Project Recommendations
for the
Kinder Morgan Canada
Trans Mountain Legacy Fund

KINDER MORGAN
CANADA INC.

MONTANA STATE UNIVERSITY
Western Transportation Institute

Project Recommendations for the Kinder Morgan Canada Trans Mountain Legacy Fund

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1. INTRODUCTION

This report recommends projects to be funded by the Kinder Morgan Canada Trans Mountain Legacy Fund.

1.1. Background

This project came about as a result of the Kinder Morgan Canada (formerly Terasen Pipelines) Anchor Loop project environmental consultation. The Kinder Morgan Canada (KMC) Anchor Loop project twinned the former TMX oil pipeline through Jasper National Park (JNP) and Mount Robson Provincial Park (MRPP). Three years prior to the project's start in 2007, KMC actively consulted stakeholders from a number of jurisdictions and backgrounds to receive input on environmental concerns and requirements.

The condition of co-operation by participating environmental non-government organizations (ENGOs) was a commitment by KMC to undertake an ecological project or series of projects that would result in a net ecological benefit to the two parks. These ecological net benefits were defined to be over and above mitigation and special measures needed for regulatory approval. Logistical support for the ecological net benefit project (hereafter referred to as ecological improvement project, or EIP) is to be provided by KMC through a committed legacy fund for both parks. This fund is now known as Kinder Morgan Canada's Trans Mountain Legacy Fund.

In order to determine which projects would provide a net benefit, the Net Benefit Advisory Committee was created in 2005 and included ENGOs, Parks Canada, Mount Robson Provincial Park, and Aboriginal representatives, with KMC participating as observer. While Aboriginal representatives attended some of the committee meetings, they participated as observers rather than active participants, reflecting the fact that KMC has a separate engagement process with Aboriginal communities. The advisory committee met on numerous occasions over an 18-month period to develop a method that would allow for a fair and transparent identification of potential legacy initiatives. While some positive steps were made during this time, the process was unsuccessful. In order to move the process forward, Kinder Morgan Canada's Trans Mountain Legacy Fund was divided into three separate components to satisfy interests of individual stakeholders: Mount Robson Provincial Park, Jasper National Park and the ENGOs.

The Trans Mountain Legacy Fund is divided as follows:

- Donation of $350,000 for MRPP to support net benefit initiatives identified by MRPP
- Donation of $350,000 for JNP to support net benefit initiatives identified by JNP
- Donation of $2.2 million for EIPs

In order to determine potential EIPs, Dr. Tony Clevenger of the Western Transportation Institute (WTI) at Montana State University was contracted by KMC. Dr. Clevenger and his team (researchers Adam Ford and Niki Wilson) have worked over the past year to develop the findings presented in this report.

With the support and participation of JNP and MRPP, this process presents an opportunity to leave both a legacy of ecological improvement for the region and create a precedent for a unique public–private venture in nature conservation at a regional scale.

1.2. Study area

JNP and MRPP are part of a contiguous block of parks that comprise the Canadian Rocky Mountain UNESCO World Heritage Site (Figure 1). Mountain peaks, glaciers, lakes, and waterfalls form a striking landscape that is home to many species of fish and wildlife. The boundary between the two parks is defined by the continental divide and border between Alberta and British Columbia.

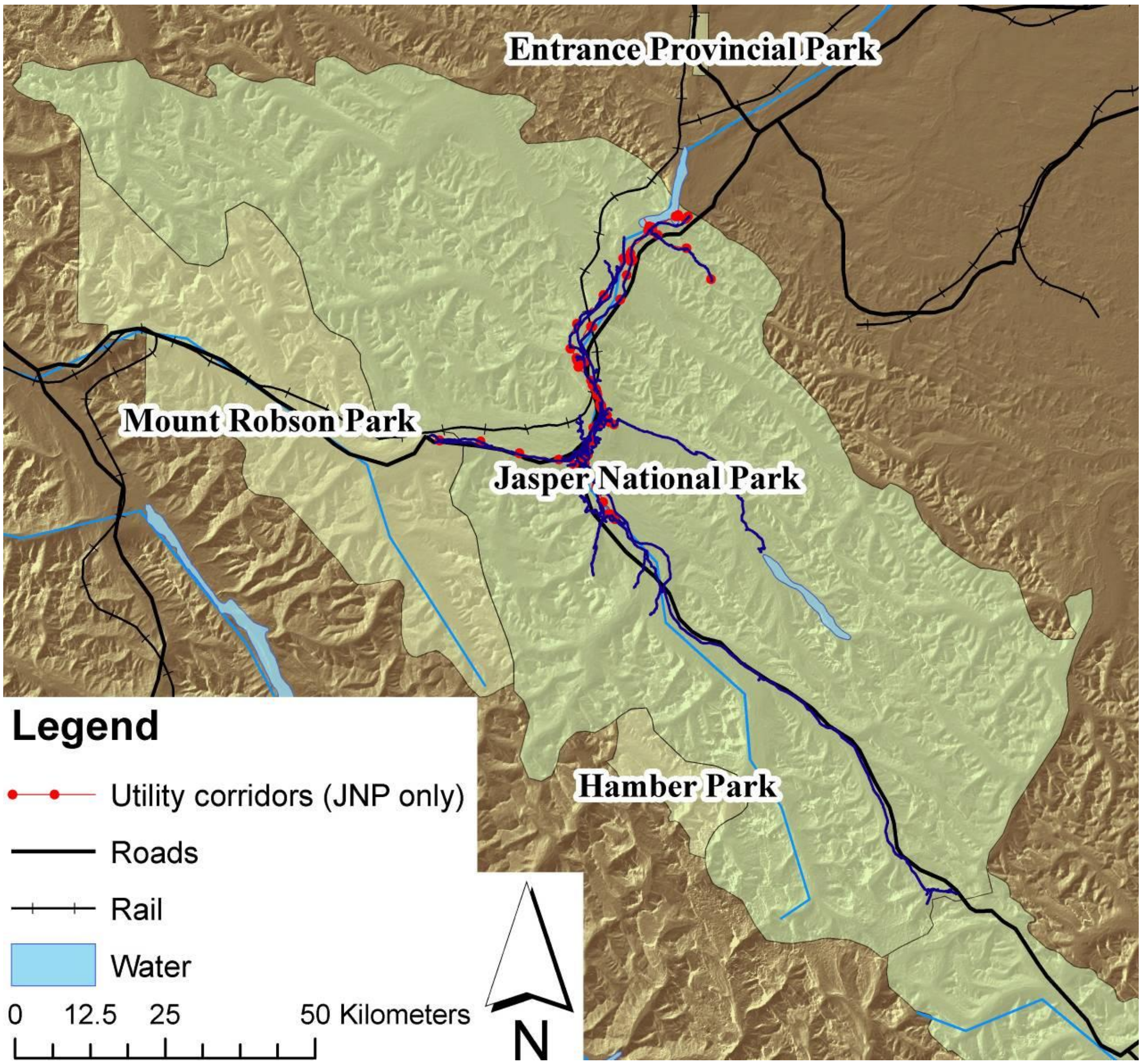

Figure 1: Study area.

Generally, the most fertile wildlife habitat in both parks lies in the valley bottoms. Wildlife uses the valley bottoms as movement corridors and for food and shelter. This is also where humans live and travel. Mount Robson is a major tourist destination, and 1.8 million people on average visit JNP every year. There is concern that human activity is negatively affecting wildlife habitat, encouraging invasive species and resulting in animal mortality on the highways and railroad.

Intensive land use in and around the parks in both provinces puts pressure on ecosystems, as does increasing human use and visitation. These and other prominent park issues are explored briefly below.

1.3. Background conservation issues

1.3.1. Wildlife mortality due to road and rail traffic

The Yellowhead Highway (Highway 16) and the Canadian National Railway (CNR) line travel east–west through both parks. Other human developments in the valley bottoms include utility lines and oil and gas pipeline right-of-ways. Wildlife mortality along travel corridors is a significant management issue recognized by MRPP and JNP.[i,ii]

Mortality levels caused by wildlife–vehicle and wildlife–train collisions may be depressing populations of some species through direct mortality and reduced connectivity between populations separated by the road and rail. Projected increases in traffic along Highway 16 and proposed CNR track-twinning are expected to exacerbate these effects.

1.3.2. Habitat connectivity

Current traffic volumes along Highway 16 and CNR may deter animals from approaching or crossing the transportation right-of-way. The barrier effects of these features are expected to increase as traffic volumes grow with the expansion of coastal ports and urban growth.[iii] Population persistence of large and wide-ranging animals increases with access to habitat. Therefore, movement across roads can be an important component for the survival of many species. Developing pro-active approaches to restore connectivity across corridors in the near future will allow management to mitigate or minimize the effects of anticipated increases in traffic.

Figure 2: Road-killed bobcat on highway in the mountain parks.

1.3.3. Human disturbance

Both JNP and MRPP experience high seasonal visitation that requires supporting facilities and accommodation. In JNP, the presence of a town site requires a waste transfer station and power generation station in addition to visitor support services.

Land-use pressures are increasing both within the parks and in their surrounding environments (for recreational use, resource extraction and overall development). Animal movement patterns are affected by the distribution of human activity and, in some areas, ungulate species may concentrate near areas that humans frequent because large carnivores avoid these areas. MRPP and JNP aim to decrease the effects of human use on animal movement and restore natural patterns of animal distribution and predator–prey dynamics.

1.3.4. Non-native plant and animal species

The spread of some invasive plant species is linked to reductions in biological diversity for both native plants and plant-dependent species (e.g., pollinators, grazing mammals). In JNP and MRPP, the transportation corridors are the main conduit for non-native species spread through both parks. Management actions depend on knowledge of the causes of invasive species spread and the distribution of invasive species hotspots. Long-term focus is needed to remediate and monitor affected areas.

Figure 3: Brook Trout found in Jasper National Park.

Although the non-native brook trout has been found in JNP for a number of years, a recent non-authorized introduction of brook trout in MRPP may be controlled if the problem is addressed soon.

1.3.5. Predator–prey interactions and ungulate management

Elk in JNP have been shown to concentrate in areas close to human activity where they may find refuge from predators. Near the town site, this has led to higher calf survival rates than in areas farther from town.[iv] Many suspect the elk population to be unnaturally high. The balance between predators and prey species is integral to ecosystem health.

Overgrazing by elk in some areas may be linked to songbird and beaver declines as well as the spread of invasive plant species. Elk, deer and moose populations also play a role in the persistence and distribution of large carnivores such as wolves and cougars. Inflated deer, elk or moose populations may lead to declines in alternative prey species such as caribou by increasing the density of predators. In addition, a high concentration of elk in areas of high human use is a concern for human safety. To restore functional predator–prey dynamics, prey populations need to be distributed in a manner that allows predators to access them. Having the tools available to manage dominant, large prey species in both JNP and MRPP has been identified as an important ecological improvement.

Figure 4: An elk grazes next to a fence near the Trans-Canada Highway in Banff National Park.

1.3.6. Species at risk

A number of species at risk have been identified both provincially and nationally in JNP and MRPP. In MRPP, Haller's Apple Moss (*Bartramia halleriana*) is a provincially red-listed species with the Conservation Data Centre and is listed as "threatened" under the Federal *Species at Risk Act*. At least eight provincially blue-listed ("vulnerable") vascular plant species occur within the park. Bull trout (*Salvelinus confluentus*) are a blue-listed species at risk located in the park south of Moose Lake in the Fraser River. Woodland caribou and grizzly bears are also considered at risk.

In JNP, species at risk include Haller's Apple Moss and woodland caribou. Grizzly bears are identified as a priority species in all park management plans where the species is found, and they are designated as a species of "special concern" by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). In JNP they are widely accepted as an indicator of ecological integrity and are used as a surrogate measure for assessing cumulative effects of regional land-use practices.

JNP and MRPP recognize the significance of all these issues on regional ecosystems. Both parks have identified management actions to address these issues; however, funding and staff shortages are constraints to research and effective delivery of management programs.

Figure 5: Haller's Apple Moss.

2. GENERAL APPROACH

2.1. Goal

The goal of this work is to identify and prioritize projects that address key ecological issues in JNP and MRPP in a transparent manner that will satisfy stakeholder concerns. In JNP, ecological issues refer to human activity in the valley bottoms of the Miette and Athabasca watersheds. In MRPP, ecological issues concern the Fraser River Watershed. These projects will be recommended for funding by the Kinder Morgan Canada Trans Mountain Legacy Fund.

2.2. Direction from stakeholders

Environmental stakeholders in KMC's consultation process requested that our recommendations be guided by a number of core principles. These principles served as the objectives of the project. First, the project should be ecological in nature. Although the building of infrastructure or identification of historical sites are considered valuable projects, the intention of the fund is to demonstrate an ecological improvement. Second, the project recommendations should strive to be outside the normal course of business for Parks Canada and British Columbia Parks. Projects that best meet this objective are beyond the day-to-day responsibilities of management in the park, but are consistent with park management objectives. Third, the project must be feasible. Feasibility is affected by the difficulty and complexity required to implement a project. Finally, ideally both JNP and MRPP will benefit ecologically from this fund. Though there are differences in ecological conditions and human impacts on the environment for each park, a project that best meets the goal will be one that has a positive effect across the region. These principles were incorporated into our work as objectives in the Analytical Hierarchy Process (AHP) described below.

2.3. Process framework

To develop an initial list of projects, we interviewed participants from Parks Canada, BC Parks and some external to those agencies. The project list was reviewed by participating agencies and externals, and then refined based on their input and a coarse filter developed by our team. Ultimately, we were left with a list of eight project suites. In order to prioritize the project suites, a subset of the interviewees participated in the AHP—a decision-making tool that guided our recommendations. Information gleaned from ecological specialists through interviews and the AHP was augmented by information obtained through a literature review. Detailed methods are provided in the Process section.

Summary of Process

Interviews →

- Choosing interview participants
- Structuring Interviews
- Conducting Interviews

⇩

Synthesize interviews and develop list of ecological improvement projects

⇩

Review of list of Ecological Improvement Projects by Parks Canada, BC Parks and Externals

⇩

Review list of Environmental Improvement Projects

⇩

Selection of five subject matter specialists from the group of interviewees to participate in AHP

⇩

Analytic Hierarchy Process (AHP) Prioritizing the projects →

- Selection of AHP participants
- Prepare participants
- Execution of AHP

⇩

Identification of key projects for ecological improvement in JNP and MRPP

⇩

Final Recommendations submitted as a report to Kinder Morgan by WTI Team

Figure 6: Summary of process.

3. PROCESS

3.1. Project setup

Start-up meetings were held in person in Jasper, and by phone with BC Parks representatives. A point person from each park was designated as our conduit for sending and receiving information to management and participants.

We obtained a Parks Canada research permit authorizing our general methods and information exchange with specialists in Parks Canada. Verbal consent to engage British Columbia government employees was provided by the point person representing Mount Robson. Montana State University's ethics committee gave approval to involve human participants in the research.

3.2. Developing a list of EIPs

To develop a list of EIPs, we began by interviewing regional ecological specialists about the conservation issues and needs in JNP and MRPP. We asked specialists to suggest any project ideas they may have. To help stimulate thought on issues and projects, we generated a matrix with ecological objectives and criteria that we distributed prior to interviews (Appendix A). We encouraged specialists to think broadly and at different temporal and spatial scales (short-term vs. long-term benefits; localized vs. region-wide benefits).

3.2.1. Interviews

We interviewed regional ecological specialists from Parks Canada, BC Parks, BC Fish and Wildlife and ENGOs.

3.2.1.1. Choosing interview participants

Parks Canada, BC Parks and ENGOs recommended specialists with a diversity of expertise. Study design and finite funds meant a limit to the number of people we could interview. Our team narrowed participant lists to roughly 12 interviews per park (including ENGO representation). The final list (Appendix B) was reviewed by Parks Canada and BC Parks representatives to ensure a comprehensive representation of disciplines.

3.2.1.2. Structuring the interview

We used the "information interview" method for this project. Information interviews are a moderately open-ended style of interview that allows the interviewee to lead the discussion. They are structured to address a specific problem—in this case determining possible EIPs that could benefit from the Kinder Morgan Canada Trans Mountain Legacy Fund.

We developed an interview guide (Appendix C) to ensure consistent structure and information was provided in each interview.

3.2.1.3. Conducting the interview

A participant package was developed and distributed to participants prior to their interview for feedback and questions (Appendix A). The package included a description of the methods and an explanation of the process. It also included a matrix made up of ecological objectives and indicators to help interviewees organize their thoughts and brainstorm potential projects.

Interviews were conducted in Prince George, Jasper, and by phone where a face-to-face interview was not possible. They were conducted behind closed doors and in confidence to allow participants to speak freely. Interviews were recorded when possible[i] for the purposes of ensuring accuracy in the written summaries provided by our team. Recordings were erased once the interviewee had reviewed the written summary from the interview and confirmed its accuracy.

Each interview consisted of the following components:

- a review of important points and information in the participant package,
- a review of the process and information about follow-up,
- open-ended “prompting” questions to engage interviewees if necessary, and
- a follow-up email with a written interview summary to be reviewed for accuracy by the participant.

During the interview process, we asked each participant to suggest other resources or contacts that could be relevant to the project. We recorded this list in the event that it could help provide project details and recommendations.

3.2.2. Synthesis of interviews and development of initial list of EIPs

The interviews provided the foundation for the development of an initial list of EIPs. To synthesize the interviews, our team developed a spreadsheet that identified issues and projects, and quantified how often each had been mentioned by participants (Appendix D). This led to a list of 17 project suites. The team wrote a general description for each suite, and identified potential project links to other suites and example actions that could be funded through the KMC Trans Mountain Legacy Fund. This information was augmented by a review of research reports, ecological databases (GIS and standard), traffic volumes, railway information, park management plans, state of park reports and other resources pertinent to the JNP and MRPP region.

3.2.3. Review of list of EIPs by Parks Canada, BC Parks and Externals

The list of 17 project suites was circulated to all interview participants and point people in JNP and MRPP with the goal of obtaining maximum feedback and information for refining projects for the AHP. JNP and MRPP each provided one response intended to represent the perspective of the group of interviewees and their agencies/departments.

3.2.4. Refining the list of EIPs

The list of 17 project suites was narrowed to eight based on feedback from Parks Canada and BC Parks. Our team also applied a coarse filter to eliminate those project suites that were clearly outside the direction provided through KMC’s environmental stakeholder consultation and the four principles of the project. For example, if a project did not have some demonstrable regional

[i] It was not possible to record phone interviews.

ecological benefit, it was removed. If it was not feasible because it required a legislation change, contravened the National Parks Act, or was not within either park's jurisdiction, it was removed. When there was a lot of overlap between project suites, they were combined. The results and rationale of this filtering process were documented.

3.3. Prioritizing EIPs using the Analytical Hierarchy Process

3.3.1. What is the Analytical Hierarchy Process?

AHP is a decision-making tool that provides a clear rationale for how decisions are made and helps people set priorities when considering both qualitative and quantitative aspects of a decision.[v] The AHP technique is particularly appealing because it serves as an excellent vehicle for discussion of multi-criteria decisions, and the relative strengths of those criteria and alternatives. The AHP works by reducing complex decisions to a series of one-on-one comparisons and then synthesizes the results in a quantitative manner to facilitate evaluation of alternatives. AHP accounts for the human dimension in decision-making as it "allows for the application of data, experience, insight, and intuition in a logical and thorough way."[vi] AHP was used to prioritize the eight EIP suites. It was also used to assign a relative weight to the project objectives as outlined below.

3.3.2. Selection of ecological specialists to participate in the AHP

A subset of five specialists (Appendix E) from the interview process was chosen to participate in the AHP. Group consensus was required to conduct the project comparisons, and therefore we limited the number of participants to help facilitate dialogue. These participants formed a group with diverse experiential backgrounds and ecological specialties. We also sought to have representation from both parks and include a participant external to both Parks Canada and the BC Government. Selection of participants was based on a number of factors, including:

- area of specialty,
- general regional knowledge,
- preparedness and performance in the interview, and
- availability.

3.3.3. AHP methods

3.3.3.1. Structure

The AHP is structured around the evaluation of alternatives or projects, with respect to the overall goal. Between the goal and the project level in the hierarchy, there can be any number of objectives, or criteria, used to evaluate the projects (Figure 6).

3.3.3.2. Goal

The overall goal of the decision-making process must be identified before engaging in the AHP. The goal of this work is to identify and prioritize projects that address key ecological issues in JNP and MRPP in a transparent manner that will satisfy stakeholder concerns. These projects will then be recommended for funding by the Kinder Morgan Canada Trans Mountain Legacy Fund.

3.3.3.3. Objectives

Objectives allow for more specificity in the hierarchy. In this case, objectives are conditions against which each project is measured. Environmental stakeholders in KMC's consultation process requested this project be guided by a number of core principles, which became the objectives in our hierarchy. As such, each project had to meet the following criteria:

- It should be feasible.
- It should be beneficial to both JNP and MRPP.
- It should be consistent with park mandates but above and beyond daily responsibilities.
- It should be ecologically significant.

Below we describe and define these criteria. These descriptions were provided to the AHP participants.

A) Feasibility

The difficulty and complexity required to implement a project will affect its ranking in this AHP. Projects with a higher level of feasibility show the majority of funds going directly to an ecological improvement. These projects will also have a high degree of certainty that they will be implemented. Factors affecting project implementation include the amount of public consultation required, the amount of data required prior to project startup and the project cost.

While public consultation is an important component of decision-making, it also adds cost, time and uncertainty to project outcomes. Consultation is recommended or required through direction in park management plans and directives. Often consensus is the desired outcome of working groups and stakeholder activities, and the final design of a project may not be known for extended periods of time as that consensus is developed. Due to this uncertainty, feasibility increases as the need for public consultation decreases.

Data requirements for project startup are based on what sources of data are already at hand. When data requirements are large it means that preliminary studies to test the effectiveness of methods or to get the necessary replications in experimental study designs may require time, money and personnel to implement. A project becomes less feasible with greater degrees of data requirements.

Costs of a project need to be given some consideration, though the purpose of this exercise is to look beyond simple financial objectives. Still, expensive projects tend to be less feasible, as the logistics involved change with cost.

B) Beneficial to both parks

Ideally, both JNP and MRPP benefit ecologically from this fund. Though ecological conditions and human impacts on the environment are different for each park, a project that best meets the goal will be one that has a positive effect across the region. There are at least two ways that projects can benefit both parks: locally and regionally. Local projects are spatially site specific in nature but are related to issues that both parks face. For example, if both parks have a need to clean up toxic waste sites, then a program and infrastructure to serve these needs could be designed to adequately benefit both parks. Regionally beneficial projects are, by their nature, broad in spatial scale. These projects may include studying animal migration patterns within and between the parks. Locally or regionally beneficial projects should not outweigh each other so long as the project benefits both parks.

C) Above and beyond management responsibilities

Projects that best meet the goal of this exercise are beyond the day-to-day responsibilities of management in the parks, but are consistent with park management objectives. The goal of the EIP is to fund work that Parks Canada and BC Parks would not likely carry out under normal circumstances. This is a unique opportunity to implement a project that would otherwise be beyond the reach of park managers, members of the public and other researchers.

D) Ecological significance

Ultimately, this exercise aims to identify projects that improve the ecological condition of the area. Projects that have a greater, positive ecological impact best contribute to that goal. There are at least five different ways that projects may contribute to ecological significance.

1) Maintain and restore native biodiversity
2) Ensure adequate habitat quality and quantity are available
3) Reduce detrimental interactions between humans and wildlife (including plants)
4) Restore landscape connectivity
5) Restore natural patterns of trophic flows

Projects that incorporate any or all of these components are ecologically significant. These components also operate at a variety of ecological (i.e., genetic, individual, population, community, ecosystem), spatial (patch, landscape) and temporal (short-term, long-term) scales.

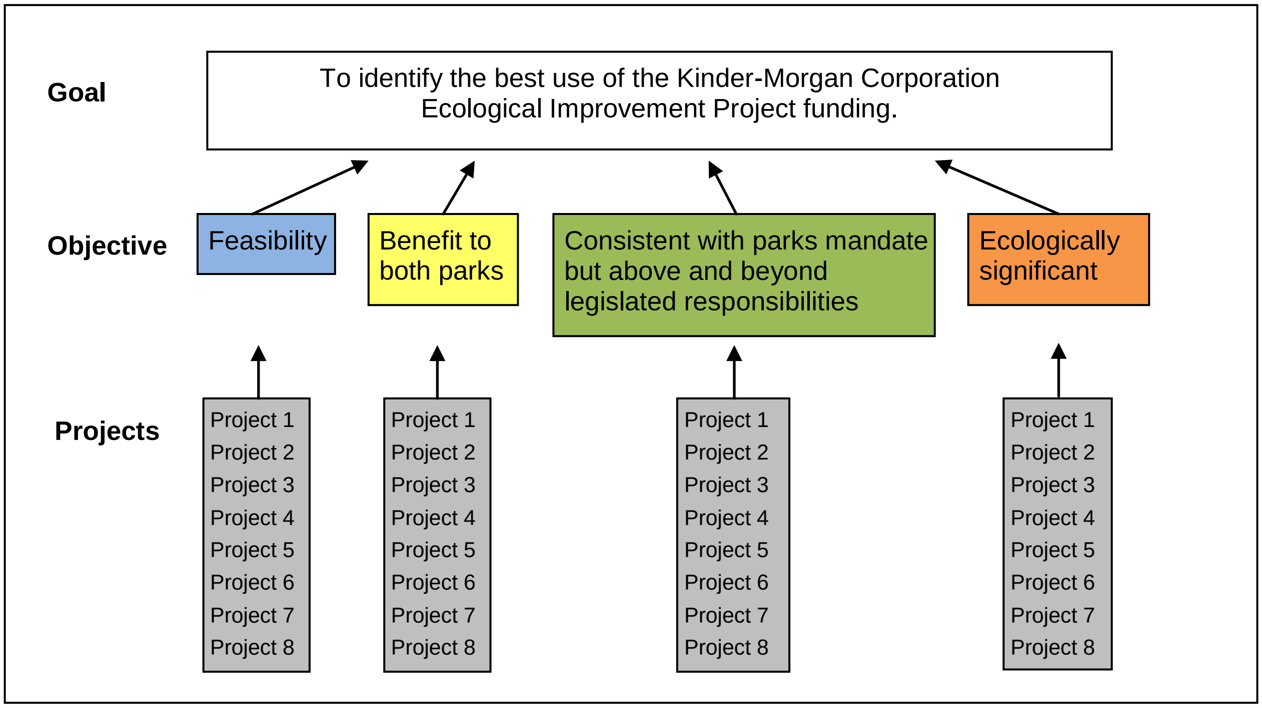

Figure 7: The Analytical Hierarchy Process structure for the Kinder Morgan Corporation Ecological Improvement Project workshop. Gray boxes are project-level, pair-wise comparisons (clusters) that are evaluated based on their capacity to meet the objectives above them. The four objectives were identified as criteria that define the best project to meet the goal.

3.3.3.4. Projects

The projects are specific ecological improvement actions that have been identified through interviews and independent assessments of park resource conservation information made by the WTI researchers. Projects are grouped together in suites of related actions to facilitate comparison between multiple alternatives. The eight project suites included:

1) Ungulate management
2) Improving ecological connectivity across transportation corridors and right-of-ways
3) Improving regional habitat suitability around lands adjacent to human use areas
4) Non-native plant management
5) Localized improvements to habitat restoration
6) Baseline population monitoring and resource inventory
7) Reduction in human-caused wildlife mortality
8) Non-native animal species management

In Appendix E we describe the ecological rationale behind each project suite along with examples of suggested actions.

3.3.3.5. Project scoring in the AHP

We used SuperDecisions v 1.6.0 to score the project suites. This software is freely available on the Internet, and was designed by AHP authority Thomas L. Saaty. For details on the mathematical procedures used by SuperDecisions, see http://www.superdecisions.com, or Saaty (1990).[vii]

Using this software we report the results of the entire AHP, including scores for the objectives, project suites within each objective and the overall model. This software allows us to describe two results for each project suite and evaluated objective: proportional score and normalized score. The proportional score describes a value that, in combination with the other project scores under a specific objective, sums to 1.0. These scores can also be thought of as a “proportion of importance” with respect to contributing towards the goal. In other words, a project with a proportional score of 0.7 makes a contribution of 70 percent towards meeting the objective, while the remaining projects make a contribution of 30 percent. We also present a normalized score, in which the top-ranked project suite received a score of 1.0, and lower-ranked project suites received a value based on the normalization coefficient used for the top-ranked project suite. This score can also be thought of as the magnitude of difference between the top-ranked suite and the other suites. These values do not sum to 1.0. Lastly, we present the inconsistency ratio, which is calculated for each cluster in the hierarchy but is not calculated for the overall model. The inconsistency ratio should be 0.1 or less, but may be greater if the group decides that its decisions are sound (Saaty 2003).[viii] The inconsistency ratio is a measure of logical consistency. For example, if A>B, and B>C, then A>C; however, if the decision reports that A<C, then the inconsistency ratio increases.

3.4. Results

3.4.1. Objective weightings

Participants found that ecological significance was approximately four times more important than the next closest objective (Table 1). Other objectives of their decision-making were notably less important. The inconsistency value of this cluster slightly exceeded the ideal threshold of 0.1, but the participants found this to be acceptable given their rankings.

Table 1: AHP scores for the objectives.

Objectives	Proportional score	Normalized score	Inconsistency ratio
Above and beyond day-to-day management	0.056	0.082	0.1159
Beneficial to both parks	0.168	0.247	
Ecological significance	**0.679**	**1.000**	
Feasibility	0.097	0.143	

3.4.2. Project scores: Above and beyond management

Improving connectivity was ranked highest by participants, followed closely by improving habitat and reducing mortality (Table 2). Unlike other objectives, the scores for the top three projects here were quite similar. This may reflect the ambiguity of this objective in the minds of the participants, as several spoke of the difficulty in identifying projects that were both relevant and beyond day-to-day management. The inconsistency ratio was within the ideal range of <0.10.

Table 2: Project score for objective "above and beyond management responsibilities." Highest score for proportional and normalized scores are in bold type.

Project suite	Proportional score	Normalized score	Inconsistency ratio
Baseline population monitoring and resource inventory	0.019	0.077	
Decrease human-caused wildlife mortality	0.222	0.891	
Improving ecological connectivity across transportation corridors and right-of-ways	**0.248**	**1.000**	
Improving regional habitat suitability around lands adjacent to human use areas	0.061	0.245	0.0961
Localized improvements to habitat restoration	0.235	0.947	
Non-native animal species management	0.048	0.194	
Non-native plant management	0.048	0.194	
Ungulate management	0.11	0.477	

3.4.3. Project scores: Beneficial to both parks

Again, ecological connectivity was the top-ranked project here, but with no clear competition. The next ranked projects scored less than half of that for improving connectivity (Table 3). This scoring pattern may be a result of the types of issues facing each park, which are generally localized in nature. However, the transportation corridor that bisects both parks is clearly common ground for discussion among participants representing both jurisdictions. The inconsistency ratio was slightly higher than we would like, but participants were satisfied with their initial responses so we declined the opportunity to change project scores.

Table 3: Project score for objective "beneficial to both parks." Highest score for proportional and normalized scores are in bold type.

Project suite	Proportional score	Normalized score	Inconsistency ratio
Baseline population monitoring and resource inventory	0.028	0.078	
Decrease human-caused wildlife mortality	0.059	0.168	
Improving ecological connectivity across transportation corridors and right-of-ways	**0.354**	**1.000**	
Improving regional habitat suitability around lands adjacent to human use areas	0.06	0.168	0.1164
Localized improvements to habitat restoration	0.18	0.509	
Non-native animal species management	0.029	0.081	
Non-native plant management	0.123	0.347	
Ungulate management	0.167	0.472	

3.4.4. Project scores: Ecological significance

Similar to Section 3.4.3, ecological connectivity ranked highest, with no clear competition from the next highest ranked projects, which were ungulate management and localized habitat improvements (Table 4). Again, the inconsistency ratio was higher than we would like, but participants were satisfied with their responses so we did not revisit their original scoring.

Table 4: Project score for objective "ecological significance." Highest score for proportional and normalized scores are in bold type.

Projects	Proportional score	Normalized score	Inconsistency ratio
Baseline population monitoring and resource inventory	0.018	0.041	0.1106
Decrease human-caused wildlife mortality	0.057	0.129	
Improving ecological connectivity across transportation corridors and right-of-ways	**0.438**	**1.000**	
Improving regional habitat suitability around lands adjacent to human use areas	0.024	0.055	
Localized improvements to habitat restoration	0.167	0.378	
Non-native animal species management	0.034	0.089	
Non-native plant management	0.078	0.178	
Ungulate management	0.180	0.411	

3.4.5. Project scores: Feasibility

Unlike previous objectives, when it comes to implementation of the project, ecological connectivity ranked quite poorly compared to other projects. Regional habitat suitability improvements, local habitat improvement and monitoring were the top three candidate projects (Table 5). With a low inconsistency ratio for this objective, participants were expressing clear logical continuity when identifying the feasibility of these projects.

Table 5: Project score for objective "feasibility." Highest score for proportional and normalized scores are in bold type.

Projects	Proportional score	Normalized score	Inconsistency ratio
Baseline population monitoring and resource inventory	0.199	0.682	0.0876
Decrease human-caused wildlife mortality	0.048	0.163	
Improving ecological connectivity across transportation corridors and right-of-ways	0.035	0.118	
Improving regional habitat suitability around lands adjacent to human use areas	**0.292**	**1.000**	
Localized improvements to habitat restoration	0.229	0.784	
Non-native animal species management	0.021	0.072	
Non-native plant management	0.099	0.339	
Ungulate management	0.077	0.262	

3.4.6. Overall project scores

As the top-ranked project in three of the four objectives, it is not surprising that improving ecological connectivity was the top-ranked project in the overall decision-making model. More surprising was the importance of localized habitat improvements and ungulate management. These two projects were never ranked very high within each objective, but were also not ranked very low compared to some others. Thus, they were able to maintain relatively moderate scores at each objective, giving them noteworthy final scores. Clearly, with a proportional score of 68 percent, the objective of ecological significance has the majority of importance in affecting the top-ranked project. Furthermore, ecological connectivity scored twice as high as the next ranked project in this objective. Thus, it is most likely because of the potential for resolving important ecological issues in the study area, and the importance of doing so with respect to the goals of the funding, that improving ecological connectivity is the top-ranked project in the AHP.

Table 6: Overall model (weighted by objectives).

Project	Proportional score	Normalized score
Baseline population monitoring and resource inventory	0.037	0.100
Decrease human-caused wildlife mortality	0.065	0.175
Improving ecological connectivity across transportation corridors and right-of-ways	**0.374**	**1.000**
Improving regional habitat suitability around lands adjacent to human use areas	0.058	0.156
Localized improvements to habitat restoration	0.178	0.476
Non-native animal species management	0.036	0.096
Non-native plant management	0.086	0.229
Ungulate management	0.164	0.439

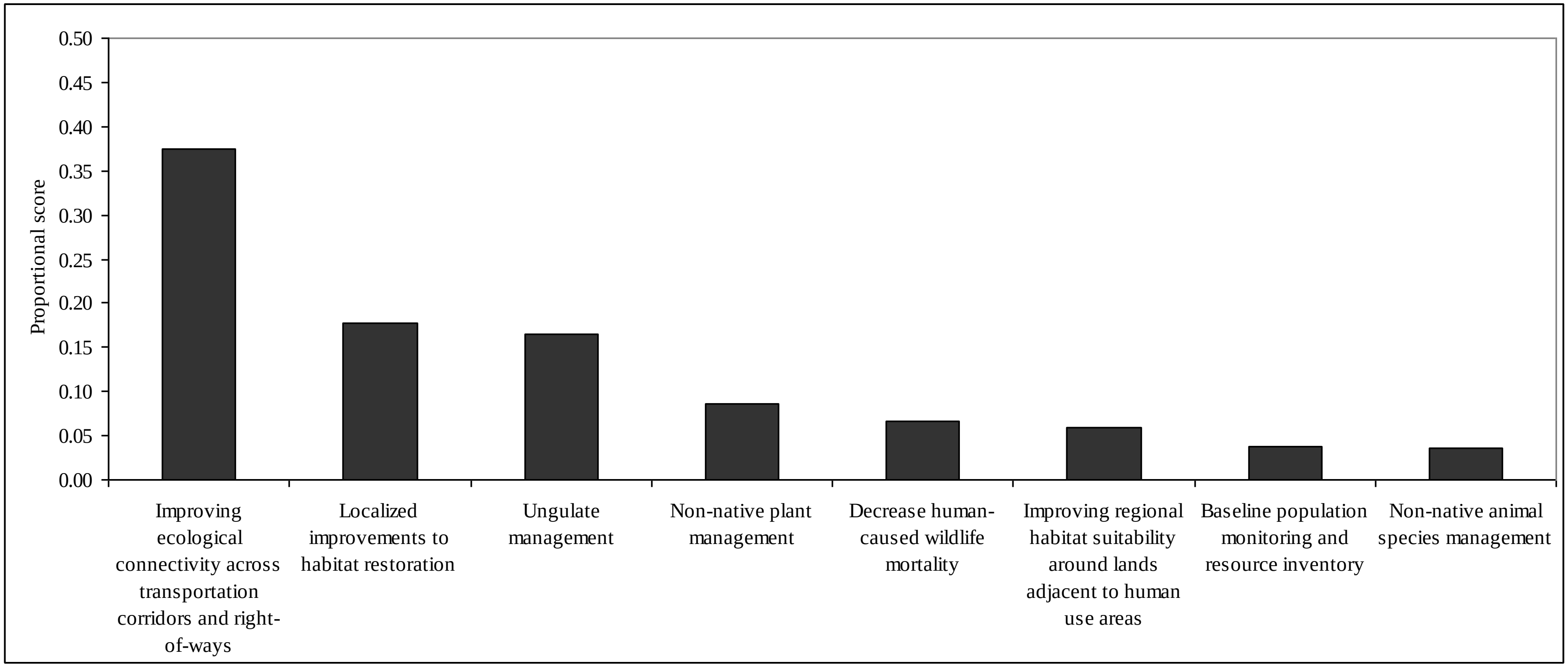

Figure 8: Final weighting of ecological improvement project suites.

3.5. Discussion

In developing a project recommendation, our team was guided by the AHP results, interviews, feedback from participants and examples of other relevant projects.

3.5.1. Feedback

At various points throughout the process we received feedback from participating government employees and members of the ENGO community. We had hoped for more feedback from non-government participants once the initial list of projects was circulated. Time limitations and a lack of further knowledge on some of the ecological issues were cited as barriers to further comment by interviewees.

We had also hoped for more individual feedback from government employees. Although coordinated responses from JNP and BC Parks were helpful in understanding how projects fit in with various management plans and initiatives, it also prevented further feedback from specialists in their areas of expertise.

3.5.2. Discrepancies with interviews

We noticed a discrepancy in the way some participants emphasized projects in interviews, versus how they were emphasized in the AHP. There may be a number of reasons for this. For instance, participants may have felt more comfortable speaking about subjects in a confidential interview than they did in an inter-agency group, or participants may have changed their minds based on new information or opinions presented by other AHP participants. We re-visited the interviews to make sure our own project recommendations were consistent with the major input we received during the interview process.

A lack of baseline data was a dominant theme in the interviews from both parks. Although this scored low in the AHP, given its emphasis in the interviews we felt it was appropriate to include the collection of relevant baseline data into the final recommendation to ensure its importance was addressed.

Likewise, although the project suite that focused on localized improvements to habitat scored relatively high in the AHP, the interviewees did not emphasize this in the same way. This suite of projects may have received a higher ranking than warranted as it was always middle ground relative to other projects.

3.5.3. Direction from the AHP

In the AHP, participants indicated that ecological significance was approximately four times more important than the next closest objective. In addition, project suites associated with improving ecological connectivity across transportation corridors and right-of-ways were considered at least twice as important as the next highest project suite. This clear direction from participants in the AHP led our team to focus on recommending projects with connectivity at their core.

3.5.4. Quantifiable synergies using the AHP score

Though the AHP results showed that projects addressing connectivity issues along transportation corridors were the best way to create ecological improvements in JNP and MRPP, a connectivity project done properly can consist of actions that overlap with some of the other project suites that were evaluated. For example, actions taken to improve connectivity may also decrease human-caused wildlife mortality, or contribute to localized improvements to habitat restoration. If you add up the AHP score of all of these project suites respectively (0.374, 0.065 and 0.058), you achieve a synergistic score of 0.497. In doing this, actions address a larger range of priorities for JNP an MRPP. The final recommendation will therefore include the suite of projects that have greatest synergistic effect on ecological improvements in the region.

3.6. Project recommendations and actions for ecological improvement in JNP and MRPP

Our recommendation will focus on improving ecological connectivity across transportation corridors and right-of-ways, but will include elements from other project suites that have appropriate synergies.

3.6.1. The importance of ecological connectivity

Connectivity across transportation corridors and right-of-ways is an issue that affects each park,[ix] both from an animal-movement perspective and from a need to decrease human-caused wildlife mortality from road and rail traffic. Based on the 20-Year Strategic Capital Plan[x] produced by the Alberta Government, a medium-term goal will see the “upgrade of Highway 16 from the Saskatchewan border to Edmonton to expressway standard, including a bypass around the City of Lloydminster and construct and upgrade interchanges at Sherwood Park, and from Carvel Corner (Highway 43 junction) to Jasper National Park. This will include new bypasses around the towns of Edson and Hinton as well as four-laning from west of Hinton to the Park entrance.” This upgrade will facilitate high volumes of traffic through both parks as goods are exchanged east to west. Experience in the Bow Valley and elsewhere has shown that the cost of mitigating the effects of railroads and highways increases every year.[xi] The sooner these issues are addressed, the lower the cost, and the more prepared both parks will be for the inevitable twinning of Highway 16.

3.6.2. Recommended project summary

Below we describe the recommended project suites and associated actions, highlighting their synergies, logical implementation sequence and integration as one project that addresses ecological connectivity issues in the region at its core. The overall recommendation occurs in three distinct steps or phases of implementation. Within each step we provide several options for accomplishing the goals of that step that vary in the amount of logistical resources required for implementation. The project steps are summarized in Table 7 and in the section below. Each step is discussed in detail in Section 3.6.3.

Table 7: Summary of project steps and synergies with other project suites. Cumulative AHP scores are the Proportional Scores from each project suite that is associated with the current step added to AHP score of the preceding step(s).

Step	Project suite associations (AHP score)	Cumulative AHP score
1. Develop a long-term population monitoring program.	• Baseline population monitoring and resource inventory (0.037)	0.037
2. Perform a regional connectivity analysis and take management actions to restore critical linkages.	• Improving regional habitat suitability around lands adjacent to human use areas (0.058)	0.095
3. Create a mitigation toolbox and identify specific actions to maintain connectivity across transportation corridors.	• Improving ecological connectivity across transportation corridors and right-of-ways (0.374) • Decrease human-caused wildlife mortality (0.065) • Localized improvements to habitat restoration (0.178) • Ungulate management (0.164)	0.876

Step 1. Develop a long-term population monitoring program. A critical first step in executing the project successfully is to collect population distribution and abundance data. Indicator species can be selected to represent a variety of taxonomic and keystone ecological processes, with appropriate monitoring methods for these species or species groups. Recent advances in species occupancy modeling enable robust estimations of species occurrence, distributions and habitat selection over time (Mackenzie et al. 2005). This information is a prerequisite to selecting management actions and predicting their effects (positive or negative).

Concurrently, a spatially accurate wildlife mortality monitoring program can be implemented to quantify the frequency and distribution of wildlife mortality events along Highway 16, the CNR and secondary roads. The duration of the monitoring programs should be long enough to a) encompass short-term variation in population changes, and b) to provide enough statistical power to enable rigorous inference of model predictions. Some of this information may be available to varying degrees in JNP and MRPP.

Step 2. Perform a regional connectivity analysis and take management actions to restore critical linkages. Applying the results of species-habitat modeling, a regional connectivity analysis can be performed to identify critical habitat linkages among landscape elements. This information will show where indicator species are most likely to move through the landscape, as well as identifying conflict areas between predicted movement corridors and human-use areas or facilities. Mitigating the negative effects of the transportation corridor on terrestrial and aquatic wildlife movement requires knowledge of where they are most likely to encounter impediments to movement, such as the highway and culverts. Furthermore, this information can be used to prioritize habitat improvement programs (e.g., prescribed burns) and human-use management (e.g., seasonal closures).

Step 3. Create a mitigation toolbox and identify specific actions to improve connectivity across transportation corridors. Using the species-habitat modeling, the wildlife mortality information, regional movement models and a detailed site-specific investigation of terrain, human use and habitat features along the highway, a "mitigation toolbox" can be created to prioritize areas for connectivity restoration using a range of management actions. Recommended management actions will reflect a range of costs and effectiveness depending on site and species-specific conditions. For example, the barrier effect of transportation corridors on wildlife includes an avoidance component (e.g., Dyer et al. 2002[xii]; Ford and Fahrig 2008[xiii]) and a mortality component. The avoidance component can be addressed through the construction of wildlife crossing structures (Clevenger et al. 2002). The mortality component can be met through highway fencing and through the removal of grain attractants from the CNR right-of-way. Some actions in the project suite *decreasing human-caused wildlife mortality* are inextricably linked to the restoration of connectivity in the region. Furthermore, identifying critical linkage zones across the railway and highway can also be used to inform the management of *localized improvements to habitat restoration*. For example, wildlife crossing structures are being located along Phase IIIB of the Trans-Canada Highway in Banff National Park in areas adjacent to restored gravel pits (i.e., borrow pits). These localized habitat features attract animals to the area and increase the likelihood of their encountering a wildlife crossing structure.

Taking action to restore wildlife movement across transportation corridors in the region will also help to restore large mammal predator–prey dynamics to a more natural level. As Hebblewhite et al. (2002) found, highway mitigation may play an important role in regulating elk populations by allowing greater access by predators. Thus, addressing connectivity and mortality issues along the highway can contribute towards *ungulate management* objectives (AHP Score: 0.164). This, in turn, has reciprocating benefits for aspen regeneration, which further contributes towards local habitat restoration actions.

3.6.3. Detailed project recommendation

In this section, the project steps are described in detail. Each step includes:

- Objective of the step
- Methods
- Actions
- Cost-weighting
- Proportionate cost distribution
- Potential collaborative projects and funding partners

- Ideal to minimal effort transition (in order of decreasing performance and cost)
- Examples

The following glossary of terms is provided to aid in reviewing each step in detail.

Objective—The action statement describing the purpose of this step within the overall recommendation.

Methods—Indicating whether the actions (see definition) are mainly field based or analytical in nature. Field-based methods require appropriate logistical support for equipment, personnel, permitting, and pilot testing. Analytical methods can generally be performed by one person, using GIS or statistical software.

Actions—The actual procedures recommended to be carried out in order to accomplish the objective and, ultimately, the overall goal of the EIP.

Cost weighting—Ongoing refers to funding requirements that will be distributed over the long-term. Front-loaded refers to “upfront” costs that are generally tied to infrastructure and equipment. End-loaded refers to costs that are required at the end of the action, generally referring to analytical procedures following field data collection.

Proportionate cost distribution—The proportion of the base funding that should be allocated to this step. Partnered, leveraged or matched funds should not be included in the calculation of this proportion.

Potential collaborative projects and funding partners—Associated projects that are planned or ongoing within the parks as part of regular management initiatives, or funding sources that have a vested interest in the action.

Ideal to minimal effort transition—In order to accomplish the objective, but taking into account uncertainty in availability of funds, suggested actions are presented in order of decreasing performance and cost.

Examples—Other projects where similar actions have taken place.

3.6.3.1. Step 1. Develop a long-term population monitoring program

Objective

To identify where species occur and in what density in order to track changes in population distribution over time and space.

Methods

1) Field surveys
2) GIS-based analyses

Actions

1) Select indicator species from a broad range of taxonomic categories and mobilities, such as:
    a. reptiles/amphibians—long-toed salamander
    b. aquatics—cutthroat trout, bull trout, river otter
    c. vegetation—apple moss, aspen, fescue
    d. small mammals—open area specialist, old-growth
    e. forest specialist
    f. ungulates—moose, caribou, elk
    g. carnivores—grizzly bears, wolves, wolverine
    h. birds—forest songbirds

    Other indicator species can be selected based on rarity, predicted sensitivity to fragmentation, or mobility.
2) Collect species status and occupancy data from regional multi-species surveys for five years prior to construction or implementation of mitigation measures. Post-construction monitoring is also essential to evaluate management effectiveness.
3) Systematically collect mortality data from railway and roads using GPS.
4) Model species-habitat relationships using survey results and remote-sensed landcover data (e.g., species occupancy models, Mackenzie et al. 2006[xiv]).

Cost weighting

1) Ongoing: monitoring staff and equipment maintenance
2) Front-loaded: monitoring equipment
3) End-loaded: development of species-habitat relationship models

Proportionate cost distribution

At least 20 percent of non-partnered or unmatched funding should be allocated to efforts ensuring baseline monitoring efforts.

Potential collaborative projects and funding partners

1) Mortality monitoring: CNR, highway maintenance personnel, park wardens, conservation officers and employees
2) Integrate monitoring efforts with pre-existing biodiversity inventories within both parks

Ideal to minimal effort transition (in order of decreasing performance and cost)

1) monitor fewer taxa
2) use less-costly field methods (in decreasing order):
    a. capture-mark-recapture (incl. radiotelemetry)
    b. relative abundance
    c. presence/absence
3) monitor fewer sites
4) fewer years of monitoring

Examples

1) Alberta biodiversity monitoring program
2) I-90 in Washington State
3) Trans-Canada Highway bear DNA project

3.6.3.2. Step 2. Perform a regional connectivity analysis and take management actions to restore critical linkages

Objective

To identify critical habitat linkages and areas where wildlife and fish movement and human activities conflict.

Methods

1) GIS-based and/or expert opinion analyses

Actions

1) Model regional landscape linkages using species occupancy methods.
2) Evaluate conflict zones and take remedial action to restore ecological connectivity in critical areas. May include seasonal closures of some facilities or vegetation management and restoration of early successional habitat components.

Cost weighting

1) Front-loaded: management action to restore ecological connectivity
2) End-loaded: analytical procedure

Proportionate cost distribution

At least 5 percent of non-partnered or unmatched funding should be allocated to efforts to "improve regional habitat suitability around lands adjacent to human use."

Potential collaborative projects and funding partners

1) None (to our knowledge)

Ideal to minimal effort transition (in order of decreasing performance and cost)

1) Empirically derived connectivity analysis using GPS-telemetry, capture–recapture rates and DNA-based genetic distance measures.
2) Empirically derived species occupancy and simulation modeling.
3) Expert opinion and simulation modeling.
4) Expert-opinion-based habitat linkage assessment.
5) Habitat linkage assessment without the assistance of an expert-opinion approach using best-guess approach of the researchers or managers.

Examples

1) Arizona Wildland Linkage project (see Beier et al. 2006[xv])
2) Trans-Canada Highway, Phase IIIB (Clevenger and Wierzchowski 2006[xvi]; Clevenger et al. 2002[xvii])
3) Lands around the Town of Banff (LATB) process

3.6.3.3. Step 3. Create a mitigation toolbox and identify specific actions to improve connectivity across transportation corridors

Objective

To facilitate the movement of individual organisms across transportation corridors in order to restore connectivity among populations.

Methods

1) Field monitoring
2) Expert opinion analysis
3) Infrastructure/technology deployment

Actions

1) Using baseline mortality distribution data, regional habitat linkage analysis and terrain features, develop a "mitigation toolbox" for transportation infrastructure in the region (e.g., Highways 93N and 16, and CNR).
2) Prioritize areas for mitigation using expert opinion or local management leadership.
3) Implement mitigation through technologies proven effective or in tandem with infrastructure reconstruction such as:
    a. grain removal truck
    b. wildlife-proof fencing along the highway
    c. wildlife crossing structures
    d. animal detection systems
4) Reduce habitat disturbance and restore local habitat conditions to increase habitat quality in areas adjacent to mitigation measures (e.g., restore gravel pits).
5) Design and monitor management actions for effectiveness.

Cost weighting

1) Ongoing: monitoring
2) Front-loaded: mitigation toolbox development and technologies/infrastructure construction, habitat restoration
3) End-loaded: field monitoring post-mitigation evaluation

Proportionate cost distribution

At least 75 percent of non-partnered or unmatched funding should be allocated to this step.

Potential collaborative projects and funding partners

1) Parks Canada Highway Service Center
2) BC Ministry of Transportation
3) CNR

Ideal to minimal effort transition (in order of decreasing performance and cost)

1) Will vary depending on local conditions derived from mitigation toolbox development, but see Huijser et al. (2007).

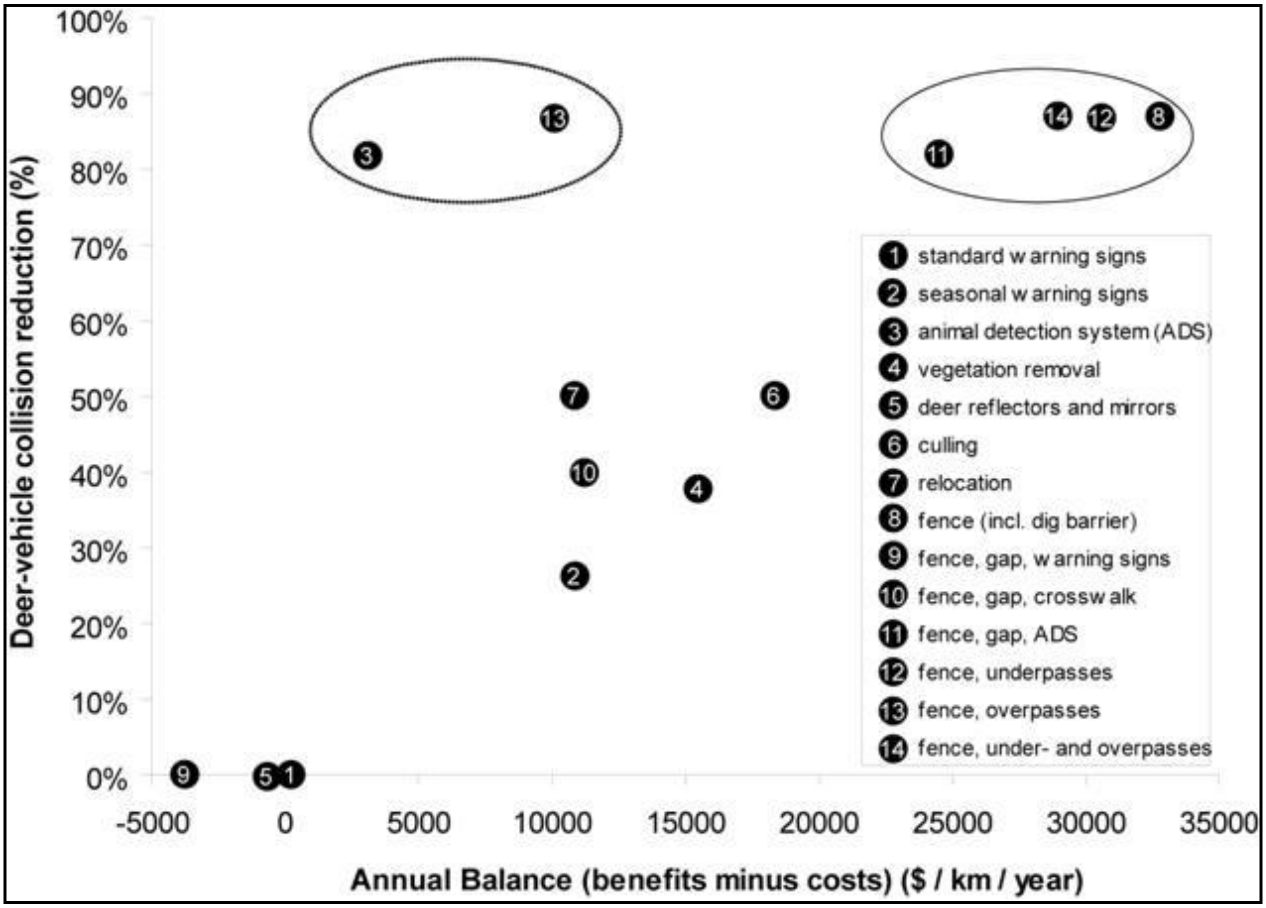

Figure 9: The relative costs and deer–vehicle collision reduction for various mitigation measures. ADS refers to animal detection system. Taken from Huijser et al. (2007:177).

Examples

1) Trans-Canada Highway in Banff National Park
2) Canadian Pacific Railway in Banff and Yoho National Parks
3) Highway 93, Montana
4) I-90, Washington State
5) I-70, Colorado
6) Coquihalla Highway, BC
7) Highway 93S in Kootenay National Park (i.e., development of mitigation toolbox). See Huijser et al. 2008.[xviii]

3.7. Implementation

In order to implement the project, financial management, project administration and project accountability need to be considered.

3.7.1. Financial management

Financial management of the project must allow for accomplishing the ecological improvement goals over a period of time. In choosing its structure, project administrators should consider expenses that are fixed costs and require expenditures in the near future (front-loaded), versus items that may benefit from the investment of funds and growing the interest to finance future project actions or those that are end-loaded.

Examples of front-end costs:

- Salaries
- Operations (e.g., vehicle expenses, fuel, field equipment, software)

Examples of end-loaded costs that invested funds could support:

- The mitigation toolbox (e.g., structures, signs)
- On-going monitoring and research
- Project steward

The financial administrator of the fund may also consider opportunities to match funds from other interested stakeholders, such as other provincial resource and land management agencies, non-profit conservation organizations, private and corporate foundations, leaseholders in the park, granting agencies, Highway Service Centre, BC Ministry of Transportation and Infrastructure, Foothills Research Institute, other industry interests, and the Federal Department of Transport, Infrastructure and Communities.

3.7.2. Communications

Communication with the public is key to the success of any project. Matching communications grants and a communications plan should be considered to facilitate the education of locals and visitors to both parks. Expecting either park to provide the communications for this project without additional funding would be burdening an already taxed communications department on both sides.

3.7.3. Education

Many educational opportunities can come from this project. Whether working with universities or schools, this is a chance to explore those opportunities.

In JNP, Parks Canada is working towards transforming the current Palisades Centre into the Palisades Stewardship. The Palisades Centre aims to bring national park stewardship and conservation messages to youth across the country and beyond. The objective is to cultivate stewards of the future for the national parks and national historic sites of Canada by encouraging Canadian youth to share a passion and appreciation for these places by developing personal connections. Youth will move beyond participation towards active ambassadorship. There are opportunities for youth from both Alberta and British Columbia to participate, and an opportunity to bring the stewardship of MRPP into this program.

3.7.4. Project steward

In addition to the detailed project recommendation above, we strongly recommend that a salaried person be hired to oversee its implementation. Given the scale of the project—spanning two provinces and protected areas, each with their own management and administration policies and styles—it will be critical to ensure the project not only meets its goals but is streamlined and efficiently run. To ensure the best use of funds, this person would:

- Supervise the project in both parks to ensure goals and objectives are met, that each park benefits equally, and that an effective regional approach is adopted and implemented.
- Manage the budget and be accountable for the funds.
- Report to the project oversight committee.

3.7.5. Oversight committee

We recommend an oversight committee to ensure the project stays true to the goals of the project. Time commitment from committee members should be minimal, and participation should be voluntary or within the scope of current positions. Potential committee members could include:

- A Parks Canada representative
- A BC Parks/Fish & Wildlife representative
- An ENGO representative
- A Kinder Morgan representative

The committee would receive brief, monthly progress reports from the project steward, and meet once or twice a year. The committee would provide guidance in the event the project steward required it. The committee would review with the project steward past goals and targets, reassess existing ones if needed, and evaluate future goals and targets. Another idea that came forward during the process is the formation of a non-profit society that could oversee the implementation of this project. The steward could be an employee of the society.

3.7.6. Building on existing programs: Leaving a legacy

There are obvious benefits to management actions that extend beyond the scope of the KMC EIP. For example, a comprehensive and long-term monitoring program will contribute towards management of both parks. In the 2000 Jasper National Park Management Plan, key actions for the maintenance of ecological structure and function included: “monitor, evaluate, and, where possible, restore vegetation, appropriate behaviour, and the population size and distribution of herbivores and carnivores” (Parks Canada 2000:15). A revised draft of the Management Plan for MRPP identifies key “Natural Values Management” issues as understanding the potential impacts of climate change on park ecosystems and determining what, if anything, should be done to minimize the impacts on less resilient species; protecting species at risk; implementing and adapting the forest health strategy to reflect changes in the ecosystem and values at risk; reducing wildlife mortality in the transportation corridor, and minimizing the distribution of non-native and invasive species (BC Parks 2008:11).

Components of this recommendation are being addressed by existing management and research activities within the region. For example, annual songbird counts, which are likely to be an important component of any long-term monitoring program, are being conducted currently in JNP and MRPP. This project provides an opportunity to build on these programs.

3.7.7. Concluding remarks

While it is recognized that protected areas are a vital component of any strategy to preserve biodiversity and maintain ecological integrity, most areas are not solely capable of this task over the long term. On their own, most protected areas are too small to maintain viable wildlife populations or sustain the effects of large natural disturbances. The protected areas of JNP and MRPP are significantly larger than most protected regions and in theory should be more resilient to the effects of external impacts. However, both parks face a unique set of conservation and management issues associated with increasing tourism, human disturbance, loss of critical habitats, predator–prey imbalance and growing transportation infrastructure.

Regional ecological monitoring and assessments are well suited to identifying these issues and, therefore, providing direction for biodiversity conservation, planning, and decision-making. But they need not be thought of as end points in the conservation planning process. Instead, they should be viewed as starting points for strategies such as collaborative research and monitoring and adaptive management.

Our project framework and recommendations for ecological improvement in JNP and MRPP present a unique opportunity to formalize and implement a long-term biodiversity monitoring and conservation planning strategy at a regional scale. While many textbooks and scientific articles in international conservation journals provide conceptual plans for a regional, transboundary management approach, very few have ever been put into practice. Indeed, this is one of the most engaging and salient opportunities for the EIP, which could serve as a model for regional, transboundary management of valued ecosystems for other locations and jurisdictions.

It is hoped that the Kinder Morgan Canada EIP will result in an enduring legacy that benefits the region. Key to the success of this project will be securing political and administrative support, cooperation between the two parks, and a mutual understanding of each park's ecological assets and deficiencies. To accomplish this goal, supporters of the project must be able to demonstrate the cooperative benefits of the fund, that it is effective at meeting its specific goals and objectives, and that it accrues ecological net benefits to the region over the long term.

4. APPENDIX A: INTERVIEW PARTICIPANT PACKAGE

Box 344
Jasper, AB
T0E 1E0

Participant
Parks Canada
Box 10
Jasper, AB
T0E 1E0

February 6th, 2008

Re: Participation in the interview process used to determine Ecological Improvement Projects

Dear Participant,

Through the Trans Mountain Legacy Fund, Kinder Morgan Canada has committed to fund projects that will result in ecological improvement for Jasper National Park and Mount Robson Provincial Park. Our team has been contracted to identify potential Ecological Improvement Projects. Attached you will find a project description that provides some background and outlines our methods.

As part of the process, interviews will be conducted with 12 subject matter specialists regarding the conservation issues and needs of the region. Specialists will be asked to do this within the ecological context and framework of the objectives they are provided with (e.g. the need to improve habitat connectivity, reduce human-related mortality, restore predator-prey relationships, eliminate non-native species). These objectives and framework are attached in an interview data sheet for your consideration. This data sheet provides a way for our team to group responses from interviewees in a way that is consistent for synthesis, however issues and project ideas need not be limited by this structure. If responses do not fall into these groupings, they will still be accounted for. Interviews will be recorded by dictaphone so that details are not lost. Participants will be contacted after their interview to review a summary that ensures their thoughts were properly captured.

You have received this letter because we have identified you as a subject matter specialist and would like to request your participation in an interview. Interviews will require approximately 1-2 hours of your time, with an additional hour of follow-up. Of the 12 people we will interview, six will then be asked to participate in the Analytic Hierarchy Process (AHP) as outlined in the project description. Participation in the AHP will require another 3-4 hours of your time.

Participants in the interview process are encouraged to think broadly. Although the current value of the ecological improvement project is fixed, projects that exceed those amounts should be considered, as in the future other resources may be available to contribute toward larger projects.

Your participation in this process will provide needed local expertise to ensure a tangible project results from this work. Please reply to Niki Wilson at nikilw@telus.net, or 780-852-2269 to confirm your participation and set up a time.

Best Regards,

Tony Clevenger
Lead Researcher
WTI, Montana State University

Niki Wilson
Researcher

Adam Ford
Researcher

Attached:

1. Project Description: *Identifying Ecological Improvement Projects for Jasper National Park and Mount Robson Provincial Park*
2. Interview Data Sheet

		Project Theme			
Objective	**Example indicators**	**Scale of ecological organization affected** • Genetic/individual • Species/populations • Community/ecosystem • Landscape	**Temporal scale** • One-time • Near term (2–5 year) • Long term/ ongoing (>5year)	**Spatial scale** • Local • Watershed • Transboundary	**Ecological structure** • Terrestrial • Aquatic • Abiotic • Biotic
Maintain and restore native biodiversity	Species richness, endangered species conservation				
Ensure adequate habitat quality and quantity are available	Extent, frequency and duration of natural disturbance regime				
Reduce detrimental wildlife–human interactions	Road mortality; habituated animals				
Restore landscape connectivity	Animal movement				
Restore natural patterns of trophic flows	Predator–prey dynamic				
OTHER					

5. APPENDIX B: LIST OF INTERVIEW PARTICIPANTS

Interviews about Jasper National Park	Interviews about Mount Robson Provincial Park
Alan Westhaver Fire and Vegetation Specialist Parks Canada **Jennifer McPhee** Non-native Plant Specialist Parks Canada	**Donna Thornton** Senior Ecosystem Biologist Kootenay Region Formerly Omineca Peace region for 20 years. Government of British Columbia
Brenda Shepherd Park Ecologist Jasper National Park Parks Canada	**Herb Hammond*** Forest Ecologist Silva Forest Foundation British Columbia
Colleen Cassady St. Clair University of Alberta (U of A) **Mike Sullivan*** Alberta Sustainable Resource Development and U of A	**Scott Back** Planning Section Head Omineca Region BC Parks Government of British Columbia
Mark Bradley Wildlife Biologist Parks Canada	**Dale Seip** Wildlife Ecologist with Forest Division (Research Scientist) Government of British Columbia
Peter Achuff Species at Risk Ecologist Parks Canada	**Kirk Safford** Ecosystem Biologist Omineca Region Temporary Assignment as Mountain Pine Beetle Specialist Government of British Columbia Former Wildlife Biologist in region
Geoff Skinner Trails Biologist Parks Canada	**Doug Herd** Wildlife Biologist Omineca Region Wildlife Division Government of British Columbia
Dwight Bourdin, Thea Mitchell, Jen Wasylyk Environmental Surveillance Officers on KMC pipeline project Parks Canada	**Bob Brade** Ecosystem Biologist Omineca Region Government of British Columbia

Interviews about Jasper National Park	Interviews about Mount Robson Provincial Park
Layla Neufeld Caribou Biologist Parks Canada	**Elizabeth Miller** Fisheries Biologist Omineca Region Wildlife Division Government of British Columbia
Shawn Cardiff Planning Manger Parks Canada	**Barb Zimmer*** Plant Ecologist Fraser Headwaters Alliance
Ward Hughson Aquatics Biologist Parks Canada	**Doug Wilson** Bird Biologist Omineca Region Wildlife Division Government of British Columbia
Wes Bradford* Wildlife Conflict Specialist Parks Canada	**Gail Ross** Interpretation and Education Project Manager for BC Parks Former Planning Section Head for Omineca -Peace Former Resource Officer for Omineca -Peace & Leaders for Omineca Peace protection strategy Government of British Columbia
	Liesbet Beaudry Forestry Consultant Prince George
	Mike Murtha* Parks Canada Planner Former Regional Section Head for Omineca Peace Region
	Wayne Van Velzen, Area Supervisor 250-566-4325 Mount Robson **Hugo Mulyk,** Senior Park Ranger Mount Robson **Chris Zimmerman** Park Ranger Mount Robson

* Provided information about both parks

6. APPENDIX C: INTERVIEW GUIDE

1. Review points from participant letter:
    a. The attached data sheet provides our team with a way to group responses, but that shouldn't limit you.
    b. Focus is on conservation issues as opposed to public safety issues, communications, infrastructure, etc.
    c. Think broadly—more partners may be able to come on and provide additional funds, larger projects may be able to be built upon.
    d. Although the funds will be focused on ecology-based projects, please feel free to bring up any communication, management or implementation concerns you may have.
    e. We are also looking to identify gaps—let us know what data is missing, what research needs to be done.
2. Quick review of process & information about follow-up.
    a. Use diagram
3. Some initial open-ended questions to stimulate conversation:
    a. What do you wish you knew more about? What data do you feel is missing? How would you describe your ability to make decisions affecting (the ecological area of their specialty) based on the data that is available to you?
    b. What are the conservation areas in your field? Which conservation issues are being addressed well? Which are not? Why?
    c. Do you have any projects in mind that would benefit from this fund? Provide rationale.
    d. Close by doing a quick verbal summary of major points.
4. Follow-up with a written summary—have participants review, okay, and add any missed points if necessary.

7. APPENDIX D: LIST OF PROJECTS IDENTIFIED IN INTERVIEWS

I. Ungulate management

Rationale

Large prey species play an important role in ecosystem health and processes:

- Overgrazing by elk in some areas may be linked to songbird declines and the spread of invasive plant species. If population densities are too high in some areas then these trophic cascades are expected to occur.
- Elk, deer and moose populations also play a role in the persistence and distribution of large carnivores such as wolves and cougars. To restore functional predator–prey dynamics, prey populations need to be distributed in a manner that allows predators to access them.
- High ungulate populations may lead to declines in alternative prey species such as caribou by increasing the density of predators.
- The distribution and abundance of suitable ungulate forage is linked to land use changes such as prescribed burns and wetland succession.
- A high concentration of elk in areas of high human use is a concern for human safety.

Having the tools available to manage dominant large prey species in both Jasper National Park and Mount Robson Provincial Park has been identified as an important ecological benefit.

Project links

Invasive plant species management

Transportation mortality

Habitat restoration and recovery

Habitat improvement

Baseline monitoring and inventory

Improving connectivity across transportation and right-of-way corridors

Improving connectivity in human-use areas

Regional planning tools

Example actions

i. Conduct population density target assessment
ii. Fence the town of Jasper
iii. Cull elk
iv. Fence or move campgrounds
v. Fence outlying commercial accommodation
vi. Assess ungulate use of new landscapes (i.e., following prescribed burns)

II. Improving ecological connectivity across transportation corridors and right-of-ways

Rationale

Current traffic volumes along Highway 16 and CNR may deter animals from approaching or crossing the corridor. The barrier effects of these features are expected to increase as traffic volumes grow with the expansion of coastal ports and urban growth. Population persistence of aquatic and terrestrial organisms increases with access to habitat. Therefore, movement across highways can be an important component for the survival of many species and conserving biodiversity. Developing pro-active approaches to the restoration of ecological connectivity across corridors in the near future will allow management to mitigate or minimize the effects of anticipated increases in traffic.

Project links

Ungulate management

Connectivity in human use areas

Decrease wildlife mortality

Example actions

i. Identify key aquatic and terrestrial habitat linkages along highways
ii. Develop site-specific management toolbox with mitigation options
iii. Construct mitigation infrastructure (crossing structures and fencing) for aquatic and/or terrestrial species

III. Improving connectivity across human use areas (e.g., trails, outlying accommodation, town sites, visitor centers)

Rationale

Animal movement patterns are affected by the distribution of human activity. In some areas, ungulate species may concentrate near areas that humans frequent because large carnivores avoid these areas. Minimizing or mitigating the effects of human use on animal movement would restore natural patterns of animal distribution in both protected areas. Developing management tools to address this issue will also benefit future changes to facility development and closures.

Project links

Ungulate management

Wildlife mortality reduction

Habitat restoration and recovery

Habitat improvement

Improving connectivity across transportation corridors and right-of-ways

Baseline monitoring and inventory

Example actions

i. Landscape linkage assessment and identification
ii. Buy out commercial operators as leases become available
iii. Close low-use roads

IV. Non-native plant management

Rationale

The spread of some invasive plant species is linked to reductions in biological diversity for both native plants and plant-dependent species (e.g., pollinators, grazing mammals). Management actions depend on knowledge of the causes of invasive species spread and their distribution.

Project Links

Ungulate management

Habitat restoration and recovery

Habitat improvement

Example actions

i. Identification of problem areas
ii. Site remediation and reclamation

V. Habitat restoration and recovery

Rationale

A number of gravel pits exist in MRPP that are nearing the end of their life and need to be properly reclaimed. JNP has identified a number of disturbed sites that need various levels of reclamation. Although sites are local, their restoration would add habitat to the landscape as a whole and in some cases may improve connectivity through key areas.

Project links

Ungulate management

Habitat improvement

Improving connectivity across human use areas

Regional planning tools

Example actions

i. Reduce impact of Horse Range in JNP
ii. Close or move campgrounds in important habitat
iii. Reduce impact of Maligne Road (JNP) in winter
iv. Rehabilitate gravel pits

v. Close secondary roads in important habitat (e.g., in JNP, Celestine Road, Highway 93A).

vi. Buy out commercial outfits in sensitive areas as leases become available.

VI. Habitat improvement

Rationale

Restoration of natural disturbance cycles increases the diversity of available forest stand structures. In the context of providing benefits to a suite of ecological functions (e.g., forage, ungulate species), these types of habitat improvements are based on landscape-level assessments of stand age distribution and their predicted effects on biological diversity. A more comprehensive assessment of vegetation inside and outside burn areas is needed to determine if management intervention is having the desired effect on the ecosystem.

Project links

Ungulate management

Habitat restoration and recovery

Baseline monitoring and inventory

Regional planning tools

Example actions

i. Management program to assess timing/location of prescribed burns, forest rotation and effects on biodiversity.

VII. Baseline monitoring and inventory

Rationale

Current and future management in both protected areas is hampered by an absence of up-to-date information on the distribution, abundance and population trends of various species. Inventories on many bird, mammal, fish, herpetofauna, invertebrate and plant species are lacking. Consequently, management actions may be carried out with inaccurate or outdated information, making adaptive management strategies difficult to implement. A multi-species biological inventory with long-term monitoring would provide a formative database to assess the impact of a variety of management actions within and adjacent to park boundaries.

Project links

Ungulate management

Improving connectivity across transportation corridors and right-of-ways

Habitat restoration and recovery

Habitat improvement

Climate change monitoring and modeling

Regional planning tools

Example actions

i. Multi-taxa occupancy surveys and long-term monitoring
ii. Modeling exercise to predict species occupancy
iii. Orthophoto/remote sensing survey

VIII. Decrease human-caused wildlife mortality

Rationale

Mortality levels caused by wildlife–vehicle and wildlife–train collisions may be depressing populations of some species through direct mortality and reduced connectivity between populations. Projected increases in traffic along Highway 16 and CNR track-twinning are expected to exacerbate these effects.

Project links

Ungulate management

Improving connectivity across transportation corridors and right-of-ways

Baseline monitoring and inventory

Example actions

i. Improved grain-removal vacuum truck for railroad
ii. Highway/train mitigation (e.g., fencing and crossing structures)
iii. Implement GPS-linked mortality data collection system

IX. Preservation of unique sites and natural heritage

Rationale

Local areas with rare archaeological or geological features are poorly documented, preserved and managed in both parks. Locating and inventorying these areas can improve their chances of preservation as well as adding new education or visitor experience opportunities.

Project links

None

Example actions

i. Arctomys cave inventory
ii. Paleontological inventory

X. Toxic site remediation

Rationale

Several sites containing toxic wastes or spillage have been identified. These products may be affecting groundwater as well as cycling through local food-webs.

Project links

Habitat restoration and recovery

Example actions

i. Site identification, risk-modeling and remediation

XI. Climate change monitoring and modeling

Rationale

Changes to local biota, natural disturbance cycles and hydrological patterns may be affected by broader patterns in regional or global climate change. Developing local models to predict the consequences of these changes can guide management activities in coming years.

Project links

Habitat improvement

Example actions

i. Construct weather station in MRPP

XII. Non-native animal species management

Rationale

Non-native animal species may be having negative effects on native biological diversity. Reducing the impacts of these species can improve the survival and reproduction of native plants and animals.

Project links

None

Example actions

i. Brook trout removal from lakes and streams—especially new introductions in MRPP

XIII. Improvement to composting practices (Jasper)

Rationale

Compost gathered from the town site of Jasper is collected at the Jasper Transfer Station. Current practices make it easy for birds (such as ravens and other corvids) to enter the composting building. This food source is likely responsible for the growth of the local corvid population. Anecdotal information suggests ravens are dropping food outside the transfer station fence, which can attract foxes, coyotes and other wildlife to the area. Other ecological effects, such as the displacement of songbirds remain a concern.

Project links

Habitat restoration and recovery

Habitat improvement

Example actions

i. In-vessel composting

IXV. Reducing the impact of the town generator (Jasper)

Rationale

A gas generator station in the eastern part of the park produces the majority of electricity used by the Town of Jasper. Its presence in the Three Valley Confluence raises questions on the impact of the generator's noise on wildlife and habitat displacement.

Project links

Habitat restoration and recovery

Habitat improvement

Example actions

i. Remove gas-fired generator and connect Jasper to the provincial grid

XV. Aerial disturbance management

Rationale

Helicopter and recreational fixed-wing aircraft use is a common feature in MRPP, and recreational use may be increasing in JNP. In some cases, helicopter tours and recreational transportation may be having a detrimental effect on high-altitude species such as mountain goats.

Project links

Habitat improvement

Example actions

i. Aerial recreation/transportation certification program

ii. A study addressing stress responses and/or movement of animals exposed to aerial disturbances

XVI. Regional planning tools

Rationale

JNP and MRPP share a common boundary and have other protected areas on their borders. Thus, human activities in the region may have an effect on ecosystems within both parks. These activities include urban developments, recreation (e.g., hunting, motorized recreation) and industrial development. These activities, in turn, may affect the distribution and mortality rates of species that move freely across the protected area borders (e.g., caribou, wolves, migratory songbirds, fish). Likewise, park management objectives aimed at minimizing disturbances on their neighbors may be in conflict with objectives that promote natural disturbance cycles (e.g., mountain pine beetle, fire). Developing a management tool to predict the effects of landscape change can help resolve or prevent inter-jurisdictional conflicts.

Project links

Improving connectivity across human use areas (trails, outlying accommodations, town)

Habitat improvement (e.g., burning, harvest rotation)

Baseline monitoring and inventory

Example actions

i. Roundtable discussions supported by data collection

XVII. Sensitive species research and management

Rationale

Sensitive species are those that are rare, thought to be declining or are listed under Federal or Provincial Species-At-Risk legislation. Some funding to support research on some of these species may be available through other sources; however, additional support can help improve management efforts to prevent extirpation or extinction. Furthermore, funding for research on some species may not be available if these species are not officially listed. Contributing to sensitive species research could help to maintain native biodiversity.

Project links

Habitat restoration and recovery

Habitat improvement

Baseline monitoring and inventory

Example actions

i. Regional landscape level model that that predicts grizzly bear density (especially on MRPP side)

ii. Understanding wolf predation on caribou

iii. Understanding wolverine movements, populations and their impacts on prey species

ID	AOC	general	issue	Project	Wes Bradford	Wayne et al MRPP	Ward Hughson	Shawn Cardiff	Scott Back	Peter Achuff	Mike Murtha	Colleen St. Clair and Mike Sullivan	Mark Bradley	Liesbet Beaudry	Layla Neufeld	Kirk Safford	Herb Hammond	Geoff Skinner	Gail Ross	ESO group	Elizabeth Miller	Doug Wilson	Doug Herd	Donna Thornton	Dale Seip	Brenda Shepherd	Bob Brade	Barb Zimmer	Alan and Jennifer	Gayle Hesse	Frequency (of project)
46	jnp, mrpp	terrestrial plant communities	absence of natural variability	landscape assessment and character description	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04
24	jnp?, mrpp	human use	helicopter use	assess effect of helos on wildlife (goat, sheep), assess mitigation options	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0.16
1	jnp	terrestrial wildlife	elk pop'n size and distribution	determine elk population targets, cull elk	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0.24
18	jnp, mrpp?	terrestrial plant communities	montane ecosystem composition	determine role of bison and FN peoples	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04
19	jnp, mrpp	environmental toxicity	groundwater contamination	site assessment and clean up	0	0	0	1	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0.16
20	jnp	human use	light contamination	assessment (DARK Skies)	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04
21	jnp, mrpp	regional	industrial activity in Athabasca Valley	assessment	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04
16	jnp, mrpp	aquatic, semi-aquatic wildlife	aquatic connectivity along transportation	replace priority culverts, data/assessment already complete	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	1	0	1	0	0	0	0	0.28
23	jnp, mrpp	education	lack of public understanding	unclear, but maybe social marketing?	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04
25	jnp, mrpp	data	lack of baseline inventory	long-term monitoring of ecosystem components,	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0.16
26	jnp, mrpp?	data	species richness	role of browsing/grazing on community (plants, mammals, birds)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04
27	jnp, mrpp	environmental toxicity	spillage from transportation	risk assessment for areas along Hwy 16	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04

28	jnp, mrpp	terrestrial wildlife	caribou declines	elk management and highway mitigation	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0.08
29	jnp, mrpp	terrestrial wildlife	wildlife mortality in transportation	photo radar	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04
30	jnp, mrpp	terrestrial wildlife	caribou declines	caribou predation study	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0.12
22	jnp, mrpp?	regional	cumulative effect	ALCES too coarse, needs similar	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04
9	jnp	terrestrial wildlife	transfer station garbage: attracts wildlife	in-vessel composting? Close it?	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0.16
2	jnp	terrestrial wildlife	elk pop'n size and distribution	determine elk population targets, fence town and refugia	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0.24
3	jnp	terrestrial wildlife	elk pop'n size and distribution	determine elk population targets, cull and fence town	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0.2
4	jnp	terrestrial wildlife	elk pop'n size and distribution	determine elk population targets, fence only	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	1	0	0	1	0	0.24
5	jnp, mrpp	terrestrial wildlife	wildlife mortality in transportation	create database of mortality along with reporting effort by CNR, MRPP	1	1	0	0	0	0	0	1	1	0	0	0	0	1	0	1	0	0	0	1	0	1	0	1	0	0	0.4
6	jnp, mrpp	terrestrial wildlife	barrier effect of transportation infrastructure (hwy 16, rail, Celestine Road et al.), linked with increasing traffic	feasibility of mitigation options (fencing and WCS), based on wildlife movement and mortality locations	1	1	0	1	0	1	1	1	1	0	0	0	0	1	0	1	0	0	0	1	1	1	1	0	0	1	0.56
17	jnp, mrpp?	terrestrial plant communities	pipeline ROW	asses and mitigate effect of ROW on wildlife	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04
8	jnp, mrpp	terrestrial plant communities	invasive plants	unclear, perhaps distribution and management options, links to grazing levels	1	1	0	0	0	1	0	1	0	1	0	0	0	0	0	1	0	0	0	1	0	1	0	1	1	0	0.4
33	mrpp	terrestrial plant communities	lack of older-aged forests	manage thistle to allow succession	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04

10	jnp	terrestrial wildlife	wildlife movement	determine effectiveness/ importance of corridors around Jasper to assist in public buy-in of management	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0.12
11	jnp?, mrpp	environmental toxicity	CN containments along ROW	assessment and clean up of ROW	0	1	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0.16
12	mrpp	terrestrial plant communities	moose marsh succession	assess role of disturbance in maintaining ecological function	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04
13	mrpp	terrestrial plant communities	gravel pits	rehabilitate pits	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0.16
14	jnp, mrpp	terrestrial plant communities	succession and disturbance	evaluate effect of interprovincial prescribed burn: benefits and risks	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0.08
15	jnp, mrpp	human use	human use in Amethyst lake or Tonquin (and other areas…)	interprovincial management required, close or buy out	0	1	0	0	0	0	0	0	1	0	0	1	0	1	0	1	0	0	0	0	0	1	0	1	0	0	0.28
7	jnp, mrpp	terrestrial wildlife	grain on tracks	better vacuum	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0.16
47	jnp, mrpp	education	wildlife mortality due to habituation	education for people	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	jnp?, mrpp	terrestrial wildlife	wolverine mgt	wolverine study	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0.04
61	mrpp	human use	access to paleontological resources	close access	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0.04
60	jnp, mrpp	data	lack of baseline inventory	red and blue listed spp inventory	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0.04
59	jnp, mrpp	terrestrial wildlife	grizzly bear modeling	diet analysis, blueberry production, rainfall model, DNA work	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0.08
58	jnp, mrpp?	aquatic, semi-aquatic wildlife	harlequin duck declines	survey on upper fraser	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0.08
57	jnp, mrpp	data	lack of baseline inventory	raptor monitoring	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.04

56	jnp?, mrpp	aquatic wildlife	bull trout assessment, blue listed spp	assess distribution	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0.04
55	jnp?, mrpp	aquatic wildlife	no stock assessment or levels of use	assess fisheries at moose lake, yellowhead, whitey, portal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0.04
54	jnp?, mrpp	climate change	no monitoring for climate change effects	set up station on berg lake	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0.08
53	?	aquatic plants	invasive aquatic plants	?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0.04
52	jnp?, mrpp?	aquatic, semi-aquatic wildlife	exotic brook trout in Yellowhead Lake	?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0.04
51	jnp	?	generator?	remove and go on prov grid	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0.08
50	jnp	terrestrial wildlife	Horse Range?	remove	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0.04
31	jnp, mrpp	terrestrial wildlife	caribou declines	effect of snow on movement	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0.08
40	jnp, mrpp	terrestrial wildlife	caribou declines	habitat modeling, forest management effects of	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04
63	mrpp	terrestrial wildlife	trapping	buy out the two traplines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0.04
34	jnp, mrpp?	terrestrial wildlife	elk pop'n size and distribution	collaring study	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0.08
35	jnp, mrpp?	terrestrial wildlife	elk pop'n size and distribution	elks survey in ‘09	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0.08
36	mrpp	terrestrial wildlife	effect of burns on ecosystem at moose lake	fund grad student work: monitoring biodiversity, animal mov't, terrain stability	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04
37	jnp, mrpp	data	lack of baseline inventory	orthophoto project, satellite images	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.08
49	jnp, mrpp	terrestrial wildlife	track twinning (soon), hwy twinning 20y	data gathering for planning mitigation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0.04
39	jnp, mrpp	data	lack of baseline inventory	songbird monitoring	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0.08

48	mrpp	education	roundhouse is damned by beavers	restore with boardwalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0.04
41	jnp, mrpp	data	lack of coordination among agencies	shared data in area between agencies	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04
42	mrpp	weather	no weather station or long-term monitoring	build weather station	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04
43	jnp, mrpp	data	lack of baseline inventory	habitat modeling: grizzly, wolverine, listed spp.	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04
44	mrpp	human use	cave management	inventory and model hydrology	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0.08
45	mrpp	data	poor data management	inventory MRPP databases	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04
32	jnp, mrpp	human use	human use in Amethyst lake (and other areas…)	plowing maligne road	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0.16
38	jnp, mrpp	data	lack of baseline inventory	elk population monitoring	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0.12

8. APPENDIX E: LIST OF AHP PARTICIPANTS

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*Wayne Van Velzen became ill the morning of the AHP and was not able to participate. Chris Zimmerman (Mount Robson Senior Ranger) sat in his place for two hours. Wayne reviewed a draft of the final report and provided his input at a later time.

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