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An Opportunity Cost Model for Species at Risk Habitat Protection in Saskatchewan's Milk River Watershed

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An Opportunity Cost Model for Species at Risk Habitat Protection in Saskatchewan's Milk River Watershed

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I. A New Direction for Species at Risk Policy?

- Canada's Species at Risk Act provides the legal foundation for the protection and recovery of species at risk [1].
- Socio-economic analyses are rarely included within the recovery planning process and instead are used as an "after-the-fact" evaluation of a project [2].
- However, including socio-economic considerations within the planning process provides large efficiency gains and cost-savings [3][4][5].
- The federal government primarily creates recovery strategies and action plans on a species-by-species basis.
- There may be additional efficiency gains and cost-savings possible by including multiple species at risk within a single action plan (Figures 1 and 2) [6].

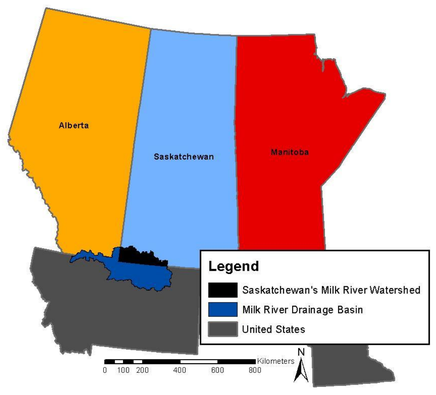

Figure 1. Map of the Milk River Watershed within Saskatchewan.

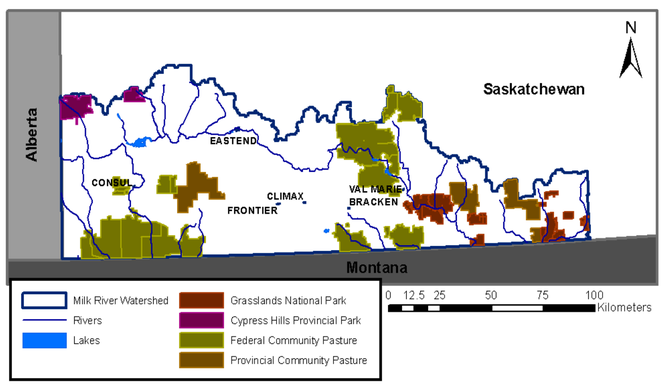

Figure 2. Detailed map of the Saskatchewan Milk River Watershed.

Research Questions:

1. **Can the inclusion of conservation costs in the critical habitat designation process potentially improve efficiency?**
2. **Can multi-species plans provide cost-savings?**
3. **How do habitat connectivity (i.e. contiguity) requirements affect conservation costs?**
4. **What combinations of quarter sections and conservation activities can optimally conserve species' habitat within the region?**

II. Creating the Marxan Models

- Two Marxan models were used to determine which quarter sections within the watershed should be included in a cost-effective habitat protection design (Figure 3) [7][8].
- One model has only two zones – protected and unprotected – while the second model provides several different conservation zone options (Table 1).
- The cost of protecting Saskatchewan's Milk River Watershed in perpetuity under the strictest conservation zones (current protected areas, new protected areas and community pasture reserves) is estimated at $1.66 billion in both models.

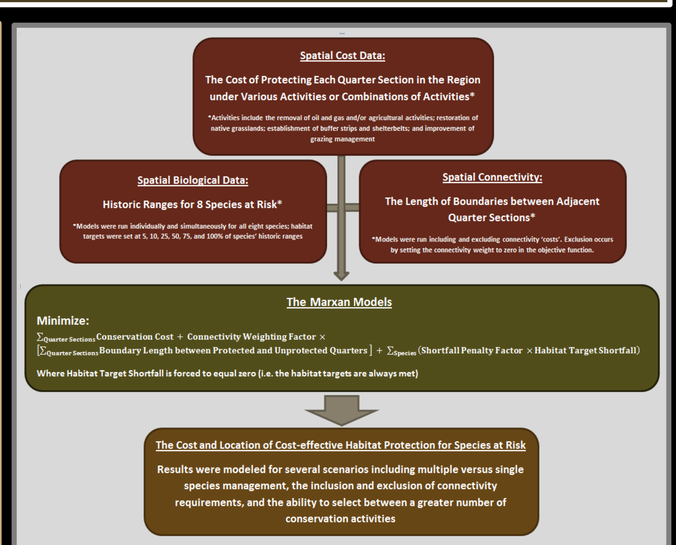

Figure 3. Diagram outlining the inputs, objective function, and outputs of the Marxan models. The second model has an additional constraint that allows conservation activities to contribute differently to effective habitat protection (see Table 1).

Table 1. The conservation zones of the Marxan models.

Conservation Zone	Contribution to Habitat Protection[1]	Costs Involved	Model 1[2]	Model 2
Retention of Current Protected Areas[3]	100% for all species	No additional costs	X	X
Community Pastures	70% for all species	No additional costs		X
Private native pastures	50% for all species	No additional costs		X
Community Pasture Reserves	100% for all species	Foregone Oil and Gas Revenues Grassland Restoration Costs+ Foregone Hay and Crop Revenues	X	X
New Protected Areas	100% for all species	Foregone Oil and Gas Revenues Foregone Agricultural Revenues (Grazing, Hay and Crop) Grassland Restoration Costs	X	X
Conservation Easements	75% for all species	20% of Agricultural Land Value		X
Healthy Grasslands	75% for all species	Grassland Restoration Costs+ Foregone Hay and Crop Revenues Foregone Grazing Revenues (from decreased stocking rates)		X
Buffer Strips	25% for all species	Cost of Establishment + Foregone Hay and Crop Revenues		X
Shelterbelts	25% for 1 species; 0% for all others	Cost of Establishment + Foregone Hay and Crop Revenues		X
Unprotected	0% for all species	No additional costs	X	X

[1] This is the proportion of a quarter section included in each conservation zone that will contribute to the "effective" habitat protection target.
[2] The current protected areas, community pasture reserves, and new protected zones are all lumped into one conservation zone (i.e. "protected") within the first Marxan model, and all other land is classified as "not protected". In this way, the first Marxan model uses a binary choice between a protected zone and an unprotected zone.
[3] All current protected areas are "locked in" within the Marxan models (i.e. they are always included within the "protected" quarter sections).

III. Including Economic Costs and Multiple Species Improves Economic Efficiency

- Including cost considerations in habitat designation results in a lower per unit cost ($/acre) of habitat protection (Figure 4).
- Designating habitat protection for several species simultaneously provides substantial cost-savings (Figures 5 and 6).
- Multi-species plans can help to reduce the additional costs required to improve habitat connectivity (Figures 5 and 6).
- Allowing the Marxan model the freedom to chose from multiple conservation zones results in a lower per unit cost ($/acre) of habitat protection (Figure 7).

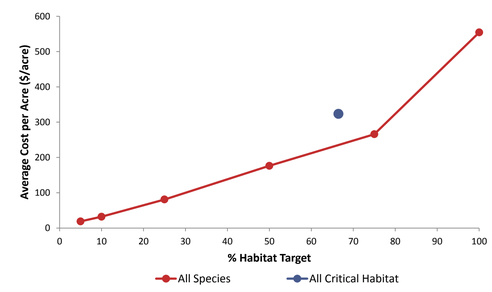

Figure 4. The cost of protecting species' historical ranges and the cost of protecting the quarter sections designated as critical habitat.

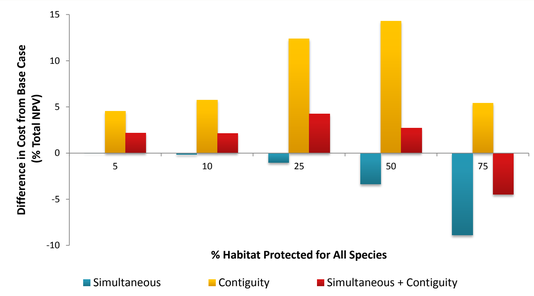

Figure 5. The difference in cost under various management scenarios in Model 1 (base case = individual species management with no habitat connectivity requirements).

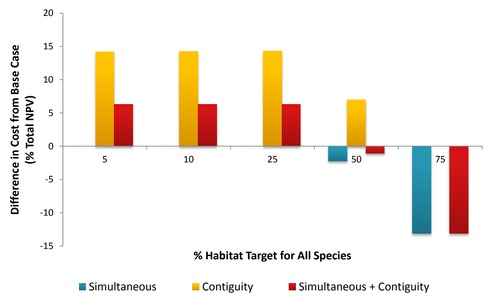

Figure 6. The difference in cost under various management scenarios in Model 2 (base case = individual species management with no habitat connectivity requirements).

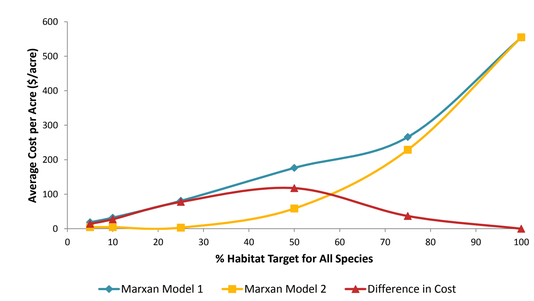

Figure 7. The average cost per acre of habitat protection for the two Marxan models.

IV. The Type and Location of Cost-effective Habitat Protection

- Habitat protection in Model 1 is concentrated on current native grasslands and protected areas. Cropland and regions with high levels of oil and gas activity are selected with the lowest frequency (Figures 8a and 8b).

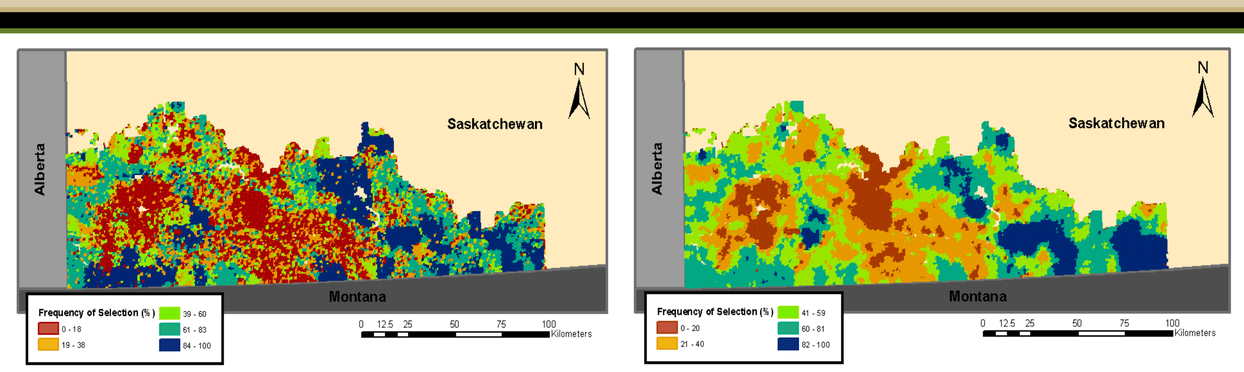

Figure 8. The frequency (%) that each quarter was selected for the 'protected zone' within Model 1, and **8b.** The same model run with habitat connectivity requirements.

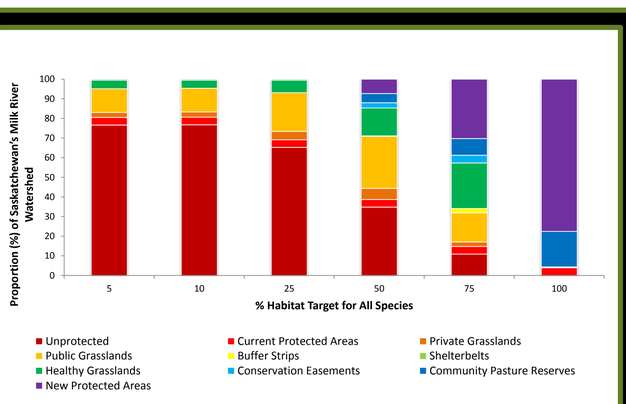

Figure 8. The proportion of Saskatchewan's Milk River Watershed that is protected in the Model 2 conservation zones.

- Habitat targets of 5, 10 and 25% can primarily be met through current management (Figure 8).
- A higher diversity of conservation zones is implemented on the landscape once habitat protection targets reach 50% or more (Figure 8).
- At the very highest protection levels, only the strictest conservation zones can provide sufficient habitat protection (Figure 8).

V. Literature Cited

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