

Ecosystem-based Automated Range (EBAR) Mapping Project

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#### Today's Webinar

Using GBIF-mediated data to inform species conservation

Introduction to EBAR project

**Data Acquisition** 

Data Management

**Developing Range Maps** 

**Limitations and Challenges** 

Successes



A Network Connecting Science with Conservation Un Réseau pour la science et la conservation

# Introduction-EBAR

- Partnership between NatureServe Canada, Wildlife Conservation Society Canada (WCSC), Key Biodiversity Areas Canada, Birds Canada, Environment and Climate Change Canada
- Based on work from NatureServe Programs, including Northwest Territories, British Columbia, Oregon, Wyoming















# Introduction-EBAR

- EBAR maps support various initiatives
  - Environmental impact assessments
  - Committee on the Status of Endangered Wildlife in Canada (COSEWIC) status assessments
  - Species At Risk Act recovery action plans
  - KBA identification
  - Provincial and Territorial Species at Risk programs and legislation















# Ecosystem-based Automated Range (EBAR)

#### Objectives

- Best available species occurrence information
- Efficiently reviewed by species experts
- Provide access to reference information
- Freely and publicly available outputs (PDFs and spatial data)



# Why Range Maps?



#### **Occurrence Data**



#### **Habitat Suitability Model**



Source: Guide for Optimal Habitat Attributes: Swift Fox (*Vuples velox*). June 2020. Saskatchewan Prairie Conservation Action Plan. 22 pp.

#### **Species Ranges**



Most Accurate and Precise

#### **Precise and Variable Accuracy**

#### **Accurate and Least Precise**



# **Ecoshape Mosaic**



Canada, Continental US, and Mexico

- Ecoshapes represent unique ecological areas
- Regional use and adoption more important that country-wide consistency
- Data sources:
  - Canadian jurisdictions (Ecodistricts, ecosections, or similar)
  - EPA (Level III Ecoregions in Alaska, Level IV in Contiguous US)
  - INEGI (Level IV Ecoregions- Mexico)
- EBAR compiled existing datasets into mosaic



### **EBAR Range Mapping Process**





### **EBAR Range Mapping Process**





### Data Acquisition





R scripts to download data from online platforms

Data Mining

Import

Python tools to import spatial/tabular data and manage taxonomy

Database

Built on ArcGIS Enterprise/Server and a PostgreSQL geodatabase running in the Microsoft Azure cloud

# Data Acquisition

#### Cleaning



Exclude records with:

- missing date or coordinates
- uncertainty distance >32km
- fossils and non-research grade data

Duplicate management

- Filter by provider unique ID
- Detect and remove records with identical species, location, date

Extracting dates from text





# Data Acquisition - GBIF

#### Data downloads 🛛 👱

- Use R Statistical software
- Can download multiple species at a time
- Select variables you want to include
- Remove fossil records







# Github repository for GBIF R Code <a href="https://github.com/NatureServe-Canada">https://github.com/NatureServe-Canada</a>



NatureServe

# **GBIF** R Code in action



library(rgb11)

#List species you would like to search
list sciNames <- c("Vulpes velox")</pre>

```
#Search for the taxonKeys of the species listed above, including subspecies and varieties
keys <- lapply(list_sciNames, function(x) name_suggest(x, rank=c("species", "subspecies", "variety"))) %>%
bind_rows()%>%
select(key)%>%
unlist(use.names = F)
```

#Search for the GBIF occurrences for the species listed above (\*Note make sure you review the limit (default is 500, hard maximum is 100,000) based on the number of occurrences likely to be returned\*)

GBIF\_occ <- occ\_search(taxonKey = keys, return="data", hasCoordinate = TRUE, limit= 60000, fields=c('occurrenceID','gbifID','scientificName',
'locality', 'stateProvince',</pre>

'individualCount', 'decimalLatitude', 'decimalLongitude', 'coordinateUncertaintyInMeters', 'day', 'month', 'year', 'basisOfRecord', 'institutionCode', 'ide
ntifiedBy', 'dateIdentified', 'license', 'recordedBy', 'issues', 'references', 'geodeticDatum', 'countryCode', 'informationWithheld', 'verbatimLocality', 'o
ccurrenceRemarks', 'species'))

```
#Identify taxonKeys that returned GBIF occurrences
GBIF_names <- GBIF_occ %>%
   sapply(., nrow) %>%
   unlist(.) %>%
   names(.)
```

```
#Merge data into single table for export
GBIF_data <- GBIF_occ %>%
   .[GBIF_names] %>%
   do.call(bind rows, .)
```

#Remove Fossil records
GBIF sub <-subset(GBIF data, GBIF data\$basisOfRecord != "FOSSIL SPECIMEN")</pre>

#### #Export as csv to specified folder

write.csv(GBIF\_sub,"C:/Desktop/GBIF\_Data.csv")

NOTE: We are currently working on improving our code to include a DOI and citation with each download

Exported csv files are then imported into our database!

# Data Acquisition - Challenges



- Dealing with duplicate data points across data sources
  - Ex. iNaturalist.org and GBIF have a lot of overlapping data
  - Identify duplicates within datasets using unique IDs (when available)
  - Prioritize providers when records have identical species, location, date (for example iNaturalist over GBIF)
  - In future we want to investigate original provider IDs where providers are already sharing data
- Moving towards a DOI system when citing data providers
- Cleaning data and managing "bad data"
  - Flagging data to exclude from range maps and from future imports

# **EBAR Platform Architecture**





### Geodatabase





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### **Geoprocessing Tools**



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### **EBAR Range Mapping Process**





# **EBAR Species Range Development**

#### **Species Data**



#### Auto-generated



NATURESERVE CANADA

#### **Expert Reviewed**



Experts provide feedback for

ecoshapes and overall range

**Reviews stored** 

in database and

applied to

maps.

### **EBAR Expert Review Tool**



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# Publishing EBAR Maps



#### EBAR webpage on NatureServe Canada website:

#### https://www.natureserve.org/canada/ebar

- Documentation on data model and workflows
- Map download by species and taxonomic group
- Training materials for expert reviewers
- Maintained priority species lists

#### ArcGIS Online:

https://www.arcgis.com/apps/webappview er/index.html?id=1027bc16ec2f48419c8029 ffea5ee3b1

**ESRI Living Atlas** 

NatureServe Explorer Pro



ioto by Harry Collins Photography.

NatureServe Canada's Ecosystem-based automated range maps (EBAR) initiative is developing publicly accessible range maps for priority species.

#### EBAR Range Mapping Project Overview

EBAR maps combine biodiversity data with expert knowledge to populate ecostrapes (which are eccregions, ecodistricts or similar ecological land classifications) with species presence information. Each ecostrape is associated with a set of references for the species information providing transparency regarding the underlying data.

NatureServe Canada EBAR maps support priority programs such as environmental impact assessments, status assessments by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), Species At Risk Act recovery action plans, the identification of Key Biodiversity Areas (KBAs) and provincial and territorial Species at Risk programs and legislation.

The objectives of the project are to develop national range maps that:

- Incorporate the best available species occurrence information.
   Can be reviewed and refined by species experts in an ongoing and efficient mannel 3. Provide access to reference information of the underlying occurrence data.
   A republicly available at no charge.
- Are provided in an electronic format that permits efficient customization and integration by biodiversity experts, organizations and decision-makers.





NatureServe Canada's "North American tornestival accohopes masaic" for EBAR mapping. Each ecologie of an EBAR map contains accessible reference information documenting the decision on whether the species is Anown to be preserve, preserve expected or Natorial, to a given acadeped (Sasamage Cart and partness).

#### https://gis.natureserve.ca/download/EBAR104178.pdf



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EBAR is relatively coarse scale data and not intended for all applications and analysis. Please see full disclaimer in metadata.

### EBAR Progress: 2019 - Present





### NatureServe Canada EBAR Team





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# Thank You



A Network Connecting Science with Conservation Un Réseau pour la science et la conservation

#### To Collaborate

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https://www.natureserve.org/natureserv e-network/canada/biodiversitydata/ebar-range-mapping