Caribou in Canada: Preserving Biodiversity Matters

WSP's team of caribou specialists have worked throughout Canada and have in-depth knowledge of caribou populations, ecology, and stressors affecting caribou.

Discover our biodiversity conservation services including our corporate caribou experience.

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Introduction

WSP is pleased to present this brochure outlining our range of corporate experience regarding caribou in Canada.

Summary of WSP Advantages, Local Presence, and Capability:
WSP's team of caribou specialists have worked throughout Canada and have in-depth knowledge of caribou communities, ecology, and stressors affecting caribou. Each of our caribou specialists are supported by a network of experts across the country.

Understanding Our Clients' Needs:
Our goal is to meet the expectations of our clients and seek innovative solutions that provide added value. We achieve this goal by developing close relationships with our clients to better understand their needs and the specific environments in which they operate. It is this understanding that enables us to help our clients succeed. We are proud of the fact that 80% of our projects are repeat business from existing clientele.

Health and Safety Management:
WSP is committed to the health and safety of employees, clients, contractors, and the public. All work performed by WSP is subject to strict health and safety policies and applicable federal, provincial, and municipal acts and regulations.

Integration of Our Services:
Our professionals are knowledgeable in a wide variety of disciplines (e.g., caribou biology, large mammal ecology, restoration and reclamation, wetland ecology) that relate to caribou ecology, and are able to communicate effectively across disciplines, which translates into seamless solutions for our clients.

Our Commitment to Quality:
Our clients can expect team members that are committed and available, a quality product delivered on time and on budget, and a product aligned with client goals and environmental policies. Our commitment has made WSP one of the most trusted sources of professional services in the world.

Caribou Services & Areas of Expertise

Through our close work with clients in industry and government, as well as our collaborative work with regulators, Indigenous communities and academics, WSP has established a reputation as a leader in the field of caribou effects assessments, mitigation, monitoring, and management. WSP has the experience of conducting environmental assessments, developing environmental impact statements, and leading clients through federal, territorial, and provincial regulatory approval processes.

As a result of our work on various projects across Canada, WSP has become an industry leader in the design, implementation and analysis of caribou mitigation and monitoring programs.

WSP has completed a myriad of projects on boreal, mountain, and barren-ground caribou in many jurisdictions across Canada, including British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, Yukon, Northwest Territories, and Nunavut. Our technical specialists have experience that spans across most sectors and across the entire project life cycle — from engagement and baseline studies to effects assessment and operational monitoring programs.

Beyond development projects, WSP has undertaken collaborative research initiatives with government, academic, industry, and community partners. WSP also has extensive experience with caribou habitat restoration and habitat offset plan development, including planning and implementation of restoration programs at the scale of entire caribou ranges.

This brochure outlines WSP's approach to environmental assessment and, specifically, how the process is applied to caribou. WSP's team of caribou specialists have the experience and technical expertise to support our clients' needs during the full project life cycle. This includes moving from environmental assessment to the application of mitigation (e.g., access control, reclamation, crossing structures, timing) to habitat restoration, caribou offsets, and long-term mitigation effectiveness monitoring.

Caribou by the Numbers

17

Number of WSP caribou specialists in Canada

>40

Number of Caribou Mitigation and/or Monitoring Plans prepared

>40

Number of Biologists to support field surveys in Canada

100%

Percent of territories in Canada for which we've completed caribou projects

>215

Cumulative number of years of caribou experience

100%

Percent of applicable provinces in Canada for which we've completed caribou projects

>100

Number of Caribou Ranges we've worked in

Environmental Assessment

WSP's technical specialists have caribou assessment experience that span across many sectors, including: mining (minerals, oil sands, peat), oil and gas (pipelines, in situ oil sands, conventional oil and gas, natural gas), power (transmission lines), infrastructure (roads), forestry, and government. The five main steps of a project include, engagement, baseline studies, effects assessment, mitigation planning, and monitoring and adaptive management (see Figure 1). The following sections present WSP's approach and experience relative to the main steps of a project's development, as it relates to caribou.

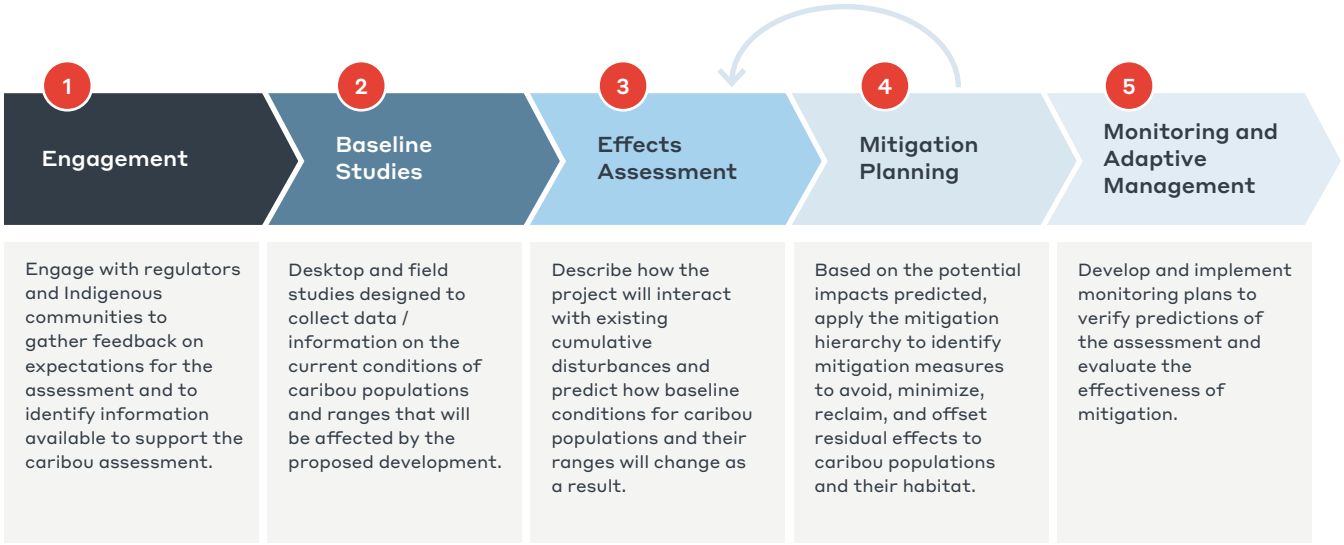


Figure 1. Primary steps of an environmental assessment.

Engagement

Regardless of the type of development, WSP encourages proponents to engage with government and Indigenous communities early in the project planning and environmental assessment process. Regulatory engagement is carried out to obtain feedback on expectations for the assessment, and acquire data/information to support the assessment. Community engagement is carried out in an effort to provide project feedback, identify areas of concern, identify business relationships and opportunities, as well as to identify avenues to incorporate Indigenous or Traditional Knowledge throughout the assessment as much as possible.

WSP is committed to developing and maintaining mutually beneficial relationships with all stakeholders in the regions we do business. We are committed to working with Indigenous Peoples in ways that are honest, respectful, welcoming, and culturally aware. At WSP, we seek opportunities to work with Indigenous partners to enhance cultural awareness and expand our understanding of the unique relationships between Indigenous Peoples, the environment, and their cultural heritage. Moreover, WSP is a signatory to the United Nations Global Compact, stating:

> “There are opportunities to involve Indigenous People in business ventures as owners, suppliers, contractors, and employees. This can contribute to the long-term success of projects and help embed business in the local community.

Indigenous Community Partnerships

WSP has a successful track record working with and engaging Indigenous Peoples and local partners on caribou monitoring around infrastructure, planning and implementation of habitat restoration, offset plan development, and caribou population recovery programs such as rearing facilities. Our partnerships include the design and planning phase of projects with joint grants or other funding applications. In addition, Indigenous Peoples have looked to WSP as a partner to execute projects in a socially, economically, and environmentally responsible way. WSP is proud of its accomplishments working with Indigenous communities and companies across Canada for the last 25 years.

As a team, WSP is committed to integrating Indigenous, diverse and local participation as a core function of the projects we work on. We provide the necessary administrative, contractual, and logistical arrangements to facilitate such involvements in a development, and in turn contribute to the social and economic well-being of communities where business is conducted to enhance supplier diversity and capacity development. Qualified Indigenous, diverse and local service providers are selected through the creation of Indigenous Diverse and Local Participation Plans developed for each project or client. These plans are developed by working with our clients, the respective Indigenous Leadership, and their business partners to identify businesses and individuals that have an interest and capacity in project-related contracting and employment opportunities.

Baseline Studies

Baseline studies are completed in order to gather data and information that can be used to prepare a detailed description of the environment that will be affected by a project. For caribou, we must consider multiple spatial scales to adequately capture effects on local populations, as well as regional effects at the scale of the caribou range. Results of baseline studies provide important context relating to:

- The current state/condition of the caribou range (existing cumulative disturbance)
- The amount and quality of habitat available
- The arrangement of habitat, including habitat fragmentation and connectivity (within and between ranges)
- Population size and trends (survival and recruitment)

Depending on the project and applicable regulatory guidance, methods for gathering baseline information and data may include (Figure 2):

Regulator Engagement
WSP has experience compiling, summarizing, and analyzing data and information received from regulatory agencies and natural resource managers, including caribou collar data, caribou habitat maps and habitat models.

Community Engagement
WSP engages with Indigenous communities. Indigenous or Traditional Knowledge shared by the communities are incorporated throughout the assessment as much as possible and in line with data sharing agreements.

Desktop Review
WSP has experience completing desktop reviews to compile and synthesize available baseline information from scientific literature, government and university studies, policy documents, caribou management plans, caribou range plans, caribou recovery strategies, scientific assessments of caribou populations, environmental assessments, and effects monitoring programs for similar developments. Following a data review, WSP completes a gap analysis to inform field studies.

Field Studies
WSP has extensive experience designing, planning, coordinating, and implementing field studies. For caribou, studies typically involve remote camera studies, aerial surveys, and winter track count surveys. Occasionally, caribou collaring programs are required, but this is typically completed in collaboration with resource managers. These study methods are often applied in follow-up monitoring programs.

Habitat Models
WSP has experience developing and applying various types of statistical habitat models, including resource selection functions and habitat suitability index models. These models are applied to the landscape to map the distribution of caribou habitat, and describe the quantity and quality of available habitats.

Disturbance Inventories/Critical Habitat
WSP uses a Geographic Information System (GIS) to produce up-to-date disturbance inventories for caribou ranges by applying methods from Environment and Climate Change Canada. These inventories allow us to map undisturbed habitat, which is typically defined as critical habitat under federal recovery strategies.

Population Viability Analysis
For some projects, survival and recruitment data have been used in population viability analysis to estimate the likelihood of caribou population persistence under baseline conditions. These analyses are also applied in effects assessments to assess relative change in the likelihood of caribou population persistence from baseline to application of a project and other potential future developments.

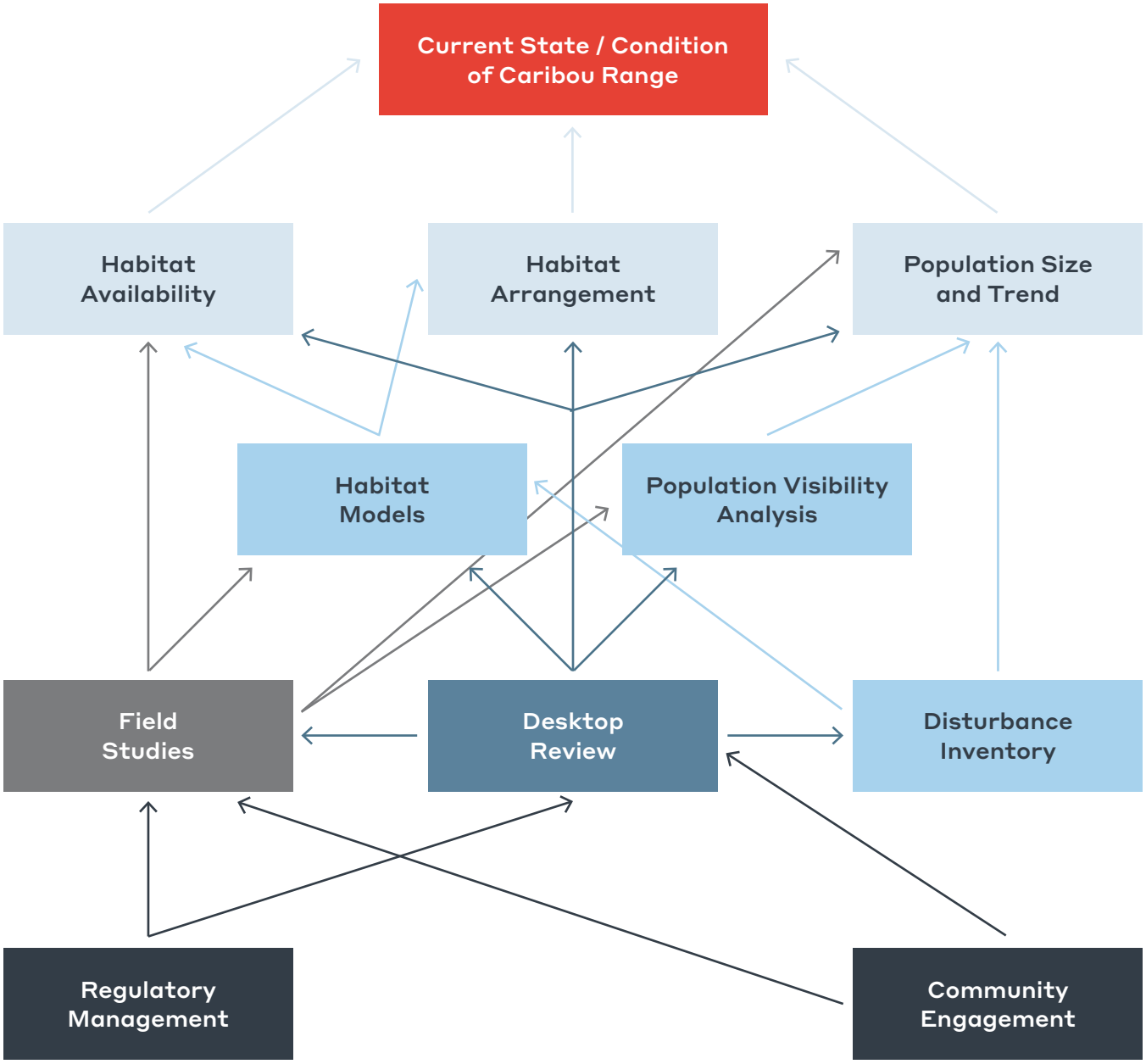


Figure 2. Network showing the flow of information among baseline data sources used to inform the current state and condition of a caribou range.

Effects Assessment

Environmental assessments are focused on changes in baseline conditions due to incremental project and cumulative effects (including reasonably foreseeable developments and climate change) using measurement indicators such as habitat quantity, quality and arrangement, and survival and reproduction. Quantitative and qualitative changes in measurement indicators are used to predict residual effects on the likelihood of self-sustaining caribou populations, after applying best practices (e.g., policies and applicable standards) and mitigation actions. The effects assessment builds on the information gathered during baseline studies to contextualize how project-induced changes (e.g., vegetation clearing, increased access for predator movement, and generating noise) are predicted to affect caribou. Specifically, caribou assessments describe the following:

- **Changes in caribou habitat availability and animal use.** These are estimated by calculating direct loss of caribou habitat and indirect loss of functional caribou habitat, by quantifying the change in range level disturbance, and by considering the amount of project overlap with existing disturbances.
- **Changes in caribou habitat distribution, caribou movement and habitat connectivity.** These are estimated using qualitative descriptions of how the arrangement of habitat is altered, by describing affected travel paths or migratory routes, identifying potential barriers to movement, and calculating the change in linear feature density to quantify fragmentation effects.
- **Changes in caribou survival and reproduction (abundance, recruitment).** These are estimated by considering how caribou survival and reproduction might change as a result of all impact types (e.g., habitat loss, reduced habitat connectivity, sensory disturbances, increased predation risk, hunting pressure and other sources of mortality).

A key part of the effects assessment is identifying where and when caribou impacts can be mitigated using the mitigation hierarchy. Mitigation planning, including the use of offsets to achieve no net loss or net positive impact, is a critical part of achieving successful and effective mitigation outcomes. Ultimately, the caribou effects assessment represents a series of predictions based on a weight of evidence approach. Therefore, some level of uncertainty always remains in the estimate of impacts and the effectiveness of mitigation. Monitoring and follow-up programs are used to verify effects predictions and the effectiveness of mitigation.

Mitigation & Offset Planning

Engineering designs and environmental policies, procedures, and best management practices to remove or reduce potential negative effects, or enhance positive effects, are identified following the mitigation hierarchy. The mitigation hierarchy describes the sequence in which different mitigation strategies should be deployed to minimize effects on caribou when designing and implementing a project. Standard mitigation hierarchies include the following (IFC 2012; BBOP 2015): avoidance, minimization, reclamation, and offsetting (see Figure 3).

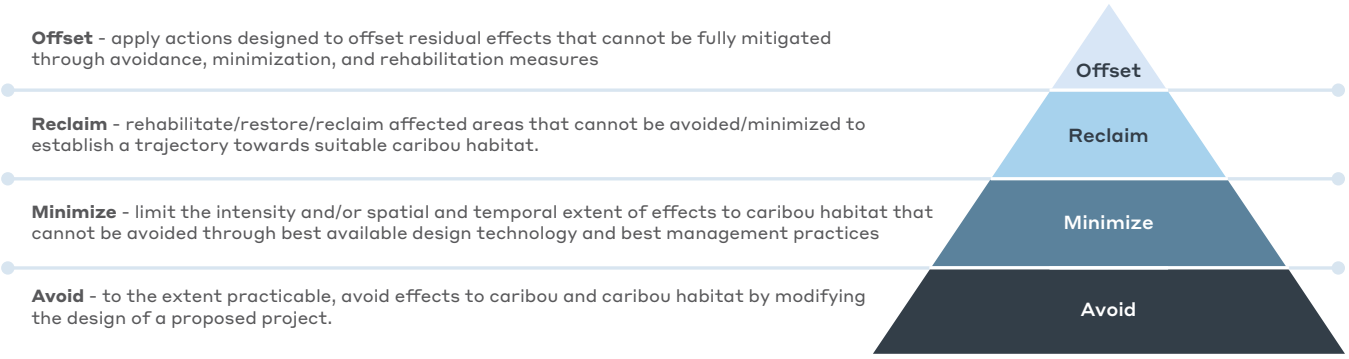


Figure 3. The mitigation hierarchy.

WSP works with clients to follow the mitigation hierarchy when operating in caribou range, and emphasizes approaches to avoid and minimize impacts to caribou populations during the planning phase of development. Measures that avoid or minimize effects reduce the residual effects of a project prior to implementing reclamation or offsetting (Figure 3). In all cases, avoidance and minimization are the most desirable and effective mitigations, with offsetting applied as the last resort. Examples of measures for each step of the mitigation hierarchy are provided in Figure 4.

Measures to offset residual effects to caribou are identified and evaluated on a project-by-project basis because the context of each project is important. Many technical factors are considered, such as project location, amount and type of habitat disturbed and reclaimed, and the duration of habitat disturbance. Regardless of the offset option applied, monitoring is recognized as a critical step in evaluating the effectiveness of mitigation activities. WSP has extensive experience implementing on and off-site caribou habitat restoration measures, and follow-up monitoring programs.

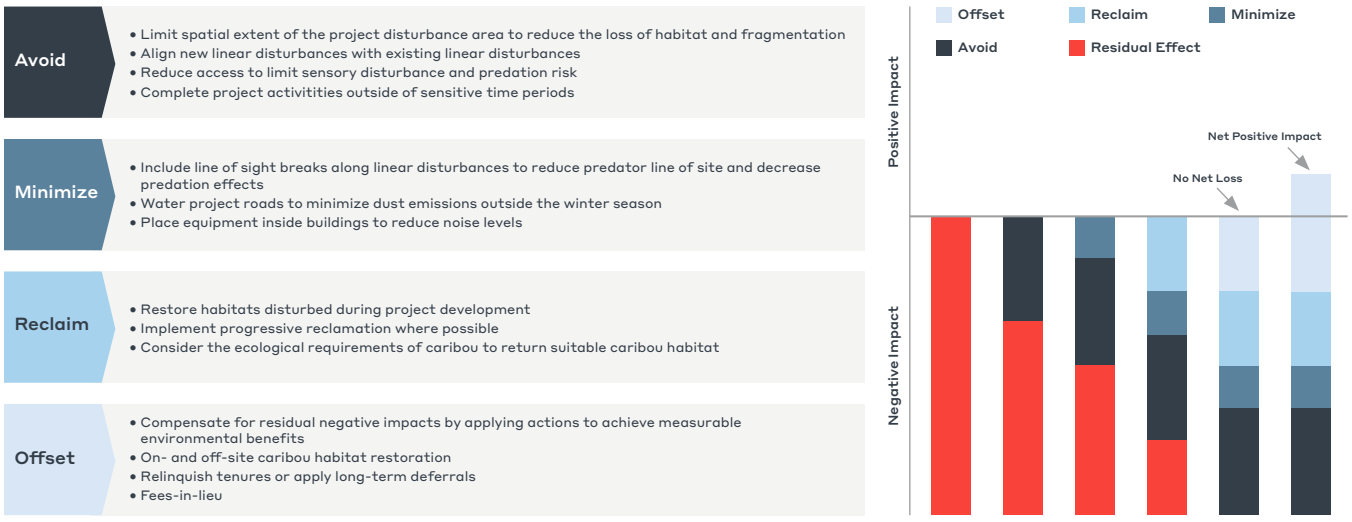


Figure 4. Examples of mitigation measures for each step of the mitigation hierarchy and illustration of how implementation reduces the negative residual effects of a project to achieve no net loss or net positive impact.

Focus on Caribou Habitat Restoration

WSP is a pioneer, having been involved in the strategizing, collaboration, implementation, and monitoring of boreal forest habitat restoration on legacy linear footprints in western Canada for over 15 years. WSP has worked with regulators and industry operators to develop reforestation standards and targets, which set and meet mitigation and offsetting requirements for new disturbance. These programs have been implemented to promote regrowth of disturbed forests through addressing site-limiting factors (removal of soil layer from initial disturbance, compaction, drainage/ moisture changes), promoting natural forest regeneration, and offsetting the impacts of industrial development on biodiversity and wildlife species at risk. Specifically, this experience has included:

- Strategic habitat restoration framework development at the provincial level
- Habitat restoration implementation on pipelines and historical seismic lines (mounding, tree and shrub planting, leave for natural regeneration, tree felling)
- Landscape level mapping, characterization of natural recovery, planning and implementation of physical vegetation restoration on over 1,000 kms of historical anthropogenic linear disturbances
- Restoration operational toolkit development, as well as collaborating with Indigenous Communities to capture spiritual and cultural considerations for restoration treatments and planning
- Long-term monitoring framework development for ground-based revegetation plots
- Project level monitoring design, data collection, analysis, adaptive management measure implementation and reporting to meet regulatory compliance
- Development of project level habitat restoration performance evaluation criteria and measurable targets
- Project level offsetting plans for mining companies operating in endangered mountain caribou range, including on-site and off-site forest restoration
- Linear footprint deactivation

Caribou Habitat Restoration Project Examples

Pilot Boreal Caribou Restoration Program Year 1 Implementation Report: Parker Caribou Range (2015-2017). First range scale restoration plan developed in Canada. Prepared for the Research and Effectiveness Monitoring Board of the British Columbia Government's Boreal Caribou Implementation Plan initiative. Implementation included over 44% of contract award going to local businesses and Indigenous-owned businesses and community. Over 1,000 km of legacy seismic lines inventoried and prescriptions applied.

Birch Mountains Operational Restoration Plans (2021). WSP, partnered with Fort McKay First Nation and Alberta-Pacific Forest Industries Inc., is developing three operational plans for Alberta Environment and Parks through a FRIAA grant. The project grant provides the opportunity to advance local Indigenous Knowledge of Fort McKay First Nation land users within the development of restoration plans, including where to restore and capture culturally acceptable restoration techniques. This is the first plan in Alberta completed with a First Nation partner.

Caribou Range Restoration Project Treatment Sites: 9 to 13 Year Follow-Up Monitoring in the Little Smoky Caribou Range (2015-2017). Restoration treatment monitoring on the first restoration sites in Canada after 9 to 13 years of growing seasons. Retrospective monitoring to determine if treating historic linear disturbances through mechanical site preparation, planting and/or seeding of tree species, as well as implementing access control measures, is an effective means of accelerating the natural rate of vegetation recovery on linear disturbances.

Pink Mountain Caribou Preliminary Tactical Restoration Plan (2021). Prepared for the British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development. Indigenous engagement initiated to support restoration area identification within the broader Pink Mountain range.

Enabling Solutions for Boreal Caribou Habitat Restoration: A Framework (2018). Prepared for the British Columbia Oil and Gas Research and Innovation Society Research and Effectiveness Monitoring Board, and the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (MFLNRORD).

Quintette Caribou Habitat Restoration Plan (2018). Prepared for the British Columbia MFLNRORD.

South Peace Caribou Restoration Tactical Plan (2018). Prepared for the British Columbia MFLNRORD, covering all South Peace Mountain caribou ranges.

Little Smoky and A La Peche Caribou Range Restoration Operational Plan for Compartment 1-09 (2017). Prepared for Alberta Environment and Parks.

Zone 1 Habitat Restoration Implementation Vegetation Monitoring Program: Parker Caribou Range (2017). Prepared for the Research and Effectiveness Monitoring Board of the British Columbia Government's Boreal Caribou Implementation Plan initiative.

Caribou Habitat Restoration Framework (2015). Prepared for Alberta Transportation.

Boreal Caribou Habitat Restoration Operational Toolkit for British Columbia (2015). Prepared for the Research and Effectiveness Monitoring Board of the British Columbia Government's Boreal Caribou Implementation Plan initiative.

Boreal Caribou Habitat Restoration Monitoring Framework (2015). Prepared for the Research and Effectiveness Monitoring Board of the British Columbia Government's Boreal Caribou Implementation Plan initiative.

Linear Deactivation Guidance (2014). Prepared for Canadian Natural, Devon Canada Corporation, and MEG Energy for consistency in restoration methods within the Regional Industry Caribou Collaboration study area.

Habitat Enhancement Programs for Canadian Natural. Primrose and Wolf Lake Projects (2003-present), Interconnect Pipeline Right-of-Way (Primrose East Project), Linear Deactivation Program (Kirby Project) (2014-2016), Cold Lake caribou range, Alberta.

Monitoring & Adaptive Management

The purpose of monitoring is to provide information on baseline conditions, address information gaps, verify impact predictions, and evaluate mitigation effectiveness, such as restoration effectiveness. Adaptive management is a tool for decision making in the face of uncertainty, and is comprised of four iterative steps: act, measure, evaluate, and adapt. In the case of caribou and development projects, actions are typically the implementation of mitigation; measurements and evaluations are undertaken through caribou monitoring; and adaptations are undertaken if monitoring results indicate that mitigation measures are not performing as expected. Adaptive management is, therefore, an on-going review of monitoring results to determine if a project is meeting its objectives and whether change is required.

WSP has completed environmental effects monitoring studies on barren-ground caribou in the Northwest Territories and Nunavut, and on boreal caribou in British Columbia, Alberta, Saskatchewan, and Ontario. Components of these monitoring programs have included the following.

Aerial Surveys

Conducting aerial surveys and completing analyses to determine:

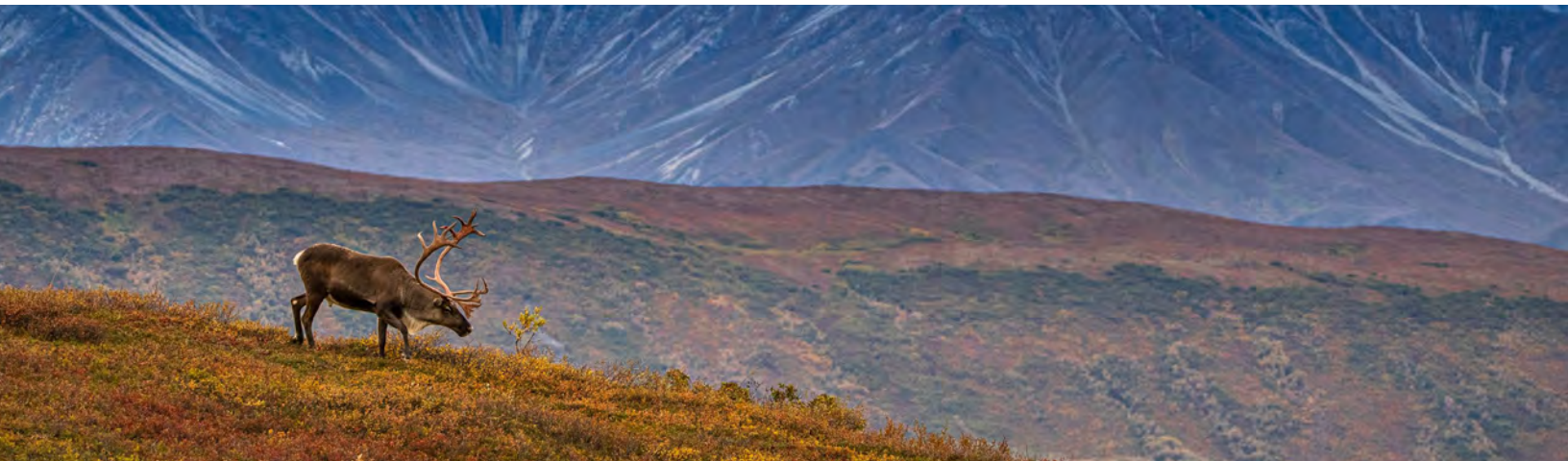
- Relative density, abundance, and distribution
- Habitat selection and zone of influence from mineral development features (including roads)
- Group composition (groups with and without calves)

Radio and Global Positioning Satellite Collar Data

WSP has obtained radio and global positioning satellite (GPS) collar data from government sources to complete the following analyses:

- Delineate annual and seasonal ranges, and seasonal range attributes (e.g., range size, location of centroid and distance between seasonal range centroids)
- Develop resource selection functions (RSFs) and other habitat models
- Determine and estimate the zone of influence for mines and access roads
- Assess movement rates in relation to natural and human-related attributes and factors (e.g., insect harassment levels, topography, lakes, mine sites and roads)
- Estimate arrival on calving ground and parturition date

WSP has also worked with project partners to implement both caribou and wolf collaring programs.



Behavioural Studies

Behavioural studies of caribou are used to understand how caribou respond to both natural and anthropogenic stimuli. They provide information on habitat selection, responses to development, and activity budgets (energy expenditure). WSP has designed and staffed barren-ground and boreal caribou behavioural studies based on established scientific methods and informed by Indigenous Knowledge for a variety of client sectors, including industry and government. Methods used in the collection of behavioural observations include the following.

Group scanning observations measure the frequency of different types of behaviour (e.g., bedded, feeding, standing, walking, running) in a caribou group over a standardized frequency of time intervals and duration to quantify the proportion of dominant behaviours in a group. These can be related to distance from mine features, group composition, seasonal and natural factors such as insect harassment indices. For certain projects, caribou are monitored as they approach a project area because their proximity to certain project activities or features trigger specific mitigation requirements. For example, in the far north drilling work is delayed when caribou are nearby.

Focal surveys provide information on activity budgets (i.e., the amount of time an animal is engaged in different behaviours), the temporal sequence of behaviours relative to stressors or other stimuli, and the length of time it takes the animal to return to a non-stressed state following a disturbance.

Remote cameras can provide instantaneous snap shots or video clips of caribou behaviour and responses to development features. Data can be used to estimate frequencies of caribou behaviour as they approach developments, and how they interact with and respond to them. For example, WSP has used remote cameras to monitor caribou response to above-ground pipelines, and to evaluate the effectiveness of mitigation measures along these pipelines (e.g., crossing structures and sections of elevated pipe). Cameras have also been used to monitor the response of caribou, their predators and other prey (deer, moose) to various restoration or access management treatments, with the objective of assessing the success of revegetation efforts in previously disturbed areas. These types of camera studies are typically combined with vegetation monitoring to simultaneously collect information on revegetation success.

WSP has extensive experience using remote cameras to document seasonal patterns in caribou occurrence and to provide insight on caribou habitat selection.

Winter track count surveys, performed on the ground or by helicopter, also provide insight on caribou habitat selection and response to development.

Vegetation Monitoring and Wildlife Response

As part of many caribou monitoring programs, WSP carries out vegetation monitoring following the implementation of restoration or access control treatments. Vegetation establishment and growth are documented to confirm that revegetation, whether natural or directly introduced through planting or seeding, is progressing as expected. An important part of these programs is concurrent monitoring of wildlife (i.e., caribou, their predators, and other prey species), and human response to these measures. These programs are typically designed as Before After Impact Control (BACI) studies such that baseline levels of wildlife and human use are documented before and after the implementation of mitigation. Monitoring for these programs is achieved using remote cameras.

Examples of Caribou Mitigation & Monitoring Plans

WSP has extensive experience developing and implementing caribou mitigation and monitoring plans to meet regulatory needs and project-specific objectives.

Caribou Mitigation Plan for the Jay Project (2017). Mitigation and offsetting plans for Bathurst barren-ground caribou herd that included: project mitigation, financial support for research to future actions on the zone of influence and management of the herd, offsetting small effects through enhanced mitigation to be applied to the entire Ekati mine site, enhanced dust suppression, accelerated progressive reclamation of mine facilities, and support for Indigenous community-based monitoring of caribou.

Caribou Mitigation and Monitoring Plan for the Bonanza Ledge Mine (2017). WSP was retained by Barkerville Gold Mines (BGM) to prepare a Caribou Mitigation and Monitoring Plan (CMMP) addressing project impacts to southern mountain caribou. The CMMP included an assessment of mountain caribou, identification of mitigation, and description of residual adverse effects. The CMMP described how the residual effects would be offset using focused habitat restoration.

Caribou and Wildlife Mitigation and Monitoring Plans for the Primrose and Wolf Lake Project (2003-present). WSP has worked with Canadian Natural since 2003 to develop and implement wildlife and boreal caribou mitigation and monitoring programs, caribou protection plans, and a habitat enhancement program within the Cold Lake Caribou Range. Operational planning for habitat restoration began in 2007 with an inventory of existing disturbances. Candidate treatment sites were identified by considering Canadian Natural's 10-year operational plan, natural re-vegetation, historical caribou observations, density of treatable sites in an area, and accessibility. Following ground-truthing, a plan was developed to identify appropriate restoration treatments (e.g., mounding, seedling planting); implementation occurred between 2011 and 2014. Seedling monitoring was carried out after 1, 3, and 5 growing seasons.

In 2015, remote cameras were deployed as part of an on-going effectiveness monitoring program. The wildlife and caribou monitoring programs have included winter track count surveys, wildlife sweeps targeting woodland caribou, and various remote camera programs to document caribou movement around the project's lease boundaries, and to monitor animal response to above-ground pipelines, pipeline crossing structures, and disturbance density.

Caribou and Wildlife Mitigation and Monitoring Plans for the Kirby Project (2013-present). WSP has worked with Canadian Natural to develop and implement boreal caribou and wildlife mitigation and monitoring plans within the East Side of the Athabasca River Caribou Range. A linear deactivation program focusing on restoring caribou habitat on legacy linear features was also developed as part of these plans. Caribou monitoring components have focused on documenting behavioural response to development using winter track count surveys and remote cameras. The linear deactivation program involved planning to identify suitable treatment sites, defining appropriate habitat restoration prescriptions for each site, and implementing restoration treatments. A habitat restoration monitoring program was developed and implemented to evaluate the success of habitat restoration efforts using seedling monitoring and remote cameras.

Caribou Mitigation and Monitoring Plan for the Dover Commercial Project (2014-2016). WSP was retained by Brion Energy (now PetroChina Canada) to prepare a boreal caribou mitigation and monitoring plan within the West Side of the Athabasca River Caribou Range. As part of this plan, WSP identified the restoration status of existing linear disturbances within the Dover Commercial Project lease by reviewing and interpreting linear feature mapping data prepared by Greenlink Forestry Inc. Based on this review, WSP identified candidate sites for the application of habitat restoration treatments. Next, a habitat restoration prioritization exercise was completed by field truthing candidate sites. An operational plan was then generated for the implementation restoration treatments on confirmed sites.

Pasquia Peat Harvest Project Woodland Caribou Habitat and Mitigation Monitoring Plan (2016). WSP was contracted to facilitate discussions with the Saskatchewan Ministry of Environment, and to prepare an approach, methods and activities to be undertaken by Premier Tech Horticulture to mitigate adverse residual effects from the Pasquia Bog Project on boreal caribou. The Project was located within the SK2 East Caribou Administration Unit within the SK2 Range. The plan also presented the monitoring activities to be undertaken to evaluate the effectiveness of the mitigation activities to minimize residual effects on caribou.

Caribou Habitat Restoration Plans for the Leismer to Kettle River Crossover Project (2012-2015). WSP collaborated with the TransCanada team to prepare a preliminary and final plan that summarized lessons learned from existing literature on habitat restoration to identify strategies and actions that could be implemented to promote restoration of disturbed caribou habitat within the pipeline project footprint. A suite of measures suitable for implementation were identified, and a conceptual guide was developed to identify sites within the project footprint where certain restoration measures would be appropriate. The final plan was prepared following consultation with the National Energy Board, which identified the location of restoration sites, provided site-specific restoration measures, and re-assessed the residual effects of the Project on caribou habitat. Detailed alignment sheets were prepared with operational guidance to allow contractors to implement measures during construction clean-up. Additional support was provided to TC Energy on access control mitigation planning and third-party review of the habitat offset plan. Indigenous communities were consulted on this.

Caribou Mitigation and Offsetting Plan for Peat Developments in Saskatchewan (2018-present). WSP was retained to prepare a boreal caribou mitigation and offsetting plan within the SK2 East and SK2 Central Caribou Administration Units of the SK2 Range. WSP consulted with the Saskatchewan Ministry of Environment to develop details on the mitigation to avoid, minimize, reclaim, and offset the residual Project-related changes to caribou habitat in the SK2 East and SK2 Central Caribou Administration Units. Specifically, WSP worked with the Saskatchewan Ministry of Environment to develop a debit and credit calculation tool to be used to determine the area requiring offsetting due to unavoidable loss of habitat during construction and harvesting operations on the bog.

Other Caribou Projects

Below are examples of other projects demonstrating WSP's wide-ranging expertise on caribou.

Boreal Caribou Rearing Facility Feasibility Study (2017). On behalf of the Government of Alberta, Alberta Environment and Parks, WSP led a team of internal and external caribou experts with an Indigenous partner to prepare a feasibility study on woodland caribou population recovery rearing facility as a recovery tool. WSP led a project team of experts who worked collaboratively to evaluate the risks, potential mitigations, and operational considerations, and using optimization tools, identified areas of highest suitability for a rearing facility, costs/benefits, and next steps.

The Use of Multipliers for a Caribou Offsetting Policy (2020). On behalf of Environment and Climate Change Canada, WSP completed a literature review summarizing all caribou offset programs in Canada, planned, implemented, and monitored to date. WSP also prepared an Options Identification Report on The Use of Multipliers for a Caribou Offsetting Policy.

West Central Alberta Caribou Habitat Selection Analysis (2014). WSP developed resource selection functions within west central Alberta caribou ranges on behalf of Alberta Environment and Sustainable Resource Development and the Foothills Landscape Management Forum using GPS telemetry collar data.

Development of Best Management Practices for Caribou in Canada (2004-2006). In an effort to determine the value of best practices to caribou conservation, the Caribou Landscape Management Association (CLMA) and the Forest Products Association of Canada (FPAC) facilitated an audit of mitigation measures and operating practices employed for woodland caribou (CLMA and FPAC 2007). Fifty-one experts from the energy sector in Western Canada, forestry sector across Canada, provincial government, consultants and academics were interviewed between 2004 and 2006 to obtain information regarding the use, efficacy and monitoring of caribou operating practices.

Development of Best Management Practices (BMPs) for Canadian Boreal Forest Agreement - Secretariat (CBFA) Regional Working Groups (2013).

Industry-led Caribou Management Options for the Canadian Association of Petroleum Producers (2008-2010). To support the resource sector's role in caribou conservation, WSP prepared an industry-led management options report. Using a gap analysis, WSP developed recommendations around mitigation and best practices to industry with parallel management actions to be led and supported by provincial governments.

Boreal Caribou Knowledge Gathering for the Nutashkuan Inuit Nation Council (2011-2013). WSP completed a study to determine the status of boreal caribou on the Nitassinan Territory. Information about the boreal caribou population was gathered through literature review, traditional knowledge surveys, aerial surveys, and deployment and monitoring of GPS radio collars over a three-year period. Data was synthesized in a report summarizing the current state of the caribou population and their habitat.

WSP is one of the world's leading professional services consulting firms. We are dedicated to our local communities and propelled by international brainpower. We are technical experts and strategic advisors including engineers, technicians, scientists, architects, planners, surveyors and environmental specialists, as well as other design, program and construction management professionals. We design lasting solutions in the Transportation & Infrastructure, Property & Buildings, Environment, Power & Energy, Resources and Industry sectors, as well as offering strategic advisory services. Our talented people around the globe engineer projects that will help societies grow for lifetimes to come.

For more infromation, visit our **Biodiversity Conservation** page.

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