Restoration of Roads and Trails in the Eastern Slopes: It Can Work

Summary of Guidance Documents

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*"Earth provides enough to satisfy every man's needs,
but not every man's greed." – Mahatma Gandhi*

Alberta's Eastern Slopes are suffering from an excess of access. Sub-regional footprint and recreation plans must consider the reality that we are in an era of restoration. A scan of literature, reports, and past and present initiatives elsewhere is intended to help land managers use the best available information to inform prioritization, methodology, and approach to restoring the Livingstone and Porcupine Hills, and along the Eastern Slopes.

Why Restoration?

Extensive literature has documented the environmental impacts of roads and trails, through both their discrete effects and more broadly through linear disturbance and cumulative effects of multiple land uses on watershed health and ecosystem integrity. Some major ecological effects of roads and trails to wildlife are disturbance and avoidance, barrier effects and habitat fragmentation, invasive species proliferation, hydrological and erosion effects, and chemical effects (Forman and Alexander, 1998).

In the Livingstone and Porcupine Hills planning area under the South Saskatchewan Regional Plan, recent analysis by the government of Alberta[1] has found motorized footprint density in the area 2.28km/km^2, nearly 4 times the known threshold for many species. This equates to 4,053km of linear access.[2] The Porcupine Hills has an approximate motorized footprint disturbance of 2.56km/km^2 equating to approximately 1000km of linear access. In order to reduce linear disturbance to levels appropriate for restoring biodiversity and watershed health, restoration is needed.

In some cases, closure so that trails are not receiving use may be sufficient to reduce fine sediment (McCaffery et al., 2007) and benefit sensitive wildlife (Switalski and Nelson, 2011), although Lloyd et al. (2013) showed recontouring roads gave better outcomes than abandonment. Active restoration of roads and trails is also needed in instances where roads or trails produce chronic erosion or impact species at risk. Although removal and decommissioning may create short-term disturbance which may temporarily increase sediment loss, long-term monitoring shows that chronic erosion can be reduced by road removal (Switalski et al., 2004). Wildlife has been shown to benefit from road removal and

[1] Personal communication, September 8, 2016; Government of Alberta Presentation October 5, 2016
[2] For reference, driving the Trans-Canada highway 4,003 km from Lethbridge, AB (the nearest major city to the Porcupine Hills) would take you to Edmundston, NB, just northeast of Quebec City, QC.

decommissioning such as for bears (Switalski et al., 2007) and rare forest carnivores such as wolverines (Bull et al. 2001).

Many successful restoration methods exist including actions specific to fisheries (Pierce et al., 2013), prescribed burning (Stanturf et al., 2014), and a more holistic view of ecological restoration away from a vegetation-centric approach (Fraser et al., 2015); however, this summary will focus on trail and road restoration. Restoration methods also differ for ecosystem type. The Livingstone and Porcupine Hills planning area includes alpine, subalpine, montane, foothills parkland, and foothills fescue grassland. Restoring native grasslands has been shown to be feasible but requires active intervention, as natural recovery is not always effective and the presence of non-native species diminishes ecological health, function, and associated ecological services (Lancaster et al., 2016).

Generally, it is found that methods that are more effective for wildlife security are more expensive (Switalski et al., 2004), but benefits of road and trail decommissioning and restoration go beyond benefits to wildlife and watersheds. Land managers elsewhere have found restoration creates economic activity (Nielsen-Pincus and Moseley, 2010) and reduces the need for maintenance in the long run (MCOSD, 2010). This indicates the importance of targeted, cost-effective prioritization for valued ecosystem components and the implementation of a sustainable funding model for ongoing land management. Dollar values cited in the document are of the country in which the project or research is based.

Alberta being “late in the game” for trail and road restoration means we can gain knowledge from the extensive research and lessons learned from other jurisdictions (for instance, see Switalski, 2014). The following literature, reports, and initiatives have been reviewed in attempt to address the following questions and guide planning: Is restoration feasible? Will restoration be an expensive endeavor? What are the planning implications for restoration? Who should pay for restoration and why?

Special Consideration for Native Grasslands

Alberta Environment and Parks, 2016. Principles for minimizing surface disturbance in native grassland – Principles, guidelines, and tools for all industrial activity in native grasslands in the Prairie and Parkland landscapes of Alberta.

This document promotes consistent and effective use of pre-site assessments for all industrial activity in native grasslands. Its intent is to provide government regulatory agencies and industry with a comprehensive set of principles and guidelines for all industrial activity in native grassland landscapes. The strategy is threefold: Avoidance of native grasslands where possible, especially in critical ecological sites identified as extremely difficult to reclaim; reducing area and impacts of industrial disturbance to the extent possible; and, developing practical methods that will allow eventual restoration of disturbed areas. Principles 5 and 6 guide the incorporation of native plant community restoration planning in all phases of development activity; monitoring and reporting results is critical to improved performance.

Lancaster et al., 2015. Long-term revegetation success of industry reclamation techniques for native grassland: Foothills Fescue, Foothills Parkland and Montane Natural Subregions.

The purpose of the research project was to provide industry and the government of Alberta regulatory agencies with results and key learnings regarding the long-term recovery of native grasslands from industrial disturbance, in particular focusing on the three abovementioned natural subregions. The project compared three categories of wellsites: prior to 1963 before Alberta's first reclamation legislation and regulation; 1963-2000 reflecting early reclamation regulation and practices; and post-2000 which applied more advanced practices. The research found natural recovery has not resulted in much recovery of the native character of plant communities. Succession in post-1980 sites were sharply influenced by cultivars that were considered acceptable substitutions at the time. Post-2000 sites expressed some hopeful native species infilling. The document also has an extensive literature review of reclamation practices that may be informative to planning (For instance see: Desserud et al., 2010; Pokorny and Mangold, 2009; Sherritt, 2012; Tannas, 2011; Woosaree and McKenzie, 2015).

Graminae Services Ltd., 2009. Ecological site restoration risk analysis: A stewardship and land use planning tool for public lands.

The purpose is to provide the government of Alberta with an analytical tool to predict ecological site restoration risk associated with industrial development on public land. It is a coarse filter approach with basic principles to avoid native grassland and shrub land plant communities, use existing disturbance, minimize disturbance footprint, reduce fragmentation and disturbance, and measure restoration success.

General Examples of Road and Trail Restoration Practices and Methods

Road Ecology Centre

The Road Ecology Centre based in California is dedicated to road ecology research and education. Its goal is to bring together researchers and policy makers from ecology and transportation to design sustainable transportation systems based on an understanding of the impact of roads on natural landscapes and human communities (Road Ecology Centre, 2016). The Centre's website (http://roadecology.ucdavis.edu) provides extensive information on research programs and its E-Library has over 450 publications.

American Trails. 9 Principles of Ecologically Sustainable Trails

American trails is a U.S. non-profit organization working on behalf of all trail interests including non-motorized and motorized recreation, working to create and protect America's network of interconnected trails. The organization has nine principles for ecologically sustainable trails (American Trails, 2016).

Although mostly about siting, designing, and engineering sustainable trails, Principle 9 to "formally decommission and restore unsustainable trail corridors" is activated as one option when a trail becomes unsustainable (the other two options are to re-design and restore the trail, or restrict use or re-classify the trail). It relies on methods from the Minnesota Department of Natural Resources' *Trail Planning, Design and Development Guidelines* (2007). Page 3.32 of the book outlines various methods for decommissioning trails: dense planting at entrances and along trail corridors, creating closure berms to block access to entrances, using slash to reinforce closures, re-naturalize corridors after closure, and provide public information and education. "Experience has shown that relying solely on fences and gates to block entrances of decommissioned trails is not very effective."

Marin County Open Space District (MCOSD), California

MCOSD's inclusive, science-based *Road and Trail Management Plan* was developed through public meetings and workshops, consultation with land management agencies, and local studies (MCOSD, 2014). The Plan "provides a framework for making decisions in an inclusive, trackable, transparent, and defensible process. It also presents a set of policies to which proposed projects must adhere." Page 6-15 outlines in detail Best Management Practices for road and trail decommissioning, for General (Table 6.1), Sensitive Natural Resources (Table 6.2), Special-Status Wildlife (Table 6.3), Special-Status Plants (Table 6.4), Invasive Plants (6.5), and Construction Contracts (Table 6.6).

Projects implemented in 2016 include restoring habitat, providing sustainable trail corridors, and eliminating sedimentation caused by unsanctioned trail construction (MCOSD, 2016). In 2007, MCOSD assessed 112 sites that posed threats to water quality and salmonid habitat. From 2008-2011, 84 sites have been restored in three projects for a total cost of $493,241. Funding came from a grant through the California Department of Fish and Game's Fisheries Restoration Grant Program, and through MCOSD through funding, staff time, and in-kind services (MCOSD, 2010).

Switalski and Nelson, 2011.

Switalski and Nelson assessed different types of road closure (gated, barriered, and recontoured) on black bear frequency and habitat in the Clearwater National Forest. Results suggested all road removal types benefit sensitive wildlife, but removal by recontouring may be the most effective strategy for restoring habitat. The results that bear frequency was significantly higher on closed roads is likely due to avoidance of humans, whereas the significantly higher frequency of bears on recontoured roads compared to gated or barriered roads positively correlated with abundance of fall foods and hiding cover.

Luce et al., 2001.

This research aims to provide guidance to managers and a framework for evaluating and prioritizing management alternatives. The four fundamental principles for a strategy for managing and closing roads are: not all ecosystems are of equal importance or value; not all roads are equal in their physical effects; not all similar physical effects have equal ecological consequences; and, not all road effects can be repaired or mitigated to equal degrees.

Kevin Van Tighem, Case studies of restoration from Sofa Fire in Waterton[3]

Kevin Van Tighem, ecologist and author with 34 years of experience working in protected areas management, recalls: "After the Sofa Fire in Waterton we were left with, I believe, 14 kilometres of bulldozed fire guard. I was responsible for their rehab. I am working from memory here but I believe it cost $20,000 to pull all the soil back on them, cover that with large woody debris, and turn as many sods right-side up as possible. The contractors were a two-man crew with a track-hoe and a quad with attached home-made raking device. This differed from trail rehab, however, in that the soil was not compacted on the fire guards and there was still a lot of live plant matter in the bulldozed spoil piles. The project was a complete success - if you have ever hiked the Sofa Basin trail the first hundred metres or so was on reclaimed fire guard and it is completely vegetated with a high proportion of native species as is the rest of those lines."

Van Tighem recommends: "In my opinion, the most cost effective approach for restoring linear trails in our landscape would be to back a trackhoe out while having it loosen the compacted tread, pull bank material in, and then pull down live trees across the track to incorporate large woody debris into the new surface. There would likely be no need for replanting although (similar to what my Waterton contractors did) it wouldn't be a bad idea to use the hoe bucket to scoop out the odd sapling and plug it into the new surface, especially close to access points. The key is to create diversity of microsites [similar to Polster's Rough and Loose technique, page 9] and to get large woody debris worked in as it protects the raw soil initially, diverts surface runoff, increases microsite diversity and provides early habitat structure for various species. There should be ample seeding-in and suckering-in from adjacent native vegetation but some attention to weeds like Canada Thistle in the first couple years would be wise."

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[3] Personal communication. September 8, 2016

Lorne Fitch, P.Biol., Eastern Slopes Restoration Criteria[4]

In addition to consideration of existing methods and models for planning and implementing restoration, the following criteria are recommended to be considered for successful restoration and reclamation of OHV trails in the Eastern Slopes of Alberta. The list could be developed into a decision-making matrix for prioritization of selecting trails for closure, restoration, reclamation, and improvement of trail standards.

- **Type of linear feature** (paved highway, gravel road, rail line, forestry road, logging road, power line, pipeline, skid trail, hiking trail, OHV trail, right-of-way). Linear features need to be documented and the total linear density calculated on a sub-basin level, i.e., to the level of Hidden Creek, White Creek, then to the entire upper Oldman watershed.
- **Type of use** (i.e., foot, horse, livestock, pedal bike, motorcycle, OHV, 4x4…)
- **Seasonality of use** (i.e., use in drier or wetter seasons, summer vs winter use, as an aspect of risk)
- **Intensity and frequency of use** (i.e., number of vehicles per day, week, or month…)
- **Topography** (i.e., soil, slope, aspect, elevation, trail intersection with stream…)
- **Degree of existing erosion** (i.e., active erosion on slopes and crossings, partial vegetation, complement of vegetation, performance of ecological functions at site)
- **Degree of natural restoration** (time since disturbance) and opportunity for re-vegetation to occur
- **Water control**, on slopes and near water courses (i.e., presence and absence of erosion checks, slope interruption, resloping and regular maintenance)
- **Risk to native fish and wildlife populations** (i.e., cutthroat area maps and work done on bull trout redd counts)
- **Proximity of roads and trails to water courses** (i.e., within 100m)
- **Number of stream crossings** (inclusive of fords, culverts, bridges)

Montana Forest Restoration Working Group (MFRWG)

The MFRWG is a collaborative group originally consisting of the timber industry, U.S. Forest Service, the conservation community, and the State of Montana. In 2007, the group developed 13 restoration principles and a plan for implementation. MFRWG is now transitioning to Montana Forest Collaboration Network (MFCN). The principles are intended to be used as guidelines for project development, and projects using the guidelines should be driven primarily by ecological objectives, be economically feasible, and promote economic and social benefits (MFRC, 2013).

U.S. Forest Service Collaborative Forest Landscape Restoration Program (CFLRP)

The CFLRP was developed to fulfill the purpose of the Omnibus Public Land Management Act of 2009. The purpose of the act was to use science-based restoration to support ecological, economic and social sustainability goals, including wildfire, watershed, and forest restoration. According to CFLRP's 5-year report, their 2010-2014 partner contributions doubled from 7% to 15% and in total the CFLR projects

[4] Personal communication. September 2016.

attracted more than $76.1 million in partner funds (CFLRP, 2015). Butler et al. (2015) wrote about the CFLRP, "by changing the legal context for collaboration, CFLRP has enabled collaboration in implementation within a preexsiting legal and organizational context that largely inhibited such activity … CFLRP cases thus reveal ways in which collaborative implementation can open the door to a new conceptualization of the environmental management process that allows for feedback across time and space, strengthens accountability to multiple stakeholders, and fosters more robust approaches to adaptive management."

Initiatives in the Blackfoot-Clearwater Valley, Montana

The Blackfoot Clearwater Stewardship Project promotes cooperative public-private stewardship across the southwestern Crown of the Continent in Montana, including restoring forests, promoting recreation opportunities, and protecting habitat for grizzly bears, westslope cutthroat trout, and mountain goats. Funding for restoration has been in part enabled by the U.S. Forest Service's Collaborative Forest Landscape Restoration Program (CFLRP).

The Southwestern Crown Collaborative (SWCC) "commits to bolstering local communities and engaging communities in our work." Some activities SWCC was engaged in 2013 were monitoring road effects and watershed restoration, restoring whitebark pine, and improving watersheds through restoration. SWCC received CFLRP funding and work associated with the program created 162 full- or part-time jobs and contributed $5 million in labor income (SWCC, 2013).

Kerkvliet (2009) provides an overview of the economics and practice of Stewardship Contracting in the Clearwater Stewardship Project in Montana. U.S. Forest Service Stewardship Contracts take the form of selling timber and using the receipts to offset some or all of the costs of restoration activities. These activities include road and trail maintenance, prescribed fire, vegetation removal for forest stand health and to reduce the risk of high-severity fires, road decommissioning, culvert removal or replacement, non-native species control, protection and enhancement of fish and wildlife habitat, and construction and maintenance of recreational facilities, including trails. The report found the project's total economic impact includes $23 million increase in final sales for 206 industry sectors in eight Montana counties, 148 full- and part-time jobs, $4.6 million increase in wages (2003 dollars), $1.4 million increase in proprietors' income, and $570,000 in indirect business taxes. 10% of the impacts arise from restoration activities paid for with the receipts from these harvests. The combination of harvesting, wood processing, restoration, administrative, and monitoring activities typical of a stewardship contract serves to spread impacts across a wider variety of economic sectors than timber harvesting alone. Expenditures are detailed in the report. The report also outlines challenges and barriers to implementing Stewardship Contracts.

Legacy Roads and Trails Program

The Legacy Roads and Trails program restores problem roads in National Forests across the U.S., mostly in the Pacific Northwest forests. Congress has given a total of $390 million from 2008-2015 for road and trail maintenance, reclamation, upgrades, and stream crossings and bridge repairs. As of 2015, restoration results include 6,722 miles (10,818km) of unneeded roads reclaimed and 1,000 stream crossings restored. The program has resulted in reduction of sediment delivery to streams at studied sites, fish accessing previously unavailable habitat, black bears frequenting areas where roads are decommissioned, and reduction in landslides after ‘storm-proofing’ (Wildlands CPR and the Wilderness Society, 2013).

The Forest Service leverages its own funds with a variety of other funding sources, including state, private, and federal. The Forest Service estimates that the program has saved $3 million per year in annual road maintenance and ~$17 million from the deferred maintenance backlog.

In California, US Congress appropriated $48.4 million in funding to the Pacific Southwest (California) region and the funds were used to reclaim ~100 miles (~161km), to fix or stormproof ~2,350 miles (~3,782km) of roads, and to fix or upgrade 8 culverts in the state (WildEarth Guardians, 2014). This roughly works out to $12,274 per km total for the program, including the cost of the 8 culverts which were not identified separately.

An economic analysis by Nielsen-Pincus and Moseley (2010) examined data collected from contractors and grant recipients to estimate the employment and economic output effects of public investments in Oregon forest and watershed restoration. They found that this restoration leads to between 15.7 and 23.8 jobs per $1 million of public investment and results in an additional 1.4 to 2.4 times the amount of economic activity as every public dollar cycles through Oregon’s economy.

Therrell et al., 2006. Case studies of restoration projects from the northwestern U.S.

This U.S. government-developed guide intends to “provide managers with information that could help them to decide whether to attempt restoration, and if so, how to go about it appropriately in the wilderness.” The guide is based primarily on examples from the Rocky Mountains westward in the United States. It is designed for small-scale impacts, such as recreation use. There are case studies describing project costs in Appendix D of the document, including:

- Lake Valhalla Project (Henry M. Jackson Wilderness along Pacific Crest Trail). Project cost $15,000 in 1991 to restore trampled vegetation on 25 campsites.
- Grouse and Hemlock Lakes Campsite Restoration Project, Desolation Wilderness, Eldorado National Forest, CA. Project cost $8,000 in 2001 for soil treatments, vegetative treatments, and sign installation to restore degraded lake basins.
- Edith Lake Campsite Restoration Project, Sawtooth Wilderness, Sawtooth National Recreation Area, ID. Project cost $1,430 in 1998 to implement closure to stock use, rehabilitating five sites using soil treatments, vegetative treatments, and sign installation.
- Lake of the Woods Campsite Restoration Project, Desolation Wilderness, Pacific Ranger District, Eldorado National Forest. The project cost $23,000 for a two year project in 2004-5, including planning, environmental analysis, and implementation including blasting trees, soil treatments, vegetative treatments, and sign installation.

Cost estimates for road and trail closure and removal

A number of researchers have estimated the cost of decommissioning and removal of roads or trails.

Harr and Nichols found it cost $3,500 in 1993 to remove and restore roads to local grade, impassable logging roads in coastal Washington.

BC-based Polster's method, Rough and Loose, is "ideal for recovering hydrologic integrity on resource access roads and where unauthorized access by motor vehicles ('quads' and 'dirt bikes') is causing ecological degradation" and "provides ideal conditions for live staking" (Polster, 2013). The estimated cost is $700/hectare.

Weaver et al. (2000) describe methods and estimates costs for road decommissioning in the northwestern U.S. to restore salmon habitat, and recommends that planners and resource managers develop generalized cost assessment techniques to improve decision-making, including sharing information across projects. An example of one such tool that was subsequently developed is the Treatments for Restoration Economy Analysis Tool (TREAT), developed by economists with the National Forest Service to assist in the estimation of economic effects (job and labor income) of restoration activities tied to the CFLRP (USDA, 2016).

Switalski et al. (2004) estimate costs of different types of road closure and removal, and their relative costs and impacts (modified from Bagley 1998). Gating and permanent traffic barriers may not fix stability problems and control surface erosion long-term, but may improve wildlife security and are cheaper. Ripping, stream crossing restoration, and full contour methods can improve stability, erosion, and wildlife security but are more expensive (the paper cites values of $400-$1200/km for ripping, $500-150,000 per stream crossing, and $3000-$200,000/km for full recontour). The paper also recommends the importance of ecologically relevant prioritization, and suggests selecting roads that affect large reaches of streams or watersheds with already low road densities.

Photo of the rough and loose technique from Polster, 2013.

References and Further Reading

Contact Andrea Johancsik to request copies of the resources at ajohancsik@abwild.ca. For more information about the AWA and Porcupine Hills Coalition, visit www.albertawilderness.ca.

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