



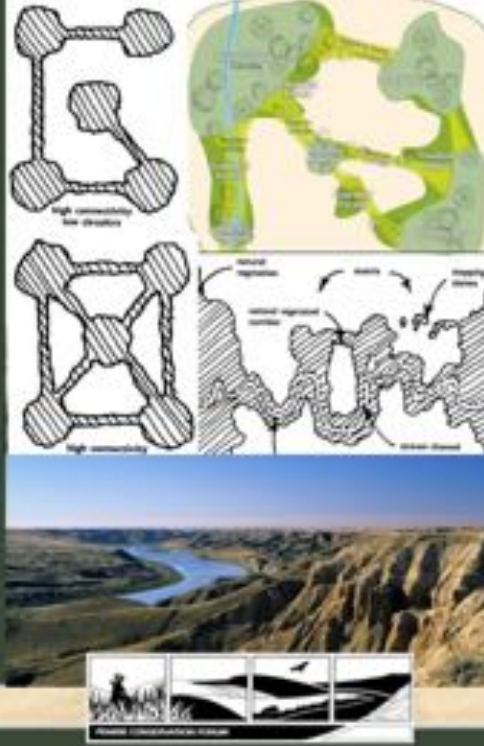
This presentation is intended to 'set the scene' as the 'information out' component of a Connecting Corridors Workshop held by the Prairie Conservation Forum in Airdrie, AB 29th Oct 2019. It frames the PCF intent for corridors and reflects in summary some snippets from an advance webinar held the previous week where the connectivity concept was explained by Dr. Leif Olsen (O2 Planning and Design, Calgary), applied research on pronghorn connectivity was presented by Dr. Andrew Jakes (NWF, Missoula), and a decision support tool to prioritize road sections for highway mitigation based on human safety and wildlife connectivity was presented by Tracy Lee (Miistakis Institute, Calgary). The presentation concludes with a summary of relevant work undertaken by the PCF and ABMI.

The workshop involved some two dozen invited experts and was designed to:

- identify key places where corridor conservation and restoration efforts should be focused (and criteria to make those selections);
- Identify criteria for determining priorities for action; and
- Make recommendations for how site projects, broader policy and public education might be undertaken.

Overview

- **Set scene**
- *Musings*
- **02**
- *Pronghorn*
- *Roads*
- *Spatial guidance*
- *Take homes*



Presentation Outline

PCF Vision

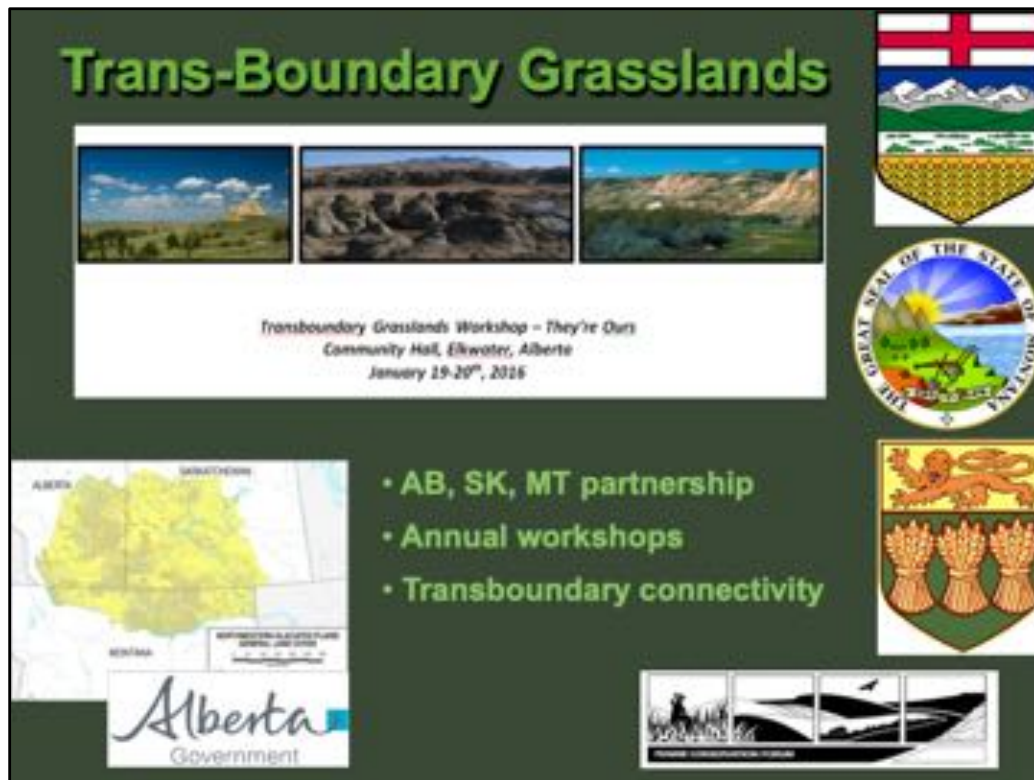
"The biological diversity of native prairie and parkland ecosystems is secure under the mindful and committed stewardship of all Albertans."



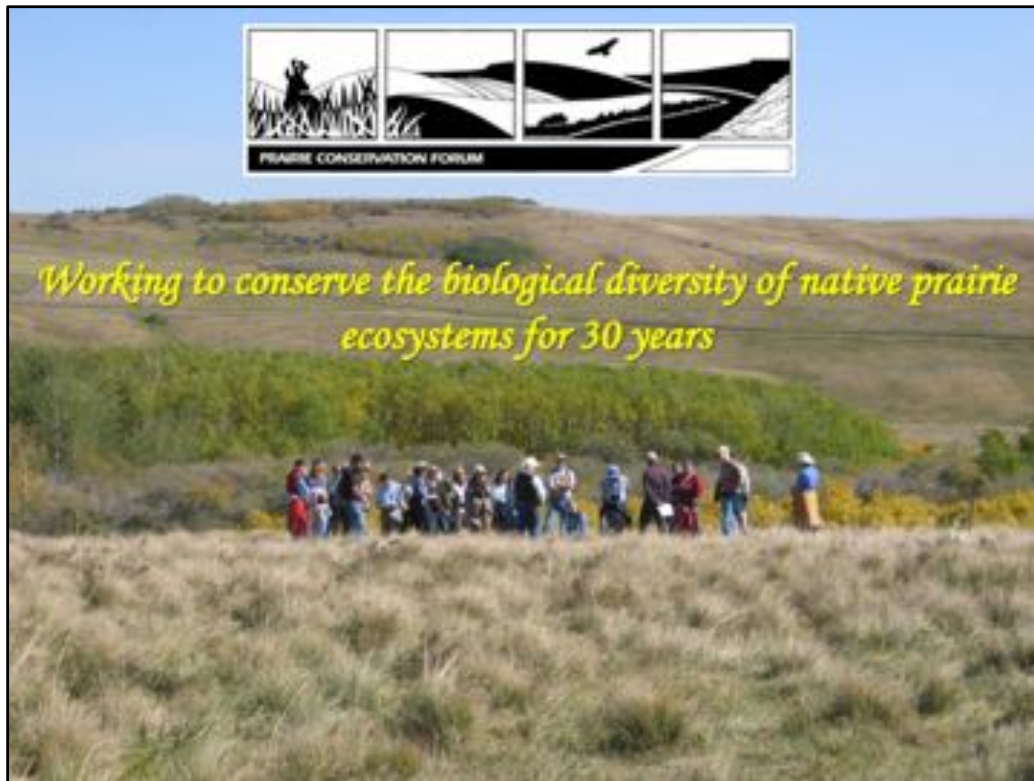
The PCF's vision describes the organization's raison d'être.



The PCAP's focus is the Grassland and Parkland Natural Regions of Alberta, but the PCF is also interested in corridor connections with our MT and SK neighbours who share portions of the broader continental sub region, the NW Glaciated Plains (or Northern Sagebrush Steppe).



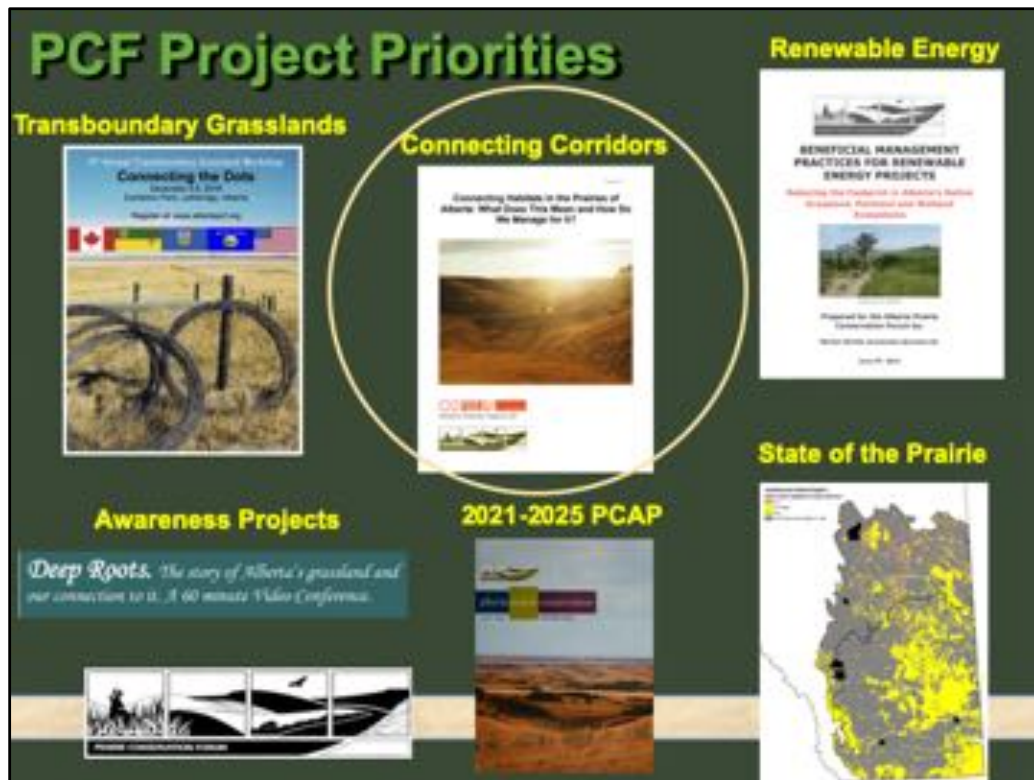
The PCF has initiated a trans-boundary partnership to address the conservation of native ecosystems in the NW Glaciated Plains. It has now held four annual workshops.



The PCF is 30 years old in 2019. It is one of the oldest and largest large landscape conservation initiatives in the world.



We hold a winter AGM, but our spring and late-summer/Fall meetings typically include a field tour, along with a business meeting so we can get out and look at what we are talking about! A significant portion of each meeting is set aside to share information about what our member organizations are up to and a more in depth 'member profile' is also a feature of every meeting.



Since the PCF moved to an 'outcomes-focused' PCAP, we have become much more action-oriented (a diverse and committed Board and membership has been critical too). In the course of the current PCAP we have made incremental progress on many of the actions flagged in the current PCAP. Importantly, we have made MAJOR progress on some big-ticket items: renewable energy, transboundary grasslands and state of the prairie.

So the PCF has a broad focus, limited resources, on-going organizational maintenance responsibilities and multiple active major project files. But given that context, connecting corridors is a current priority.

PCAP Strategic Outcomes

Maintain Large Native Prairie and Parkland Landscapes


The existence of intact and fully functioning native prairie and parkland landscapes in Alberta are the best guarantor of future regional biodiversity and environmental quality.

Conserve Connecting Corridors for Biodiversity

Habitat connectivity is essential to maintain native biodiversity and ecosystem function. The conservation and restoration of important corridors will help to maintain functional native prairie and parkland landscapes.

Protect Isolated Native Habitats

Within fragmented landscapes there exist small, isolated pockets of ecological refugia that may be as important for native biodiversity conservation as larger prairie and parkland landscapes. These need to be identified, studied, and possibly protected.



In the 2011-2015 PCAP there was a major shift to link recommended conservation actions to three over-arching strategic outcomes.

Overview

- Set scene
- *Musings*
- 02
- Pronghorn
- Roads
- Spatial guidance
- Take homes

This section includes a number of context-setting musings.

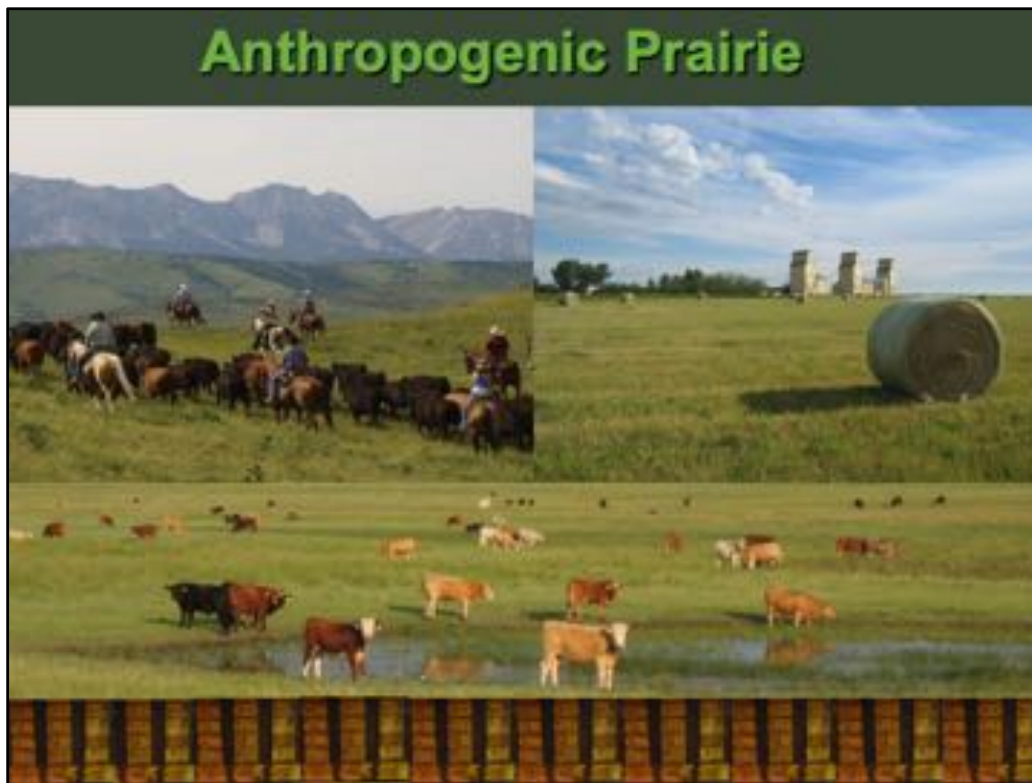


In the anthropocene, the planet's dominant self-focused species has established its occupancy footprint and movement/transportation infrastructure across all sectors of its multifarious endeavours.

Canada's Ecumene



Where people live, they modify landscapes. Canada is a vast land and its population mostly hugs the southern border with the USA. This human footprint lies heavily on prairie and parkland Alberta, although arid portions of the Palliser Triangle retain significant native vegetation and relatively small human populations.



Nonetheless, even the rural areas are anthropogenic landscapes.



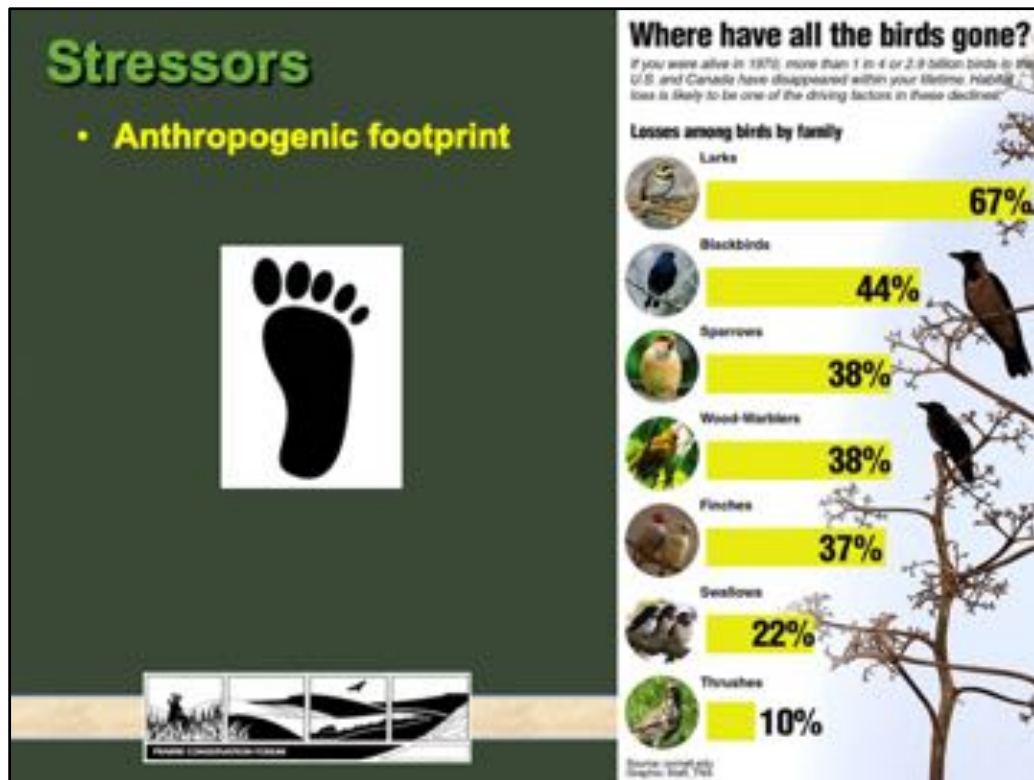
Native plants and animals endemic to these landscapes that are sensitive to human footprint and presence, make do in the interstitial spaces remaining in the human matrix. Other 'anthropogenic generalist' native species have adapted to human-modified landscapes.

Mental Checks

- **Pathways of movement:** through space and time to secure viability of native species and ecosystems
- **Species bias:** not just mammals and 'at risk' species. Vegetation, microfauna and abiotic processes (wetland recharge) are critical. And common bird species are declining in abundance too.
- **React to problems:** versus retain what we've got.
- **Native specialists and anthropogenic generalists:** importance of structural connectivity for the former.



A few key points to keep in mind.



To this point in time, losses to native biodiversity are almost exclusively a product of human footprint and human activity. These losses continue apace as recent research on North American birds has shown. Alarming, the loss is not just amongst native specialists, but anthropogenic generalists too. Common species are also becoming less abundant.



But a new compounding stressor is coming that has the potential to impact the climatic requirements of individual species, recalibrate biomes and open pathways for opportunistic invasive species and disease vectors.

Now we are hard-wired as a patch disturbance species, so don't expect that to stop. The imminent ability to grow our own meat in a lab may decimate rural societies, but is unlikely to result in us turning back the real estate to the native critters.

The Climate Footprint, itself an artifact of the Anthropocene, may have an impact that dwarfs that of it's human predecessor.

Human avoidance

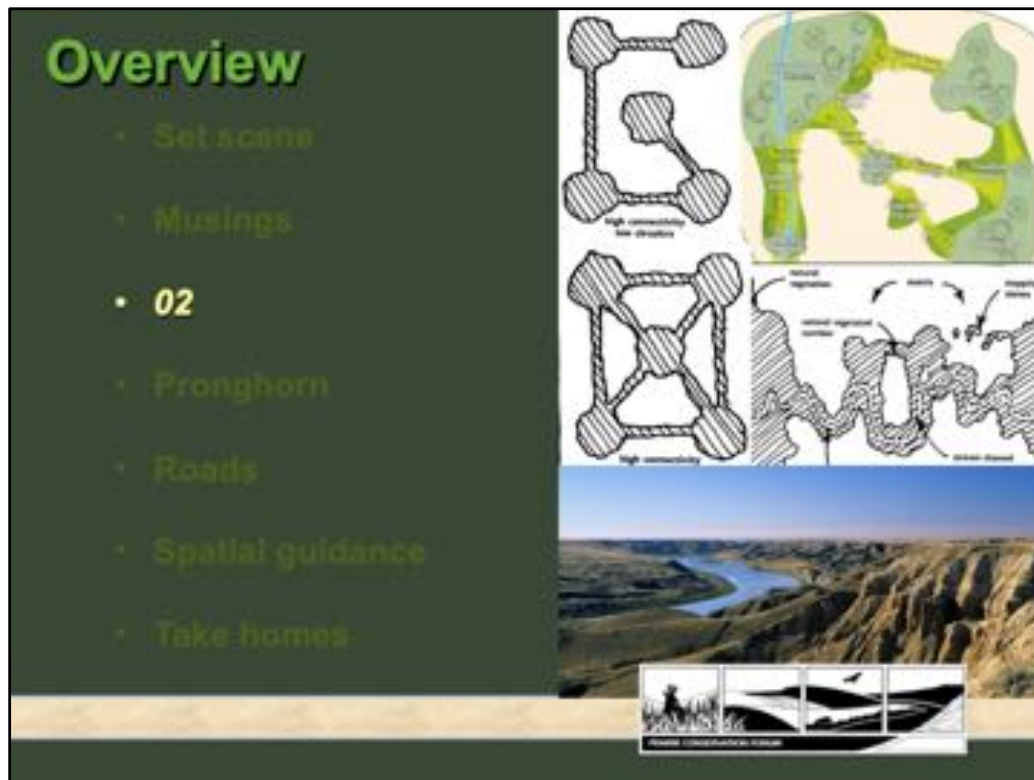
Light pollution



Night lights



Final point of musing. Categorizing all human land uses for modelling exercises is a herculean task, especially across jurisdictions. And for the purposes of looking at human averse species on large landscapes, probably unnecessary. We light where we go.



“The Challenges of Maintaining Connectivity in the Prairies” Dr. Leif Olsen, 02 Planning and Design. Webinar presentation 24th Oct 2019. A few selected and edited highlights.



O2 commissioned report looks at what needs to be connected and what factors facilitate or inhibit movement.



Summary report specifically looks at connectivity requirements for prairie and parkland plants, waterfowl, grassland birds, raptors, reptiles, amphibians, large and small mammals.

Current workshop is next step to help identify spatial priorities (what and where).

http://www.albertapcf.org/rsu_docs/pcf_o2_connectivity_final_20170626a.pdf

Connectivity

- **Structural:** Physical connectedness of the landscape
 - spatial configuration of land cover
 - cover composition, type, phase
 - susceptible to natural and anthropogenic disturbance events
- **Functional:** ability of individual species to move through the landscape.
 - food, shelter, breeding
 - susceptible to natural and anthropogenic disturbance events
- **Connecting corridors:** a component of the overall native species connectivity network.
 - linear (riparian corridors) or patches (stepping stones)

Problem with structural: Lots of native species move across native and anthropogenic landscapes with alacrity (deer, robins, coyotes)
 Advantage of structural:

- native vegetation is as much native species as native mammals are. Fragmentation, dissection, isolation negatively impact (seed dispersal, microbial activity, invasives)
- native specialists prefer/need native landscapes.

Problem with functional: needs to be nailed individually for each species (every microbe, arthropod, graminoid, moss, forb, reptile, bird, mammal).

Advantage of functional: if you nail it, you've nailed it and know with a high degree of confidence what interventions will secure connectivity (Jakes' pronghorns – locations of Hwy crossings in AB and SK, 18" smooth bottom wire).

Connecting corridors: Corridors are linear reaches of natural vegetation which connect core habitats by providing cover and shelter from disturbances in the surrounding landscape. This is the current PCF strategic outcome. Recognize that it's a long way from addressing connectivity (the other two PCAP strategic outcomes as well as management of the anthropogenic landscape are critical elements). But it's a start and a key component. We want to know WHERE on the landscape we need to keep, restore or create native corridors that will have the most benefit for native species and processes (including abiotic – e.g. underground aquifer that sustains a string of wetlands that are critical for waterfowl connectivity).

Movement: Help and Hinder

Certain land cover types may facilitate movement

- Provide cover
- Block perception of nearby disturbances
- Act as habitat

Certain land cover types may inhibit movement

- high-traffic roadways
- fencing
- areas with extensive disturbance (light, noise, etc)
- Non-native agricultural, urban and industrial landscapes

Certain land cover types may act as true barriers

- Large waterbodies
- Dams
- Mountain ranges



Credit: mostly Leif Olson

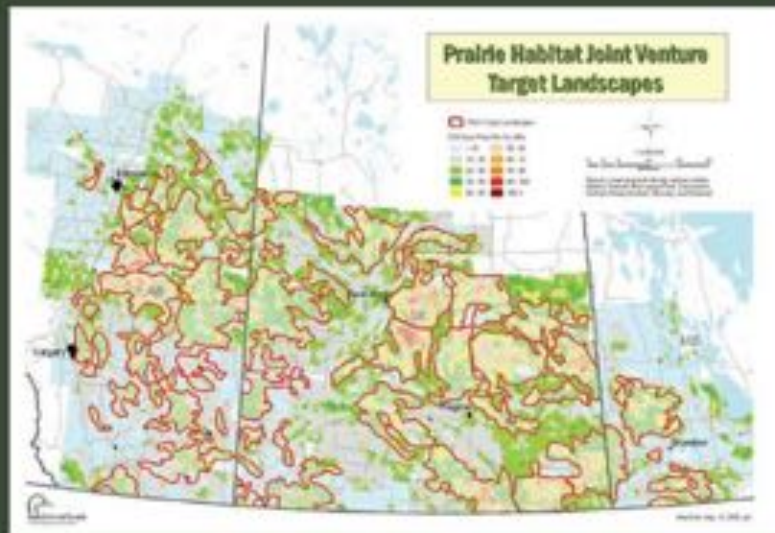


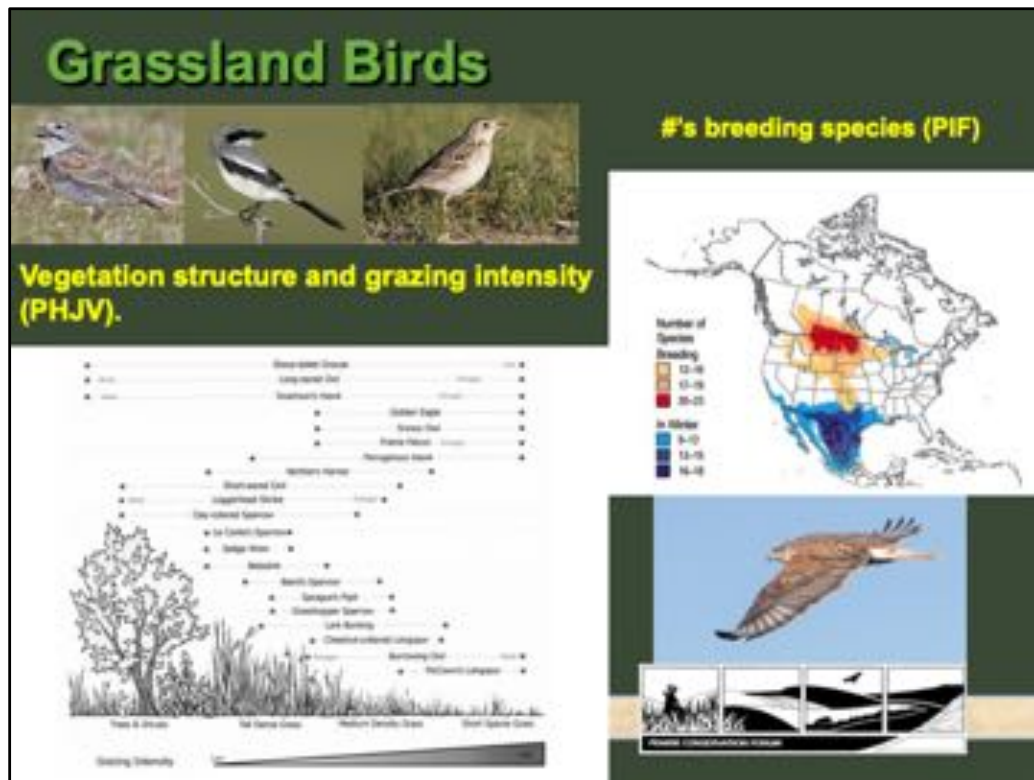
This material is not in the 02 webinar presentation, but is taken from their PCF report:
http://www.albertapcf.org/rsu_docs/pcf_o2_connectivity_final_20170626a.pdf.

For each group looked at general life cycle and habitat requirements, movement patterns, movement facilitators and movement inhibitors.

Photo credits: Ian W Dyson

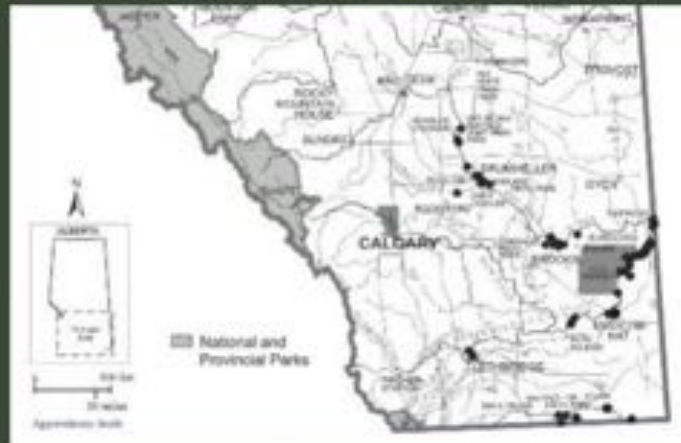
Waterfowl





Prairie and Parkland Alberta is the north western portion of a larger transboundary region where North American grassland birds breed. At an ecosite level, different bird species need differing vegetation types, condition and structure.

Herptiles and Amphibians



Remaining populations of the Great Plains Toad.



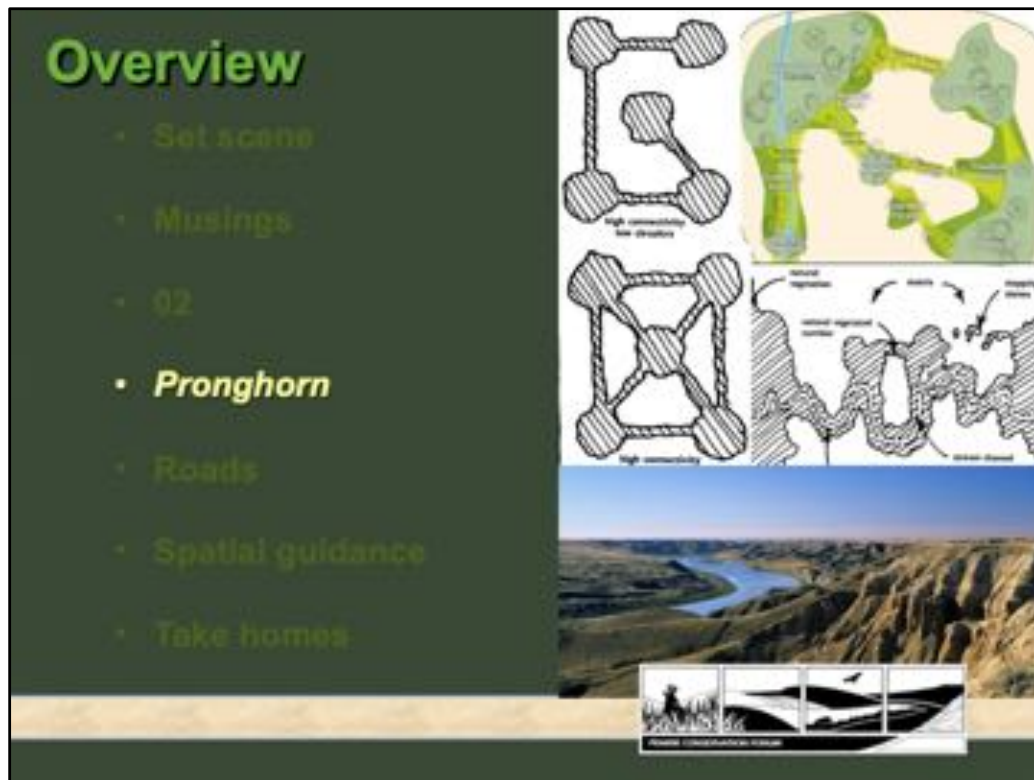
Here's a critter whose distribution is both highly localised and linear (corridors) in nature.

Reptiles

Greater short-horned lizard: known occupancy and potential range

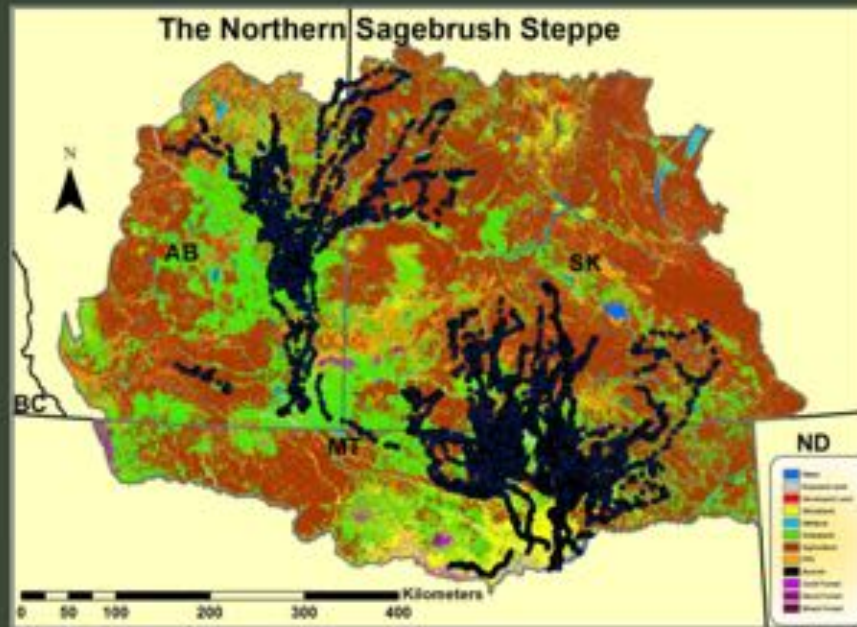


...as is this one.



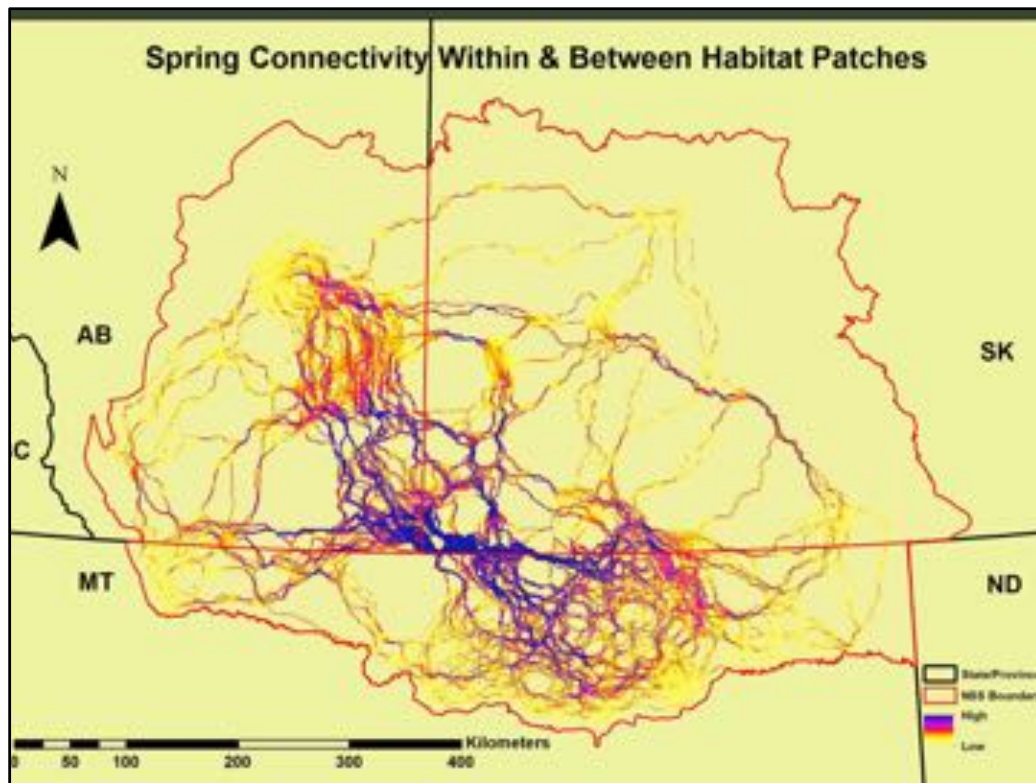
“Pronghorn: A focal Species for Grassland Connectivity.” Dr. Andrew Jakes, National Wildlife Federation, Missoula, MT. PCF Webinar presentation 24th Oct 2019. A few selected highlights.

Pronghorn and Prairie Conservation



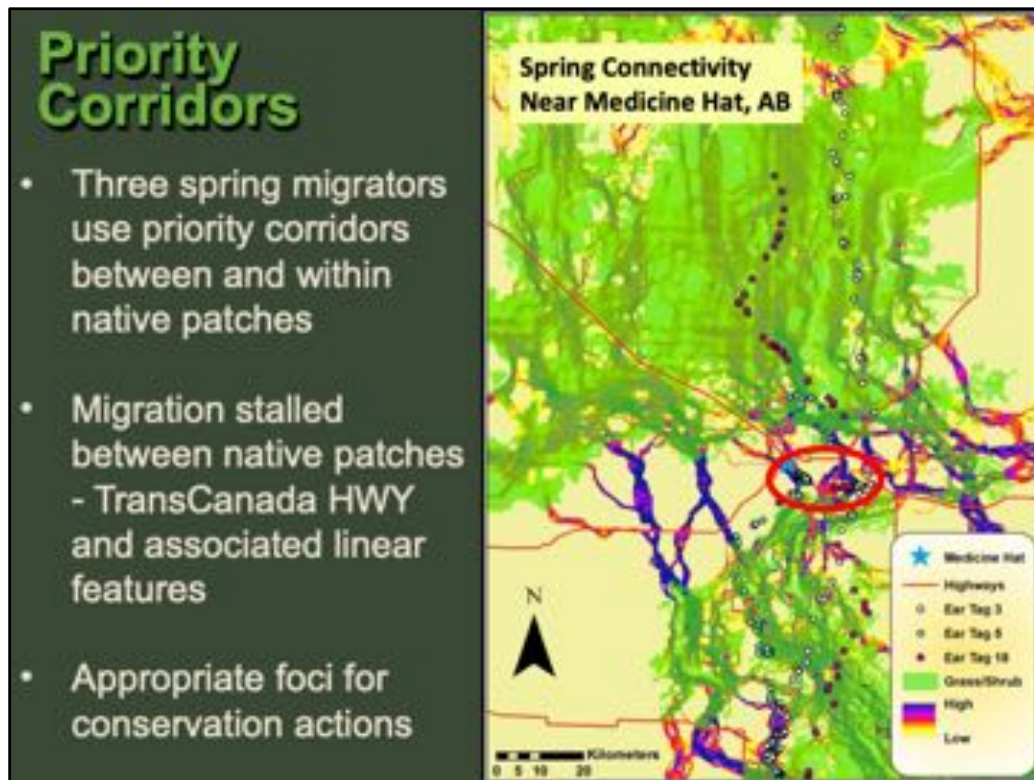
Andrew's talk focused on applied science using wildlife movements with a goal of providing tools for on-the-ground implementation. His work has focused dominantly on mapping the spatial seasonal movements of pronghorn, which are partially migratory, using both tracked animals (about 150) and modelling approaches, and ways of mitigating obstacles to that movement, especially fencing and road crossings.

Credit: Andrew Jakes



Credit: Andrew Jakes

Linkage mapper model. Blue areas show high connectivity importance between habitat patches. Note the importance of the AB/MT/SK transboundary area.



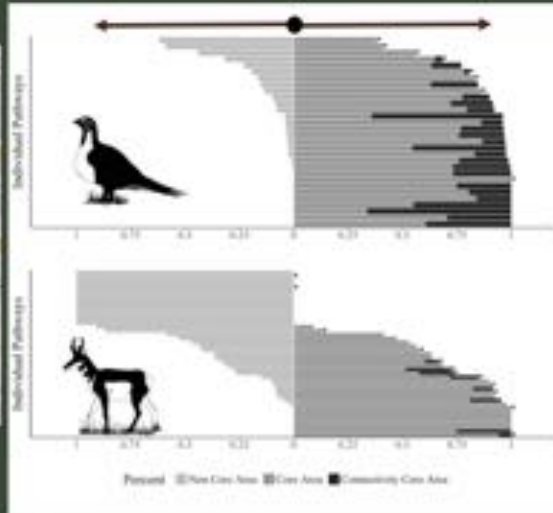
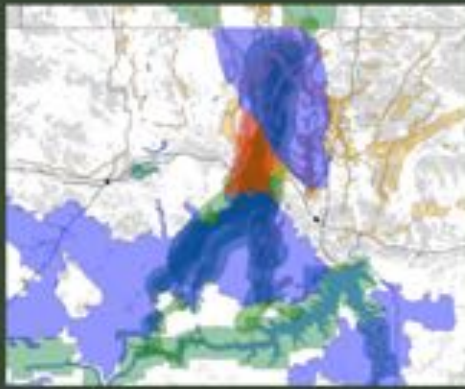
Validation of the connectivity modelling with tracked animals superimposed and showing the bottleneck imposed by the Trans-Canada.

An example of a priority corridor between grassland areas that are used by pronghorn. One of three identified across the NSS. The others are Bowdoin NWR near Malta, MT and Fasaaran State Park, near Glasgow, MT.

Credit: Andrew Jakes

Conservation Status: Priority Areas

Pathway: *outside of Core Area, inside Core Area*



Optimization modelling looking at threats. Overlay migratory pathways with high risk of cultivation areas to identify priority areas to target conservation easements. Have found a high degree of convergence for migratory pathways for pronghorn and sage grouse.

Blue – Sage Grouse Priority Areas of Conservation

Red – Connectivity Core Area – Only 1 of 2 identified for Sage grouse

Credit: Andrew Jakes



Andrew is in the final stages of submitting a paper to integrate ducks and grassland birds with sage grouse, and pronghorn seasonal movements. Hope to identify priority migration focal species in the NSS.

- Number of Waterfowl – core areas in the NSS
- Number of Grassland birds – core breeding areas in the NSS – Red means 4 spp overlap, orange means 3, yellow means 2 and blue means 1. (Baird's Sparrow, Sprague's Pipit, CC Longspur, MC Longspur).
- Seasonal range and migratory pathways for Greater – sage grouse
- Overlay with pronghorn seasonal ranges and migratory pathways – how much? Can a terrestrial animal serve as an umbrella for feathered endemic species?

Credit: Andrew Jakes

Intact lands: the conservation priority

- Primary Threat is Tillage
- Identify Intact Parcels Vulnerable for Cultivation
- Overlay Migratory Pathways with Parcel Data
- Prioritize Parcels Based on High Value to Migration & High Risk for Cultivation



*Based on climate, soils and topography

Using research to guide conservation action.

Credit: Andrew Jakes



“Improving Highway Safety for Wildlife and People in Alberta” . Tracy Lee, Miistakis Insitute, Calgary; Dr, Adam Ford, UBC Okanagan, BC and Dr. Tyler Creech, Center for Large Landscape Conservation, Bozeman, MT. Presentation by Tracy Lee. PCF Webinar presentation 24th Oct 2019. A few selected highlights.



Project was to develop a decision support tool to prioritize road sections for highway mitigation based on human safety and consideration of wildlife populations.

Circuitscape Linkage Mapper: open source modelling that borrows algorithms from electronic circuit theory to predict connectivity in heterogeneous landscapes. Models relationship between landscape characteristics and the cost of moving through the landscape for the locations among which animal movement is to be modeled.

Functional models: tailored to species, models resistance layers, nodes and seasonal layer.

A Risk Index was also developed using RCMP records of animal carcasses from AVCs along roads in the South Saskatchewan Region. This index enabled the identification of highway sections with a high human safety risk.

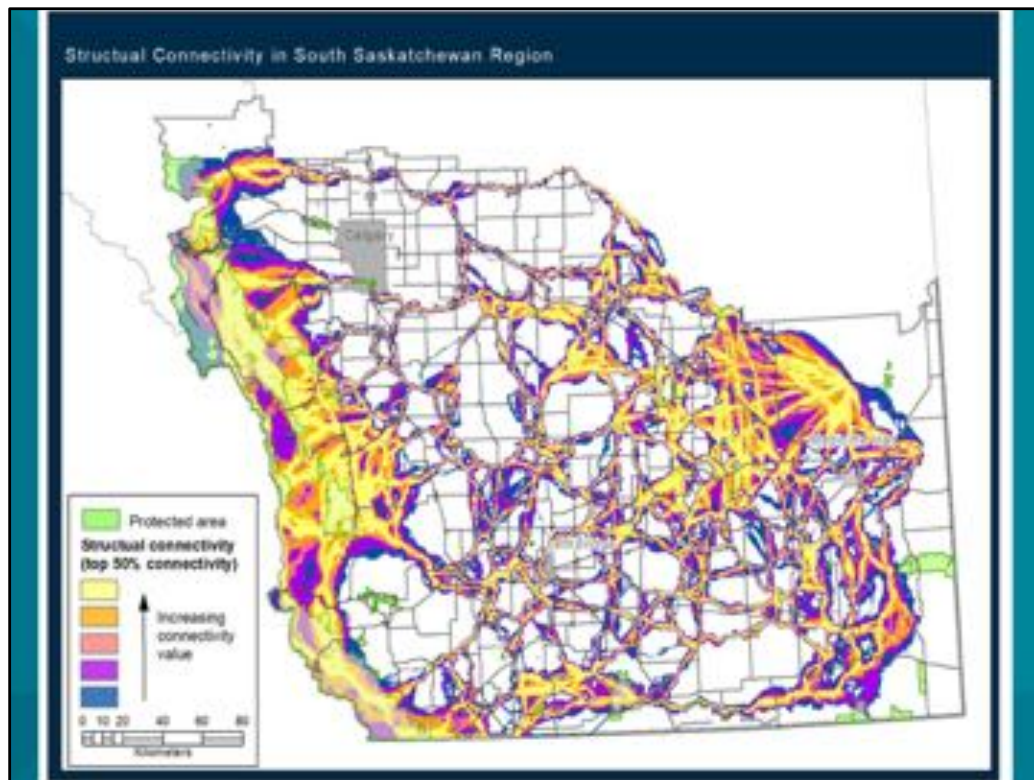
We developed functional connectivity models for four focal species (pronghorn, rattlesnake, grizzly bear, and mule deer) and species-neutral structural connectivity model using ArcGIS Linkage Mapper software, and then derived Connectivity Value Indices for highway sections by extracting values from the connectivity model outputs. We compared AVC Risk Indices and Connectivity Value Indices to determine whether and where priority locations for these two factors overlap at two spatial scales: (1) traffic control sections (TCS) representing areas with similar traffic volumes that are created by

AT and are useful for informing priority areas for highway upgrades and mitigation; and (2) kilometer sections, which could inform mitigation assessments occurring on specific sections of Alberta highways.

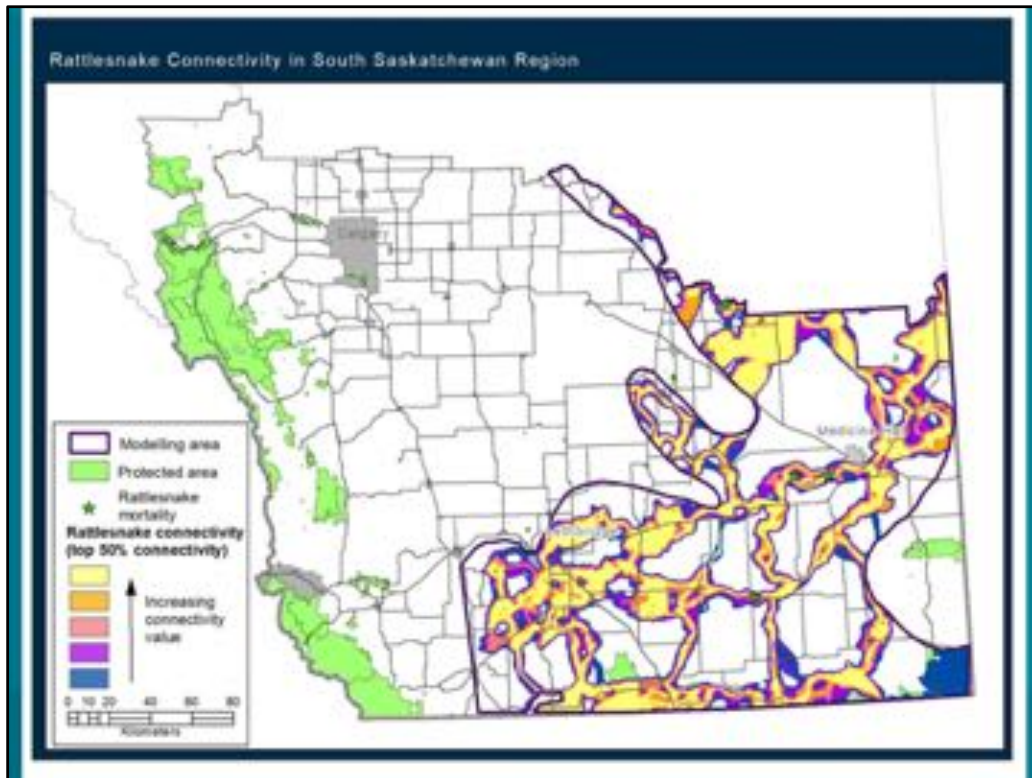
We explored different scenarios for combining the AVC Risk Indices and Connectivity Value Indices by using a weighted average approach that allowed greater emphasis on either human safety or wildlife connectivity value. Use AEP and Transportation staff to agree on modelling approaches.

Content Credit: Tracy Lee Miistakis Institute

Photos credit: Ian W Dyson



Credit: Tracy Lee Miistakis Institute
Yellow highest structural connectivity across landscape types.

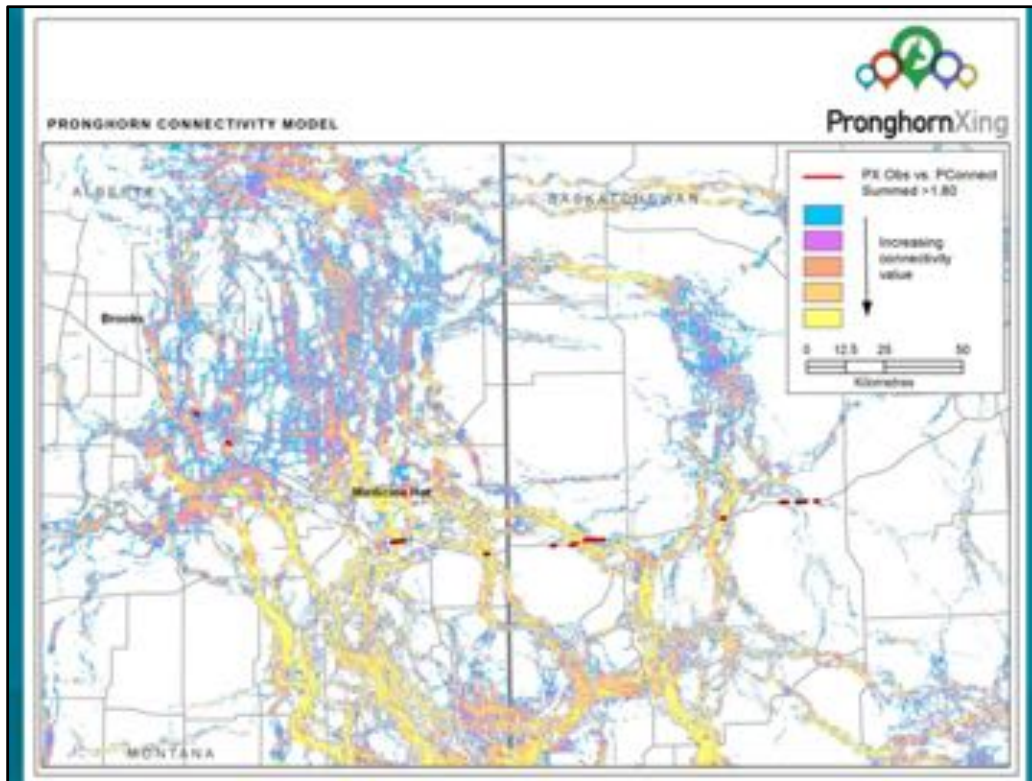


Credit: Tracy Lee Miistakis Institute
Functional connectivity model for rattlesnake.



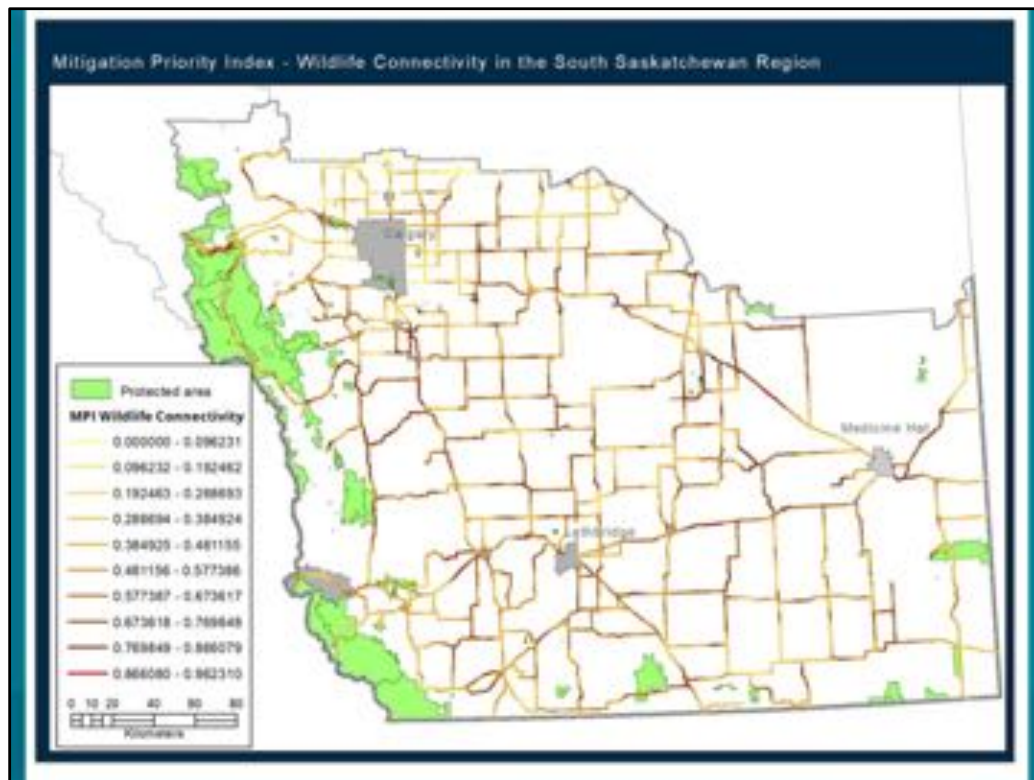
Credit: Tracy Lee Miistakis Institute

Connectivity value index (mean value of connectivity model per km of road) generated to help AB Transportation understand where. Yellow low movement, red high movement.



Credit: Tracy Lee Miistakis Institute (from Andrew Jakes)

Andrew's connectivity model, yellow highest movement. Work with Andrew and ACA on citizen science project. Downloadable app, people report sightings (red dots superimposed on connectivity model).

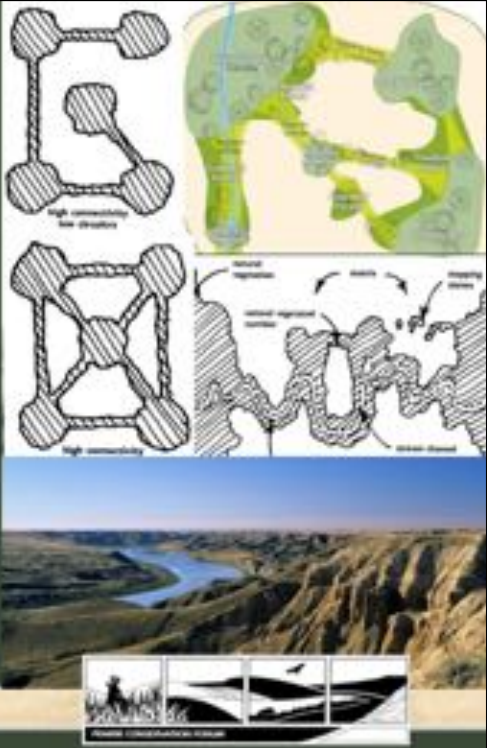


Credit: Tracy Lee Miistakis Institute

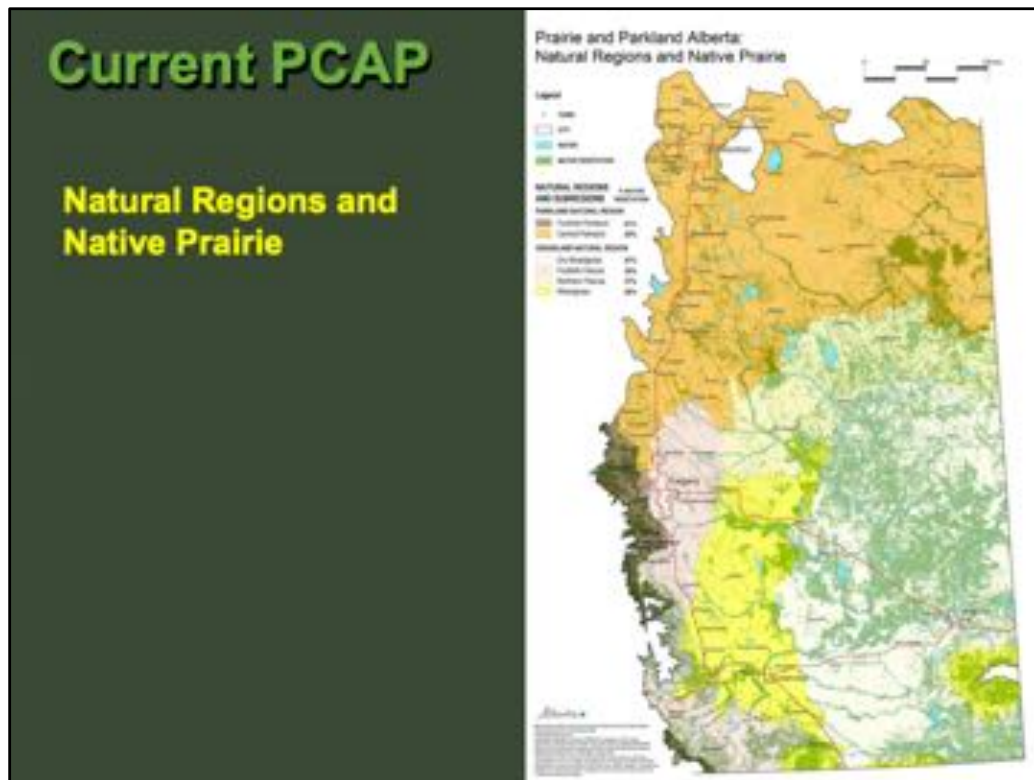
Weighted average of all wildlife connectivity indices. As move yellow to red shows higher level of agreement between the different models.

Overview

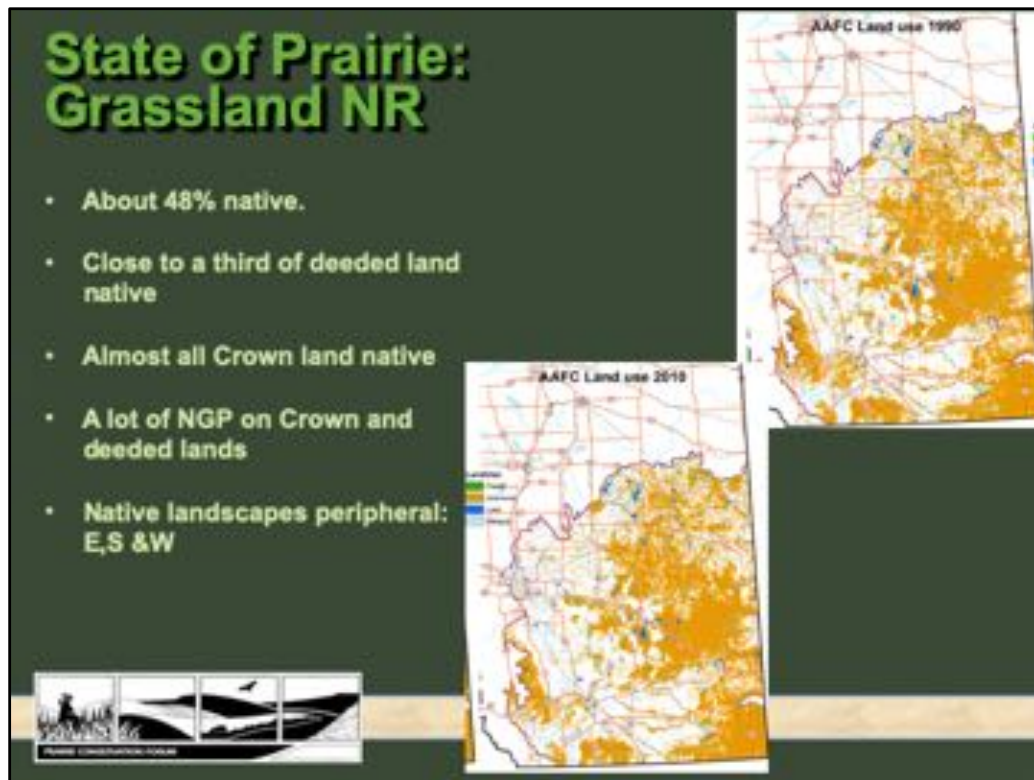
- Set scene
- Musings
- 02
- Pronghorn
- Roads
- **Spatial guidance**
- Take homes



This portion of the presentation reviews spatial guidance generated by the PCF and its partners that is also relevant to the corridor/connectivity discussion.



This map from the PCAP depicting Natural Regions and sub regions with native vegetation superimposed shows some clear patterns in terms of structural connectivity.



The PCF's recent State of the Prairie project looking at multiple inventories confirms some clear patterns at the Natural Region scale.

Grasslands Natural Region:

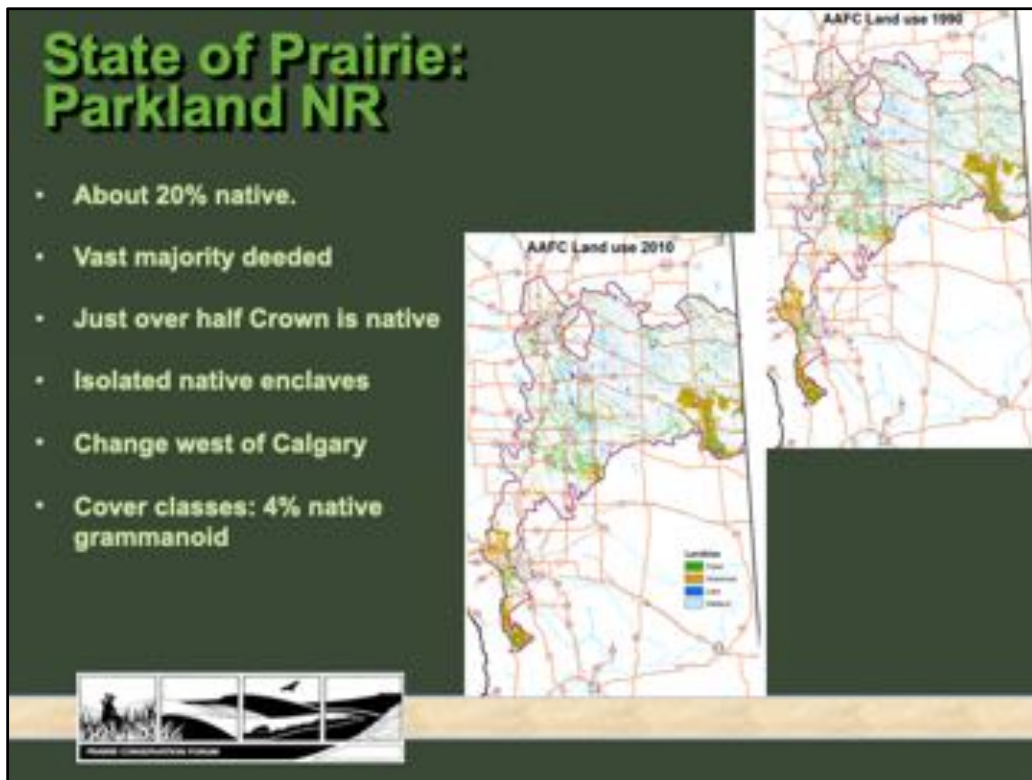
About 48% of the GNR is in native cover.

About 70% of the land in the GNR is deeded. Of this about 30% is native. About 30% of the GNR is Crown land. Of this about 90% is native. But because of the differences in land ownership, the amount of native in each ownership category as percentage of the region as a whole is not too dissimilar. About 27% of the native land cover in the GNR is in Crown ownership and about 21% of the native land cover is deeded.

In GNR sub regions, most native cover in the Dry Mixed Grass (around 60%) and least in the Foothills Parkland (around 30%)

In the GNR the major remaining NGP landscapes are in the Palliser Triangle – south of Cypress Hills/Milk River area, Suffield CFB, The Special Areas, the Milk River Ridge, Waterton Front, Hwy 22 area Foothills fescue, parts of the EID and major river corridors.

The greatest loss of NGP has been on the Blood Reserve with a 20 year reduction from 53% to 34% native cover. The Piikani Reserve also shows a loss of about 8% over the same period. The Mixed Grass sub region has lost about 5% of its native cover.



Parkland Natural Region:

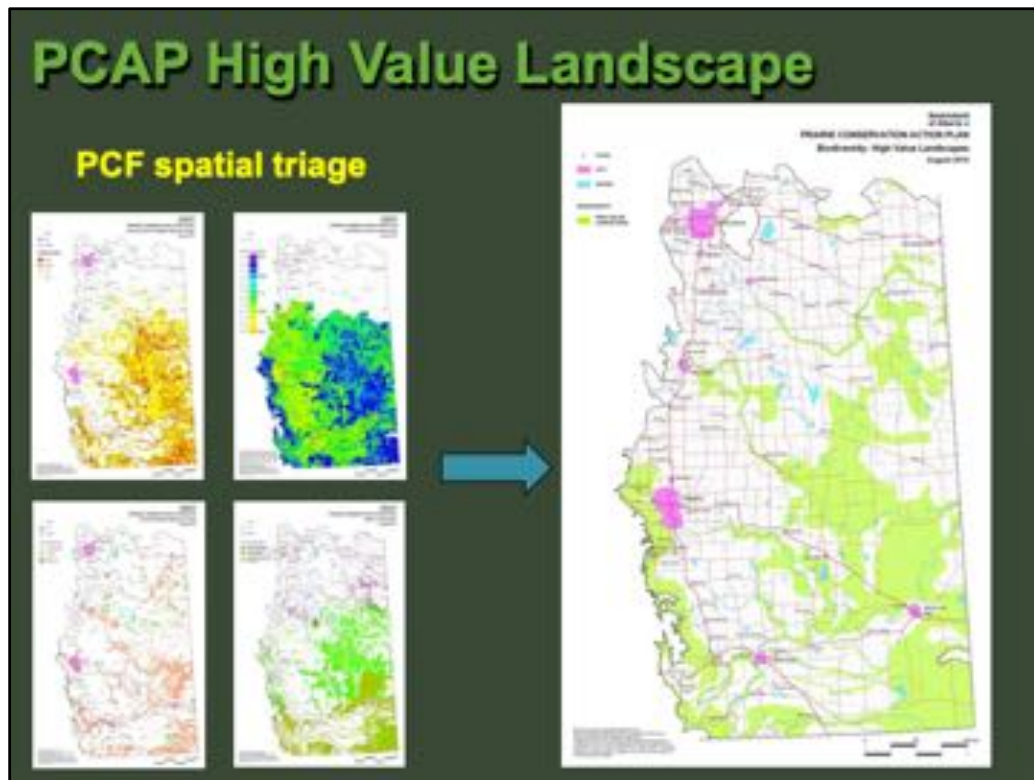
About 20% of the PNR is in native cover.

Almost 90% of the land in the PNR is deeded. Of this about 16% is native. Just over 10% of the PNR is Crown land. Of this almost 55% is native. The amount of native in each ownership category as percentage of the region as a whole is as follows: almost 6% of the native land cover in the PNR is in Crown ownership and about 14% of the native land cover in the PNR is deeded.

In the PNR the remaining native landscapes are highly localized – between Wainright and Sounding Lake in the Central Parkland and between Longview and the northern Porcupine Hills west of Nanton in the Foothills Parkland. There is a smaller node of native lands in the Rumsey area in the Central Parkland, but elsewhere in the PNR there are only small fragmented parcels of native cover ranging from 7% - 15% of the landscape.

Within the PNR, trees constitute a significant portion of the native cover, the remaining native grasslands are very meagre – only 4% of the Central Parkland as a whole.

There has been an overall 13% loss of native cover on the Pigeon Lake, Erminskin, Louis Bull, Samson and Montana Indian Reserves in the south central and western portion of the Central Parkland.



This is the PCF's key 'corridor/core areas' map generated at a Natural Region scale considering both high level structural and functional information.


The PCAP 'High Value Landscape' map was generated in 2010 for the 2011-2015 PCAP and primarily considered areas of converging spatial correspondence from amongst the following information sources:

- Priority areas for multiple species at risk;
- Ecosystem Goods and Services;
- Environmentally Significant Areas; and
- Native landscapes (NPVI, GVI and Central Parkland Native Vegetation).

(sophisticated 'Light table GIS analysis' by Dolan and Dyson ☺, also looked at DU waterfowl priority areas)

Grassland and Parkland Biodiversity Status

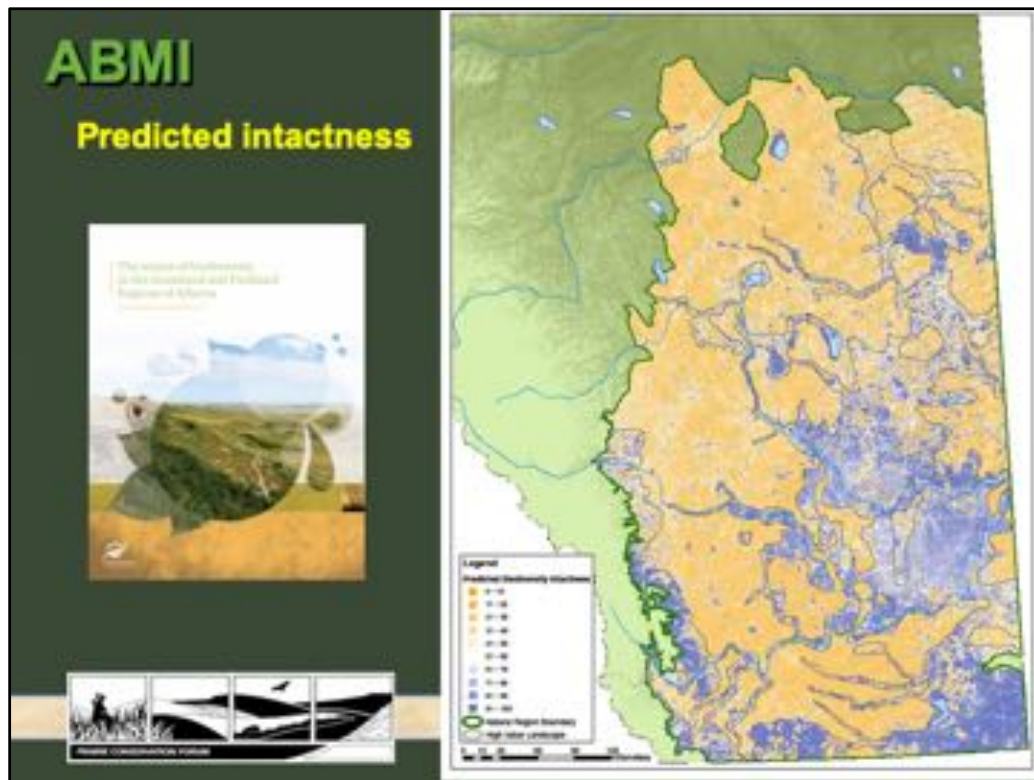
- Assessed status of 197 species.
- In High Value Landscape intactness similar for all taxa 68% - 70%.
- Outside High Value Landscape intactness range 32% for vascular plants to 58% for native birds.
- Human footprint 2-3x higher outside High Value Landscape than inside (except energy).
- Average effective mesh size in the High Value Landscape is 11.9 km² compared to only 0.4 km² outside.



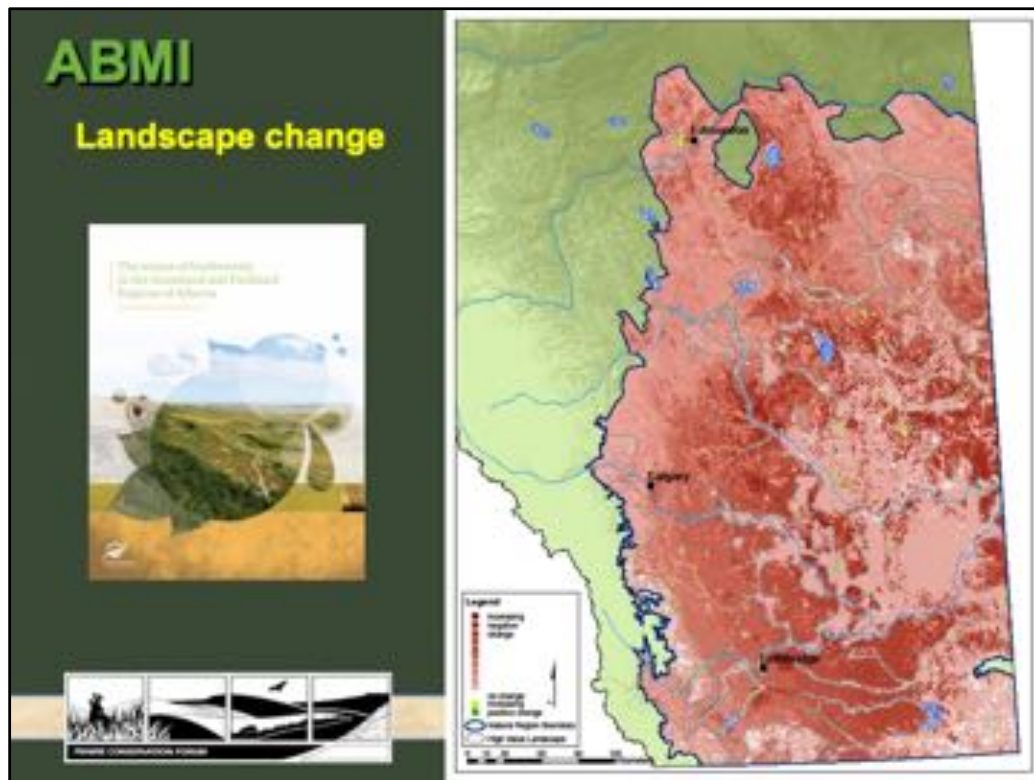
The image is a presentation slide titled "Grassland and Parkland Biodiversity Status". It features a list of five bullet points on the left side, detailing the assessment of 197 species and comparing habitat intactness and human footprint between the High Value Landscape and the surrounding area. On the right side, there is a composite image: at the top, a map of the High Value Landscape; below it, the ABMI logo; and at the bottom, a small inset image of a grassland landscape. The slide has a dark green background with yellow text for the bullet points.

The PCF partnered with ABMI to assess the status of biodiversity in the Grassland and Parkland Natural Regions. The assessment focused specifically on assessing habitat intactness within and outside the High Value Landscape. Results confirm the importance of the High Value Landscape.

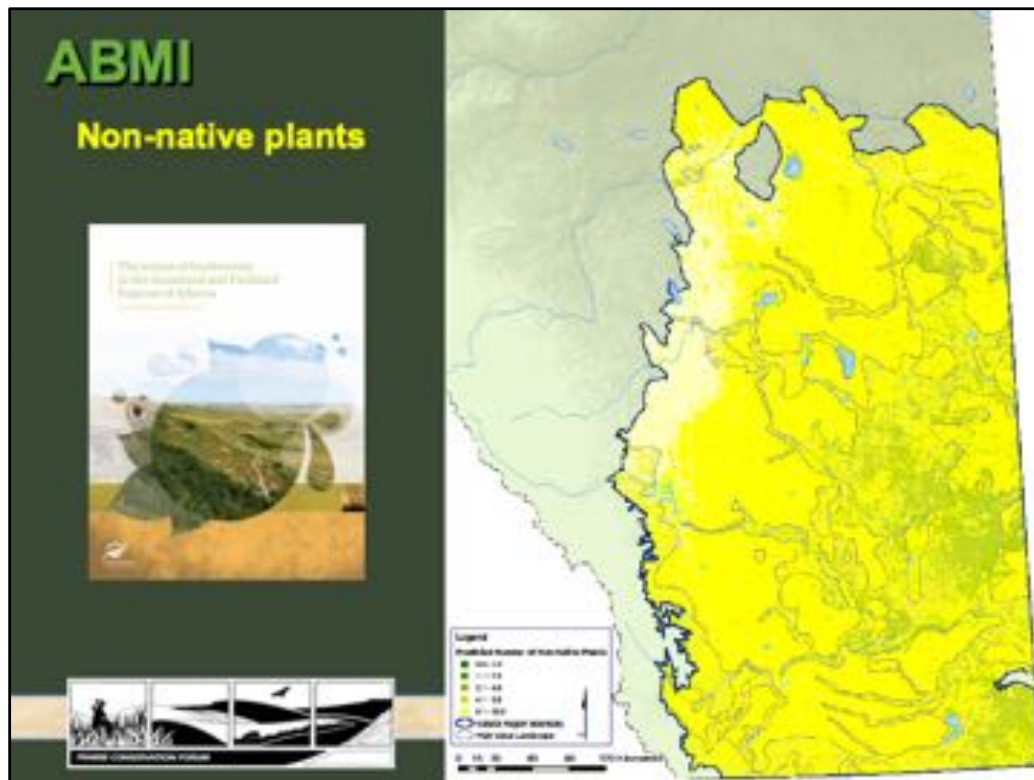
Mesh size is a measure of habitat fragmentation. Effective mesh size is a measure of the size of native vegetation patches combined with distance to edge at a particular scale. Larger mesh size values occur in bigger native vegetation patches further from the edge of human footprint, whereas smaller mesh size values indicate smaller patches and more human footprint. Average effective mesh size in the High Value Landscape is 11.9 km² compared to only 0.4 km² outside.



There is a striking level of convergence between high areas of predicted intactness and the High Value Landscape.



And a mirror-image relationship with anthropogenic land use change.



Non native plants and invasive species are a major problem throughout prairie and parkland Alberta, though marginally less so in the High Value Landscape.



The final section of the presentation recaps some key take home messages.

PCF making a difference

- Influencing plans and policies
- Developing Information and tools for our members
- Leading on projects that wouldn't get done otherwise
- Raising awareness/building commitment



The PCF exerts an influence on applied conservation in four main ways:

Influencing Plans and Policies: examples:

- NWA Suffield
- Provincial grass
- GOA policy on mitigation/reclamation for conventional and renewable energy
- Conserving native ecosystems in regional plans

Providing information/tools for members: examples:

- NPVI/GVI

Undertaking projects that build a foundation for future conservation action:

- Landscape Patterns
- State of Biodiversity
- Connectivity
- State of Prairie

Raise public awareness

- Deep Roots
- Helen Schuler native garden
- Blood youth field trips
- Website

- Conferences: PCESC,AIA

Good information on what corridors are important, where and why is a prerequisite to moving forward effectively with any of these approaches.

Corridor Take Home Messages

- Corridors are a component of connectivity.
- Our current focus is on (multi-scale) corridors in the Grassland and Parkland Natural Regions (and across boundaries with SK and MT) that are likely important pathways for multiple native species and processes.
- Corridors are one of three strategic outcomes priorities and a current major project priority.
- Our interest is ALL native species in this dominantly anthropogenic landscape and where we can have most positive impact.



Corridor Take Homes (cont)

- All we need is definitive mapped occupancy, range, travel patterns and inhibitors for all native prairie and parkland species!
- Jakes' work. Gold standard in applied science. Alignment of tracked and modelled data, spatial identification of inhibitors (roads, fences, cultivation).
- Miistakis, CLLC, UBC work. Engage govt players. Combine structural and multi species functional modelling. Speak to human risk too. Spatially identify priority road reaches.
- At a Natural Region scale, PCF has identified patches and corridors (vegetation, multi-species, ES, ESAs).



Corridor Take Homes (cont)

- **ABMI intactness analysis verifies the higher value of the High Value Landscape.**
- **Conversion of native landscapes continues, albeit at a modest pace, and invasive species are a major problem.**
- **PCF has limited capacity and many priorities, but demonstrated ability to show environmental leadership, influence policy, provide tools for our members and educate Albertans.**



What we need today



- Focus on spatial corridors that support multi-species connectivity at regional, sub-regional or local scales.
- Verify, correct or trash what we've done (High Value Landscapes) and id other corridors. Identify selection criteria.
- Less can be more.
- Just starting. Next: *The Matrix!*



Final slide outlines hopes/expectations for the workshop. Note: this is just a start.



Presentation by Ian W Dyson. October 2019.