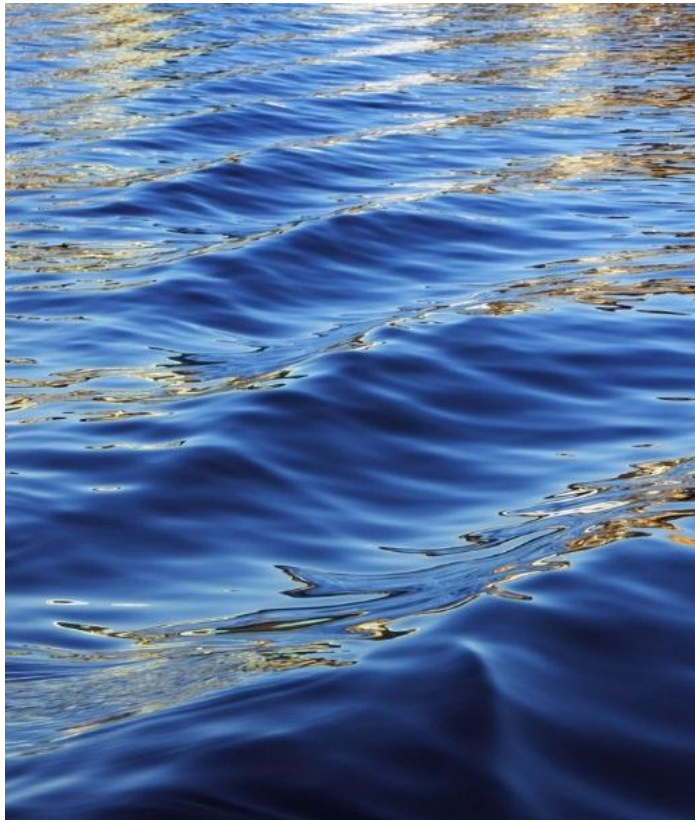
Alberta EFP SAR Tool Development

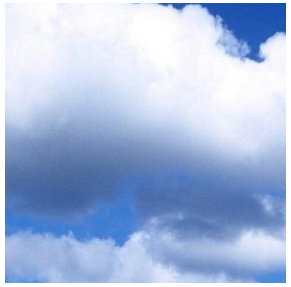


Paul Watson and François Blouin

Moncton, November 15, 2019

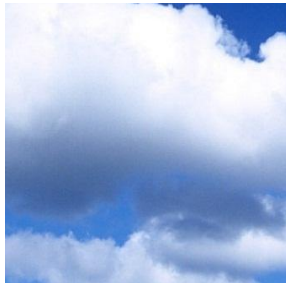
BUILDING ON A SOLID FOUNDATION
Alberta EFP
ENVIRONMENTAL FARM PLAN

Background



- Growing demand for sustainable sourcing from purchasers of agricultural commodities and indirectly, consumers.
- All major sustainable sourcing initiatives have a SAR component and a more general Habitat/Biodiversity protection component.
- This piece is essential to keeping EFP relevant in a sustainable-sourcing ecosystem

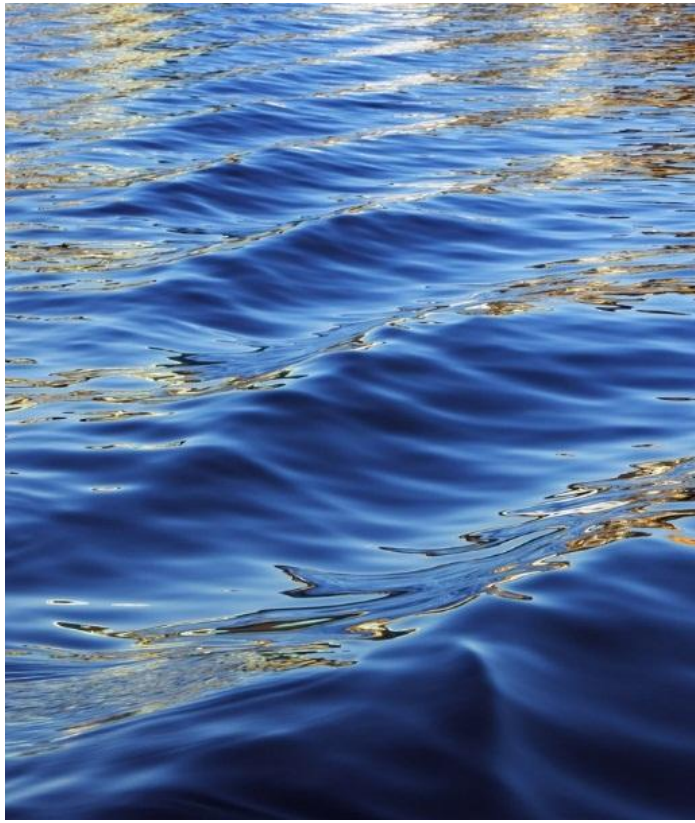
Background



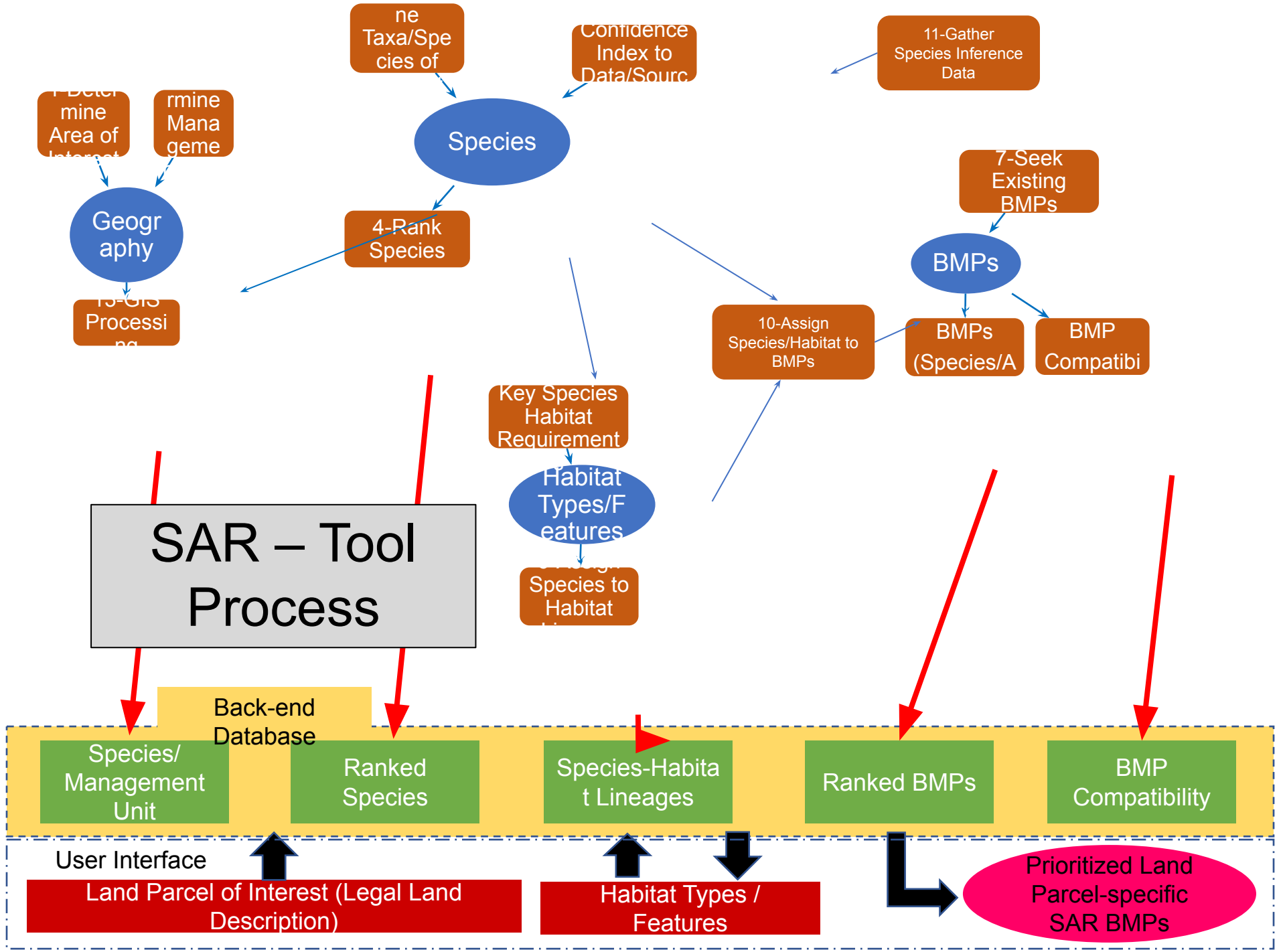
- We want:
  - Producer to know what species at risk may be on their operation
  - Become aware of best practices on how to conserve SAR habitats
    - Some are very easy and many are beneficial to their operation
  - To ensure we communicate in the least threatening way with producers

- We are in the process of revising and will be beta-testing again

How the SAR Tool Works



BUILDING ON A SOLID FOUNDATION
Alberta
EFP
ENVIRONMENTAL FARM PLAN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Confidence Index to Data/Sourc
11-Gather Species Inference Data
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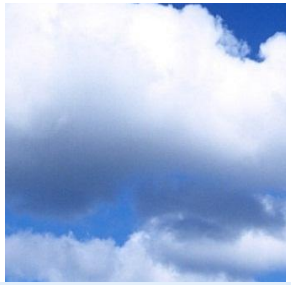
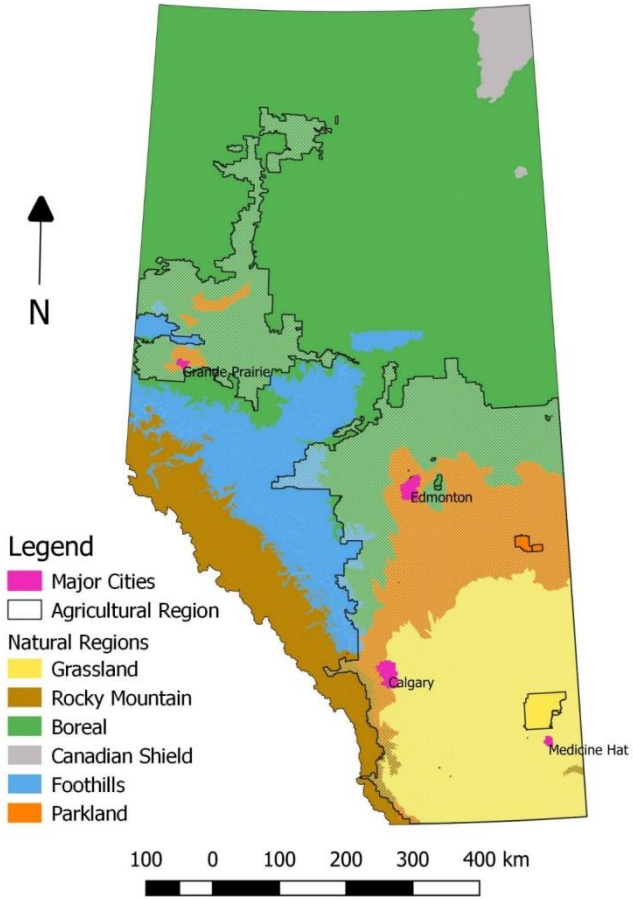
rmine Mana geme
Species
7-Seek Existing BMPs
Geogr aphy
4-Rank Species
BMPs
Processi
10-Assign Species/Habitat to BMPs
BMPs (Species/A
BMP Compatibi
Key Species Habitat Requirement
Habitat Types/F eatures
Species to Habitat
SAR – Tool Process
Back-end Database
Species/ Management Unit
Ranked Species
Species-Habita t Lineages
Ranked BMPs
BMP Compatibility
User Interface
Land Parcel of Interest (Legal Land Description)
Habitat Types / Features
Prioritized Land Parcel-specific SAR BMPs

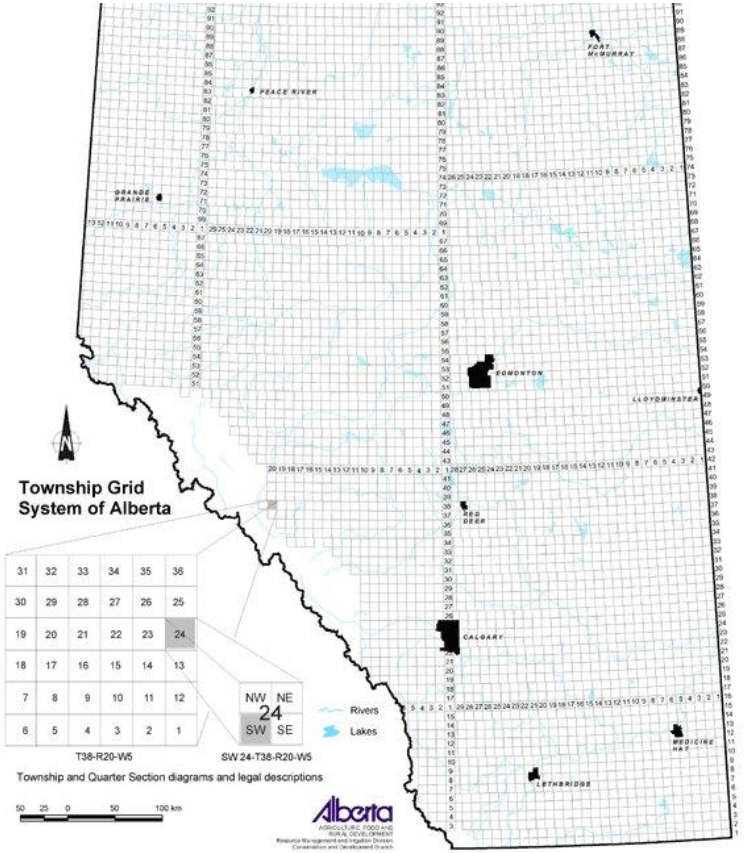


SAR Tool Process

Determine (1) Area of Interest and (2) Management Unit:

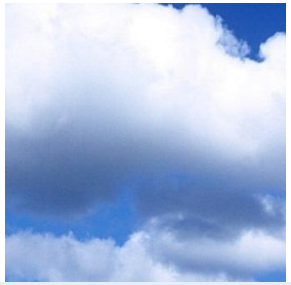


Agricultural Region of Alberta

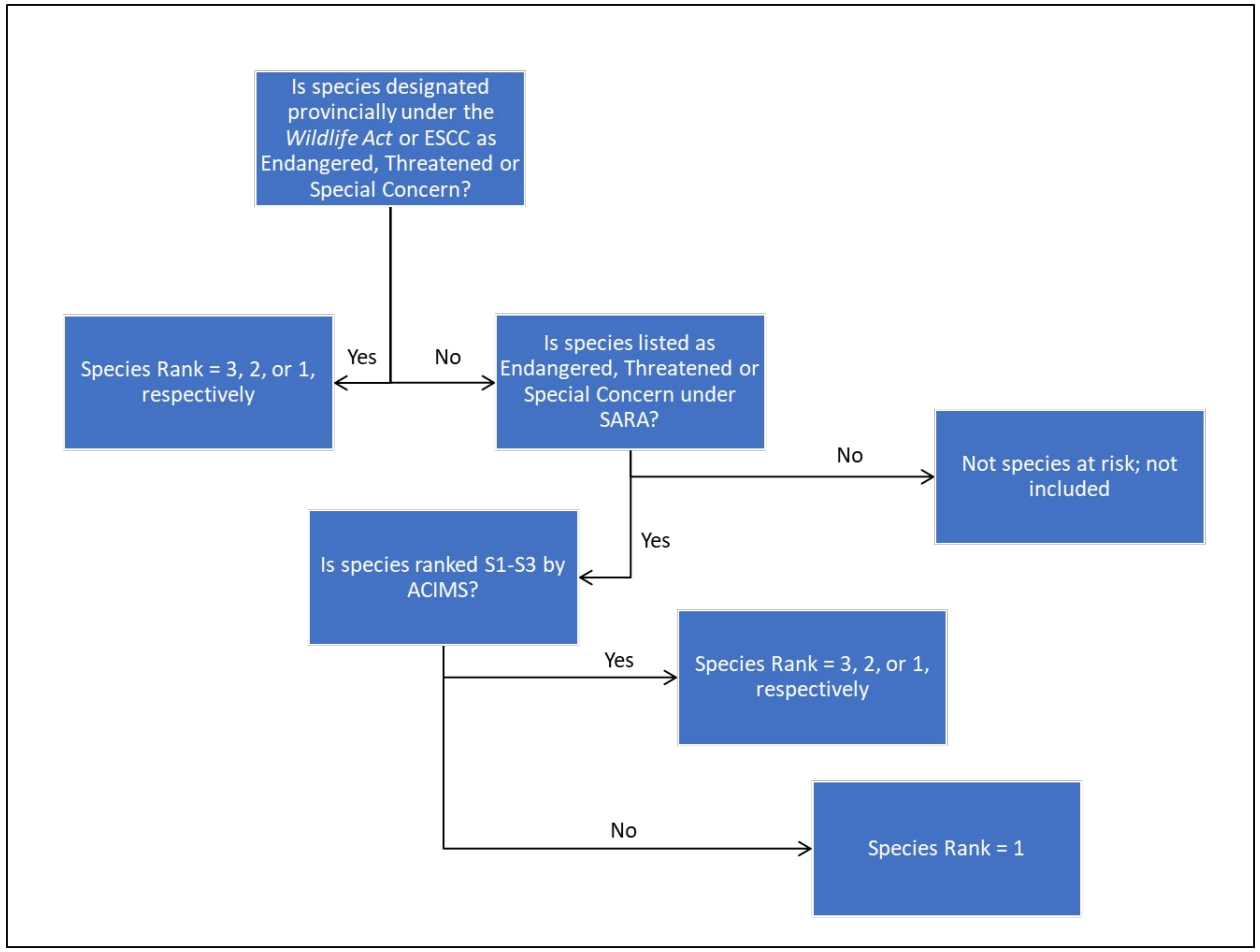


e.g., SW 24-38-20-W5

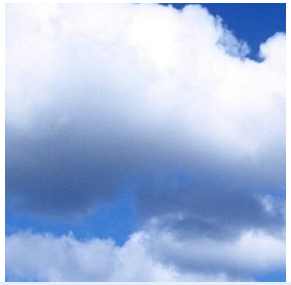
SAR Tool Process



(3) Species Selection and (4) Ranking (level 1):



SAR Tool Process



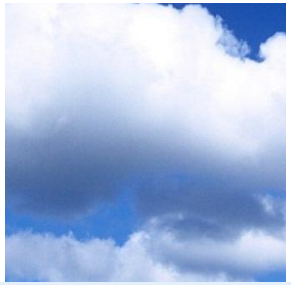
(4) Ranking (level 1): -> level of Endangerment (rank: 3-1)

Burrowing Owl (Endangered)
Rank = 3

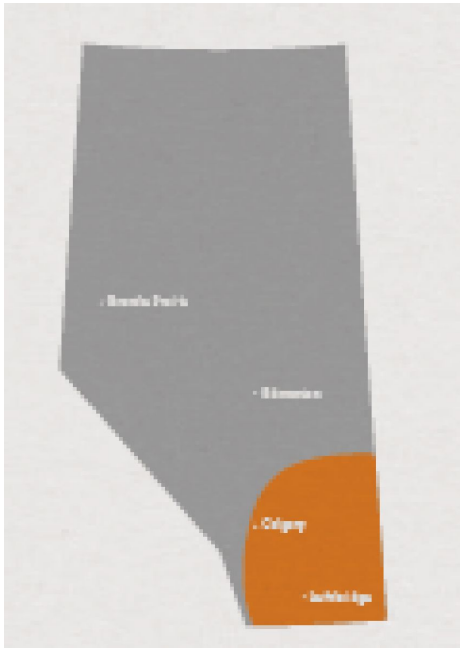
Small-flowered Sand Verbena (Threatened)
Rank = 2

Sprague's pipit (Special Concern)
Rank = 1

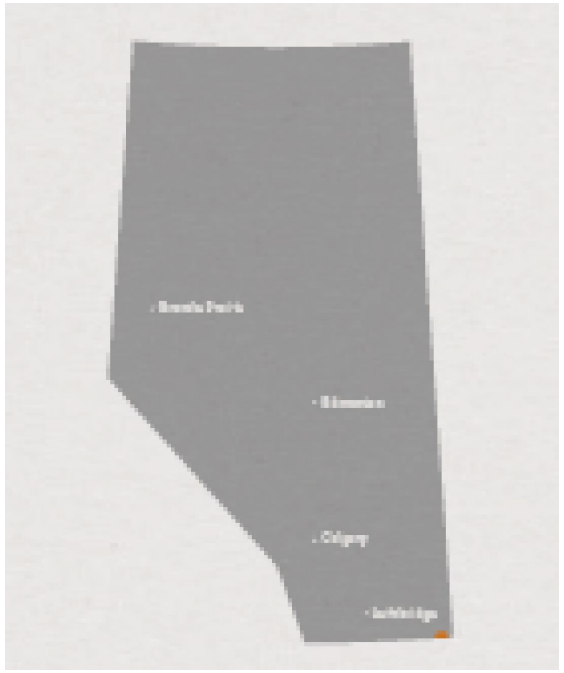
SAR Tool Process



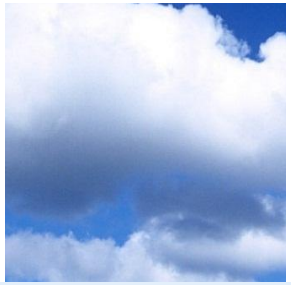
(4) Ranking (level 2 - Modifiers) : Range (Score : 1-2)



Long-billed Curlew (wide-ranging) – Score = 1

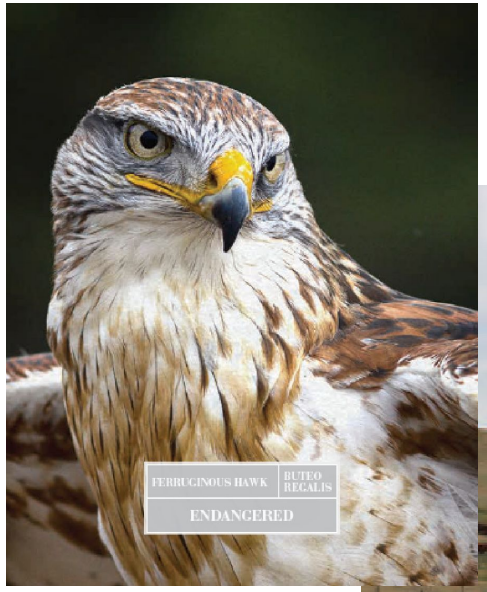


Mountain Plover (narrow-ranging) – Score = 2



SAR Tool Process

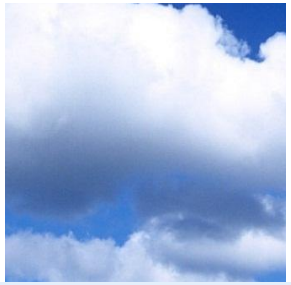
(4) Ranking (level 2 - Modifiers) : Specific Habitat Features (Score : 1-2)



Ferruginous Hawk (trees/shrubs) – Score = 2

Common Nighthawk (open habitats) – Score = 1

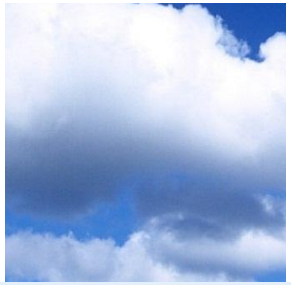
SAR Tool Process



(4) Ranking (level 2 - Modifiers) : Area sensitivity (Score : 1-2)

Short-eared owl (rel. to meadow vole pop'ns) – Score = 1

Sprague's pipit (>65 ha; 160 ac) – Score = 2



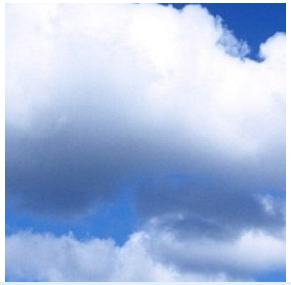
SAR Tool Process

(4) Ranking (level 2 - Modifiers): range of ecological tolerance (narrow/broad; Score : 1, 2)

Yucca, Five-spotted Bogus Yucca Moth, Non-pollinating Yucca Moth, Yucca Moth – Score = 2

Grizzly Bear (habitat generalist, large home ranges) – Score = 1

SAR Tool Process

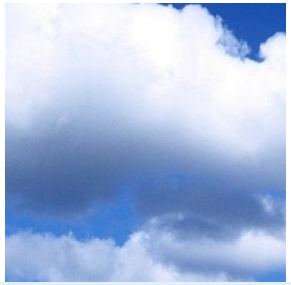


(4) **Modified Species Rank** = Level 1 + (sum of Level 2)/10

Species	Species Rank (Level 1)	Range: Wide ranging = 1 Narrow ranging = 2 (Level 2)	Strong association with specific habitat features No = 1 Yes = 2 (Level 2)	Displays minimum area requirements No = 1 Yes = 2 (Level 2)	Has a narrow range of ecological tolerance No = 1 Yes = 2 (Level 2)
Barred owl (*Strix varia*)	1 (Special Concern)	1	2	2	2

MSR (Barred Owl) = 1 + (1+2+2+2)/10 = 1.7

→ Ranked Species



SAR Tool Process

(5) Determine Key Species Habitat Requirements and (6) Assign Species to Habitat Lineage

Trumpeter Swan: Breeding habitat: shallow areas of water in ponds/lakes with emergent vegetation, beaver and/or muskrat lodges

- ○ **Water and wetlands**
  - □ **Ponds and Lakes**
    - -- **Shallow (less than 3 feet or 1 metre) with floating plants, beaver and /or muskrat lodges**

- Up to three levels of Habitat Types / Features

=> "Habitat Lineage" for Trumpeter Swan

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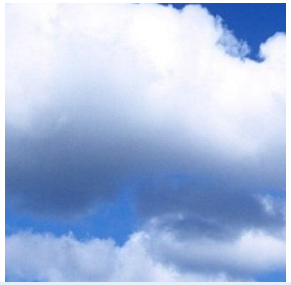
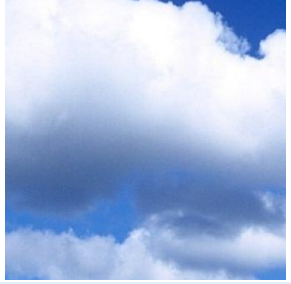
SAR Tool Process



(5) Determine Key Species Habitat Requirements and (6) Assign Species to Habitat Lineage

- ◯Badlands, cutbanks, cliffs, or other areas of exposed rock
- ◯Cultivation (irrigated)
- ◯Cultivation (non-irrigated)
- ◯Hay (irrigated)
- ◯Hay (non-irrigated)
- ◯Homestead
- ◯Native Grassland
- ◯Tame Pasture
- ◯Water and wetlands
- ◯Wood or Shrubs
- ◯Milkweed plants present

SAR Tool Process



(7) Seek existing BMPs (published and grey literature; species experts, etc.)

78	**Desired Outcome**: Intact old mixedwood forests with large diameter trees and snags. **One way to do it**: Retain large stands of old (> 100 years old) mixedwood forest with large diameter trees (live or dead; greater than 14 inches [35 centimetres]). Avoid building roads in forests but if a road is necessary, it should be placed in younger stands and be temporary. Avoid clearing trees or digging dugouts that attract cattle. Leave deadfall, leaning trees or cover plants. **Where**: In forested areas where barred owls, bats and warblers (birds) occur. **Why**: Larger intact old mixedwood stands offer multi-level habitats for birds and bats: 1) large trees and snags provide cavities and cracks for barred owls and bats to breed in, 2) tree foliage provides cover for nesting warblers and an abundance of caterpillars, budworms and other insects and spiders to feed their chicks, 3) lower spruce and fir trees or limbs provide cover for owl chicks, and 4) open space under the trees allows owls to fly and hunt prey from the woody debris on the ground.
79	**Desired Outcome**: Reduced disturbance in barred owl nesting habitat. **One way to do it**: Minimize disturbances at nest sites, including noise and traffic. **When**: Especially during the barred owl breeding period (March 1 - August 15). **Where**: Within 300 feet (100 metres) of a barred owl nest tree (usually snags or poplar/aspen trees greater than 14 inches [35 centimetres] diameter). **Why**: To improve breeding success. Barred owls are sensitive to human activities and avoid disturbed areas.

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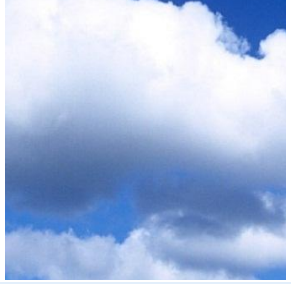
SAR Tool Process



(8) Assess BMP Compatibility (compatible, incompatible)

BMP_ID1	BMP1	BMP_ID2	BMP2	Compatibility
37	**Desired Outcome**: Large patches of silver sagebrush grassland. **How to do it**: Retain native silver sagebrush grassland. **Why**: **Greater sage-grouse** and sage thrashers are considered sagebrush obligates as they require sagebrush vegetation in part or all of their life cycles. Sagebrush shrubs are used to conceal nests of ground-nesting sage-grouse and shrub (> 1 yd or > 1m tall)-nesting sage thrashers. They are also used by both species as cover to escape predators. Sagebrush constitutes > 47-60% of adult sage-grouse diet in summer and 100% in winter. Large patches (> 250 ac or > 1 km2) of silver sagebrush are selected by hens for nesting and in Canada, three quarters of nests are within about 5 km of a lek (dancing ground) and up to 15 km.	35	**Desired Outcome**: Replacement nesting structure for the **ferruginous hawk**. **How to do it**: Install an artificial ferruginous hawk replacement nest platform, in consultation with a provincial biologist. **Where**: Where a natural nest fell or was damaged. **Why**: Ferruginous hawks don't typically build their own nest but will enlarge abandoned stick nests from other species and use them year after year. When destroyed, they readily use artificial replacement nesting structures that have the start of a nest on them.	-1

BMP Compatibility

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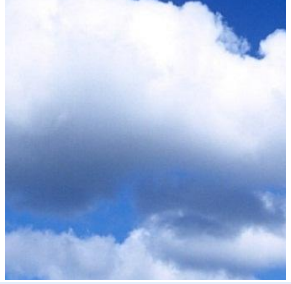
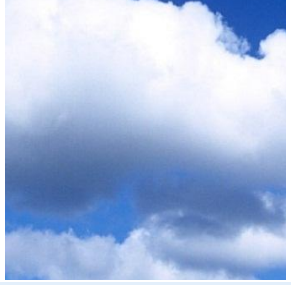
SAR Tool Process



(9) Rank BMPs – Benefit to species and Likelihood of Adoption

BMP_Desc	BMP_Rank	Barrier to Adoption Cost	Barrier to Adoption Time	Barrier to Adoption Economics	Adoption Likelihood
Desired Outcome: Large blocks of intact native prairie. **One way to do it: Retain and maintain land as native prairie.** **Where: Across the prairies.** **Why: Many grassland plants and animals, including butterflies, moths and other beneficial insects, need lots of space and/or do not survive well after their prairie habitat is broken and replanted.**	3	3	3	2	2.67

SAR Tool Process

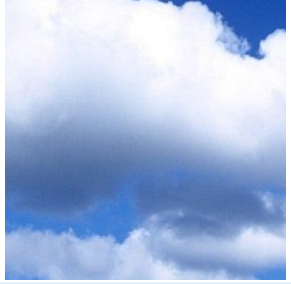


(10) Assign Species/Habitat Lineages to BMPs

HabitatCode	SpeciesID	SpeciesCount	BMP_ID	BMP_Desc	BMP_Rank	Adoption Likelihood
NaGBareGo, NaGBareNG, NaGMod, NaGSageNG, NaGSageGO, NaGSand, NaGShrubs, NaGUng, BadL, Cliff, ShrubUpl, MilkWe, WetEphemem	WESP, BUOW, CCLO, FEHA, SAGR, LOSH, LBCU, MCLO, OKRA, SEOW, SPPI, BDSP, SWFO, PRRA, RACE , MOPL, PRFA, GPTO, CONI, SATH, WHMO, VFMO, DDMO, GEGE, GWGR, MONA, PYDM, SMEC, TICR, SMGO, DWWH, WBFL, HFLO	33	1	**Desired Outcome: Large blocks of intact native prairie.** **One way to do it: Retain and maintain land as native prairie.** **Where: Across the prairies.** **Why: Many grassland plants and animals, including butterflies, moths and other beneficial insects, need lots of space and/or do not survive well after their prairie habitat is broken and replanted.**	3	2.67

→ Ranked BMPs

SAR Tool Process



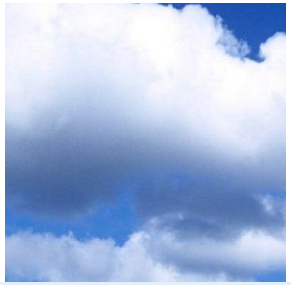
(11) Species Inference Data and (12) "Confidence Index"

- "Confidence Index"($_{naïve}$): a relative value (0 - 1) representing how reliable the data is at inferring species occurrence (by ext. suitable habitat) at a location of interest, given how the data was captured.
  - *Actual observation in breeding habitat with GPS coordinates (5 m res.): CI = 1*
  - *Range map: CI = 0.1 (no habitat information but greater probability inside range than outside range)*
  - *Habitat/Species Prob. Models: CI = 0 – 1 (= normalized index of habitat suitability)*

→ **NOT an actual PROBABILITY OF SPECIES OCCURRENCE**

→ **Gets multiplied by "2" (up to max of 1) when user selects habitat lineage (CI =)**

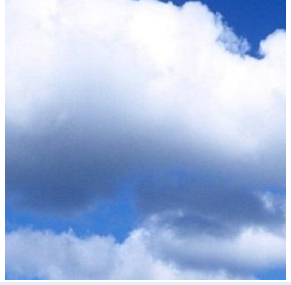
SAR Tool Process



(11) Species Inference Data and (12) “Confidence Index”

- Multiple data sources/taxa - various levels of CI (accuracy/protocol, etc.):
  - Conservation Data Centre/NatureServe EO point/polygon data (0.2 – 1)
  - Provincial/federal/private databases - FWMIS/ACIMS/ECCC/private (0.2 - 1.0)
  - Critical Habitat Maps (1.0)
  - Grizzly Bear Zones (AB) (0.8 – 1)
  - Existing Habitat Models (RSF/HSI); Species Prediction/Probability Models (*normalized between* 0.1 - 1.0)
  - Global Biodiversity Information Facility (GBIF) (0.2 – 1)
  - eBird Data (0.2 - 1)
  - Bumble Bee Watch (0.2 – 1)
  - Species Range Maps (0.1)….. Etc.

SAR Tool Process



(13) Data and GIS Processing

- ELCODE (key field) added to data set
- Project data to Canada Lambert Conformal Conic (NAD 83 datum)
- Models clipped to species range maps
- Point data buffered where relevant
- Inference data assigned CI and “source”

- Python 2 Script (ArcGIS 10.x):
  - Summarizes species inference data from all sources at quarter section (mgt unit) level
  - Selects source with highest CI for each species in the mgt unit

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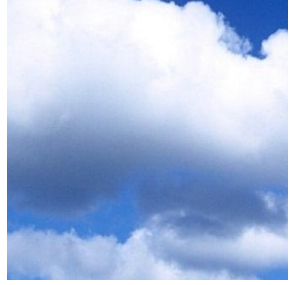

How it Works:

USER INTERFACE

BACK-END DATABASE

1- Land Parcel of Interest (Legal Land Description)

User Entry: e.g., SW-4-5-6-W4

query

Species/ Management Unit

(Naïve) List of species in quarter section (Mgt Unit)

2- Habitat Types / Features

Selection of Habitat Types / Features by User (up to three levels)

Species-Habitat Lineages

Selected Habitat Lineages and their associated species

Two lists of species compared; matching species kept

Reduced and "informed" list of species-habitat lineages

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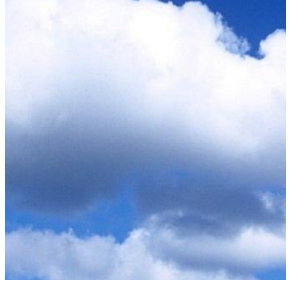
How it Works:



USER INTERFACE

BACK-END DATABASE

Reduced and "informed" list of species-habitat lineage

Matching habitat-species

Ranked BMPs

Land parcel - specific SAR BMPs + Ranks

BMP Compatibility

Ranked Species

Calculation of Conservation Opportunity Points

Compatible BMPs Package 1

incompatible

Compatible BMPs Package 2

List of potential species at risk

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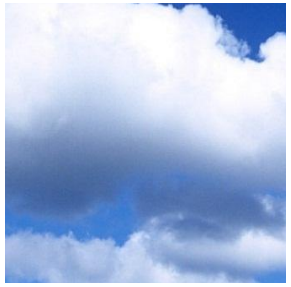
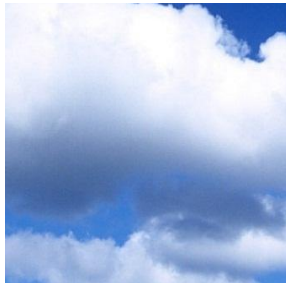
This is what the output looks like:



Species at Risk	Conservation Opportunity	COP	Priority
Ferruginous hawk; Burrowing owl; Loggerhead shrike; Prairie rattlesnake; Prairie falcon; Sprague's pipit; Chestnut-collared Longspur; McCown's Longspur; Baird's Sparrow; Long-billed curlew; Short-eared owl; Common Nighthawk	**Desired Outcome:** Large blocks of intact native prairie. **One way to do it:** Retain and maintain land as native prairie. **Where:** Across the prairies. **Why:** Many grassland plants and animals need lots of space and do not survive well after their prairie habitat is broken and replanted.	57.18	High

This is how it's calculated:



Conservation Opportunities: Σ Action Priority$_{(all\ spp)}$ x BMP Rank // per individual BMP

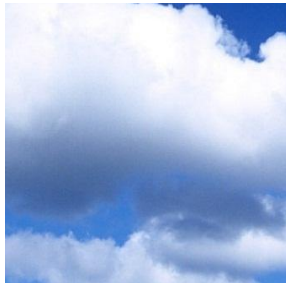
Species ID	Source	CI (naïve)	Modified Species Rank	CI (informed) (doubled up to 1)	Action Priority
Ferruginous Hawk	FWMIS	1	3.6	1	3.6
Burrowing Owl	HSI	0.5	3.5	1	3.5
Chestnut-collared Longspur	FWMIS	0.8	1.7	1	1.7
Prairie Falcon	RSF	0.9	1.6	1	1.6
Baird's Sparrow	FWMIS	0.8	1.6	1	1.6
Prairie Rattlesnake	RSF	0.7	1.6	1	1.6
Sprague's Pipit	RSF	0.5	1.6	1	1.6
Loggerhead Shrike	RSF	0.8	1.5	1	1.5
McCown's Longspur	eBird	0.2	1.6	0.4	0.64
Long-billed Curlew	eBird	0.2	1.5	0.4	0.6
Short-eared Owl	eBird	0.2	1.4	0.4	0.56
Common Nighthawk	eBird	0.2	1.4	0.4	0.56
Barred Owl	Range Map	0.1	1.7	0	0
				Combined Action Priority (= Σ Action Priority):	19.06
				BMP Rank (BMP ID #1):	3
				Conservation Opportunity Priority (COP)	57.18

Retained from Habitat/Feature selection

Not retained from Habitat/Feature selection

COP accounts for expected impact (+) of BMP on multiple species

Revisions to output



- Here's a package for one location

Conservation Opportunity	NB of Species	ModSrank	BMP_Rank	Sum of CI (naïve)	Sum of ActionPriority(i)	Conservation Opportunity Points (old approach)	Priority (old approach)	% of Total CO Value
Desired Outcome: Large blocks of intact native prairie. One way to do it	9	18.1	3	5.6	14.56	43.68	High	14.03
Desired Outcome: Connected blocks of native prairie. One way to do it:	9	18.1	3	5.6	14.56	43.68	High	14.03
Desired Outcome: Naturally occurring trees or shrubs on native prairie.	9	18.1	3	5.6	14.56	43.68	High	14.03
Desired Outcome: A grassland with patches of bare ground, short and t	8	14.3	3	4.5	10.48	31.44	High	10.10
Desired Outcome: Undeveloped native prairie. One way to do it: Restri	7	13	3	4.6	10.36	31.08	High	9.99
Desired Outcome: Improved breeding habitat for grassland birds. One	5	10.2	3	4.2	9.24	27.72	High	8.91
Desired Outcome: Reduced pesticide contamination. One way to do it:	8	14.5	2	4.7	10.68	21.36	High	6.86
Desired Outcome: Reduce pesticide contamination. One way to do it: L	4	8.2	3	2.2	6.46	19.38	High	6.23
Desired Outcome: An intact prairie landscape devoid of invasive non-n	9	18.1	1	5.6	14.56	14.56	Medium	4.68
Desired Outcome: Prairie patches one quarter (160 acres, 65 hectares)	6	9.2	2	3.6	6.56	13.12	Medium	4.22
Desired Outcome: Protect water quality and riparian habitats. One way	6	12.1	2	1.6	6.16	12.32	Medium	3.96
Desired Outcome: Low disturbance in grassland bird breeding areas. Or	5	10.2	1	4.2	9.24	9.24	Medium	2.97
Desired Outcome: Healthy wetlands, ponds, rivers and streams. One w	4	7	3	0.6	1.96	5.88	Low	Removed
Desired Outcome: Shallow areas of clear, clean and undisturbed water	1	2.6	3	0.1	0.52	1.56	Low	Removed

Total Conservation Value for Package #1: 311.26

Alberta Environmental Farm Plan

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