



***Landscape management strategies for the
conservation of large mammal species***

A collaborative approach

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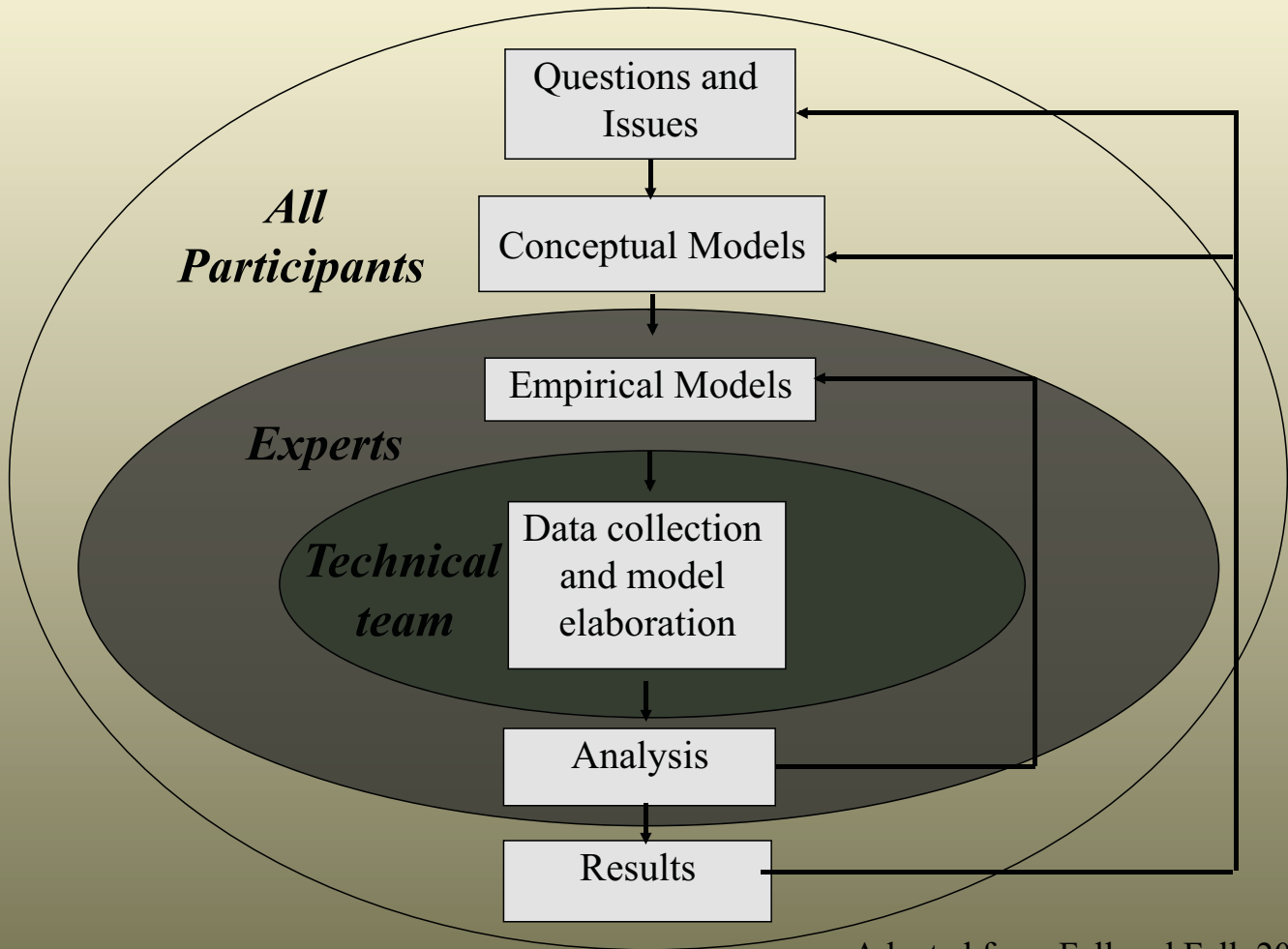
Complex problems

- Large area - mapping issues
- Long time frames - variability and uncertainty
- Elaborate socio-economic and policy environments - bound resource conflict
- Myriad values to be considered
- Variety of spatial and temporal scales over which ecological and economic processes operate



Combining our talents

- Combining diverse sources of expertise to generate novel ideas and solutions
- Leading to a better understanding of the issues, the activities and the ecological dimensions of the forest
- Allowing for better communication and co-operation



Adapted from Fall and Fall, 2003

Landscape management - goals

Effective protection is provided through management of the amount and type of human developments and potentially natural disturbances.



Forest planning and operational practices should provide a forest landscape that ensures woodland caribou are able to move freely across it through time.

Pikangikum First Nation - O'Flaherty, Davidson-Hunt and Manseau. 2008. Ecology and Society.



Conceptual models

- Minimize disturbance around sensitive areas
- Maintain and/or increase large patches of habitat
- Maintain and/or restore connectivity between core habitat areas (creating a functional landscape mosaic)
- Maintain key species interactions and functional diversity
- Maintain appropriate natural disturbance regime





Empirical models

- **Site level (animal)**
Sensitive areas
- **Range level (herd)**
Population and habitat analysis
- **Landscape level (metapopulation)**
Landscape genetic and habitat analysis

....Manitoba data

Empirical models – site level

Scale

Spatial (small areas) and temporal (seasonal).

Pattern based

Identify and ensure buffer around sensitive areas, minimize disturbance.

Process based

Spatial separation from other ungulates and predators, minimize ecosystem-specific threatening processes.

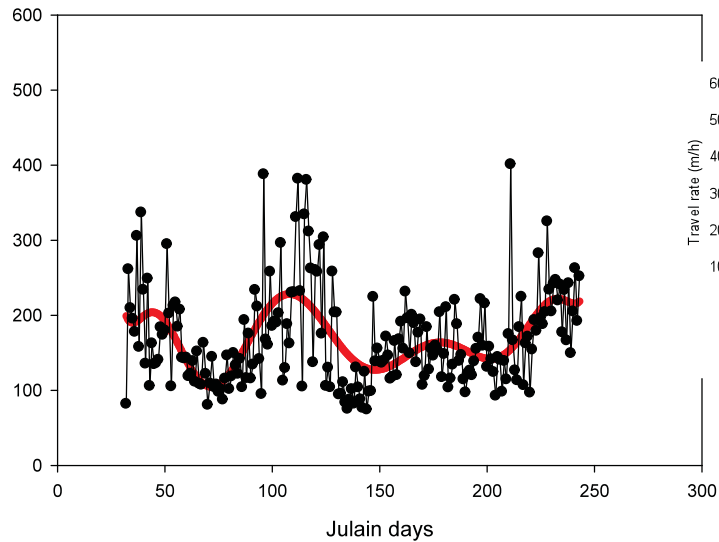
Data

Experts knowledge, telemetry, vegetation data.

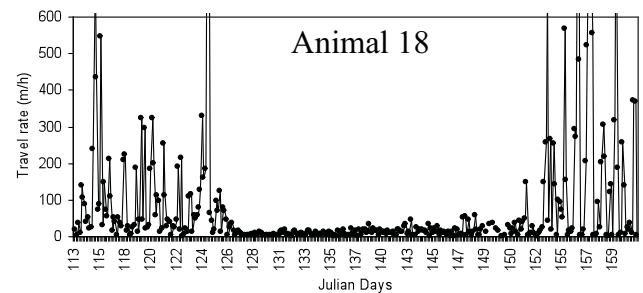


Sensitive areas

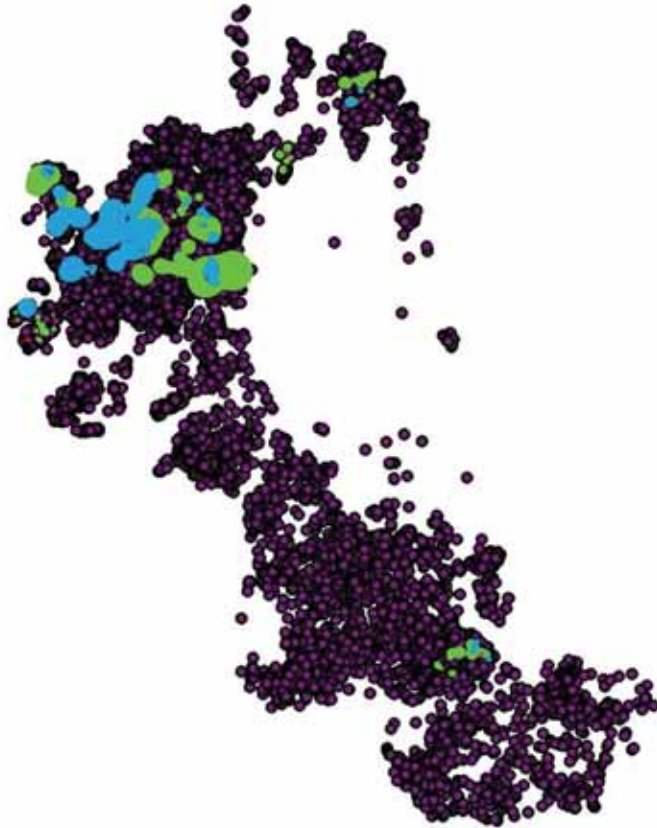
K-N calving animals Feb-Sept travel rates
(10th order polynomial regression)



Movement rates



Kississing-Naosap herd



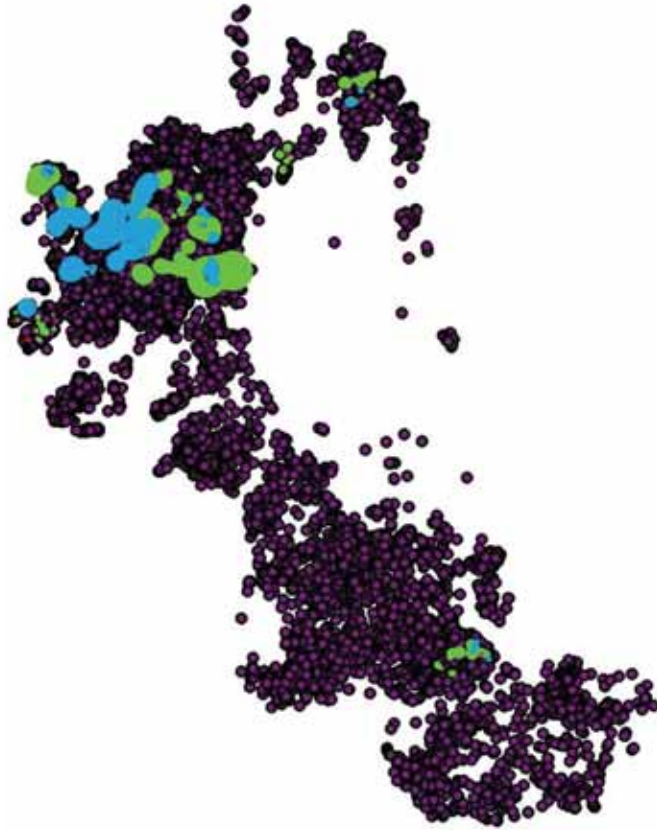
Pre-calving, calving and post-calving areas



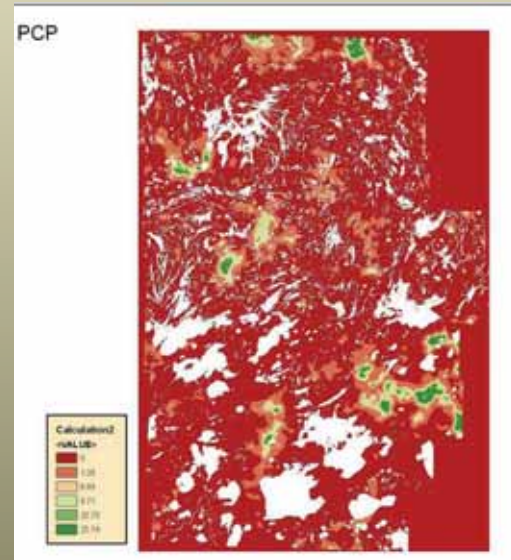
Animal 18

Dyke. 2008. Masters thesis. NRI.

Kississing-Naosap herd



Calving Season



Predictive mapping

Dyke, 2008. Masters thesis. NRI.



Empirical models – range level

Scale

Spatial (animal distribution, forest management unit) and temporal (planning process)

Pattern based

Quality and quantity of habitat, types, amount and spatial distribution of natural and anthropogenic disturbance.

Process based

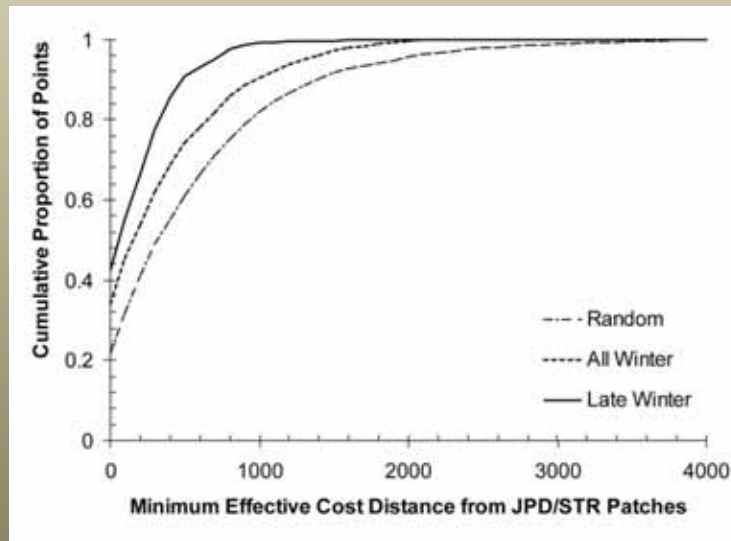
Movement corridors, stepping stones and functional attributes of habitat patches, spatial separation from other ungulates and predators, alternative habitat to account for natural landscape disturbances such as fire and insect infestation.

Data

Experts knowledge, telemetry, population and vegetation data.

Range level – landscape habitat analysis

Distance to high quality habitat patches – strong selection



O'Brien, Manseau, Fall, Fortin. Biol. Cons. 2006.



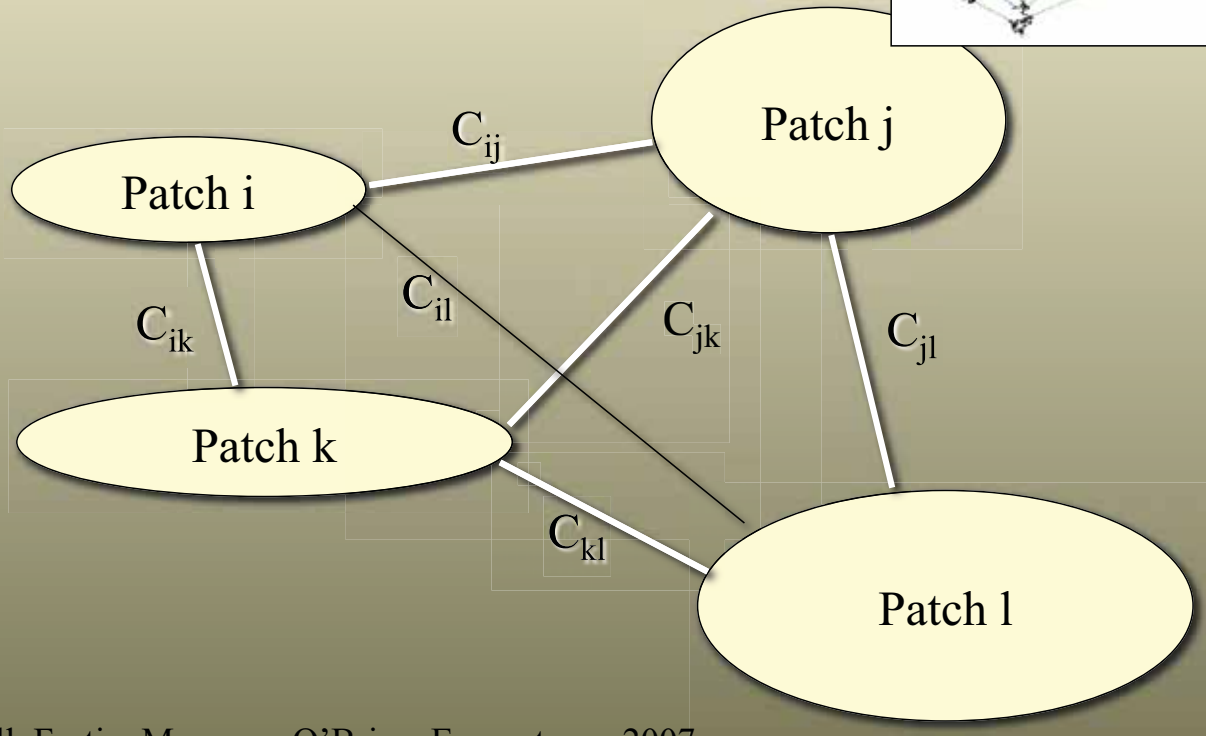
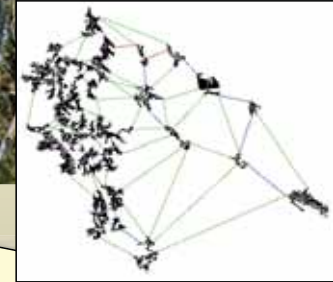
Range level – landscape connectivity

Definition - the degree to which a landscape facilitates or impedes movement (Taylor et al. 1993).

It relates to:

- the amount of habitat;
- the configuration of habitat; and
- the intervening land types.

Landscape Connectivity

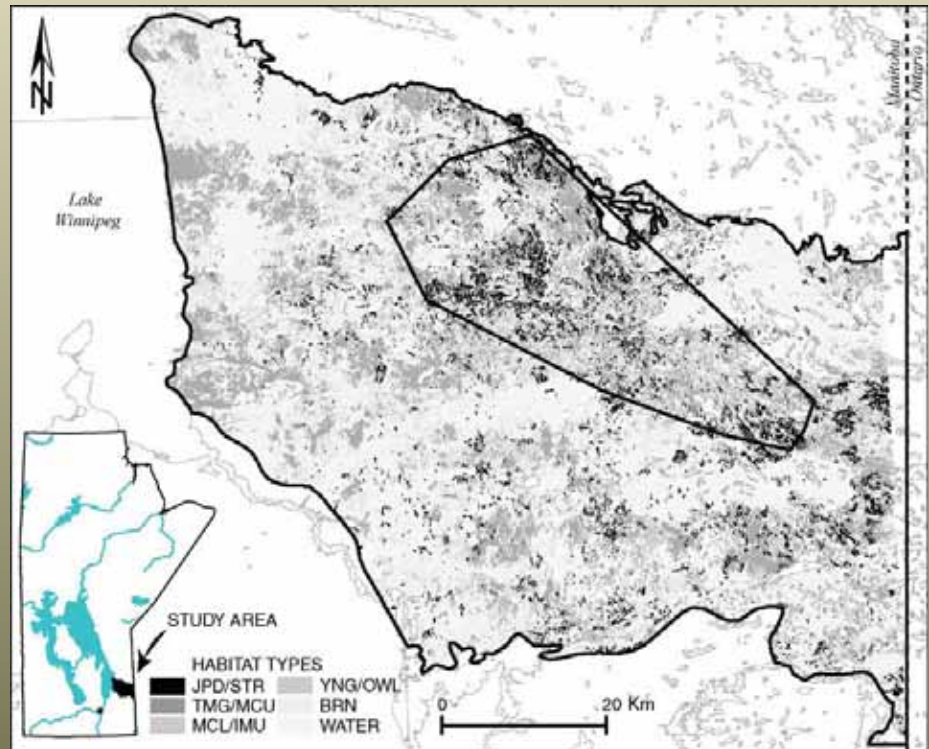


Fall, Fortin, Manseau, O'Brien. Ecosystems. 2007.

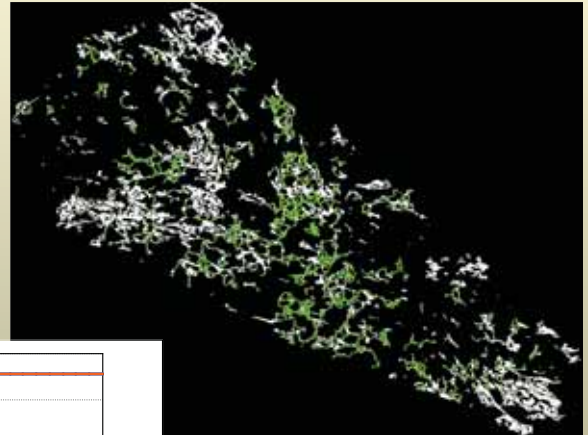
Landscape connectivity analysis

Range level

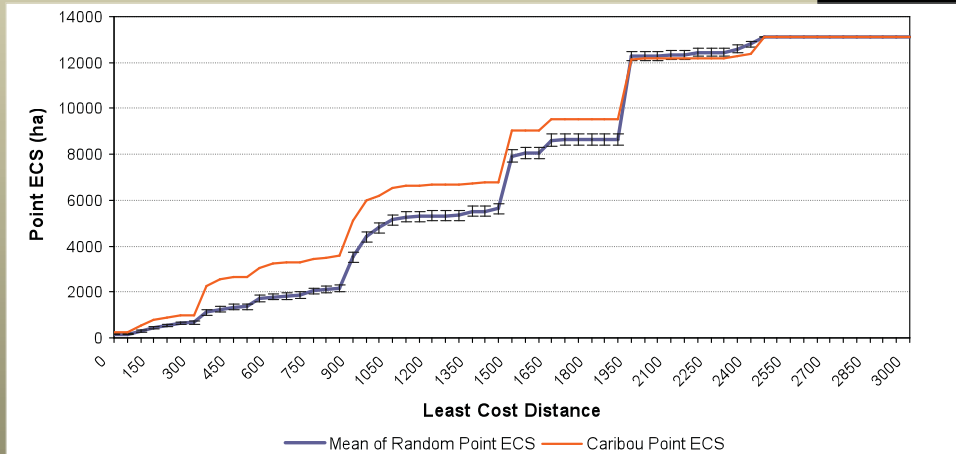
- Habitat map (winter)
- Cost map
- Graph extraction
- Validation



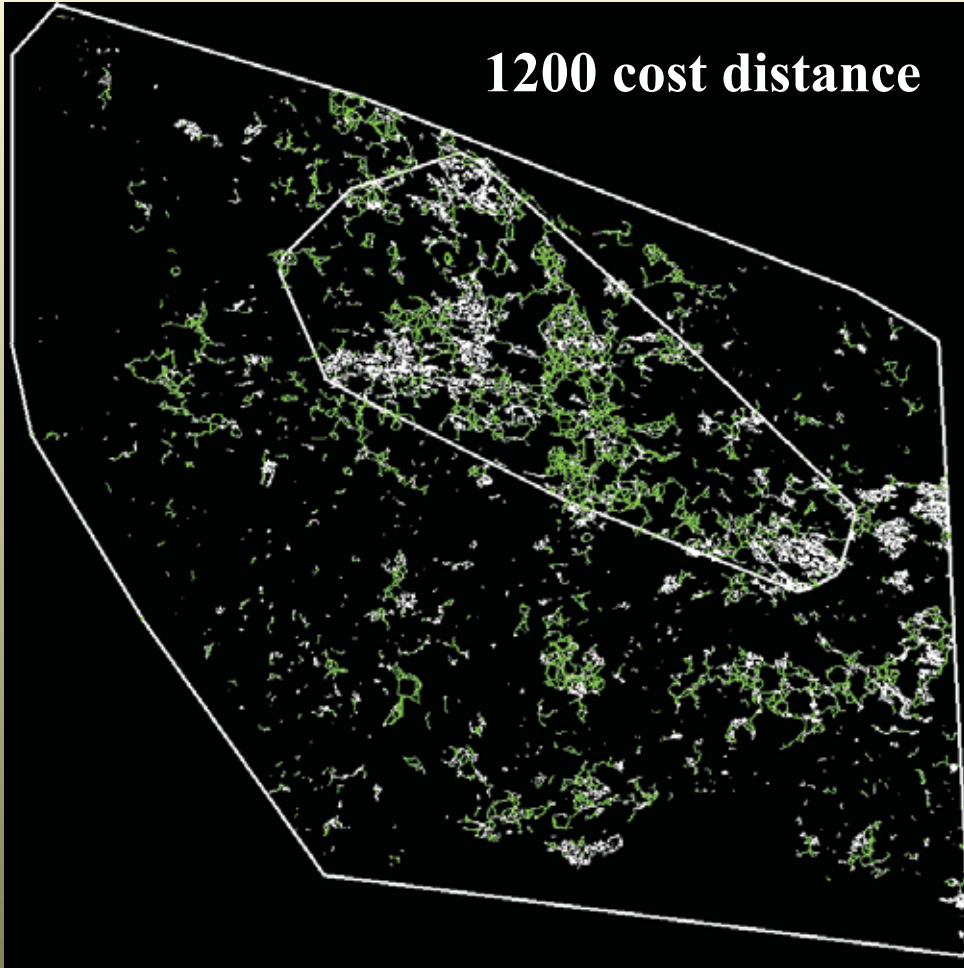
Landscape connectivity



800 cost distance



1200 cost distance



O'Brien, Manseau, Fall, Fortin. Biol. Cons. 2006.



Empirical models – landscape level

Scale

Spatial (metapopulation, region, province) and temporal (many decades)

Pattern based

Quality and quantity of caribou ranges; types, amount and spatial distribution of natural and anthropogenic disturbances.

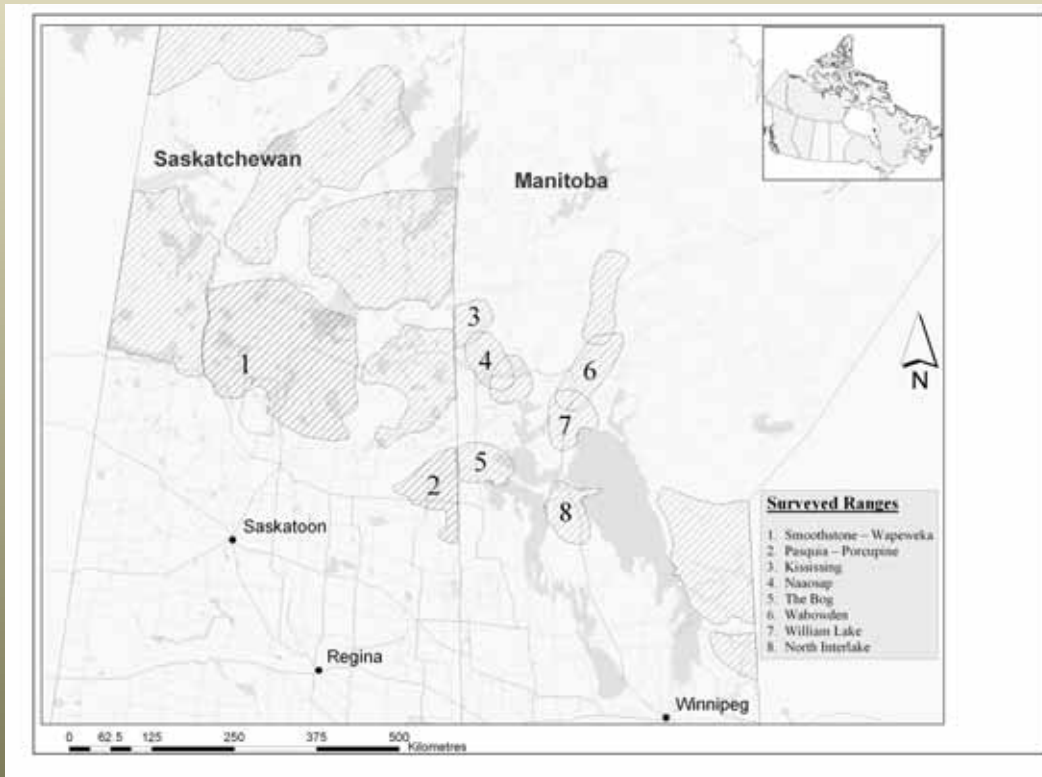
Process based

Movement corridors, stepping stones and functional attributes of caribou ranges.

Data

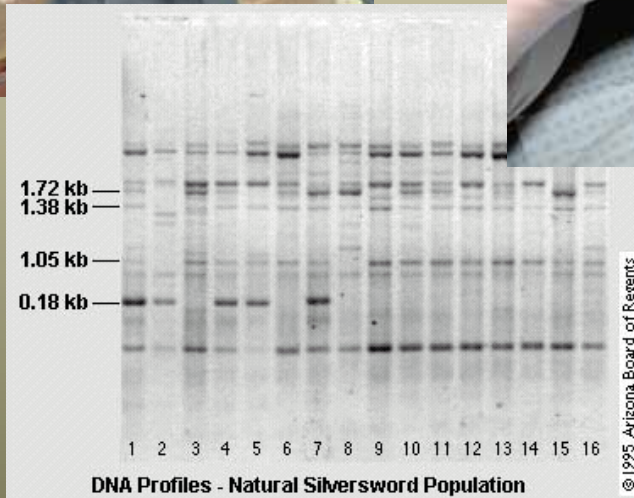
DNA, vegetation data.

Landscape level

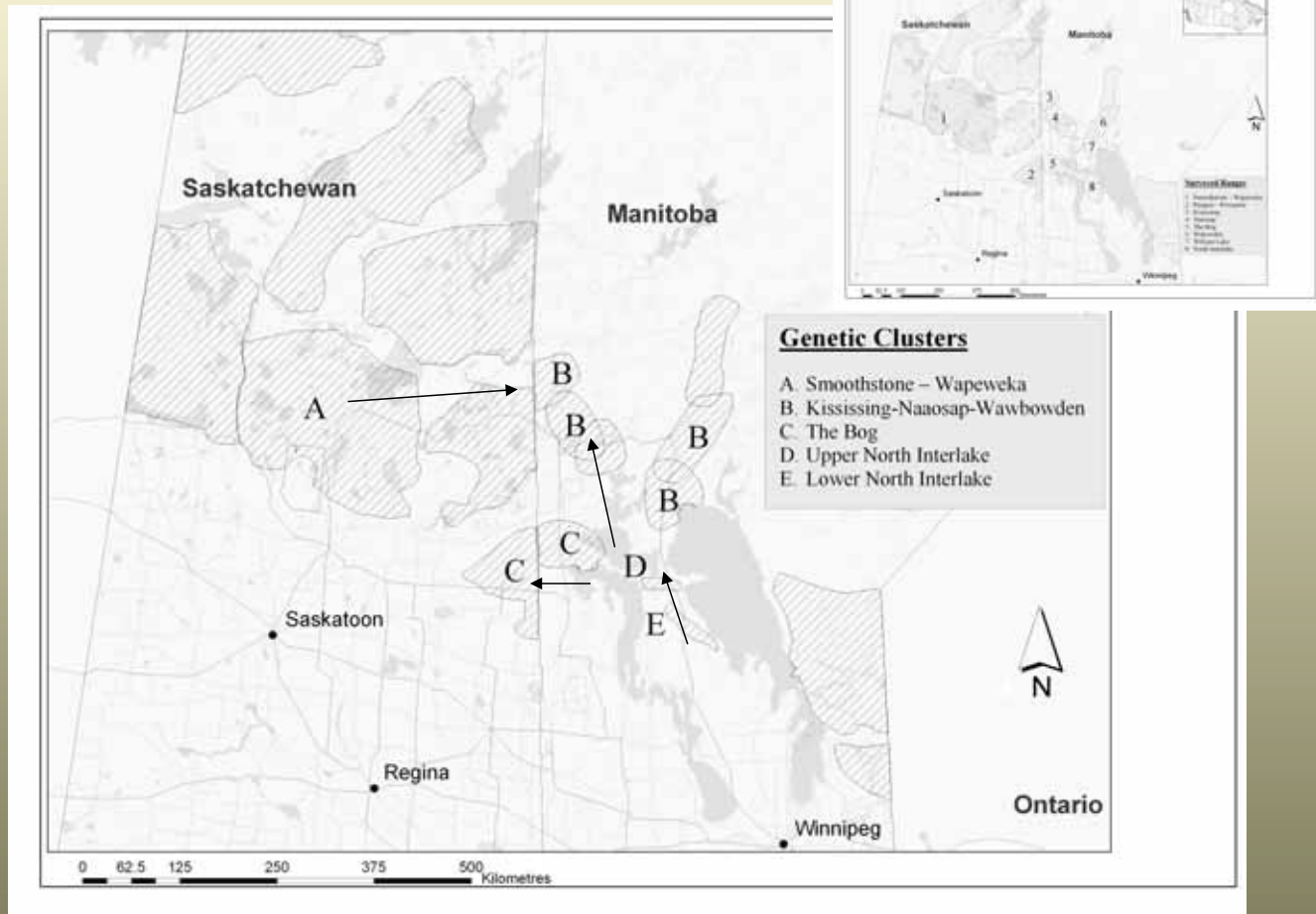




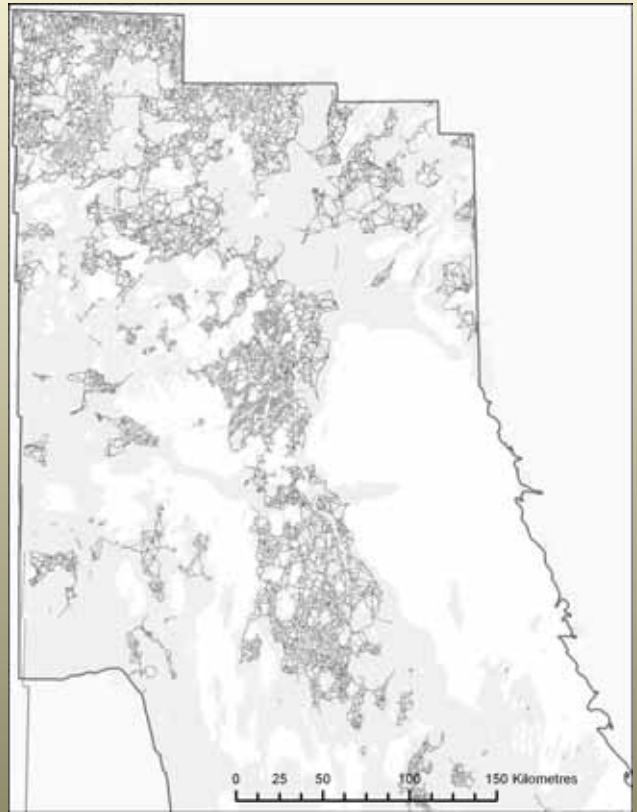
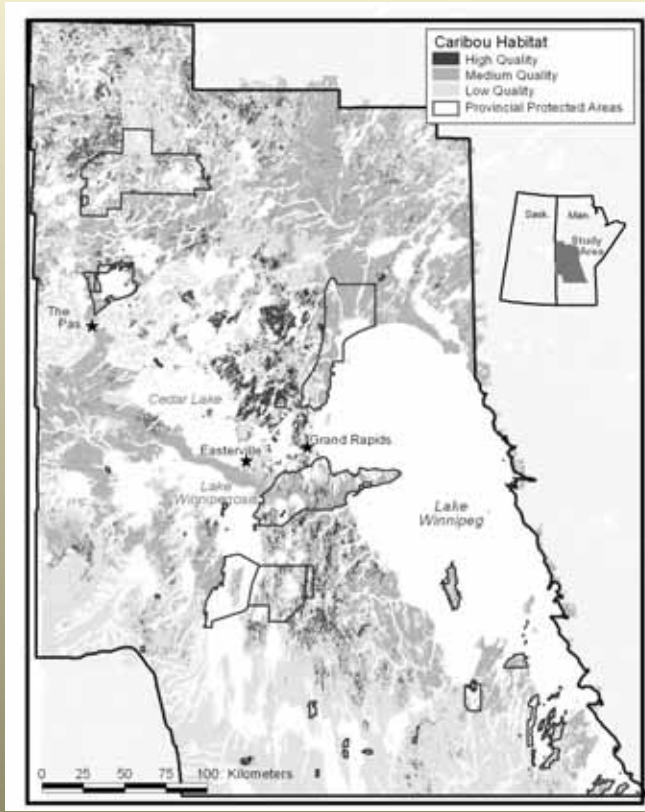
DNA Extraction & Marker Amplification



Ball, Pither, Manseau, Petersern, Clark, Kingston, Morrill and Wilson. Cons. Genetic. 2007.



Ball, Manseau and Wilson. Mol Ecology (submitted)



10000 cost distance



Conclusion

- Collaborative approach provides for a better definition of the issues, the questions of conceptual models.
- Analyses help answer some questions (quantify some parameters) and continuously redirect the research efforts...from one scale to another. Advanced technical support (GIS, spatial analysis etc.) is necessary in all landscape-level planning efforts.
- The co-production of knowledge allows for a better understanding of the results and its relevance to forest management, land use and recovery activities, establishment and management of protected areas.

Ahtik are moving animals (*ehbeemosaych*) so a holistic approach is needed to preserve the complexity and dynamism of the forest mosaic as a whole, as opposed to simply preserving specific patches of the current forest that are identified as critical habitat.

Pikangikum First Nation - O'Flaherty, Davidson-Hunt and Manseau. *Ecology and Society*. 2008.



An integrated landscape management effort to effectively protect boreal species and achieve forest management goal.



Contributors

Andrew Fall, Dan O'Brien, Mark Ball, Jeff Clark, Richard Pither, Paul Wilson, Michael O'Flaherty, Iain Davidson-Hunt, Marie-Josée Fortin, Stephen Petersen, Jennifer Keeney, Sones Keobouasone, Kent Whaley, Dale Cross, Vicki Trim, Dan Frandsen, Lou Torretti, Tim Trottier, Al Arsenault, Fiona Moreland, Brad Tokaruk, Ed Kewal

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<http://www.lecol-ck.ca> [LE.Caribou]