resolution (<20MB)

Text and Copyright Graphics Specifications:

1. Text format: per *Report* template; however, graphic text and text boxes can vary
2. In-text references throughout, as follows:
 - Represent as a superscript number and edit the Link, as follows:
 - Hyperlink to the url (Insert>Links>Link) of the reference,

- Edit the [screen tip](#) to describe the landing page of the reference (e.g., 'Click to visit the Government of Canada's Western Harvest Mouse Recovery Plan'),



- Number references in the order that they are mentioned, with that number used for every subsequent superscript of that reference,
 - Use in the first sentence of each paragraph within which it is used,
 - Format multiple references separated with a comma and no space (e.g., ^{1,2,3}), and
 - Cite them in the References section of the *Report* on page 3 (note that the citation must also be added to the References tab in the *Framework Tool*)
3. Proprietary graphics must include credit and/or copyright markings
- a. Credit photographer
 - b. Copyright per lender requirements or if property of PCF, as follows: PCF©[current year] (e.g., PCF©2024)

Appendix D – Other Potential End Users

1. South Saskatchewan Regional Plan biodiversity management framework, where output can be provided and incorporated as a species indicator.
2. Provincial SAR status assessment updates, in support of one of the assessment criteria on sinks or sources, or another on habitat fragmentation or isolation.
3. Protecting isolated habitats prior to any land use activity on public lands, where proponents are required to query the GoA's landscape analysis tool (LAT). This tool triggers the need for further investigations, so if PCF pursues this, then they may also recommend incompatible activities or mitigations that they deem appropriate.
4. Future MULTISAR Conservation Value assessments.
5. Consultants and industry are more likely to utilize the spatial data outputs if they are available as downloads. The reason is that they can conduct spatial analyses to examine different options when conceptualizing an activity.
6. Members of PCF may provide input on what map specifications and attributes are useful as the project progresses. These members include GoA, non-profit organizations (E.g., Nature Conservancy of Canada's database, Alberta Conservation Association and Alberta Biodiversity Monitoring Institute), and municipalities (e.g., Milk River).
7. Key Biodiversity Area – NatureServe Canada, Wildlife Conservation Society Canada and Birds Canada are partnered on a project to identify KBAs.

EXAMPLE of End Use Defining Project Parameters
MULTISAR Conservation Value Model

- 15m X 15m grid
- MULTISAR used extent of GVI
- Value of 0 assigned to rasters within MULTISAR extent but outside the known species range
- CV attribute is a value between 0 and 1

Appendix E – Input Data Management

Input Dataset Storage Specifications

1. File Pathway and Naming Convention:
IH#/Data/Deliverables/[ProjectID]“_ModelInput_”[RefID][_date]
2. File Type (variable): ESRI shapefile, .gdb, .tiff, etc.
3. Projection: North_American_1983_CSRS_Transverse_Mercator
4. Data Type (variable): Vector/Raster
5. Attribute Field(s): must have a legend or look up table describing the values in the field

Input File Metadata

Metadata must be added to both shapefiles in the ‘Item Description’, as follows:

- Title: “Isolated Habitat Resistance Layer for” [Species Common Name] [IH#]
- Thumbnail of a layer.
- Tags: Isolated Habitat, [Species Common Name], Resistance Value
- Summary: [Resistance Layer] data input used to determine isolating conditions for [IH#] [Species Common Name]
- Description: brief summary of data sources and processing. Additionally, Mappers should include the isolated habitat legend.
- Credits: “Prairie Conservation Forum. Contact: info@albertapcf.org”
- Use Limitation:
 - For Internal Use Only

Input Spatial Dataset Reference Update

In the Mapper’s *Framework Tool*/Reference tab, Mappers must add the source input datasets as new records and fill-out/populate associated attributes for each record. This needs to be completed before files can be named for transmittal, as the Mapper’s *Framework Tool*/Reference tab is where the [RefID] is created.

Appendix F – Output Spatial Data Management

Output Spatial Data Deliverables Specifications

1. File Pathway and Naming Convention:
 - a. **IH#/Data/Deliverables/[ProjectID]“_Habitatfor” [_Species Code][_date]**
 - b. **IH#/Data/Deliverables/[ProjectID]“_IsolatedHabitatfor” [_Species Common Name][_date]**
2. File Type: ESRI shapefile or .gdb
3. Projection: North_American_1983_CSRS_Transverse_Mercator
4. Data Type: Vector
5. Attribute Fields:
 - Delete all temporary fields and keep fields that support the analysis (e.g., comments)
 - Contains ALL habitat polygons
 - Required fields (generally presented as ‘Name: value (field format)’):
 - i. Unique ID: ([SpeciesCode]+ “ID”+[unique whole number]) (E.g., FEHAID1) (text string)
 - ii. Comment: rationale for isolation (concatenate results) (text string)
 - iii. Area: area in hectares (numeric, float)

Output Spatial Dataset Metadata

Metadata must be added to both shapefiles in the ‘Item Description’, with the following information (where Isolated Habitat is substituted for Habitat as appropriate):

- Title: “Isolated Habitat for” [Species Common Name] [IH#] [Life Phase/Descriptor] (substitute in “Habitat” as required)
- Thumbnail of a proper map showing legend, habitat polygons, imagery, north arrow, Grassland Natural Region boundary, and scale bar. (Note: Thumbnail files should be saved in **IH#/Data**)
- Tags: Isolated Habitat (or just Habitat), [Species Common Name]
- Summary: “ Isolated Habitat Patches for” [Species Common Name, Species Scientific Name]
- Description: include an abstract summary, which will predominantly be derived from the project checklist information. Additionally, Mappers can include the isolated habitat legend.
- Credits: “Prairie Conservation Forum. Contact: info@albertapcf.org”
- Use Limitation:
 - Given the sensitivity associated with Species-at-risk locations, mapping results have been buffered. Isolated habitat polygons may be downloaded for analysis purposes only and not used for species detection purposes.
 - The use of the contents of our *data is at your own risk*. We exclude any liability for damages arising directly or indirectly from the use of our data for any purpose.

Project Records Update

In the Mapper’s *Framework Tool*/Reference tab, Mappers must add the two (2) new output spatial datasets by populating attribute fields for each layer.

Appendix G – Member Groups

- [Alberta Chapter of the Wildlife Society](#)
- [Alberta Conservation Association](#)
- [Alberta Grazing Lease Holders Association](#)
- [Alberta Native Plant Council](#)
- [Alberta Wilderness Association](#)
- [Cows and Fish \(Alberta Riparian Habitat Management Society\)](#)
- [Ducks Unlimited Canada](#)
- [Grassland Restoration Forum](#)
- [Multiple Species at Risk Program \(MULTISAR\)](#)
- [Nature Conservancy of Canada](#)
- [Operation Grasslands Community](#)
- [Southern Alberta Land Trust Society](#)
- [Waterton Biosphere Reserve Association](#)
- [Western Sky Land Trust](#)
- [Saskatchewan Prairie Conservation Action Plan](#)