EBAR Tools Documentation

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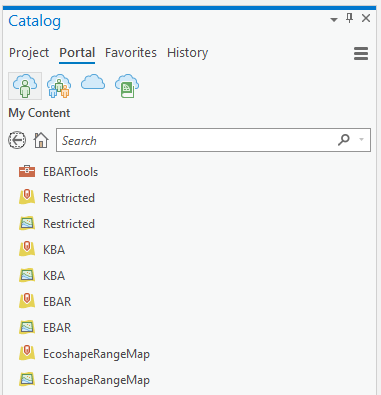
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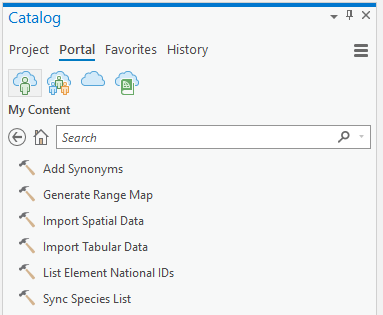
# Background

For general EBAR project background please see <https://www.natureserve.org/natureserve-network/canada/biodiversity-data/ebar-range-mapping/ebar-maps> and <https://www.natureserve.org/natureserve-network/canada/biodiversity-data/ebar-range-mapping/ebar-maps>.

# Usage

Tools published to the EBAR Tools geoprocessing service run against the production ebarkba geodatabase. Access tools in ArcGIS Pro via the Portal tab in the Catalog Pane:

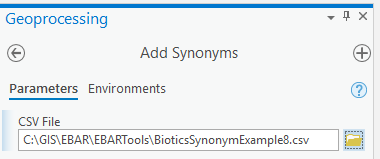




# Tool Parameters and Tips

## Add Synonyms Tool

Add BIOTICS Synonyms not already in the Species or Synonym tables



CSV File: a file of Biotics synonyms created using the query “OneDrive\EBAR\Data Mining\Species Prioritization\Biotics Sync\BioticsSynonymDownloadSQLWithShortCitation.txt”.

Build Bulk Download Table Tool

Builds a html table of per category/taxa EBAR PDF and Spatial Data zip links to be embedded in <https://www.natureserve.org/natureserve-network/canada/biodiversity-data/ebar-range-mapping/ebar-maps>.

No parameters, uses IncludeInDownloadTable (see details in the Build EBAR Download Table Tool) to include spatial data only for IncludeInDownloadTable=1.

Build EBAR Download Table Tool

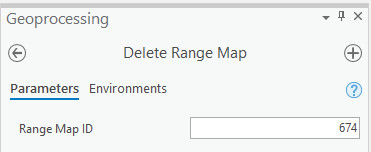
Builds a html table of per species EBAR PDF and ZIP downloads links to be embedded in <https://www.natureserve.org/natureserve-network/canada/biodiversity-data/ebar-range-mapping/ebar-maps>.

No parameters, uses IncludeInDownloadTable field to only provide a spatial data link for IncludeInDownloadTable=1 and generate the html Status column as follows:

* 1 = Expert Reviewed
* 2 = Insufficient Data
* 3 = Partially Reviewed
* 4 = Low Star Rating

## Delete Range Map Tool

Delete Range Map and related records from the EBAR geodatabase.

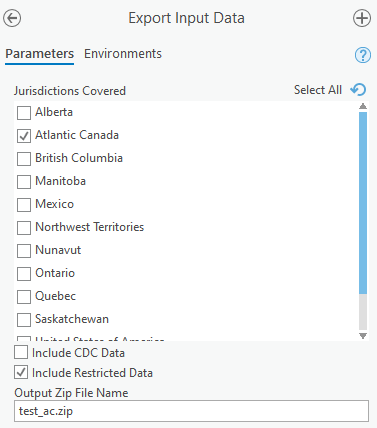


Range Map ID: RangeMapID of the record to be deleted.

WARNING: this tool has some basic checks to prevent inappropriate deletions including ensuring that RangeStage is set to “Delete”, but completed deletions cannot be undone.

Export Input Data Tool

Export InputPoint/Line/Polygon and BadInputPoint/Line/Polygon records, always excluding "other" DatasetTypes and EBAR Restricted records.



Jurisdictions Covered: select jurisdiction(s) to include in the export; note that each jurisdiction is buffered by 32km then the buffer is used in an intersect to select InputPoint/Line/Polygon records for inclusion.

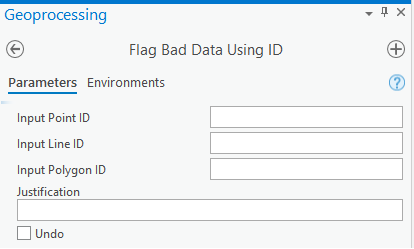
Include CDC Data: optionally include data from NatureServe Networks partners (Conservation Data Centres and Natural Heritage Programs), but not EBAR Restricted records.

Include Restricted Data: optionally include Restricted records.

Output Zip File Name: name of the file to be created and posted for download (e.g. <https://gis.natureserve.ca/downloads/test_ac.zip>).

Flag Bad Data Using ID Tool

Flag bad input data using an InputPoint/Line/PolygonID. Note that only one ID at a time can be processed.



Input Point ID: InputPointID of the record to be moved from InputPoint to BadInputPoint.

Input Line ID: InputLineID of the record to be moved from InputPoint to BadInputPoint.

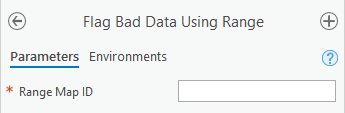
Input Polygon ID: InputPolygonID of the record to be moved from InputPolygon to BadInputPolygon.

Justification: Rationale for flagging the record as bad.

Undo: Undo an existing bad data record by moving it back to InputPoint/Line/Polygon.

Flag Bad Data Using Range Tool

Use reviewed range to identify and flag bad input data.



Range Map ID: RangeMapID of the high-quality, reviewed RangeMap outside of which Input data for primary and secondary species will be flagged as bad data by moving them to the BadInputPoint/Line/Polygon tables. Please note:

* Affected record counts reported by this tool may be too high in some cases! However, the number of records added to the bad data tables is consistent with those deleted from the input data tables. We would like to hear if you have any insight into the cause of this issues.
* Bad data will be subsequently ignored in the Generate Range Map and Export Input Data tools.
* Use this tool judiciously, as records flagged can only be unflagged by moving them back to the original tables.
* Do not use ranges limited to specific subnational jurisdiction(s) or custom polygons, because this the Range Map tool does not record those limits and therefore this tool does not yet have the smarts to implement those limits.
* Input records with no MaxDate will be ignored, regardless of where they occur.
* Bad data will not be updated when a record with the same DatasetSourceUniqueID is imported via the Import Tabular Data and Import Spatial Data tools. If you wish to import such a record, first delete the relevant bad data record based on DatasetSourceUniqueID.

## Generate Range Map Tool

Generate Range Map for a species from available spatial data and from review records marked with UseForMapGen=1.

Uniqueness for a Range Map (i.e., whether a new one gets created or an existing one overwritten) is based on the combination of:

* Species (including any Secondary Species selected)
* Version
* Stage

It is on our enhancement list to add Scope to the uniqueness fields, but for now using a unique Stage label is our workaround. For most species, the workflow has been to generate a Global range and send it for expert review, then a Canadian Range would use that review and get a Stage of "Expert Reviewed" or "Expert Reviewed (Partially Reviewed)". If we have both Canadian and Global ranges, that becomes part of the Stage label (e.g., see Myotis septentrionalis).

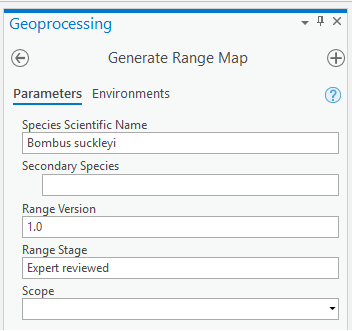
If a Range Map has been published or has Reviews in progress or completed, this tool won't allow you to overwrite it.

In addition to creating/updating records in the RangeMap, RangeMapEcoshape and RangeMapEcoshapeInputDataset tables, input data that can be viewed by reviewers in the EBAR Reviewer app is saved in the RangeMapInput table, with restrictions implemented as follows:

* Records with InputDataset.Restrictions = E (Restricted EBAR) are never visible in EBAR Reviewer
* Records with InputDataset.Restrictions = N (Non-restricted) are always visible in EBAR Reviewer
* Records with InputDataset.Restrictions = R (Restricted) are only visible in EBAR Reviewer if DatasetSource.CDCJurisctionID is not null, DatasetSource.RestrictionBySpecies=1 AND the species is NOT included in the RestrictedJurisdictionSpecies table.

For CDCs that have agreed to allow their otherwise restricted data (see InputDataset.Restrictions described below in the Import Tools) to be shown in the EBAR Reviewer app, provide the CDCJurisdictionID in the appropriate DatasetSource records(s). For CDCs with exceptional species that should never be shown in the EBAR Reviewer app, create a RestrictedJurisdictionSpecies record for each CDC/species combination. The following table summarizes the rules:





Species Scientific Name: name of the primary species for the range map (see BIOTICS\_ELEMENT\_NATIONAL table for valid values).

Secondary Species (optional): one or more additional species to be included in the range map (see BIOTICS\_ELEMENT\_NATIONAL table for valid values).

Range Version: a label for the version of the range map, to allow multiple versions/stages to be created over time (note that fields IncludeInEBARReviewer and Publish determines which range maps are available in the EBAR Reviewer web app).

Range Stage: a label for the stage within version of the range map, to allow multiple versions/stages to be create over time.

Scope (optional): the geographic coverage of the range map (Canadian = N, Global = G, North American = A); if Canadian is selected, only those Ecoshapes in Canada are included in the output.

Jurisdictions Covered (optional): one or more jurisdictions indicating the extent of the range map; only those ecoshapes intersecting the Scope, Jurisdictions Covered, AND Custom Polygon Covered are included; if not provided, all ecoshapes are used for the extent.

Custom Polygon Covered (optional): a feature class with one or more polygons indicating the extent of the range map; only those ecoshapes intersecting the Scope, Jurisdictions Covered, AND Custom Polygon Covered are included; if not provided, all ecoshapes are used for the extent.

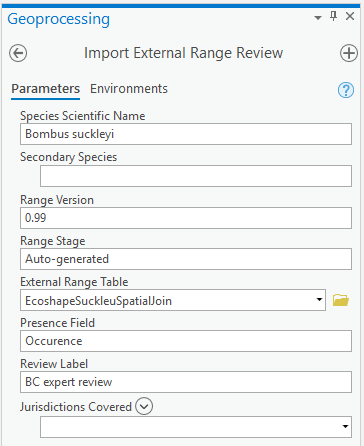
## Import External Range Review Tool

Creates review records for an existing range map based on third-party polygons, as if the review had been performed using the EBAR Reviewer.

A range map must be generated before this tool can be used. Subsequent range maps for the combination of species, range version and stage will apply the review records created by this tool (i.e. they will have UseForMapGen set to 1).

The External Review Polygons must have an EcoshapeID field that matches the EBAR EcoshapeID values. If necessary (for instance if the range was generated using an older version of the Ecoshapes), this can be done in pre-processing, for example:

* If there is a good match with Ecoshape names, run an Add Join based on name and Keep All Target Features. Be careful with this approach because some Ecoshape names are repeated across jurisidictions!
* If Ecoshape name matching is not possible, running Spatial Join with Ecoshapes as the Target Features and the External Review Polygons as the Join Features, Keeping All Target Features and with the Are Identical To match option.
* For all matched/joined records calculate a new EcoshapeID field in the External Review Polygons.
* For unjoined Ecoshapes, if any, comparing them to the External Review Polygons and:
  + If using Presence field, setting it appropriately.
  + If not using a Presence field, deleting Ecoshapes that are not part of the range.



Species Scientific Name: the primary Species for the Range Map to apply the review to.

Secondary Species: additional Species included in the Range Map to apply the review to.

Range Version: version label, which together with Species and Stage, uniquely identifies the Range Map to apply the review to.

Range Stage: stage of the Range Map to apply the review to.

External Range Table: table containing the EcoshapeIDs that constitute the results of the external review. If necessary, for example if there are multiple species in the same dataset, use a Definition Query or Select by Attributes to limit the records to be used. See the pre-processing notes above for information on creating this table. Note that this could also be an EBAR RangeMap (e.g., EcoshapeOverviewRangeMap with its Definition Query set to an Expert Reviewed range).

Presence Name Field (optional): name of the field in the External Range Table containing the reviewed Presence value for the Ecoshape. If not provided, all External Range Polygons are assumed to be Present.

Review Label: descriptive label to be recorded with the review records.

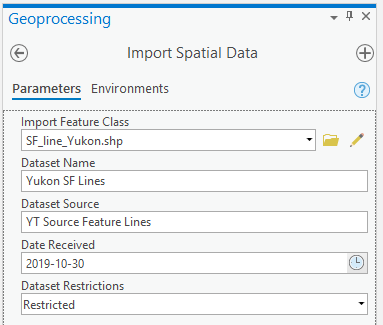
Jurisdictions Covered (optional): one or more jurisdictions indicating the extent of the external review (only ecoshapes within the selected jurisdictions(s) will be marked up in the review); if not provided, all jurisdictions are used for the extent.

Username: the username from the Expert table to assigned to the review records

## Import Spatial Data Tool

Imports spatial data from a shapefile or feature class into the InputDataset table of the EBAR geodatabase and one of the InputPolygon, InputPoint or InputLine feature classes.

Import tool results are being tracked at “OneDrive\EBAR\_Sensitive\_Material\RG Import Logs.txt” and “OneDrive\EBAR\_Sensitive\_Material\CT\_ImportLogs.txt”.



Import Feature Class: point, line or polygon shape file or file geodatabase feature class containing the species data to be imported.

Dataset Name: descriptive label for the database (combined with Dataset Source and Date Received, uniquely identifies an InputDataset).

Dataset Source: the name of the specification for the dataset source (see DatasetSource table for specifications details and valid values). In the DatasetSource, UniqueIDField and ScientificNameField are required, and fields used as MinDateField and MaxDateField must be of type text and contain values in the following formats:

* yyyy?mm?dd
* yyyy?mm
* yyyy

With no day it assumes 1, with no month it assumes 1. “?” can be any character.

Date Received: the data the dataset was received.

Dataset Restrictions: an indicator of restrictions, if any, on use of the data, as follows:

* Non-restricted – no restrictions.
* Restricted – can be accessed by members of the EBAR-KBA team assuming security requirements for the dataset have been met.
* Restricted EBAR – can only be accessed by NatureServe Canada members of the EBAR project.

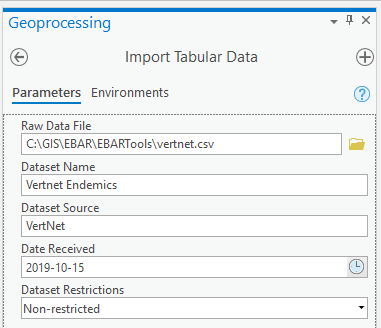
## Import Tabular Data Tool

Imports tabular data into the InputDataset and InputPoint tables of the EBAR geodatabase

Import tool results are being tracked at “OneDrive\EBAR\_Sensitive\_Material\RG Import Logs.txt” and “OneDrive\EBAR\_Sensitive\_Material\CT\_ImportLogs.txt”.

If a tabular dataset to be imported does not have an existing field mapping (see field mappings in Design Notes below), one option is to rename/add CSV fields to match those in the “Other” field mapping. After importing using the “Other” field mapping, create a new DatasetSource record with the correct name and citation for the source, then edit InputDataset.DatasetSourceID to match the new DatasetSource.

iNaturalist.ca data should be preprocessed using the geoprocessing tools available at <https://github.com/NatureServe-Canada/iNatExchangeTools>. This will ensure that the correct handling of obscured versus unobscured records. Note that geoprivacy=private records are not imported.

A

Raw Data File: CSV file containing point species data to be imported.

Dataset Name: descriptive label for the database (combined with Dataset Source and Date Received, uniquely identifies an InputDataset).

Dataset Source: the name of the specification for the dataset source (see DatasetSource table for specifications details and valid values).

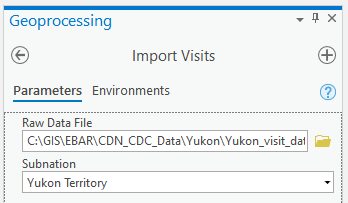
Date Received: the data the dataset was received.

Dataset Restrictions: an indicator of restrictions, if any, on use of the data, as follows:

* Non-restricted – no restrictions.
* Restricted – can be accessed by members of the EBAR-KBA team assuming security requirements for the dataset have been met.
* Restricted EBAR – can only be accessed by NatureServe Canada members of the EBAR project.

## Import Visits Tool

Imports visits and relates them to the appropriate InputPoint/Line/Polygon based on SFID and Subnation. Note that visits should be imported after the corresponding InputPoint/Line/Polygon Source Feature records, so that the correct InputPoint/Line/PolygonID can be assigned based on matching the SFID and Subnation.



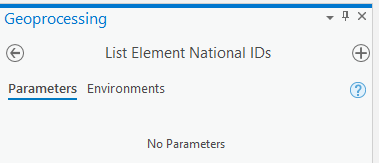
Raw Data File: CSV file containing visits data to be imported. If you are exporting from Excel, please use the CSV (not CSV UTF-8) option in the Save As dialog. Before importing, it is recommended to check that the CSV has the correct date formatting (yyyy-mm-dd). Also note that there is no field mapping mechanism, and the CSV must contain the following fields/columns, even if empty:

* SOURCE\_FEATURE\_ID
* VISIT\_DATE
* VISIT\_NOTES
* VISITED\_BY
* DETECTED\_IND

Subnation: the subnation that the visit data pertains to.

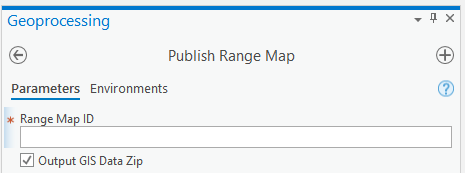
## List Element National IDs Tool

Lists existing ELEMENT\_NATIONAL\_ID values from the BIOTICS\_ELEMENT\_NATIONAL table of the ebarkba geodatabase. ID values can be copied (up to 1000 at a time) and used with the query “OneDrive\EBAR\Data Mining\Species Prioritization\Biotics Sync\ BioticsSpeciesDownloadSQLWithShortCitation.txt” to generate input file for the Sync Species List tool (see below).



## Publish Range Map Tool

Creates JPG, PDF, and Spatial Data (ZIP) for a single EBAR RangeMap. Outputs go to the download\_folder configured in EBARUtils.py.



Range Map ID: RangeMapID of the RangeMap to be published.

Output GIS Data Zip: boolean flag indicating that a Zip file of spatial data will be created.

Publish Range Map Sets Tool

Creates a Spatial Data (ZIP) package for multiple EBAR RangeMaps with the same Category/Taxa. Outputs go to the download\_folder configured in EBARUtils.py.

Graphical user interface, application

Description automatically generated

Category [optional]: the Biotics category label for the RangeMap spatial data package to be created, or None to automatically create one for each category/taxa and overall for all published RangeMaps.

Taxa Group [optional]: the Biotics taxa group label for the RangeMap spatial data package to be created, or None to automatically create one for each category/taxa and overall for all published RangeMaps.

## Summarize Downloads

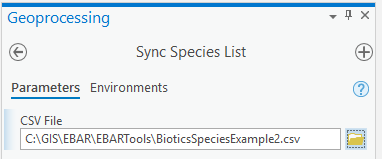
Summarize by month the number of times EBAR PDFs and Spatial Data Packages have been viewed or downloaded. This tool analyzes the Internet Information Services (IIS) logs and returns the summary of downloads/views in the tool messages.

Graphical user interface, application

Description automatically generated

## Sync Species List Biotics Tool

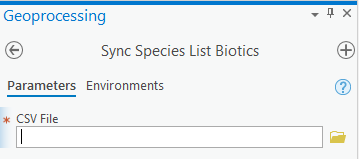
Synchronize the BIOTICS\_NATIONAL\_ELEMENT and Species tables with Biotics.



CSV File: a file of one or more Biotics species created using the query “OneDrive\EBAR\Data Mining\Species Prioritization\Biotics Sync\BioticsSpeciesDownload.txt”. Existing species (based on ELEMENT\_NATIONAL\_ID) in the BIOTICS\_ELEMENT\_NATIONAL table of the ebarkba geodatabase will be updated, and new species will be added.

## Sync Species List KBA Tool

Synchronize the Species table with BIOTICS\_NATIONAL\_ELEMENT table and update the Species table with fields used to identify KBA trigger species based on WCS KBA research.



CSV File: a file created in R from multiple queries to determine KBA trigger species. Existing species are matched based on ELEMENT\_NATIONAL\_ID to the BIOTICS\_ELEMENT\_NATIONAL table of the ebarkba geodatabase. Records in the species table will be updated, and new species will be added, if there is a successful match.

# EBAR Taxonomy Handling Summary

[ArcGIS Python Geoprocessing Tool Name]

* Regular sync with Biotics to store Species attributes in EBAR-KBA database (multi-step, semi-automated process because some attributes are not available via NSX Taxon API).
  + [Sync Species List Biotics tool]
  + [Add Synonyms tool]
* When importing external observation/occurrence data, match on (Canadian) National Scientific Name or its Synonyms.
  + [Import Tabular Data tool]
  + [Import Spatial Data tool]
* EBAR ranges generated and reviewed using a primary species (National Scientific Name and its Synonyms). Optionally include one or more secondary species (National Scientific Name), for instance to include data from an infraspecies.
  + [Generate Range Map tool]
* When generating metadata for publishing, species attributes are retrieved via NSX Taxon API where available, otherwise from EBAR-KBA database latest sync.
  + [Publish Range Map tool]

For additional details, please see EBAR Tools Documentation above, GP Tool Algorithms.txt and source code on GitHub.

# Range Map Production and Publishing Workflow

Status and notes related to range map production and publishing are managed outside the EBAR-KBA in a spreadsheet (the 2021 version is at XXXXXXXXX). The general workflow is as follows:

* Acquire and import available spatial and tabular data for the species.
* Run the Generate Range Map tool to produce an automated-generated draft range:
  + Species: select Primary and optionally Secondary, as appropriate
  + Range Version: X.0 (0.X for experimental drafts only)
  + Range Stage: Auto-generated
  + Scope:
    - Global – generally
    - North American – when we know the Global range extends beyond North America
    - Canadian – when we know the data outside Canada is very incomplete, or we have specific requests for Canadian ranges only
  + Coverage: optionally limit by Jurisdiction and/or Custom Polygon when subspecies not separable using selected Species. If both are specified, the Jurisdiction(s) must include those covered by the Custom Polygon
* Optionally set RangeMap.IncludeInDownloadTable = 0 (Not Reviewed) and run the Publish Range Map tool using the RangeMapID created in the previous step to generate a PDF for the automated-generated draft, for instance to share with prospective reviewers.
* Have the auto-generated draft range reviewed using the [EBAR Reviewer app](https://gis.natureserve.ca/ebar) ([documentation](https://1drv.ms/b/s!Ajv6BHSXrqqqmdINvZRmaArGoZx_wA?e=d44esC)) by inviting Experts and creating Review records.
* Check completed reviews and approve them for use by setting Review.UseForMapGen = 1 and EcoshapeReview.UseForMapGen = 1.
* Re-run the Generate Range Map tool to produce a reviewed draft range:
  + Species: as above
  + Range Version: as above
  + Range Stage: Expert Reviewed, Expert Reviewed (qualifier text, e.g., Partially Reviewed – Canadian or Low Star Rating)
  + Scope: as appropriate, repeat as necessary using different scopes (and be sure to use different Range Stage descriptions for each)
  + Coverage: as above
* Repeat the steps above as necessary to further refine and review the range. For example, reviewers may provide additional data that can be imported.
* Ensure that Expert.PublishName and Expert.PublishComment are set appropriately for the range reviewers.
* When the range is ready for publishing:
  + Set RangeMap.IncludeInDownloadTable as follows (this drives the watermark in the map/pdf):
    - 0 = Not Reviewed
    - 1 = Expert Reviewed and high quality (no watermark)
    - 2 = Insufficient Data
    - 3 = Partially Reviewed
    - 4 = Low Star Rating
  + Prepare the range for publishing:
    - Run the Publish Range Map tool using the RangeMapID of the appropriate version/stage/scope, optionally checking the “Output GIS Data Zip” option (normally when RangeMap.IncludeInDownloadTable = 1)
    - Check the Output GIS Data Zip checkbox if desired (normally only when RangeMap.IncludeInDownloadTable = 1)
    - Review all PDFs and a sample of the GIS Data Zip files, and if necessary repeat above steps.
    - Set RangeMap.Publish = 1 (this will also make the range available in the EBAR Public app on ArcGIS Online)
  + Publish all ranges that are ready for public sharing:
    - Run the Publish Range Map Sets tool for all Categories and Taxa Groups if many ranges are new or have been updated, otherwise run it for those Categories and Taxa Groups with ranges that are new or have been updated
    - Make live for downloading by running the Build EBAR Download Table tool and Build Bulk Download Table tool (these regenerate the tables at <https://www.natureserve.org/canada/ebar> for all RangeMap.Publish = 1 ranges)

# Expert Review Workflow

To be done

# Species Sync Workflow

* Get CSV output file of species and KBA information (existing and new) generated from Chloe's R code (Chloe currently does this).
* Run Sync Species List KBA tool passing in the CSV file from the previous step. This syncs KBA fields for existing species and outputs a list of ElementNationalIDs for new species (i.e. those not in the EBAR database).
* Run List Element National IDs tool to get the list of IDs for existing species. For new species, determine its Element National ID.
* Login to Central Biotics (<https://bioticscentral.natureserve.org/biotics/login.jsp>) using a web browser and run the Biotics Species Download and Biotics Synonym Download queries (available at “OneDrive\EBAR\Data Mining\Species Prioritization\Biotics Sync”), passing in the ElementNationalID(s) and downloading the output CSVs (this is done in batches because the query allows a maximum of 1000 species at a time).
* Run Sync Species List Biotics tool, which syncs Biotics fields.
* Run Add Synonyms tool, which adds any new synonyms for our species.
* Run Sync Species List KBA tool again, to sync KBA fields for new species.

# Design Notes

* For tabular DatasetSourceTypes, the Import Tabular Data tool uses field mappings defined in TabularFieldMapping.py to translate between the fields of the DatasetSource (GBIF, VertNet, etc.) and the InputPoint table.
* For spatial DatasetSourceTypes, the Import Spatial Data tools use field mappings defined in the DatasetSource table (field names ending with “Field”) to translate between the fields of the DatasetSource (provincial CDC, state NHP, etc.) and the InputPoint/Line/Polygon tables.
* Spatial Datasets must also be given a DatasetType in the DatasetSource table, with values as follows:
  + Area of Occupancy (used for KBA only, not used for EBAR) – polygons depicting the known occupancy locations for a species, similar to a range estimate.
  + Critical Habitat – polygon areas of critical habitat from an authoritative source, such as a species recovery plan.
  + Element Occurrences – point, line or polygon EOs from a NatureServe member program (CDC or NHP).
  + Habitat Suitability – polygon areas of suitable habitat from an authoritative source, such as a NatureServe HSM.
  + Other Range (used for KBA only, not used for EBAR) – polygon estimate of existing species range.
  + Range Estimates – polygon estimate of existing species range from an authoritative source, such as a peer reviewed paper.
  + Source Features – point SFs from a NatureServe member program.
  + Species Observations – point observations.

# Source Code Control and Editing

See <https://github.com/NatureServe-Canada/EBARTools> for source code. Regularly check code changes into this repository.

Recommended to use an interactive development environment (IDE), such as Visual Studio (<https://visualstudio.microsoft.com/vs/community/>) or PyCharm (<https://www.jetbrains.com/pycharm/>) to facilitate interactive debugging. The Python file for each tool (e.g. ImportTabularDataTool.py) contains a controlling process at the end which allows you to start the tool by running that file, passing parameters for debugging.