

## **Map Production Process**

### **Data Is Mined/Imported/Cleaned**

#### **All Records**

- Exclude data with uncertainty distance greater than 32 km (which is also the largest possible iNaturalist obscured coordinate inaccuracy, calculated as the diagonal of a 0.2 degree “square”)
- Duplicate records are retained
- Remove data without dates
- Data will be categorized based on access permissions:
  - Restricted (EBAR) – no one beyond EBAR team can access data
  - Restricted (EBAR-KBA) – no one beyond EBAR-KBA team can access data
  - Limited- only people who meet access requirements can access (e.g. signed data sharing agreement, completed data sensitivity training)
  - Open- data has no access restrictions and can be shared within teams and with partners

#### **iNaturalist**

- Research grade only
- Unobscured data used with uncertainty distance provided
- Obscured data where we were not provided private coordinates gets uncertainty distance based on 0.2 X 0.2 degrees

#### **BISON/ecoengine/iDigBio/GBIF**

- Remove fossils
- Remove data without coordinates
- Include infraspecies
- Remove iNaturalist records

#### **Conservation Data Centres**

- Remove SFs linked to EOs, if we have the EOs
- Do not apply uncertainty distance cut off to EO

### **Data is combined to create Maps**

#### **Full Species**

If a full species qualifies then the infraspecies should be rolled up for mapping.

This is because all the infraspecies qualify by default as they are nested in the full species. If an infraspecies is not ranked it is likely because it is equal to or is more endangered than the full species.

Examples:

- Gray ratsnake should include: *Pantherophis spiloides* pop. 1 (GL-SL) *Pantherophis spiloides* pop. 2 (Carolinian) and *Pantherophis spiloides* (US)
- *Crataegus sheila-hippsiae* should include: *Crataegus sheila-hippsiae* var. *saskatchewanensis* and *Crataegus sheila-hippsiae* var. *sheila-hippsiae*

### **Infraspecies**

If an infraspecies qualifies then some full species information may need to be rolled down for mapping.

These will need to be reviewed on a case by case basis to determine the best approach. In some situations, records from the full species can be applied to the infraspecies, but not always.

Examples:

- Infraspecies *Martes americana atrata* is N1, while the full species *Martes americana* is N5, so only *Martes americana atrata* should be mapped
- Infraspecies *Ursus americanus kermodei* is endemic, but the full species *Ursus americanus* is N5, so only *Ursus americanus kermodei* should be mapped

### **Ecoshape Species Presence Populated**

Note: Points are buffered by the reported accuracy (uncertainty distance) or 10 m if no accuracy is reported, and lines are buffered by 10 m regardless of the reported accuracy, which allows points, lines and polygons to all be processed with the same polygon-based core algorithm to determine ecoshape overlap.

Present

- Species observation indicates the species can be found in this ecoshape (observations without dates are ignored unless EO with EORank, re-introduced populations are included)
- Overlap with EO or SF
- Overlap with final or proposed Federal Critical Habitat (the species must be present for Critical Habitat)
- Expert/local knowledge that species is present (will be strongly encouraged to contribute data)

### Presence Expected

- There are no species observations in this ecoshape, but one of the following is true:
  - Expert/local knowledge that species is expected to be present
  - Contains range or suitable habitat based on authoritative source

### Historical

- All species observations are at least 40 years old
- EO indicates an Extirpated or Historical population (EO rank of H, H?, X or X?)

This is implemented by first using the following rules, applied in top to bottom priority order when multiple input data overlap an ecoshape:

DatasetType	EORank	MaxDate	Ecoshape Presence
Element Occurrences	NOT NULL AND NOT 'H', 'H?', 'X', 'X?', OR	<=40 years old	Present
Source Features		<=40 years old	Present
Species Observations		<=40 years old	Present
Critical Habitat			Present
Range Estimate			Presence Expected
Habitat Suitability			Presence Expected
Element Occurrences	'H', 'H?', 'X', 'X?'		Historical
Element Occurrences	NULL, AND	>40 years old	Historical
Source Features		>40 years old	Historical
Species Observations		>40 years old	Historical

Then any EcoshapeReview records for the current version of the Range Map with UseForMapGen=1 are applied, potentially resulting ecoshapes being added to or removed from the range or having their Presence changed.

### Evaluate if Map is Ready to Send for Review

Understanding that data mining will never be truly complete, and our desire to have maps “continually” updated, we can use this decision tree to determine if the map is ready to send for expert review.

- If all CDC data has an EO rank date within the last 5 years. CDCs do data mining and expert review during species enhancements.
- If the species had a range map (e.g. COSEWIC assessment and status report or IUCN) developed in the last 5 years and the map matches well
- If the species is well studied and the data is accessible (e.g. a turtle is more likely to be considered to have sufficient data before an unnamed cave arthropod)
- If the species is poorly studied and can be confident all the data is included (e.g. there is one known specimen of the unnamed cave arthropod)

Maps are sent for expert review via Online Review Tool (EBAR Reviewer)

[User Guide](#) will be provided.

When a reviewer is recruited and give a user account, they will be informed that the EBAR-KBA team can share their name and contact information with other reviewers. They will also be credited as a reviewer on the NatureServe Canada website (e.g. We thank the following expert reviewers: Mosses - Christine Terwissen, Randal Greene; Arachnids - Patrick Henry).

Reviewer logs in and must click “Accept” in warnings page:

- I agree that my comments will be kept in a database to support the EBAR-KBA project
- In using this tool, you will be accessing information that may include location information of rare and threatened species, including species subject to persecution and harm. You agree to use this information only for the purposes of EBAR range maps review, and not for any other purposes, and agree not to share the draft models with anyone else via screenshots or other means. (This is based on MoBI, and we will credit them generally for sharing their code under the Apache 2.0 licensing – see <https://github.com/vannizhang/species-reviewer/blob/master/LICENSE>)

User selects Species in side panel

Selected Species is indicated at top of side panel along with Range Map Version, Stage and Date, and link is provided there to get species detail in a new browser window/tab on NatureServe Explorer via species GLOBAL\_ELEMENT\_ID (part of the Explorer URL)

Ecoshapes for species are symbolized transparently using a single hue with varying lightness, to support ability to see base map or context layer underneath:

- Present (dark)
- Presence Expected (light-mid)
- Historical (light)

User clicks on existing Species Ecoshape:

- Ecoshape attributes (Jurisdiction, Name, Parent Ecoregion, Ecozone, Input Datasets Summaries) displayed in side panel
- Optionally selects “Remove from Range” in side panel
- If Remove selected:
  - Must select Reason for Removal:
    - Presumed extirpated
    - Never was there
    - Reported but false
    - Transient/**Vagrant** (determine preferred term or use both)

- Must provide Notes
- Optionally provides Reference
- Reference automatically created as pers comm with reviewer name-date (in overall range map metadata, if reviewer has agreed to public sharing of their identity???)
- Ecoshape “Removed” hatch overlaid
- If Presence=(H)istorical, optionally selects “Add to Range” in side panel
- If Add selected:
  - Must provide Notes
  - Optionally provides Reference
  - Ecoshape “Added” hatch overlaid

User clicks on new Species Ecoshape:

- Ecoshape attributes (Jurisdiction, Name, Parent Ecoregion, Ecozone, Input Datasets Summaries) displayed in side panel
- Optionally selects “Add to Range” in side panel
- If Add selected:
  - Must provide Notes
  - Optionally provides Reference
  - Ecoshape “Added” hatch overlaid

User selects multiple Species Ecoshapes (via Ctrl-click, lasso, and/or side panel options for “Select all Ecoshapes in Jurisdiction”, “Select all Ecoshapes in Ecoregion” or “Select all Ecoshapes in Ecozone”???)

- Ecoshape attributes section of side panel indicates “Multiple Ecoshapes Selected” and “Warning: choices will impact/override all selected Ecoshapes”
- Optionally selects “Remove from Range” (greyed out if no selected Ecoshapes are in range) and fills “Remove” fields as described above
- Optionally selects “Add to Range” (greyed out if all selected Ecoshapes are in range) and fills “Add” fields as described above

[Can they do both Remove and Add with same selection??? Suggest only one or the other for user and programmer simplicity (multi-select has enough complexity even in this “simple” proposal)!!!]

User provides Overall Star Rating out of 5 and Comments (based on MoBI provide credit). These apply to overall range not individual ecoshapes and will determine the level of additional work needed for each map

- 1-Star: Terrible representation of species range, extensive edits need to be made or data sources added, a new version of the map should be sent for review
- 2-Star: Poor representation of species range, many edits needed, or some data sources needed, a new version of the map should be sent for review

- 3-Star: Moderately good representation of species range, several edits needed, or some data sources need to be added before the map is ready to be published
- 4-Star: Good representation of species range, some edits needed before the map is ready to be published
- 5-Star: Excellent representation of species range, the map is ready to be published

User can return to Species at any time based on their schedule/availability and see their existing Additions and Removals

When finished or deadline reached, user clicks Submit and gets warning that once submitted the Review will be final for this range map version for this species. This will trigger notification to the EBAR team. Users can then look at, but not change, reviews they have completed.

### Maps are refined based on expert review

All information collected during expert review is stored in the review tables of the database.

### **Added or Removed Ecoshapes**

- Re-run map based on reviews
- If changes are substantial will send map to be reviewed again

### **Conflicting Review**

- Allow reviewers to contact each other and discuss conflict
- EBAR team follows up with reviewers and moderates discussion
- Seek tie breaker reviewer if necessary
- NSC EBAR team will provide final decision if tie breaker not secured

### Maps are published and/or loaded to Biotics

- Ideally, maps will be published on Explorer 2.0
  - NSC EBAR will coordinate with NS Erik Gelhausen (replacement TBD as of April 23, 2020) to confirm when Explorer 2.0 has required functionality to 1) provide download of EBAR maps and 2) display EBAR maps in the Explorer map viewer
    - Even if Explorer 2.0 provides functionality to display/download we will require NSC webpage to describe/promote availability of maps and may be necessary to provide display/download from webpage until Explorer 2.0 ready

- French language translations for NSC webpage info and certain content/headings of Explorer 2.0, but currently no French language functionality planned for online review tool/database
- Detailed [methodology](#) document will be published with maps
- The database will be maintained on the Azure server and administered by WCSC/NSC
- Maps will include metadata with the following:
  - Summary of reviewer comments
  - Average Star-rating
  - Species/infraspecies included in map
  - How to cite map
  - Summary of information used (e.g. NatureServe, BISON, iNaturalist, etc.)
  - Species information (name, rank, rank date, codes)
  - Map date and version
- CDCs can choose to load maps to Biotics in [Distribution-Natural](#):
  - Need to load ecoshape mosaic to Ecoregion
  - Can load presence values and reason for ecoshape removal to OccurrenceStatus
  - Can load 'T-Transient' in MigrantStatus
  - Can load references to Full Citation
  - Can assume OriginStatus is 'N- Native or natural'