ROCKY MOUNTAIN TRENCH ECOSYSTEM RESTORATION PROGRAM

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Rocky Mountain Trench Ecosystem Restoration Program

Restoring Nature's Balance.

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Front cover photo: **PIPELINE PASTURE** on Waldo North Range Unit after restoration logging. The site, on the northeast side of Koocanusa Reservoir, is grazed by domestic cattle, elk, mule deer and white-tailed deer. (Susan Bond photo)

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CHINA NORTH PASTURE on Cherry-Ta Ta Range Unit before and after restoration logging. Forest density was reduced from 700 stems per hectare to 20 mature sph. The site, along Hwy 95A south of Ta Ta Creek, is winter range for elk and deer, and provides excellent habitat for badgers, an endangered species in BC. (Randy Harris photos)

THE ECOSYSTEM RESTORATION STORY

TRENCH ER
Restoring Nature's Balance.

The Rocky Mountain Trench Ecosystem Restoration Program – the Trench ER Program – is a collaborative undertaking by 30 partners to restore grasslands and open forests for the enduring benefit of plants, animals and people.

Program partners represent a full array of resource users and land managers: government agencies, First Nations, the forest, ranching and guide-outfitting industries, wildlife conservation and hunting associations, land conservation trusts, naturalist and environmental societies, and other citizen stakeholder groups.

The program operates in the southern Rocky Mountain Trench – the East Kootenay and Upper Columbia Valley region of southeastern British Columbia, Canada.

Exceptionally rich ecological diversity is a hallmark of the region. Its range of ecosystems – from alpine to forests, from wetlands to grasslands – provides habitat for nearly every species of large mammal found in North America, along with a host of smaller mammals, birds, fish, insects, reptiles and amphibians. It is the low-elevation grassland and open forest ecosystems, though, that support the greatest biological diversity and the greatest concentration of human settlement and development.

This handful of sentences tells the essential story. But beyond the basic facts lies a tale of conflict, resolution and action going back many decades.

As long ago as the 1950s it was becoming evident that the grasslands and open forests of the southern Trench were changing for the worse. Modern-day wildfire suppression was bringing an end to the cycle of frequent, low-intensity fires that had maintained these ecosystems for thousands of years. The result was a creeping invasion of forest ingrowth and encroachment. The first obvious symptom of poor ecosystem health was less forage for the region's herds of domestic livestock and wild ungulates, particularly elk.

By the 1970s, conflict between ranching and wildlife interests over the diminishing grazing resource had become fiery and emotional. By the 1980s dozens of reports, studies and inquiries had documented the conflict and put forward a variety of remedies.

Reduced forage production and grazing capacity weren't the only negative consequences of deteriorating grasslands and open forests. Evidence was mounting that ingrown forests were more susceptible to diseases and insect attacks. Trees growing in these dense stands were often malformed and had little economic value as timber products. Critical habitat for many wildlife species was being lost as trees encroached on grasslands, and the build up of forest fuels was an increasing wildfire hazard.

In the 1990s, competing (and combative) resource users finally began to put aside their differences and seek common ground. Stakeholders representing a broad range of interests came together to participate in two BC Government initiatives that proved significant: the East Kootenay Trench Agriculture/Wildlife Committee and the Commission on Resources and Environment. Both the committee and the commission concluded that the solution to conflict lay in restoring the natural resources that were so vital to the plants, animals and people of the Trench – its grassland and open forest ecosystems.

The provincial government responded with the Kootenay-Boundary Land Use Plan and implementation strategy, which provided the legal framework for fire-maintained ecosystem restoration, and in 1998 the ER Program's first Steering Committee was established.

The pages that follow tell the rest of the story. *Blueprint for Action 2013* is a comprehensive review of the ER Program's first 15 years – progress made, lessons learned, and the way ahead. It is the third "Blueprint" and most substantive report to date, coming as it does midway through what was conceived as a 30-year program. It is meant for the reader who is new to the world of ecosystem restoration, as well as those with specialized knowledge. Beginner or expert, you'll find it a good read.

– THE EDITORS

NOTABLE EVENTS

2006 BC Government announces a province-wide ecosystem restoration initiative modelled on the Trench ER Program.

Natural resource managers from the Government of Mongolia visit the Trench to learn about grassland/open forest restoration operations.

2007 Randy Harris starts work as the Rocky Mountain Natural Resource District's first ER Team Leader, a new full-time position.

BC's first non-renewable forest licences specifically for ecosystem restoration are awarded in the Trench.

2009 University of Mississippi graduate students arrive in the Trench for an intensive three-week internship in hands-on ecosystem restoration.

2011 University of British Columbia professors and graduate students present recent research on Kootenay fire history and forest stand dynamics to ER Program partners.

ER partners host a record number of restoration field tours for program funders, college students, wildfire managers, conference delegates and the public.

THE ER PROGRAM'S Dutch-Findlay project on the west side of Columbia Lake won the Land Trust Alliance of BC's outstanding land program award in 2011. The project is an excellent example of cooperation among ER partners and funders. Encompassing 4,500 hectares of Crown land, private conservation properties and a cattle ranch, the long-term project has multiple objectives: enhancing wildlife habitat, particularly for the rare Lewis's woodpecker (at right), reducing wildfire risk to nearby Canal Flats, and improving grazing for cattle, elk and deer. Treatments to date include hand slashing, a prescribed fire (above), and creation of 93 wildlife trees.
(Randy Harris photos)

FIRE ECOLOGY OF THE SOUTHERN ROCKY MOUNTAIN TRENCH

BY DON GAYTON, MSC, PAG

Don Gayton is a consulting ecologist and author. Previously, he worked for the BC Ministry of Forests Range Program and FORREX. He considers the experience of working with the pioneers of fire-maintained ecosystem restoration in the Trench as one of the highlights of his career. Don has published many academic and popular articles and books. He lives in Summerland, BC. (Ivan Gayton photo)

When David Thompson entered the southern Rocky Mountain Trench in the spring of 1807, he encountered a much different landscape than we see today. He saw grasslands and widely spaced trees, calling them "open meadows, which become more and more spacious as one proceeds southward."

Subsequent European travellers all noted the "fine bunchgrass and scattered pine and larch of large growth" in this broad valley between the Rocky and Purcell mountains. These written observations are supplemented by a remarkable series of landscape photographs taken in 1883 by George Mercer Dawson of the Geological Survey of Canada.

Not surprisingly, these 19th century visitors – Dawson, Moberly, Baillie-Grohman and others – simply assumed that nature had arranged the trees and grass to grow that way. They made no connection between the condition of the open, "parkland" landscapes of the Trench and the frequent use of fire by First Nations. This was not surprising, since Europeans at the time saw fire as inherently evil, and further believed that First Nations people lived as simple hunter-gatherers, never managing the land in any way.

Nearly two centuries elapsed before ecologists finally understood the historical connection between trees, grass and fire. Firm evidence for the frequent fire regime comes from veteran trees that were scarred – but not consumed – by previous fires.

Fire History – Innovative forest scientists like Dr. Lori Daniels and Robert W. Gray were able to determine fire histories by locating these old "cat-faced" trees and taking samples from them. Using the science of dendrochronology, they were able to date the years of fires in the Trench, going all the way back to the year 1323.

These fire-scar studies revealed some startling numbers: in the period 1600 to about 1890, around the time of first European settlement in the Trench, fires were extremely common. In fact, the dry Douglas-fir and ponderosa pine forests along the bottom of the valley burned on average every 15 years, with some intervals as short as two years, and others as long as 30 years or more. In addition, the scientists found that these same frequent fires tended to carry up into the mountain slopes adjacent to the valley, where western larch grows.

FIRE HISTORY. This cross-section or "cookie" cut from a 400-year-old western larch has 10 fire scars, each one dated by counting the tree's annual growth rings. Fire scarred this tree 10 times between 1628 and 1907. The tree germinated about 1590 and was felled near Canal Flats in 1994. (Don Gayton photo)

FOREST CHANGE OVER TIME. An open stand of mature ponderosa pine, at left, photographed near Wildhorse Creek, Fort Steele, by George Mercer Dawson. (National Archives of Canada photo) In the re-take, 130 years after Dawson, the open forest has filled in and Douglas-fir has replaced ponderosa pine as the dominant tree species. (Randy Harris photo)

GRASSLAND CHANGE OVER TIME. Grasslands on the western benches above Columbia Lake, at left, photographed by Herbert Wendell Gleason, who described his viewpoint as "overlooking Ellis and Stoddart ranch." (Glenbow Archives photo #NC-53-116) A re-take 107 years later shows the grasslands overtaken by forest encroachment. The site is now The Nature Trust of British Columbia's Hoodoo conservation property. (Rob Neil photo)

LANDSCAPE CHANGE OVER TIME. The northeastern end of Columbia Lake, headwaters of the Columbia River, by George Mercer Dawson, at left. (National Archives of Canada photo) In the re-take, note how the previously open areas on the middle-ground slopes have become forested and the marshes have advanced. (Randy Harris photo)

DEGREE OF DEPARTURE

Fire scientists Bruce Blackwell and Robert W. Gray analyzed the time between fires – called the "historical fire return interval" – of the various landscape polygons within the Rocky Mountain Trench. Then they determined the years elapsed since the last fires. Based on this information, they assigned a current "condition class" to each polygon. The results put much of the southern Trench into the "severely departed" class, meaning that no fires had occurred for more than twice the historical fire return interval.

First Nations & Fire – Wildland fires are started by either lightning strikes or humans. We now understand that First Nations traditionally used fire for many reasons: improving game habitat, enhancing the productivity of berry and root crops, creating defensive sightlines, and so on. These traditional practices were very widespread, ranging from the boreal forests of northern Canada, through the valleys of British Columbia's southern Interior, into the dry forests of the western United States, and even in certain wet coastal areas and high-elevation sites.

Evidence of First Nations occupation of the Trench dates back 11,000 years, and it is safe to assume they applied fire to the landscape for much if not all of that time. As a result, the vegetation of the southern Rocky Mountain Trench is highly adapted to frequent fire; we live in what ecologists call a "fire-maintained ecosystem."

This frequent fire regime, which lasted for thousands of years, began to change around 1890 and then ended abruptly in 1940, a fact that is obvious from the tree fire-scar records. Several factors contributed to this. New herds of cattle and horses consumed the grassy fuels that carry fires, and settler trails and farms acted as unintentional firebreaks. But most importantly, traditional First Nations land management activity was disrupted by the creation of Indian Reserves, and their fire practices were banned.

The dramatic decrease in fire frequency was punctuated by a series of large wildfires in 1910-1920, triggered by severe drought combined with logging, mining and railroad activity. Then organized fire suppression began in the 1930s with the installation of fire lookouts. By the end of World War II, firefighting became highly mechanized and highly effective, and we entered the "Smokey Bear" era. Virtually no fire scars have formed since 1940.

Unintended Consequences – This thumbnail fire history brings us up to the 1970s, when local ranchers and hunters recognized that the forage base for cows, elk and deer was slowly disappearing as open grasslands became closed forests. Like their First Nations predecessors, they began doing small prescribed burns, but more rigorous government regulations and liability concerns soon ended this activity. The forage losses continued, however, and other problems arose as well.

Biologists noted the rich biodiversity of the native grasslands was being slowly eroded by the encroaching forest canopy. Forest health specialists observed the dense new stands of fir and pine were experiencing water stress, making them much less likely to reach their full growth potential and more prone to insect attack.

Then another, larger problem loomed, not only in the Trench but in other populated valleys of BC's southern Interior: wildland-urban interface (WUI) fires. These were becoming more frequent and more destructive due to fuel build-ups in fire-excluded forests. The 1985 Spen Fire near Canal Flats, and the Lamb Creek and Plumbob fires south of Cranbrook in 2003, are some local examples of WUI fires. Other notable fires occurred near Penticton in 1994, Salmon Arm in 1998, and Kelowna and Barriere in 2003. These fires caused much property damage and forced the evacuation of thousands of people. All were made worse by decades of uncontrolled fuel accumulation and fire exclusion.

Fire Mechanics – Let's have a look at how fire – and the lack of it – affects the Trench landscape. Every year forests produce fuel in the form of dead branches, needles, bark and dead trees. In wet ecosystems these fuels are rapidly converted to nonflammable humus by the abundant microbes and insects living in the soil. In the dry Interior, breakdown is much slower and forest fuels persist for decades.

The frequent fire regime of the pre-1940 period kept these fuels from accumulating, at the same time as it thinned tree seedlings and saplings. Sun-loving grasses, flowering plants and shrubs – vegetation that provides forage, habitat and diversity – prospered. The scattered mature trees became virtually fireproof, with thick protective bark, few low-hanging branches, and few nearby juvenile trees to carry flames up into their crowns. Fires in these landscapes were "surface" oriented: quick, cool fires that consumed fuels lying on the ground and rarely got up into the forest canopy to become "crown" fires.

Fuel accumulation is important, but fire is also driven by weather patterns. When a long fire-free interval (which means lots of accumulated fuel) coincides with a summer of hot, dry and windy weather, severe fires are a common result. Such a coincidence occurred in 2003 – BC's record year for private property lost to wildfire. There will be more of these years to come.

Scientists traditionally defined ecosystems as either "fire maintained" or "fire initiated." Fire-initiated forest ecosystems burn rarely, but when they do, nearly all trees are killed by "stand-replacing" fires, and a new even-aged forest starts from seedlings. Fire-initiated forests are typically found in northern, coastal and high-elevation environments. At mid-elevation sites in the Trench, we encounter a "mixed-severity fire regime" – a record of frequent fires mixed with the occasional severe fire. This regime produces a range of ecosystem conditions across the landscape, which helps to create the diversity of wildlife and habitat that the Trench is famous for.

Forest Encroachment & Ingrowth – The outcome of many decades of fire exclusion in the southern Rocky Mountain Trench has been a gradual, multiple shift: open grasslands have become treed grasslands; treed grasslands have changed to open forests; and previously open forests have become closed forests. The incursion of trees into traditional grasslands is a process known as forest encroachment; the increase in tree cover of existing forests is called forest ingrowth. These twin processes have dramatically altered the Trench landscape, as can be seen in the paired photos below.

Steve Taylor and his colleagues at the Canadian Forest Service analyzed the Ta Ta Creek area,

FOREST ENCROACHMENT, above, in a sagebrush grassland near Invermere. (Don Gayton photos)

FOREST INGROWTH, below, in Saddle Pasture. The large light-coloured patch showing in 1951 had become darkened with trees by 2004. Canal Flats is visible at the top of the photos with the Kootenay River flowing on the right. (BC Ministry of Forests airphotos)

SUN LOVERS. Arrow-leaved balsamroot is a welcome springtime sight on south-facing slopes in the Trench. (Susan Bond photo)

north of Kimberley, by comparing 1952 and 1992 airphotos. After eliminating any areas affected by logging or other activity, they arrived at a sobering estimate of landscape change. Fully half of the area of grassland and open forest had shifted to closed forest over the 40-year period. They calculated that if no corrective action were taken, the entire area would become closed forest by 2032.

Another major change in Trench landscapes over time is the loss of large veteran trees. When trees are "open grown" they can reach prodigious size and age, even in dry climates. Early high-grade logging practices eliminated virtually all of these veterans. Our current dry forests are not only much denser than in the past, they have also shifted to younger, smaller diameter trees. The few remaining veterans are now at risk as they encounter competition from young trees growing up around them. Along with the shift in tree age and density come a shift in species; the fire-tolerant ponderosa pine and western larch are giving way to the less fire-adapted Douglas-fir.

The major native grassland plants of the Trench are all sun-loving species. When bluebunch wheatgrass, Idaho fescue, arrow-leaved balsamroot, bitterbrush and others are shaded by encroaching trees, they lose their vigour, stop producing seed, and eventually die out. As trees grow denser, soils become more acid and forest-floor species such as pinegrass and kinnikinnick take over. For grazing animals, this shift represents a "double whammy," because plants that are able to grow under a forest canopy produce less forage than grassland plants, and their nutritional value is substantially lower.

Scientists investigating forage production have found that a treeless native grassland can yield in the order of 1,000 kilograms per hectare (400 pounds per acre). An open forest with less than 15% tree cover actually produces even more forage, around 1,500 kg per ha. This falls off to 500 kg per ha in more dense forests, and drops to a token amount under a completely closed forest canopy. As a result of this shift, elk and cattle tend to concentrate on the few remaining

OPEN GRASSLAND < 5% tree cover

TREED GRASSLAND 5–15% tree cover

OPEN FOREST 15–40% tree cover

CLOSED FOREST > 40% tree cover

ECOSYSTEM RESTORATION:

"… the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed."
(Society for Ecological Restoration, 2004)

The goal of fire-maintained ecosystem restoration: "to restore fire to its natural role in the ecosystem to the maximum extent, consistent with safety of persons, property and other resources." (Heinselman, 1978)

open grasslands, resulting in overgrazing and weed invasion.

Ecosystem Restoration – This *Blueprint for Action* describes how the partners in the Rocky Mountain Trench Ecosystem Restoration Program are tackling the forest ingrowth and encroachment problem. In doing so, they join the ranks of a growing worldwide movement known as ecosystem restoration, or ER for short. ER is founded on some basic principles:

» Ecosystems are complex, and function much like living organisms.

» Human activities have damaged many ecosystems, some to the point of total destruction.

» Individuals and society have some responsibility to understand how ecosystems work, to help maintain healthy ecosystems, and to aid the recovery of damaged ecosystems.

» Restoring ecosystems is a slow and sometimes painful process, requiring ongoing commitment and continuous learning.

» Restoring ecosystem disturbance processes (such as fire) is often critical to the success of ER projects.

» The short-term cost-benefit analysis of ER is usually negative, but positive payoffs come in the long term.

The "brand" of ER we engage in here is called "fire-maintained ecosystem restoration." We are fortunate to have many local field practitioners and scientists skilled in the science, technology and art of fire-maintained ecosystem restoration. We also have close ties with specialists in the adjacent US who wrestle with similar problems, in ecosystems very much like ours.

Climate Change – Just as extreme weather events are now compelling urban areas to confront climate change, rural areas must now also factor it in to every land management activity. Based on our current knowledge, climate change will intensify the need for fire-maintained ecosystem restoration. As the climate warms, the wildfire season is expected to be up to three weeks longer by 2045. This means there will be a longer window of opportunity for interface fires. The frequency of severe drought is also expected to increase, leading to increased tree mortality – more fuel – and a greater probability of large, severe wildfires. We have already witnessed the combined effects of a warming climate, fire suppression and poor forest management that triggered the recent pine beetle epidemic that killed millions of hectares of lodgepole pine in central BC.

Noted BC scientist Dr. Richard Hebda argues that the most effective preparation for climate change is to restore our current ecosystems so they are in the healthiest possible state. This gives them the resilience to respond to the unprecedented changes that climate change presents.

Living within a fire-maintained ecosystem presents a complex set of challenges that we are just now beginning to confront. One thing is clear, however: our traditional approach of total fire exclusion has become increasingly unworkable. Certainly we will always continue to put out wildfires in and around towns and communities. But the philosophy of "total fire suppression" has now been replaced with "fire management," which includes suppression, fuels management, *and* fire-maintained ecosystem restoration.

Here in the Rocky Mountain Trench we do have our work cut out for us, and this Blueprint shows us the way.

WHAT IS NATURAL?

Fire-maintained ecosystem restoration presents a fascinating paradox. We try to restore ecosystems back to their "natural" condition, but what constitutes "natural" in ecosystems like ours, which are adapted to millennia of human intervention? We traditionally define "natural" and "wilderness" as untouched by humans, but contemporary ecology tells us we need to re-think those terms as they apply to the dry forests and grasslands of western North America. In fire-maintained ecosystems, it is ecologically "unnatural" to suppress the human use of fire. Food for thought.

PRAIRIE CROCUS and blades of rough fescue emerge together in early spring on a grassland near Ta Ta Creek. (Susan Bond photo)

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SOME REPRESENTATIVE SPECIES
of Grasslands & Open Forests in the Southern Rocky Mountain Trench

PLANTS

Arrow-leaved balsamroot	*Balsamorrhiza sagittata*
Bitterbrush (antelope-bush)	*Purshia tridentata*
Bluebunch wheatgrass	*Pseudoroegneria spicata*
Idaho fescue	*Festuca idahoensis*
Kinnikinnick (bearberry)	*Arctostaphylos uva-ursi*
Narrow-leaved desert parsley	*Lomatium triternatum*
Needle-and-thread grass	*Hesperostipa comata*
Pinegrass	*Calamagrostis rubescens*
Prairie crocus	*Anemone patens*
Prickly rose	*Rosa acicularis*
Richardson's (spreading) needlegrass	*Stipa richardsonii*
Rough fescue	*Festuca campestris*
Saskatoon	*Amelanchier alnifolia*
Scarlet gaura*	*Gaura coccinea*
Small-flowered penstemon	*Penstemon procerus*
Wild licorice*	*Glycyrrhiza lepidota*

MAMMALS

American badger*	*Taxidea taxus jeffersonii*
Cattle	*Bos primigenius*
Columbian ground squirrel	*Spermophilus columbianus*
Mule deer	*Odocoileus hemionus*
Rocky Mountain bighorn sheep*	*Ovis canadensis*
Rocky Mountain elk	*Cervus elaphus*
White-tailed deer	*Odocoileus virginianus*

BIRDS

American kestrel	*Falco sparverius*
Columbian sharp-tailed grouse**	*Tympanuchus phasianellus columbianus*
Lewis's woodpecker*	*Melanerpes lewis*
Long-billed curlew*	*Numenius americanus*
Mountain bluebird	*Sialia currucoides*
Western bluebird	*Sialia*
Western meadowlark	*Sturnella neglecta*
Vesper sparrow	*Pooecetes gramineus*

AMPHIBIANS & REPTILES

(may occur if there are adequate waterbodies)

Columbia spotted frog	*Rana luteiventris*
Western painted turtle*	*Chrysemys picta bellii*
Western toad*	*Anaxyrus boreas*

INSECTS

(all of the following are butterflies)

Alexandra's Sulphur	*Colias alexandra*
Persius Duskywing	*Erynnis persius*
Melissa Blue*	*Lycaeides melissa*
Aphrodite Fritilliary	*Speyeria aphrodite*
Common Alpine	*Erebia epipsodea*
Common Ringlet	*Coenonympha california*

*Indicates a rare or at-risk species

**Species extirpated in the East Kootenay

THE STEERING COMMITTEE

A VIEW of the Rocky Mountain Trench and Kootenay River from Ta Ta Creek, with smoke from a prescribed fire rising above the Rockies to the east. The Trench is one of earth's most distinctive geographic features. Extending for 1400 kilometres from Montana, through British Columbia, to the Yukon border, it is visible from space. (Susan Bond photo)

The Steering Committee was established by the BC Government in 1998 to plan and deliver a fire-maintained ecosystem restoration program on designated Crown land in what is now called the Rocky Mountain Natural Resource District.

In the intervening 15 years, the committee's strategic planning, fund-raising and operational activities have evolved into today's Rocky Mountain Trench Ecosystem Restoration Program.

The founding Steering Committee was conceived as a multi-sectoral group representing provincial natural resource agencies, the ranching and forest industries, program funders and a broad range of citizen stakeholder organizations. That governing concept has been maintained and expanded over the years to include representation by BC Parks, East Kootenay Wildlife Association/BC Wildlife Federation, First Nations, Parks Canada, and Rocky Mountain District's Range Advisory Committee.

A Changing Strategy – Strategic planning is a fundamental responsibility of the Steering Committee. The committee's first strategic plan, published in 2000 as *A Blueprint for Action*, set a goal of restoring 135,000 hectares to open range or open forest condition by 2030, and maintaining those conditions in perpetuity. Roughly 40% of the total would be restored to open range, 60% to open forest.

VISION

We envision a restored landscape functioning at its ecological potential and thereby supporting:

» The native and historical matrix of trees, plants and animals

» A sustainable forage resource for wild and domestic grazing ungulates

» Social, economic and cultural needs as they relate to the Open Range and Open Forest landscapes of the Rocky Mountain Trench.

MISSION

1. Provide guidance, direction and support to the ER Program Operations Committee.

2. Support and enable the restoration of priority areas in the Rocky Mountain Trench.

3. Enable the maintenance of priority areas in perpetuity.

4. Raise funds and build partnerships to meet restoration and maintenance goals.

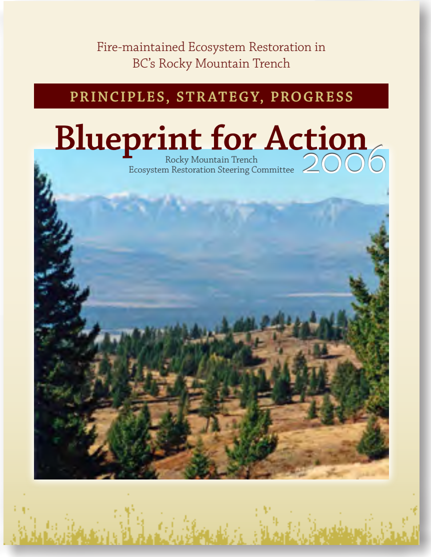
5. Provide a communications and outreach program to various publics, including stakeholders, funders, residents, partners and members.

6. Collaborate towards implementation of the fire-maintained ecosystem objectives of the Kootenay–Boundary Land Use Plan.

The goal was based on two factors:

1. an estimated 114,000 hectares of grassland and open forest converted to closed forest since 1952, and
2. an ongoing conversion rate estimated at 3,000 hectares per year.

Annual operating targets for commercial harvesting, slashing and prescribed burning were established to return the 114,000 hectares to their historic condition and halt ongoing conversion.



Six years after formulating this plan, the Steering Committee published *Blueprint for Action 2006* to review strategy and report on progress.

The original strategy was maintained. Operationally, annual targets for harvesting and slashing had been achieved or exceeded in most years. Prescribed burning targets, however, were falling short by substantial margins and have continued to do so.

As a result, the Steering Committee began taking a hard look at its strategy and is now in the process of making significant changes.

The New Plan – The 2000 strategy was clear, quantifiable and time limited, but the committee has concluded that its scope and timeframe must be revised. The difficulty of meeting prescribed burning targets is largely responsible for changes in strategic direction.

OPEN RANGE & OPEN FOREST

The Kootenay-Boundary Higher Level Plan, adopted by the BC Government in 2001, is the legal basis for fire-maintained ecosystem restoration on Crown land in the Trench. The plan's implementation strategy, produced in 1997, identified approximately 250,000 hectares in the Trench as fire-maintained ecosystem. This total was subdivided into 4 ecosystem components: shrublands, open range (grasslands), open forest and managed forest. The ER Program focuses on restoration of the open range and open forest components. Restoration is aimed at reducing tree density as follows:

» Open Range: less than 75 stems per hectare (sph), with a target of 20 sph

» Open Forest: a range of 76 to 400 sph, with a target of 150 sph.

BURN STATS. The ER Program's best year for prescribed burning on Crown land occurred in 1998 when 10 fires were ignited. The poorest year occurred in 2011 when conditions did not permit any fires to be lit. The average since 1997 is 3.8 burns per year. (Randy Harris photo)

The ER Program's current operating area is about 109,000 hectares. For planning purposes, it has been divided into "logical burn units" of 350 hectares each. Maintaining the total operating area in open range or open forest condition would require a prescribed fire on each burn unit at least once every 20 years. Such a maintenance schedule would require 16 prescribed fires every year.

However, operational experience shows that fewer than 4 prescribed fires, on average, are actually completed each year. Smoke control regulations, stringent burn-impact guidelines and current weather patterns are the constraining factors. Available burn windows are so limited, in fact, that using prescribed fire to maintain the entire operating area is no longer considered workable.

Consequently, the Steering Committee is examining alternatives, including reducing the total area under active restoration management.

Under this option, the full range of restoration treatments – including periodic maintenance burns – would be concentrated on the most productive sites, those with the potential to produce the best ecological outcomes. Existing open forest stands with good bunchgrass growth are the obvious choice. Twenty-seven priority range units have been identified (page 41) but more work is needed to determine specific high-priority sites within each range unit.

On sites not designated as high priority, desired stand density could be achieved through a mix of hand slashing, machine mastication and commercial harvesting.

Another emerging option, although still at a very early stage, is development of a local bioenergy industry that would utilize marginal wood as feedstock for small-scale heating systems. Low-priority sites could be managed for short-rotation bioenergy production, and this potential market could contribute to program goals by providing an economic incentive to thin ingrown forest stands.

The Steering Committee is taking a cautious approach in revising its restoration strategy and adopting new operational targets. Operational effectiveness while maintaining desired ecological outcomes is key. Criteria and limiting factors for various treatment options have been developed to aid in setting future targets (page 14).

AN OPEN FOREST site on Premier Ridge immediately after machine mastication in 2012. Premier Ridge, adjacent to Premier Lake Provincial Park, is a valuable winter range for elk, deer and bighorn sheep. (Randy Harris photo)

Wildlife Corridors – Another development in the committee's evolving strategic plan involves opening the forest canopy along mid-elevation mountain drainages to provide migration corridors for wild ungulates.

Denser forests in the up-slope side drainages – again, the result of fire exclusion over the past 75 years – provide poor migration routes for wild ungulates. Linking low-elevation winter ranges to spring and summer habitats through restoration is expected to facilitate migratory behaviour of elk – and reduce agriculture conflicts and grazing pressure on Trench habitats.

Non-migratory "homesteader" elk that graze year-round in the valley bottom have been a source of conflict for many decades. As forage on Crown range dwindled, cattle and wild ungulates competed for grazing in ever-diminishing areas, and domestic hayfields provided an accessible and palatable alternative for elk and deer. Restoring the productivity, sustainability and carrying capacity of Crown range was a crucial factor in establishing the ER Program in 1998.

Nevertheless, by 2001 ranchers were installing wildlife fencing to keep elk and deer off their hayfields, and by 2010 the Kootenay Elk Management Plan was calling for a 20-40% reduction in elk populations at the south end of the Trench, from Canal Flats to the US border.

The provincial government responded by expanding hunting seasons to include open seasons on elk cows and calves in a newly created low-elevation management zone in the south Trench. Elk populations were reduced by 35% – from an estimated 12,000 animals in 2008 to about 7,500 today – and antlerless elk open seasons were cancelled in 2013 to avoid further reductions.

Yet, despite the significant decrease in elk numbers, crop damage on private land has persisted. Ironically, more abundant and earlier forage on restored rangeland may be contributing to the continuing presence of homesteader elk.

Thus, a new restoration priority is to open up transitional corridors to higher-elevation summer range. These migration routes will also benefit mule deer and bighorn sheep populations which are at risk due to habitat loss.

The Steering Committee anticipates that grazing pressure on Crown range will be reduced, benefiting domestic livestock, wild ungulates and other grassland-dependent species.

HEREFORD CATTLE grazing on forested Crown range. (Randy Harris photo)

As with elk in recent years, cattle numbers have seen a similar decline, from 26,187 in 2001 to 17,320 in 2011, reflecting a 48% reduction in the number of ranching operations in the East Kootenay. There are several contributing factors: plummeting cattle prices following the 2003 BSE (bovine spongiform encephalopathy) crisis and slow recovery of critical export markets; reduced local markets due to tighter meat inspection regulations; and fewer young people opting to take over family ranches.

MID-ELEVATION FORESTS on mountain slopes have become much denser over the past century as these photos show. At left is a view of the Upper Columbia Valley from near Wilmer, photographed by Herbert Wendell Gleason. (Glenbow Archives photo #NC-53-545). On the right is the same scene 107 years later. (Randy Harris photo)

FUTURE CROWN LAND TREATMENT OPTIONS

Treatment	Criteria	Limiting Factors	Actual Averages 1997-2013	Proposed Future Treatment Options	Estimated Annual ER Program Costs
Logging	Requires sawlog volume >90m³/ha.	Forest Licence to Cut limited to <5000m³. District's current allowable annual cut for restoration = 20,000m³/yr. Limited by markets, acceptability of Douglas-fir as pulpwood, ponderosa pine as sawlog.	696 ha/yr	500 ha/yr	no direct cost
Slashing/ Spacing	Requires stand density <5000 stems/ha, <10cm diameter/stem.	High costs of $1200-$1900/ha. Logistics of burning piles, meeting venting regulations. Larger, denser stands not cost effective. No felling of trees >15cm diameter.	1008 ha/yr	1500 ha/yr	$1,125,000
Mastication	Stands of any density, any stem size. Use on non-merchantable stands with <75m³/ha sawlog volume.	Front-mounted masticators have issues on stony ground. Debris left on ground has possible effects on high-intensity fires or soil chemistry.	174 ha/yr	750 ha/yr	$1,275,000
Prescribed Burning	Site must have defendable secure boundaries, adequate fuel to generate sufficient heat to reduce stocking.	Only 2-3 burn windows per year. High costs of logistics.	921 ha/yr	2100 ha/yr (6 burns @ 350 ha)	$90,000
Bioenergy Harvest	Stems 10-25cm diameter, stands with little or no bunchgrass on site.	No local bioenergy market as yet. Factors unknown for identifying marketable stands.	–	500 ha/yr	Unknown. Ideally, no direct cost.
		TOTALS	**2,798 ha/yr**	**5,350 ha/yr**	**$2,490,000**

TARGET OPTION: Treat entire operating area once every 20 yrs = 5,350 ha/yr
TARGET OPTION: Treat 50% of operating area once every 20 yrs = 2,675 ha/yr

ER PROGRAM FUNDERS 1997–2013

The following funding sources have supported ER Program activities on Crown land. Their contributions have paid for on-the-ground restoration and fuel management treatments, scientific research and monitoring, mapping, database development, public outreach and communications. We acknowledge their support with sincere thanks.

Funding Source	Total Contribution
Job Opportunities Program	$3,460,288
First Nations Emergency Services Society	1,626,767
Land Based Investment Account	1,521,358
Fish and Wildlife Compensation Program – Columbia Region	1,542,137
Community Adjustment Fund	1,221,813
Forest Investment Account	1,085,889
Habitat Conservation Trust Foundation	809,685
Forest Renewal BC	433,490
Grazing Enhancement Fund	422,567
Steering Committee Fund – supplemented by FLNRO	408,052
Columbia Basin Trust (CBT) Environmental Initiatives Program	299,524
Community Gaming Grant	266,000
Rocky Mountain Elk Foundation	231,295
Union of BC Municipalities	203,135
BC Wildfire Management Branch	184,518
BC Ministry of Forests, Lands and Natural Resource Operations (FLNRO)	120,291
Kootenay Livestock Association (KLA) – Ministry of Forests grant	75,564
BC Ministry of Agriculture	49,058
BC Ministry of Environment	49,027
BC Cabinet Land Use Committee	46,300
CBT Grassland & Rangeland Enhancement Program – KLA	40,900
Enhanced Forest Management Program	31,437
Fraser Basin Council BC CLEAR Fund	22,500
Village of Canal Flats	20,000
Premier's Sheep Fund	19,370
BC Ministry of Transportation and Highways	16,177
Agriculture Environment & Wildlife Fund	16,000
BC Wildlife Federation	16,000
Human Resources Canada	10,033
Small Business Forest Enterprise Program	9,138
TOTAL	**$14,258,313**

RESTORATION FUNDING. Kootenay East MLA Bill Bennett and ER Program partners visit Cutts Pasture, a high-priority restoration area south of Elko. A BC community gaming grant paid for a thinning project in 2010, which was followed in October 2013 by a prescribed fire conducted by the BC Wildfire Management Branch and funded in part by the BC Land Based Investment Account. The ER Program relies on a wide range of BC government and non-government funding sources. (Susan Bond photo)

COMMUNICATIONS & OUTREACH

The Steering Committee adopted its first formal communications strategy in 2007. Main objectives of the plan included:

- develop a distinct identity for the ER Program
- develop consistent key messages
- increase public support through education and awareness
- maintain and strengthen the partner/stakeholder base through improved internal communication, and
- develop a schools outreach program.

Better external and internal communication was one of four top priorities identified by Steering and Operations Committee members at a 2008 governance workshop.

Communication activities began in 2009 with development of two logos and a tagline. This was followed in 2010 by launch of a website that featured a comprehensive online research library of historic and contemporary documents, airphotos and maps related to all aspects of fire-maintained ecosystem restoration in the Trench. As of Fall 2013, the digital library's collection holds 440 items, all of which can be searched by keyword and downloaded.

Since 2009, the ER Program has also produced print and online newsletters; distributed press releases and articles; hosted field tours for the media, public, college students and program funders; made presentations to local, regional and provincial audiences; installed temporary information signs at restoration sites; produced promotional clothing items; and attended a wide range of public events throughout the Trench.

Nature's Benefits – a 2012 project comprising brochure, slide show and portable display – focused on the ecological goods and services provided by grasslands and open forests in the East Kootenay and Upper Columbia Valley.

Currently, the ER Program's communications contractor is developing a curriculum-based program that will introduce Trench ER principles and practices to middle school science classes.

The Steering Committee's pre-2009 communication activities included two editions of *Blueprint for Action*, three productions for Knowledge Network's Westland TV series, and presentations at provincial and international conferences.

ALL SMILES. The ER Program display is a popular stop for students attending regional science fairs. (Susan Bond photos)

THE OPERATIONS COMMITTEE

BY BJ RANDALL HARRIS, RPF

The ER Program's Operations Committee plans and delivers on-the-ground restoration projects. In recent years the committee has grown in size and scope, a major step forward for effective ecosystem restoration in the Trench.

While the ER Program continues to focus primarily on the Crown landbase, it also encompasses "parallel" restoration programs in provincial and national parks, on private conservation properties and First Nations reserves. Most recently, fuel management/wildfire hazard reduction has become yet another parallel program that the ER Program facilitates under its planning and operational umbrella.

Most government and non-government agencies involved with fire-maintained ecosystem restoration in the Trench are now represented on the Ops Committee. Together these partners make for a strong coalition that cooperates on joint projects and manages for common goals across multiple land jurisdictions. The addition of new partners to the program means fire-maintained ecosystems can be restored across the landscape, rather than on a patchy, piecemeal basis.

Ops Committee members also bring professional know-how and experience to the restoration process. Foresters, technicians, wildlife biologists, agrologists and ecologists each contribute specialized knowledge of the diverse natural resources in fire-maintained ecosystems.

The committee meets three times a year. At the January planning meeting, program partners propose projects and recommend an annual workplan to the Steering Committee. In March and September they set budgets, discuss policy and priorities, and report out on completed projects.

Fuel Management – As of 2012, local governments implementing wildfire protection plans within a 2 kilometre radius of their communities have been invited to the planning meeting so their work can be coordinated with restoration workplans. For instance, more than 90% of the high-priority areas requiring treatment under the Regional District of East Kootenay's Community Wildfire Protection Plan (CWPP) are within the ER Program's operating area. First Nations implementing CWPPs in and around reserve lands also participate.

Beyond the 2 km limit of CWPPs, contiguous restoration projects have created large landscape-level fuel breaks at several locations in the Trench, and more are planned. Fuel breaks across the landscape are effective in stopping "mega" fires, extreme wildfire events which are predicted to increase as climate change progresses.

Reducing wildfire hazard around communities and across the landscape usually requires forest thinning and burning, familiar treatments to the ER Program. With some tweaks, fuel management projects can mesh with restoration objectives. In fact, prescriptions for fuel treatment designed to meet ER Program objectives can produce even more effective barriers to the spread of wildfire, and create forest stands that are more resilient to wildfire.

Randy Harris is Ecosystem Restoration Team Leader for the Rocky Mountain Natural Resource District, BC Ministry of Forests, Lands and Natural Resource Operations. A professional forester for 34 years, Randy chairs the ER Program's Operations Committee and sits on the Steering Committee as Operations liaison. He lives in Cranbrook, BC.
(Hillary Page photo)

OPS COMMITTEE members on a field trip to the Dutch-Findlay project area on the west side of Columbia Lake. This stand of mature trees, with a rich understory of native vegetation, is the restoration ideal for open forests in the Trench.
(Sue Crowley photo)

THE LIFE CYCLE OF A RESTORATION PROJECT

The process outlined here applies to restoration projects on Crown land. Projects in provincial and national parks, on private conservation properties and First Nations reserves follow similar steps but aren't bound by BC Government legislation and regulations such as the Forest & Range Practices Act, Kootenay Boundary Higher Level Plan and Ungulate Winter Range Orders, all of which apply to Crown land projects.

From planning to prescribed burning, a typical restoration project takes about five years. This article describes what's involved and some of the things we've learned.

1. PLANNING

The ER Program's operating area targets 109,400 hectares of designated Crown land. (Provincial and national parks, private conservation properties and First Nations reserves occupy an additional 32,250 hectares within the operating area.)

In 2011 the Operations Committee proposed a new planning regime for restoration on Crown land in the Trench. As of 2013 the program's previous five-year plans were replaced with:

» a Forest Stewardship Plan that spells out the ER Program's legal obligations

» a companion document that provides detailed operating guidelines, sets measurable targets and establishes monitoring protocols. (Program partners are encouraged to use this as an operations manual.)

» an annual workplan that lists specific projects, including location, size, intended treatment, cost estimate and funding source, and a five-year workplan that sets out the order and timing of restoration treatments.

Range Units – For planning purposes, the ER Program uses range units and pastures to identify project priorities and locations. A range unit is a defined area of Crown land allocated under tenure to ranching and guide-outfitting operations for livestock grazing. Range units contain from 3 to 12 pastures, each one fenced to facilitate rotational grazing.

The ER Program's operating area encompasses 40 range units and 271 pastures. Restoration plans have been prepared for all range units. Treatments are scheduled on a pasture-by-pasture basis.

Project Selection – Projects can be proposed by any ER Program partner, however, the Ops Committee's choice of projects is driven largely by established range unit priorities (page 41).

The committee uses a scoring system to evaluate and rank range units according to biological, planning and feasibility criteria. For example, presence of red- and blue-listed species, elk and bighorn sheep; biodiversity; and grassland condition are each graded against a possible total. High scores indicate high priority for restoration.

Interface fire risk, marketable forest products, off-road vehicle use, regional significance and special features are also considered in management decisions but are not used as part of the scoring. The committee introduced the scoring method in 2009 to facilitate project selection. Current priorities are based on a 2012 evaluation.

Funding – Restoration projects are funded from a variety of sources (page 15). While fund-raising is not a direct responsibility of the Ops Committee, projects with funding in place are most likely to be selected. Where a project funder targets a specific resource value, such as wildlife habitat enhancement or fuel management, that project may be implemented sooner than a project on a priority site. Funds managed by the Steering Committee are always allocated to priority restoration sites.

Referrals – The ER Team Leader refers annual workplans to stakeholders and First Nations for comment and consultation. This is important where a proposed project could affect a particular interest, such as a ranching operation's grazing plan or a First Nation's cultural resource. Where a prescribed burn is planned, for instance, the rancher must rest the site from grazing for one season before the burn and plan only light grazing in the season following. As of 2012, the Team Leader also does referrals and consultation for local governments' fuel management projects.

2. PRESCRIPTIONS

Once a project site is selected, it requires a prescription (see sample prescription in Companion Document). This is a detailed plan – usually prepared by a professional forester, biologist or agrologist – that spells out how a site will be restored, maintained and monitored.

The prescription boundary is reviewed by a "burn boss" so that individual treatment units use existing roads, streams, gullies and other topographical features as potential fireguards. Incorporating these features at the prescription stage facilitates prescribed burning. The intent is to create a “logical burn unit” of 60 to 700 hectares where fireguards are put in place only once and trees are manipulated so fuel build-up doesn’t create problems during subsequent prescribed fires.

The prescription sets specific restoration objectives and describes how a wide range of resource values – 22 in all – will be addressed if they occur on site.

Every project within 2 kilometres of housing is assessed for fire risk and fuel management, for instance. Other values taken into account include riparian areas, community watersheds, old growth forests, archaeological sites, wildlife trees, recreational trails and public utilities. Before a prescription is implemented, adjacent landowners and other interested parties are notified when work is about to begin.

The prescription divides the project site into treatment units, each of which has its own plan setting out: type of treatment; number, size, spacing and species of trees to be left on site; areas to be left untouched for wildlife purposes; and maximum allowable soil disturbance.

Invasive Plants – Also known as non-native plants or noxious weeds, invasive species are a particular concern because they damage ecosystems by displacing native vegetation. Invasives often establish after soil is disturbed by restoration treatments.

Prescriptions identify invasive plants on site and provide measures to reduce infestations, including grass seeding, chemical spraying, biological control agents and hand pulling. The ER Program contracts with the East Kootenay Invasive Plant Council to treat high-risk sites, with a special focus on eliminating spotted and diffuse knapweed, blueweed, hound’s tongue and Dalmatian toadflax.

Agrologists and other specialists on the Ops Committee have developed a “restoration” seed mix that is fast growing to control soil erosion, reduce the opportunity for invasives to establish, and act as a nurse crop for longer term recovery of native grasses. The current seed mix is subject to change as restoration practitioners track its effectiveness in meeting these objectives.

Wildlife – The ER Program manages for all wildlife found on restoration sites, with special emphasis on wild ungulates – elk, deer, bighorn sheep, moose and mountain goats – and species identified as rare or endangered. Many habitat requirements can be met by reducing tree density, increasing understory vegetation and incorporating other resource-value objectives as necessary. Where a project site contains a legally designated wildlife habitat area (WHA) for a threatened species, the prescription must contain guidance from biologists and ecologists knowledgeable about the species.

Within the ER Program operating area, WHAs have been established for these species: American badger, flammulated owl, grizzly bear, Lewis’s woodpecker, long-billed curlew, western screech owl and Williamson’s sapsucker.

3. TREE REMOVAL

The first on-the-ground treatment in restoring a site is to remove excess trees. Forest stands are thinned through commercial timber harvesting, hand slashing with chainsaws or by machine. Often a combination of thinning methods is required.

Sites are thinned to Open Range or Open Forest density. The ER Program’s target tree density for

ER PROGRAM SEED MIX 2012

Species	Percent by Weight	Percent by Species
Slender wheatgrass	35%	19%
Pubescent wheatgrass	25%	21%
Dryland alfalfa	20%	23%
Perennial ryegrass	15%	17%
Orchard grass	5%	17%

SEEDING. A road seeded after logging on a restoration site at China North Pasture, south of Ta Ta Creek. (Susan Bond photo)

PROTECTING BADGER HABITAT. A badger family emerges from a burrow at a restoration logging site where burrows were protected by a WHA. Trees around burrows were flagged and left as high stumps to indicate "no machine" zones during logging. The American badger, an endangered sub-species in BC, lives in grasslands and open forests where it finds suitable soil for digging and abundant prey in the form of ground squirrels. (Susan Bond photos)

ROCKY MOUNTAIN BIGHORN SHEEP above Columbia Lake. Bighorn sheep forage in grasslands within sight of protective forest cover. (Randy Harris photo)

MULE DEER often gather at restoration logging sites, like the one below at the Armstrong conservation property, where they browse on branches of felled trees. Mule deer thrive in habitat created and maintained by fire. Restoration treatments will improve habitat and aid in recovery of declining populations. (Susan Bond photo)

Open Range sites is 20 stems per hectare, leaving a forest canopy of about 10% cover. On Open Forest sites, the target is 150 sph, equal to forest canopy cover of roughly 25% (page 8).

One-third of retained trees in each category must be of the largest diameter found on site. This means, in practice, that remaining trees are the biggest, most mature specimens. Ecosystem restoration sites are exempt from BC's reforestation requirements.

Very occasionally, a young forest stand can be thinned with prescribed fire but the flames usually kill only seedlings under a metre tall and even then, only when there's a good fuel bed of grass and other fine fuels to generate sufficient heat.

Logging – Most stands require a mechanical thinning treatment and the preferred method – one with no direct cost to the ER Program – is to have the stand logged commercially by companies with a long-term forest tenure or a temporary licence.

The ER Program has been successful in using a special portion of the Rocky Mountain Natural Resource District's allowable annual cut to direct the issuing of five temporary non-renewable forest licences (NRFLs) to harvest 2,235 hectares of high-priority treatment areas. This yielded 171,000 cubic metres of wood to help drive the local forest industry.

The ER Program has also experimented with hiring local contractors to log sites but finding buyers for the resulting decked wood has proved difficult. It is much more cost-effective to assess a stand's timber yield then put it out to tender as a competitive forestry licence, or to issue an "occupant licence to cut" to an ER Program partner.

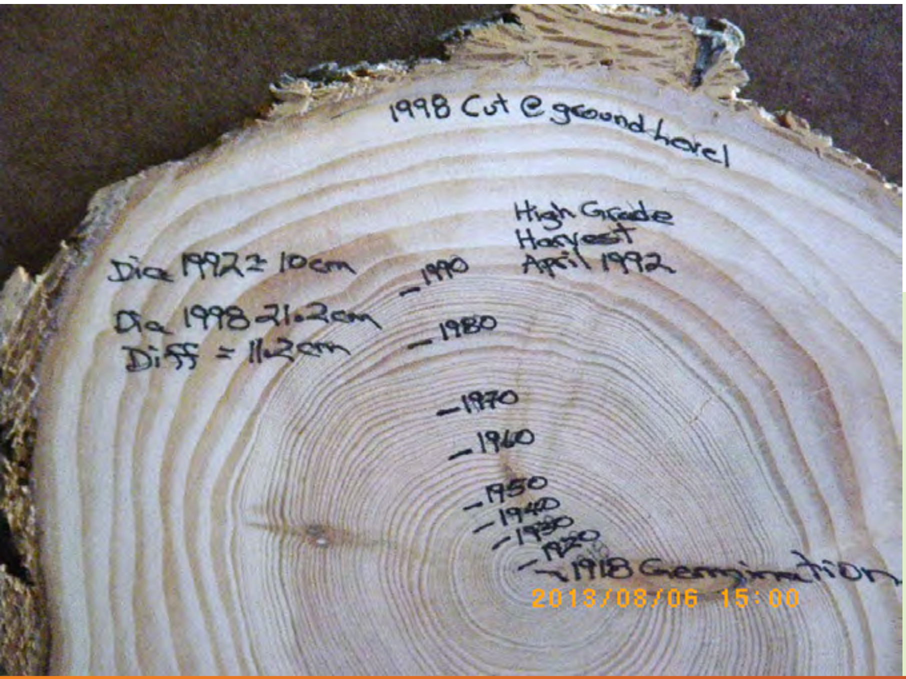
Trench Wood – The economics of logging on restoration sites is a major obstacle to commercial thinning. Restoration sites are extremely marginal wood-growing areas, producing what is known locally as "Trench" wood. Timber volume is low and the predominant species, interior Douglas-fir and ponderosa pine, are of poor quality. Douglas-fir is generally of poor form – short, with a pronounced taper, and many large limbs – making it of limited value as a sawlog, typically the most valuable timber product. Ponderosa pine is harvested mostly for pulpwood.

For the thinning process to break even, the harvested block should average at least 90 cubic metres of sawlog-sized trees per hectare. A cubic metre is the volume of wood in a telephone pole; a logging truck holds about 35m³ on average. A good stand should produce at least three logging truckloads of sawlog-sized material per hectare.

If market conditions are right and transportation costs

LOGGING. A feller-buncher cuts and piles trees on China North Pasture, at right. This restoration site was harvested by Tembec in 2011 after the company submitted a successful bid for a non-renewable forest licence.
(Susan Bond photo)

AFTER THINNING. Indian Springs Pasture, middle and Airport Pasture, bottom.
(Brian Dureski photos)



THINNING EFFECTS. This cross-section of a Douglas-fir shows the tremendous increase in growth potential when a dense forest is thinned. As the dating shows, after 70 years of very limited growth, this fir had doubled in size just 6 years after the stand near Cranbrook was thinned from an estimated 2,000-3,000 stems per hectare to 300-400 sph. The fir grew rapidly in the thinned forest because more moisture, light and nutrients became available to residual trees.
(Tree history & photo by Jeff Allen)

reasonable, trees that don't meet sawlog standards can be logged and chipped for kraft pulp production at the Skookumchuck pulp mill. Logging debris can be ground as hog fuel to produce electricity at the mill's co-generation plant. NRFLs issued in 2010-12 were used to produce pulp chips and hog fuel.

On sites where commercial logging is uneconomic, the ER Program must find funding to pay for other thinning methods.

Thinning Options – Government employment programs resulting from the 2008 global economic downturn provided the ER Program with millions of dollars in funding – and some valuable lessons. BC forestry companies were especially hard hit by the US housing crisis of the day. Five sawmills in the Trench closed their doors, one permanently, throwing 1,238 people out of work at the time.

The ER Program facilitated successful applications for $4.7 million in provincial and federal funding from the Job Opportunities Program, Community Adjustment Fund and Forest Investment Account. Between September 2008 and April 2010, program partners and others sponsored nine crews of unemployed forestry workers in Radium Hot Springs, Canal Flats, Cranbrook and Jaffray.

Job-creation grants provided 15,741 days of employment for 150 individuals who hand thinned and piled small-diameter trees on nearly 4,000 hectares of ingrown forest stands. Crews also burned piles on 630 hectares, cleared 21 hiking trails and built 2 kilometres of nature trails. Their work opened up a lot of rangeland and provided the ER Program with new insights into crew productivity and the cost effectiveness of hand slashing versus machine thinning.

Based on this experience, the program has developed a range of options to reduce forest stands where low-volume, non-merchantable wood predominates. There are four major methods.

1. Stands with trees less than 15 centimetres diameter at breast height (cm dbh) and with fewer than 2,000 stems per hectare (sph) can be thinned by hand using chainsaws. (BC's Worksafe guidelines allow only certified fallers to cut trees over 15cm dbh.) On these sites, the felled trees can be scattered to act as fuel for prescribed burns.

2. Denser stands up to 5,000 sph, with trees under 15cm dbh, can be hand thinned and the trees piled for follow-up pile burning. Burn rings must be raked and grass-seeded to reduce invasive plant growth. This method is more expensive but useful on steep slopes or sensitive soil types or stands. On sites with more than 5,000 sph, or with trees 10-15cm dbh, hand slashing becomes inefficient and too costly.

3. Mastication – using a small skid steer to cut, chip and scatter trees in one pass – works on denser stands if slopes are under 30% and trees under 15cm dbh. Mastication can eradicate both standing trees and piles.

4. Mastication by excavator-mounted chipping machines or front-mounted mastication machines are options on slopes up to 55% and stems up to 45cm dbh. These machines can usually manoeuvre between

PULP CHIPS & HOG FUEL. Harvested logs are stripped of branches and bark before being processed on site as pulp chips and loaded into "B-Train" transport trucks. Debris left after logging and chipping is ground as hog fuel. (Susan Bond/Randy Harris photos)

trees and reduce them to pulpwood-sized chips or better yet, chunks the size of a fist. This method is typically cheaper than slash and pile treatments, and soil nutrients remain on site, usually without effect to soil biochemistry.

Mastication options thin a stand in one pass at reasonable cost, while maintaining environmental values and meeting effective treatment guidelines. If a follow-up prescribed burn is missed, chips left on the ground generally will decompose within 2 to 5 years. A recent study by Tom Hobby indicates that mastication produces less greenhouse gas emissions than pile burning and may, in some cases, be a source of carbon credits.

HAND SLASHING & PILE BURNING. Crews hired with job-creation grants hand slashed, piled and burned small-diameter trees on thousands of hectares in 2008-10. (Susan Bond/Randy Harris photos)

MASTICATION. An excavator with a mounted chipping head, right, thins a dense stand on Brewery Ridge, east of Fort Steele. A skid steer, below, at work in another treatment unit on Brewery Ridge. Thinning will improve bighorn sheep and mule deer habitat. (Randy Harris photos)

WILDLIFE TREES. Veteran trees are preserved by flagging them before logging (left), and by raking flammable litter away before a prescribed burn (right). Veteran trees become valuable wildlife trees as they decay and die. Wildlife trees provide habitat for more than 70 species of birds, amphibians and mammals in BC. The ER Program has created dozens of wildlife trees using an innovative fungal inoculation method. (Kari Stuart-Smith/Randy Harris photos)

Bioenergy – The Rocky Mountain Trench Natural Resources Society, a founding partner in the ER Program, is pursuing alternative markets for Trench wood. Some opportunities exist to export raw logs to nearby US mills but demand, transportation costs and government regulations are limiting factors. In 2010, the society launched its first efforts to develop bioenergy as an option to traditional local markets.

Activities to date include a tour of Montana schools participating in Fuels for Schools – a US program that encourages public institutions to convert to wood heat – and a series of workshops on development and operation of small-scale, wood-fired heating systems.

The society has also joined forces with the Cities of Cranbrook and Kimberley, Ktunaxa Nation, aq'am (St. Mary's Indian Band) and Nupqu Development Corp. to further explore bioenergy opportunities that could make use of Trench wood and provide long-term funding for restoration and community wildfire protection projects.

Public Involvement – Community groups supporting ecosystem restoration and wildlife habitat enhancement are teaming up with ER Program partners to thin ingrown forest stands in the Trench. Numerous volunteer workbees have been sponsored by:

» Lake Windermere District Rod & Gun Club at The Nature Trust of BC's Hoodoo conservation property and Nature Conservancy of Canada's Kootenay River Ranch conservation property

» Cranbrook Community Forest Society in the interpretive forest on the outskirts of Cranbrook

» Fernie Rod & Gun Club on the Wigwam Flats near Elko. The Wigwam Flats hand-slashing project earned the club the BC Wildlife Federation's prestigious Roderick Haig-Brown Conservation Award.

4. PRESCRIBED BURNING

The next step in restoring a fire-maintained ecosystem site is to re-introduce fire with a prescribed burn – also called a broadcast burn. The first burn typically follows 2 years after a stand has been thinned to Open Range or Open Forest density.

Prescribed burning keeps tree regeneration in check, rejuvenates native grasses and shrubs, recycles nutrients into the soil, and removes debris left after thinning treatments.

Every prescribed fire requires a prescription and a burn plan, prepared by a provincially certified burn boss, that sets out measurable objectives within defined boundaries and describes ignition methods, crew requirements and safety procedures.

Prescribed burns are carried out when fuel conditions favour a low-intensity burn that can be easily controlled within pre-established fireguards, and when venting conditions comply with BC Ministry of Environment smoke control regulations. These require that smoke production is either dissipated or carried out of the airshed within 96 hours of light-up.

Challenges – The big challenges to prescribed burning are restricted burning "windows" and limited manpower. The ER Program is addressing these by expanding the burning season and turning to BC's Wildfire Management Branch for expert assistance.

Burns have typically taken place in the month of April, after snowmelt and before new plant growth is too far advanced. The program pulled off successful burns in October 2012 and 2013, and intends to schedule more fall burns to marginally increase the number of burning days each year. Even on a "good" burning day, however, successful ignition of a site can be restricted to a narrow window of a few hours when temperature and relative humidity are most favourable.

As of 2013, most fires will be conducted by the Wildfire Management Branch (WMB) which has the necessary crews and expertise. This increase in capacity is critical to the ER Program. An added benefit is that direct costs for a burn will be halved, from $70 per hectare to $27 to $39 per ha. Anticipated changes to BC legislation will allow WMB to conduct burns on non-Crown land, a potential benefit for ER Program partners.

WMB managers see prescribed burning as a good training opportunity. Seasonal firefighting crews also work on local interface fuel projects when they aren't on fire duty.

Maintenance – Follow-up maintenance burns on a restoration site should mimic the historical fire regime described in the Ecology section. Ideally, maintenance burns should be scheduled every 10 years on sites south of Skookumchuck and every 15 years north of it. To fine tune actual timing of routine maintenance, surveys should be done every five years. However the realities of resources and burning windows dictate otherwise.

Weather conditions typically allow burning on only 2 or 3 days in spring and 1 or 2 days in fall. Six to 15 prescribed burns would have to be lit on each favourable day to keep up with the schedule above, and maintain the entire ER Program operating area. Logistically this is unfeasible, and the smoke production would be huge.

As a consequence, the ER Program will focus on burning only the highest priority sites and only when those sites require a burn. Fires will not be lit unless there is a need to: reduce regenerating trees under one metre high; reduce thatches and mats of grass and herbaceous matter; rejuvenate aging shrubs; or reduce debris after thinning treatments.

Not every hectare will be fully restored as described in *Blueprint for Action 2006*. For more on the ER Program's current strategic direction, see page 12.

5. MONITORING

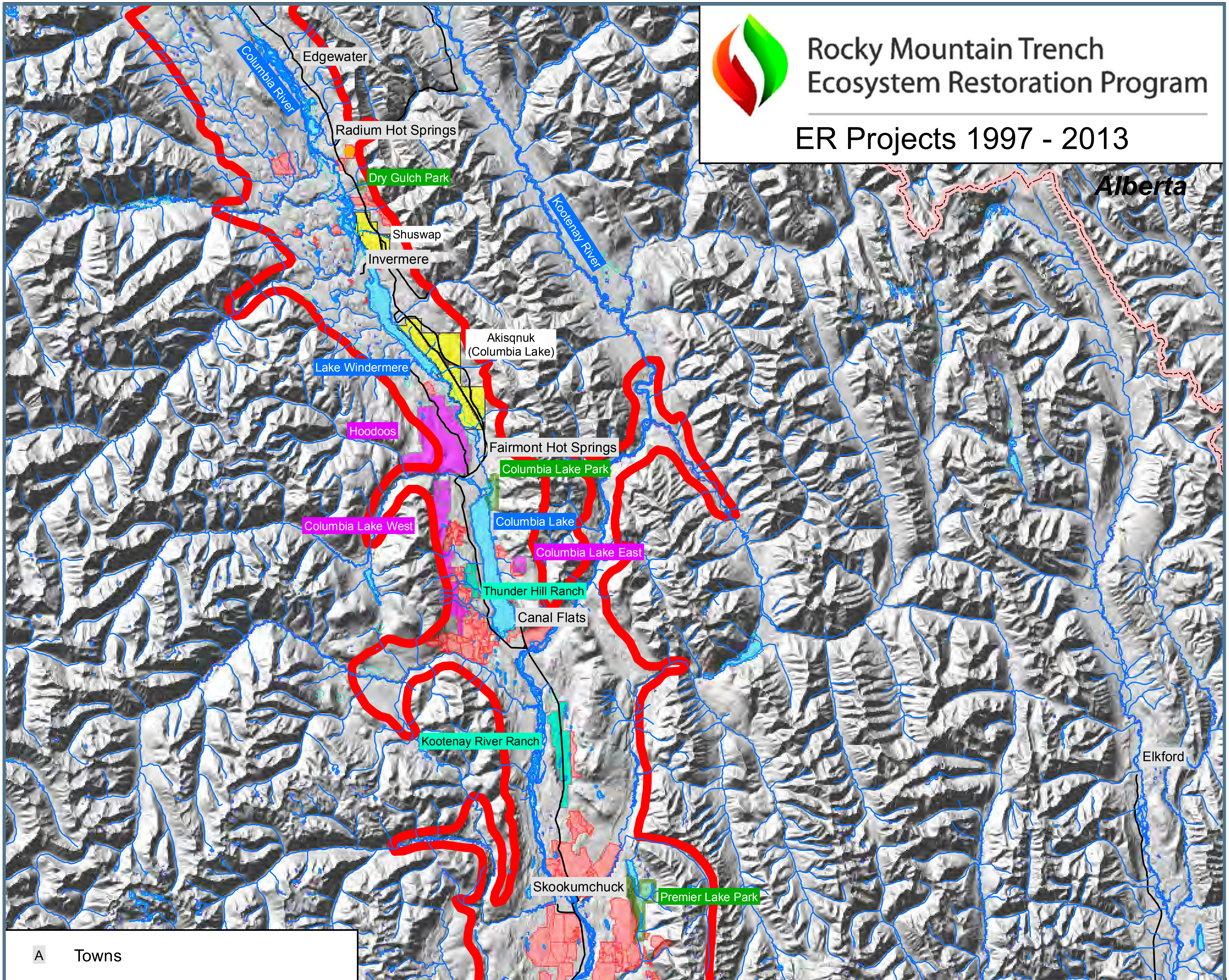
The Ops Committee is responsible for developing and maintaining a 10-year monitoring workplan. Monitoring restoration sites before and after each treatment is crucial in measuring effectiveness and ecological impacts. Monitoring provides valuable feedback on what is happening on the ground and, more importantly, assists in refining future restoration prescriptions. At this time, however, the cost of monitoring is not built into each project budget and finding funding for this essential expense can be difficult.

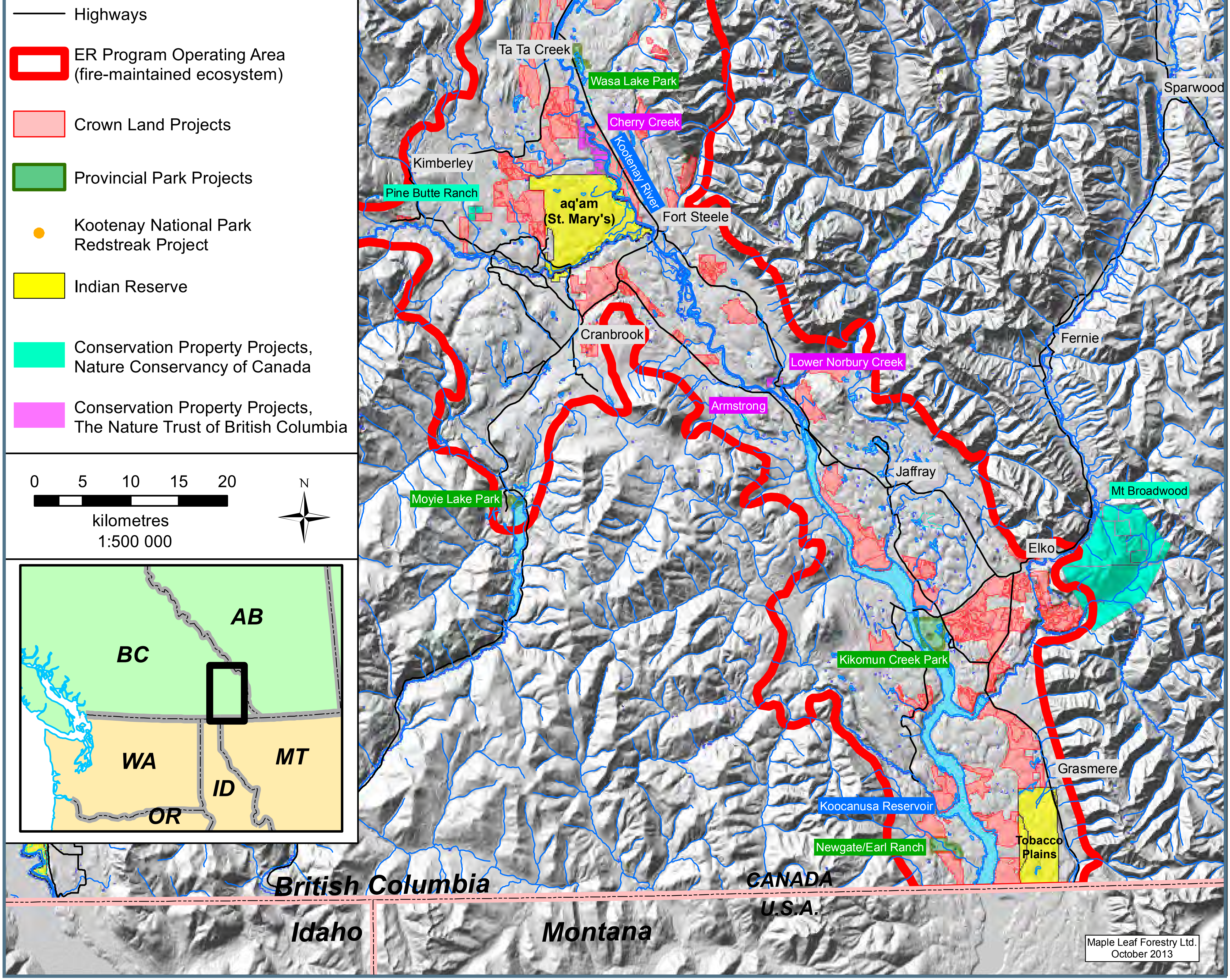
For a full discussion of monitoring, including results to date, see the Learnings section.

THE RESTORATION PROCESS. Clear Lake Pasture south of Jaffray before thinning, during a prescribed burn, and after thinning and burning. Prescribed fires are lit by ground crews using drip torches and by helicopters dropping "ping pong" balls filled with glycol that ignite on impact. (Randy Harris photos)

Rocky Mountain Trench Ecosystem Restoration Program

ER Projects 1997 - 2013




Highways
ER Program Operating Area
(fire-maintained ecosystem)
Crown Land Projects
Provincial Park Projects
Kootenay National Park
Redstreak Project
Indian Reserve
Conservation Property Projects,
Nature Conservancy of Canada
Conservation Property Projects,
The Nature Trust of British Columbia
0 5 10 15 20
kilometres
1:500 000
N
AB
BC
WA
ID
MT
OR
Ta Ta Creek
Wasa Lake Park
Cherry Creek
Kootenay River
Kimberley
Pine Butte Ranch
aq'am
(St. Mary's)
Fort Steele
Sparwood
Cranbrook
Fernie
Lower Norbury Creek
Armstrong
Jaffray
Moyie Lake Park
Mt Broadwood
Elko
Kikomun Creek Park
Grasmere
Koocanusa Reservoir
Newgate/Earl Ranch
Tobacco
Plains
British Columbia
CANADA
U.S.A.
Idaho
Montana
Maple Leaf Forestry Ltd.
October 2013

CROWN LAND TREATMENTS 1997-2013

*A hectare is counted in the total each time it is treated.

FISCAL YR Apr-March	Logging (ha)	Thinning (ha)	Slash & Pile (ha)	Pile Burning (ha)	Prescribed Burns (ha)	Prescribed Burns (#)	Grass Seeding (ha)	Total Area (ha)	Hectares in Maintenance
1997-1998	418	–	100	–	212	3	–	730	–
1998-1999	835	–	908	30	1,590	10	–	3,363	–
1999-2000	1,004	–	441	–	1,442	5	–	2,887	–
2000-2001	245	–	2,057	6	1,609	6	–	3,917	–
2001-2002	307	–	3,661	–	1,239	4	–	5,207	–
2002-2003	506	–	576	221	394	3	–	1,697	–
2003-2004	65	–	571	233	2,261	5	–	3,130	–
2004-2005	443	–	976	–	1,120	3	–	2,539	–
2005-2006	80	–	388	48	1,369	4	–	1,885	–
2006-2007	112	–	1,074	247	1,202	5	–	2,635	–
2007-2008	1,480	–	789	42	187	1	200	2,698	187
2008-2009	–	363	512	262	462	4	25	1,624	901
2009-2010	337	112	2,888	475	602	2	–	4,414	938
2010-2011	982	119	516	858	278	2	175	2,928	599
2011-2012	1,705	145	274	1,053	–	–	212	3,389	629
2012-2013	2,616	130	389	64	767	3	1,163	5,129	1,812
Annual Averages	696 ha	54 ha	1,008 ha	221 ha	921 ha	3.8 burns	111 ha	3,011 ha	317 ha
TOTALS	**11,135**	**869**	**16,120**	**3,539**	**14,734**	**60**	**1,775**	**48,172***	**5,066**

CROWN LAND PRE- & POST-TREATMENT ACTIVITIES 1997-2013

FISCAL YR Apr-March	Range Unit Plans	Prescriptions (ha)	Fireguards (km)	Monitoring Installations
1997-1998	3	–	–	–
1998-1999	4	–	–	–
1999-2000	3	–	–	1
2000-2001	8	511	–	–
2001-2002	9	260	3	3
2002-2003	4	1,512	–	3
2003-2004	–	–	1	1
2004-2005	–	1,963	–	1
2005-2006	–	203	–	3
2006-2007	–	4,038	–	–
2007-2008	–	15,784	2	2
2008-2009	–	4,033	–	–
2009-2010	–	14,943	–	–
2010-2011	–	2,467	–	1
2011-2012	–	497	–	–
2012-2013	–	884	2	–
TOTALS	**31**	**47,095 ha**	**8 km**	**15**

PIPELINE PASTURE on the Waldo North project in 2007 after first-phase logging. Koocanusa Reservoir in the foreground and on right. The front cover of *Blueprint for Action* shows a view of Pipeline Pasture in 2011. (Randy Harris photo)

THE WALDO NORTH PROJECT

The Waldo North project was developed by the Rocky Mountain Trench Natural Resources Society to demonstrate the ecological effectiveness and economic benefits of large-scale, integrated, self-financing restoration projects.

At the time it was launched in 2007, the 1,588-ha Waldo project on the northeast side of Koocanusa Reservoir was the largest ever undertaken on Crown land in the Trench.

The goal: develop a project model that would produce superior ecological outcomes and advance the ER Program at a faster pace. Key features:

» operate on a larger scale than previously

» manage the project solely for restoration outcomes

» reduce forest cover to optimum Open Range/ Open Forest densities

» remove merchantable and non-merchantable trees in one operation

» use timber sale profits to finance treatments that are not revenue producing.

The Waldo project has provided the ER Program with valuable first-hand experience in harvesting and marketing low-volume, low-value forest stands and has demonstrated the significant efficiencies in combining slashing with logging.

The Trench Society is a coalition of 10 hunting, guiding, ranching, wildlife and environmental groups, making it the ER Program's most representative public voice. The society has sponsored many restoration activities over the years, from scientific research to communications and outreach.

Waldo North remains a work in progress but it is an exemplar of innovative, big-picture thinking.

WHAT DOES IT COST?

Restoration costs vary from project to project, depending on a number of factors: site size, complexity of topography and biodiversity, forest stand density, and road access. Following are cost ranges for various restoration activities, based on 2013 prices.

Treatment/Activity	Lower	Upper
One Prescription	$5,000	$10,000
One Prescription with Timber Cruise	$8,000	$20,000
Create Wildlife Trees (inoculate or protect from fire)	$75	$250/ha
Hand Slash & Scatter Debris	$90	$500/ha
Hand Slash & Pile	$780	$1750/ha
Pile Burning & Seeding	$50	$500/ha
Machine Thinning (feller-buncher & skidder)	$1700	$2500/ha
Machine Mastication	$900	$1800/ha
One Prescribed Burn	$15,000	$35,000
Intensive Monitoring	$800	$2500 per plot

THE "PARALLEL" PROGRAMS:
Parks, Conservation Properties, First Nations

Akisqnuk First Nation – *Wendy Rockafellow, MBA, Chief Administrative Officer*

In partnership with the Fish and Wildlife Compensation Program, we are undertaking a 650-hectare ecosystem restoration project to enhance ungulate winter range and habitat for endangered species on reserve lands.

The project began in 2011 with development of the Akisqnuk Wildlife Habitat Plan, followed in 2011-13 by stand management prescriptions, environmental impact and archaeological assessments. Prescriptions called for hand slashing, pruning, piling and burning small-diameter trees, maintaining identified wildlife trees, and treating noxious weeds.

About 118 ha of Open Range and Open Forest habitat was identified for initial treatment, and 49 ha were successfully treated in 2013. Tree density on the most heavily ingrown sites was reduced from approximately 3,200 stems per hectare to 74-400 sph.

In addition, we will complete 80 ha of forest fuel reduction (community wildfire protection) work on Crown land adjacent to the restoration project. Debris piles will be burned in late Fall 2013, which will complete both projects currently scoped and funded.

Several training courses were provided to Akisqnuk First Nation crews in conjunction with these projects.

aq'am (St. Mary's Indian Band) – aq'am has initiated an 800-hectare restoration project on reserve land. Treatment began in Winter 2011-12 when Tembec logged 187 hectares.

In 2013 work proceeded on a community wildfire protection plan with 112 ha of hand slashing, piling and burning in the Eager Hills area adjacent to the reserve.

aq'am has also completed a lands inventory project, identified "leave tree" specifications, and is working to protect endangered species such as the flammulated owl and northern leopard frog.

BC Parks – *Mike Gall, Conservation Specialist, BC Parks Kootenay Okanagan Region, Ministry of Environment*

The East Kootenay was the first region in BC to use tree removal to meet ecosystem restoration objectives in a provincial park. A pilot project was approved in 1996 and since then, BC Parks has undertaken restoration projects in six parks and on conservation lands at two locations in the Trench.

However, ER in BC Parks continues to be challenged by the very high costs associated with tree removal as the largest, most commercially valuable trees are protected from harvesting. Trees that are removed are more difficult to market as usually they are not high-quality sawlogs, thus the cost per hectare for harvesting is high.

PREMIER LAKE PROVINCIAL PARK. Elk and mule deer on a thinned site. (Craig Gentle photo)

KOOTENAY RIVER RANCH. A public field tour was held at this NCC conservation property in Spring 2008, after logging the previous winter. (Susan Bond photo)

THE REDSTREAK project site in Kootenay National Park. (Susan Bond photo)

SIGNS alert the public to restoration operations underway by the Shuswap Band. (Susan Bond photo)

BC Parks also requires that all tree removal is done on frozen ground with sufficient snow cover to protect park values and limit site degradation. Planning costs tend to be higher as well given the high level of public scrutiny and need for more detailed prescriptions.

BC Parks has developed its own Best Management Practices for planning, road design and engineering, and harvesting, which set high standards for all restoration work.

We have made great progress toward meeting our ER goals and objectives for provincial parks in the Trench. The challenge in future will be to secure adequate funding to maintain treated sites over the long term.

Nature Conservancy of Canada – *Hillary Page, RPBio, Conservation Operations Coordinator, Canadian Rocky Mountains Program*

NCC's restoration objectives include: restoring habitat for threatened species, restoring grassland and open forest ecosystems, and decreasing the risk of catastrophic forest fire.

Challenges to meeting these objectives include: finding funding on an annual basis, matching funding deadlines with operations, and staff capacity to manage projects.

We have long-term vegetation management plans for three conservation properties in the Columbia Valley (Ashworth Hoodoos, Kootenay River Ranch, Thunder Hill Ranch) and intend to continue to deliver ER on all three. We are currently planning our first-ever prescribed burn.

NCC generally does mechanical thinning only in winter on snow-covered ground.

Parks Canada – A multi-year, 400-hectare ecosystem management project was launched at the south end of Kootenay National Park in 2003.

The Redstreak project has two main objectives: (1) restore grassland and open forest ecosystems that the Radium-Stoddart bighorn sheep band historically relied on for winter range, and (2) reduce dangerous forest fuel loads and the risk of catastrophic fire adjacent to Redstreak campground and the village of Radium Hot Springs.

The site was logged in Winter 2003 and prescribed burns were conducted in Spring 2005, 2009 and 2012. The site was monitored in 2005, 2006 and 2009.

Shuswap Band – *Brad Munroe, Wildlands Eco-Forestry*

An initial wildfire protection pilot project was implemented within the Shuswap Reserve in 2009. It targeted structures and Band resources within 100 metres of heavy forest fuel-loading and threatened with potential loss to wildfire.

An ER/forest fuel management program involving forested lands, grasslands and drainages within reserve boundaries was created and implemented in 2010-11.

Some aspects of this program included: forest fuel thinning, a hydrological assessment of the Shuswap and Stoddart Creek drainage systems, invasive weed update mapping and treatment, and badger habitat analysis. Successful completion of these projects evolved into development of a comprehensive Community Wildfire Protection Plan (CWPP) encompassing adjacent Crown land extending 2 km beyond reserve boundaries.

Crown land was targeted for the operational phases of the CWPP and divided into 3 phases for treatment. As of Fall 2013, the Band is completing the third and final phase of this program.

We have been able to conduct operations year-round, with minor seasonal delays during spring breakup and midwinter heavy snows. Hand falling, pile and burn techniques are preferred. Mechanized treatment includes using a Bobcat with root grapple and a harvester-forwarder to transport slash to predetermined burn locations. A line skidder was occasionally used on steep slopes, and mulching equipment where feasible.

Public acceptance of treatments initially created a challenge, especially within areas of increasing recreational use such as Dry Gulch and Juniper Heights. Positive feedback is generally increasing, however, as treatment progresses.

Beyond the objectives of WUI (wildland-urban interface) treatment, community education and training of local displaced forest workers were important aspects of each project. As a result of this training and capacity building, the Band successfully completed a large BC Hydro power line right-of-way project and has undertaken other projects on an ongoing basis.

The Nature Trust of British Columbia – *Rob Neil, RPBio, Kootenay Conservation Land Manager*

The Nature Trust launched its first restoration project in the Trench in 2004 at its Cherry Creek conservation property.

In the decade since, TNT has treated the following conservation properties: Hoodoo 293 ha, Cherry Creek 217 ha, Columbia Lake West 133 ha, Big Ranch 57 ha, Armstrong 32 ha, Lower Norbury Creek (O'Grady) 23 ha, and Musil 14 ha, for a total of 769 hectares.

Tobacco Plains Indian Band – *Scott Witbeck, RPF, Project Manager, Nupqu Development Corp.*

Our primary objective was to reduce fuel loads on Crown land adjacent to the Band community. These forest stands had a high or very high hazard risk as identified in the Band's CWPP.

Other benefits included: ecosystem restoration, range improvements and wildlife habitat enhancement.

A portion of the 2013 treatment unit included an active Christmas Tree Permit area and we worked with the permit holder to identify and implement a strategy that would not adversely affect his operation, while meeting treatment objectives.

Slashing, pruning and piling were carried out by the Tobacco Plains Indian Band Development Corp., with supervision contracted to Nupqu Development Corp. Once conditions permit, pile burning will commence, likely in Fall 2013.

BEFORE & AFTER. Logging in the winter of 2012-13 removed forest ingrowth from The Nature Trust's Lower Norbury Creek conservation property. (Rob Neil photos)

PARKS, CONSERVATION PROPERTIES & FIRST NATIONS
TREATMENTS & FUNDING 1997-2013

YEAR	LOCATION	AREA (ha)	TREATMENT	COST	FUNDING
1997-98					
BC Parks	Kikomun Creek	760	management plan	$20,000	BCP
1998-99					
BC Parks	Kikomun Creek	309	planning, tree removal, prescribed burn	$11,000	BCP
1999-2000					
BC Parks	Kikomun Creek	112	tree removal, thinning	$94,000	BCP/RMEF/HCTF
2000-01					
BC Parks	Wasa Lake	50	management plan	$2,500	BCP
2001-02					
BC Parks	Kikomun Creek	45	tree removal	$60,000	BCP
2002-03					
BC Parks	Kikomun Creek	45	tree removal, prescribed burn	$52,000	BCP/WMB
Parks Canada	Redstreak KNP	81	logging	–	Parks Canada
2003-04					
BC Parks	Kikomun Creek	42	tree removal	$125,000	BCP
	Wasa Lake	80	burn plan, tree removal	$69,000	BCP
2004-05					
BC Parks	Kikomun Creek	215	tree removal, prescribed burn, monitoring	$132,000	BCP/FWCP/WMB
2005-06					
BC Parks	Dry Gulch	20	tree removal/thinning	$48,000	BCP
	Kikomun Creek	100	planning/prescription	$39,000	BCP/HCTF
	Premier Lake	80	prescription/planning	$22,000	BCP/HCTF
	Wasa Lake	40	prescribed burn	$10,000	HCTF/BCP
Parks Canada	Redstreak KNP	–	prescribed burn, monitoring	–	Parks Canada
2006-07					
BC Parks	Premier Lake	230	tree removal, monitoring	$73,000	BCP/HCTF
	Kikomun Creek	200	monitoring	$5,000	HCTF
	Dry Gulch	5	thinning	$9,000	HCTF
NCC	Kootenay River Ranch	35	slashing	$73,200	RMEF
Parks Canada	Redstreak KNP	–	monitoring	–	Parks Canada

YEAR	LOCATION	AREA (ha)	TREATMENT	COST	FUNDING
2007-08					
BC Parks	Premier Lake	140	prescription, planning, tree removal	$432,000	BCP/ HCTF
	Moyie Lake	20	tree removal	$80,000	BCP
	Kikomun	23	thinning/mastication	$52,000	BCP/ HCTF
NCC	Kootenay River Ranch	35	pile slash	$30,000	RMEF
2008-09					
BC Parks	Kikomun Creek	90	prescribed burn, monitoring	$62,500	HCTF
	Premier Lake	90	tree removal, burn plan	$237,350	BCP/ HCTF
	Wycliffe Corridor CL	80	prescription	$8,200	HCTF
	Newgate/Earl Ranch CL	100	prescription	$6,000	HCTF
NCC	Kootenay River Ranch	23	slash & pile		
		43	burn slash piles		
		50	rehab burn piles	$83,000	RMEF/BCTPL
	Pine Butte Ranch	22 trees	create wildlife trees	$10,371	FWCP
2009-10					
BC Parks	Premier Lake	157	burn plan, thinnning/salvage, tree removal	$272,500	HCTF/BCP/JOP/LBI
	Kikomun Creek	35	thinning	$90,000	JOP/LBI
NCC	Kootenay River Ranch	87	slash & pile	$62,385	CBT/JOP
	Thunder Hill Ranch	48	slash & pile	in-kind	JOP
		19 trees	create wildlife trees	$12,500	CBT
Parks Canada	Redstreak KNP	100	prescribed burn	$65,000	Parks Canada
		–	monitoring	–	Parks Canada
Shuswap	Reserve	~35	planning/forest thinning	$99,500	NRC/SB
2010-11					
BC Parks	Premier Lake	60	prescribed burn, tree removal	$144,000	HCTF/BCP
	Moyie Lake	20	tree removal	$32,000	BCP
NCC	Kootenay River Ranch	28	mastication	$36,257	CBT
	Thunder Hill Ranch	40	burn slash piles	$38,100	RDEK/CBT
Shuswap	Reserve	~350	forest thinning/ER	$2 million	CAF/SB

YEAR	LOCATION	AREA (ha)	TREATMENT	COST	FUNDING
2011-12					
Akisqnuk	Reserve, adjacent Crown land	368	prescriptions	$34,250	FNESS/CBT/NRC
aq'am	Reserve	58	prescription	–	FNESS/NRC
BC Parks	Premier Lake	120	burn plan, attempted prescribed burn	$19,000	HCTF
NCC	Thunder Hill Ranch	10	mastication	$16,000	RDEK/CBT
Parks Canada	Redstreak KNP	150	prescribed burn	$60,000	Parks Canada
Shuswap	adjacent Crown land	~250+	planning/forest thinning	$1.3m/3 yrs	FNESS/SB
Tobacco Plains	Reserve, adjacent Crown land	349	prescriptions	$34,460	FNESS/UBCM/CBT/NRC
2012-13					
Akisqnuk	adjacent Crown land	81	slash/prune/pile	$240,000	UBCM/FNESS/AFN
	Reserve	49	slash/prune/pile	$185,000	FWCP/AFN
aq'am	adjacent Crown land	112	slash/prune/pile/burn	–	FNESS/UBCM/CBT
BC Parks	Premier Lake	290	prescribed burn, monitoring, prescription	$37,000	HCTF/BCP
	Kikomun Creek	200	monitoring	$7,700	HCTF
	Columbia Lake	200	prescription	$16,700	HCTF
Shuswap	adjacent Crown land	~250+	forest thinning	Year 2	FNESS/SB
Tobacco Plains	adjacent Crown land	89	slash/prune/pile/burn	$265,000	FNESS/UBCM/TPIB

Not included in table: The Nature Trust of BC treated 769 ha on 7 conservation properties, 2004-2013.

Abbreviations

AFN	Akisqnuk First Nation
BCP	BC Parks
BCTPL	BC Trust for Public Lands
CAF	Community Adjustment Fund
CBT	Columbia Basin Trust
CL	BC Parks Conservation Land
FNESS	First Nations Emergency Services Society
FWCP	Fish and Wildlife Compensation Program – Columbia
HCTF	Habitat Conservation Trust Foundation
JOP	Job Opportunities Program
KNP	Kootenay National Park
LBI	BC Land Based Investment Account
NCC	The Nature Conservancy of Canada
NRC	Natural Resources Canada
RDEK	Regional District of East Kootenay Columbia Valley Local Conservation Fund
RMEF	Rocky Mountain Elk Foundation
SB	Shuswap Band
TPIB	Tobacco Plains Indian Band
UBCM	Union of BC Municipalities
WMB	BC Wildfire Management Branch

WHAT MONITORING IS TELLING US

BY HILLARY PAGE, RPBIO

Hillary Page started her career as a plant ecologist in the Rocky Mountain Trench. In 1997, as an undergraduate student in Conservation Biology, she began monitoring restoration projects sponsored by the Fish and Wildlife Compensation Program. The experience lead to a Master's degree in Trench restoration effectiveness monitoring under Dr. Edward Bork, a rangeland ecology and management specialist at the University of Alberta. Hillary has worked as an independent biologist, focusing on vegetation surveys and monitoring in the Trench, and currently is the Nature Conservancy of Canada's Conservation Operations Coordinator, responsible for delivery of stewardship on NCC's Canadian Rockies properties. She lives in Invermere, BC with her husband and two young children.
(Tim Ennis/NCC photo)

Monitoring data collected at restoration sites over 12 years have produced some surprising and unexpected results. Reducing tree cover to open the forest canopy has produced good response from shrubs, an important resource for wildlife, but has not resulted in an overall increase in bunchgrasses, the principal diet of grazing cows and elk. This article presents preliminary findings from a 2013 analysis of the data.

WHY MONITOR?

Given the significant financial and human resource investment in ecosystem restoration, it is the responsibility of ER Program agencies to collect data that can inform practitioners and the public about the effectiveness of restoration treatments. Without monitoring, it is impossible to tell if restoration objectives are being achieved. Monitoring can also provide early warning signs about unintended effects or unexpected results.

Agencies that support restoration have long recognized the importance of effectiveness monitoring.

As early as 2002, Machmer et al. summarized the ecosystem restoration monitoring that had taken place in the Trench since 1999. The summary revealed there were a large number of monitoring installations (18), the bulk of which were monitoring understory – grass, shrub and forb – response to restoration treatments. Sites were located throughout the ER Program operating area. (The number of installations increased to 23 by 2011. The map on page 41 shows the current installations. Sites referenced in this article match the letters in the map legend.)

SUMMARY OF MONITORING TO DATE: *Moving toward consistency*

The 2002 Machmer summary revealed there was little consistency among data collection methods used by the various monitoring agencies. This lack of consistency made it difficult to roll up results and report on the ER Program's overall success at the Trench level.

In order to promote consistency and provide meaningful indicators of restoration effectiveness, while keeping monitoring costs reasonable, the Steering Committee at the time chose 4 objectives as high priorities from among 13 recommended in the Machmer report. The committee decided that ecosystem restoration monitoring in the Trench should measure:

1. Stand structure and overstory vegetation: crown closure, tree density, diameter, species and decay class.
2. Understory structure and composition: grass, herb and shrub per cent cover by species, species richness and composition.
3. Forage production: kilograms per hectare by species, grazed and ungrazed.
4. Status of invasive plant species: per cent cover by species, number of species.

The Steering Committee also recommended that monitoring projects use the standardized overstory and understory monitoring protocols developed in 2002 by Machmer et al. (since modified by the ER Program's Science Committee).

MONITORS AT WORK. Agrologist Gary Tipper, left, and Hillary Page measure understory vegetation at the Kootenay River Ranch monitoring installation – Site G on map page 41.
(Nigel Finney photo)

SUMMARY OF MONITORING TO DATE: *Moving toward answers*

In 2012, the ER Program tackled the enormous job of collating into one database all data collected at 23 monitoring installations between 1999 and 2011.

The database project included sites that used the Machmer protocols, as well as those that used other collection methods. Data had been collected by the Ministry of Forests, Lands and Natural Resource Operations, Rocky Mountain Trench Natural Resources Society, Fish and Wildlife Compensation Program, The Nature Trust of British Columbia and Nature Conservancy of Canada.

The next step was to examine the data and see if there were consistent ecosystem response trends emerging at the Trench level.

To reduce potential sources of variation in the data, only sites that used similar monitoring methods and had more than one year of data collection were included in the 2013 analysis. This meant that only 8 of the 23 monitoring sites were analyzed for understory vegetation cover response and only 6 sites were used to analyze production response.

("Cover" refers to aerial cover of plants; it is measured as a percentage of space occupied by specific plants within a defined plot. "Production" refers to the abundance of plant species in the plot, and is the actual weight of plant mass after drying for 48 hours in an oven.)

Monitoring at each site tracked change in the vegetation community using measurements taken before treatment and at varying intervals after treatment. Individual reports on each installation revealed significant and interesting results, but those results vary across the Trench and through time.

For example, Fish and Wildlife Compensation Program monitoring at North Stoddart Creek (Site B) revealed a significant increase in bunchgrass cover over 10 years; monitoring at Rocks Pasture (Site U) recorded a significant decline in bunchgrass cover over 9 years.

Site results also varied depending on the time elapsed between treatment and monitoring. At Kootenay National Park's Redstreak restoration project (Site A), for example, pinegrass cover did not change in the 2 years after thinning, but then declined significantly after 5 years.

In order to summarize response of the understory plant community, individual species in the database were assimilated into functional groups. Functional groups are plants with similar traits that perform similar roles in the ecosystem. They include: Forbs, Shrubs, Sedges and Non-natives. Grasses were split into three groups: Bunchgrass (fescues, junegrass, needlegrasses and bluebunch wheatgrass), Pinegrass and Other Grasses (such as bluegrasses).

Monitoring is designed to detect changes in these broad functional groups and see if the primary objective of improving the variety and abundance of native understory vegetation is being met by restoration treatments.

Variables that potentially could affect plant community response were also tracked. These included: time since treatment, biogeoclimatic zone, and type of treatment (harvest only or harvest & burn). The interactions between these treatments were also considered.

Another important variable is intensity of treatment: tree density (stems per hectare) before and after treatment. While density was reduced at all sites, before and after measures could not be included in the analysis because they were either not collected at all, or different measuring methods were used where they were collected. For instance, monitoring at some projects measured volume, while others measured crown cover. Thus, overstory data, as defined in objective 1 above, are not included here due to lack of data or inconsistent data.

UNDERSTORY VEGETATION at North Stoddart Creek – Site B on map page 41. Bunchgrass cover increased significantly over the 10-year period. (Hillary Page/ Barb Houston photos)

VEGETATION COVER RESPONSE SITES

Site		BEC Zone
A	Redstreak	IDF
B	Stoddart North	IDF
D	Hawke Road	IDF
H	Sheep Creek	IDF
I	Wolf Creek	PP
N	Old Airport	PP
O	Gina Lake	PP
U	Rocks	IDF

VEGETATION PRODUCTION RESPONSE SITES

Site		BEC Zone
D	Hawke Road	IDF
H	Sheep Creek	IDF
I	Wolf Creek	PP
N	Old Airport	PP
O	Gina Lake	PP
U	Rocks	IDF

UNDERSTORY PLANT COMMUNITY RESPONSE: *Nothing is constant except change*

The overriding story arising from the preliminary analysis is that plant community response is highly variable. Plant community response is driven by the plant community (biogeoclimatic zone), the type of treatment, and the time since treatment. These variables were accounted for in the analysis but other important variables, such as domestic and wildlife grazing, precipitation, invasive plant encroachment and recreational use, were not included.

Understory Production – Production values in the table below indicate that both sedge and shrub production have increased significantly since treatments were initiated at the 6 sites analyzed. There were no changes detected in forbs or bunchgrasses, and pinegrass production was too variable to indicate any trend.

Functional Group	Treatment Effect?[1]	
	Trend	p-value[2]
Bunchgrass	→	n/a
Sedges	↑	0.004
Forbs	→	n/a
Shrubs	↑	0.023
Pinegrass	No discernible effect	n/a
Non-natives	→	n/a

[1] Treatment Effect means the Functional Group has increased ↑ or declined ↓ significantly over time. → indicates no significant change.

[2] The p(probability)-value is a statistical value. In this case, if the p-value is less than 0.05, the data are statistically significant.

A NOTE ABOUT BIOGEOCLIMATIC ZONES:

BC's Biogeoclimatic Ecosystem Classification (BEC) is a unique system that defines and names the province's ecosystems. In the BEC system, climate is considered the principal environmental factor influencing ecosystem development. BEC has divided British Columbia into 14 broad, climatically distinct areas, usually named after the dominant climax tree species. These areas, called biogeoclimatic zones, are differentiated by distinct patterns of vegetation and soil.

The ER Program operating area contains 2 BEC zones: Ponderosa Pine, the warmest and driest zone, and Interior Douglas-fir, the second warmest.

BEC further refines ecosystem classification by identifying sub-zones and variants within each biogeoclimatic zone.

It is important to keep in mind there are inherent differences in the data based on BEC zone. For example, the table below shows that bunchgrass and forb production was higher in the Ponderosa Pine zone, while shrub production was higher in the Douglas-fir zone.

Functional Group	BEC Effect[1]	BEC Zone with higher production levels
Bunchgrass	Yes	Ponderosa Pine
Sedges	No	n/a
Forbs	Yes	Ponderosa Pine
Shrubs	Yes	Douglas-fir
Pinegrass	No	n/a
Non-natives	No	n/a

[1] BEC Effect indicates if values were significantly higher ($p<0.05$) in the Ponderosa Pine or Douglas-fir zone.

The results above must be interpreted with caution based on the type of treatment and the BEC zone. For example, although shrub production appears to have increased across both zones, it appears shrub production is actually declining in the Douglas-fir zone while increasing in the Ponderosa Pine. This indicates significant interaction effects between the treatments and the BEC zone.

Understory Cover – Based on data collected at 8 sites, there were significant differences detected in understory cover over time. This response was highly variable depending on where the site occurred (Ponderosa Pine or Douglas-fir) and the treatment.

Functional Group	Treatment Effect?[1]	
	Trend	p-value
Bunchgrass	→	n/a
Sedges	↑	0.000
Forbs	↓	0.033
Pinegrass	→	n/a
Non-natives	↓	0.022

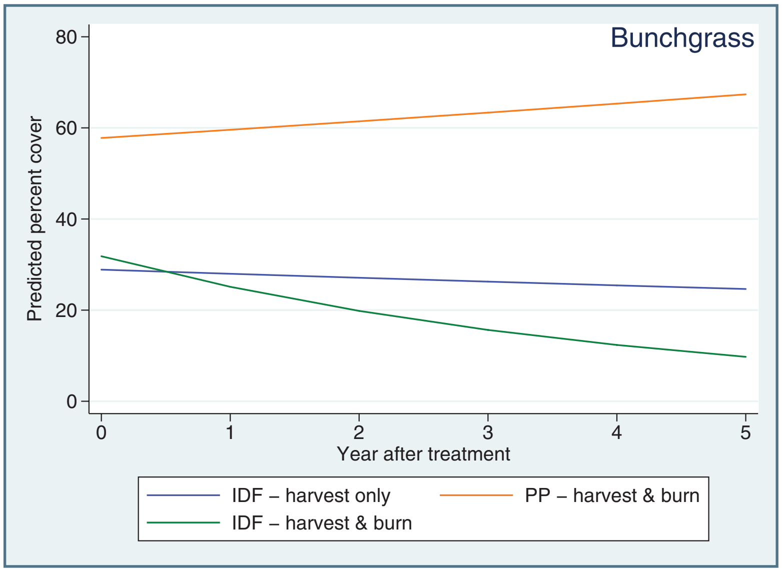
[1] Treatment Effect means the Functional Group has increased ↑ or declined ↓ significantly over time. → indicates no significant change.

Similar to production data, there were inherent differences in the cover data based on the BEC zone, as seen in the next table.

Functional Group	BEC Effect[1]	BEC Zone with higher production levels
Bunchgrass	Yes	Ponderosa Pine
Sedges	Yes	Ponderosa Pine
Forbs	Yes	Ponderosa Pine
Pinegrass	Yes	Douglas-fir
Non-natives	Yes	Douglas-fir

[1] BEC Effect indicates if values were significantly higher ($p<0.05$) in the Ponderosa Pine or Douglas-fir zone.

Bunchgrass – There was no overall trend detected for bunchgrass over all sites, as the figure below shows. Lack of trend detection is due to the fact that bunchgrass cover appears to be responding differently based on site and type of treatment. Generally, cover is significantly higher in Ponderosa Pine sites and appears to be increasing over time, whereas it is declining in the Douglas-fir sites. The difference in plant community response based on Ponderosa Pine (PP) or Douglas-fir zone (IDF) was significant.



Pinegrass – Unlike bunchgrass cover, pinegrass cover was significantly higher in the Douglas-fir sites overall. However, there is a significant treatment effect by site which means pinegrass is declining in the Douglas-fir zone, whereas it is increasing in the Ponderosa Pine zone.

Forbs – Forb cover was one of only two functional groups to decline over time after treatment across both types of sites. This response is complicated by BEC zone, as forb cover appears to be increasing at Ponderosa Pine sites and declining at Douglas-fir sites. Treatment type also significantly affects forb response.

Forbs – flowering plants that are not grasses – encompass a large number of species that will respond differently to treatments. Strawberry, for instance, will respond differently than wild onion. Individual species' response will have to be examined further to better understand forb response to restoration treatments. It should be noted that a significant decline in forb production (dry weight) was not detected.

Non-native Species – Non-native species cover has declined over time across all sites. Generally, non-native cover was higher in the Douglas-fir plots, although there was no difference detected in the response between Ponderosa Pine and Douglas-fir sites. The decline in cover is not mirrored in the production data, where no change was detected.

Sedges – Although sedge cover is higher in Ponderosa Pine sites, similar to the production response, it has increased in both vegetation zones.

WHAT ARE THE DATA TELLING US?

The lack of consistent increase in vegetation cover and production across the Trench is surprising. A common hypothesis was that opening the forest canopy would result over time in significant cover and production of bunchgrasses, forbs and shrubs (and concomitant decreases in non-natives and pinegrass).

Results shown here and at Miller Road (page 42) indicate that initial hypotheses may not be correct. Although results indicate a significant increase in shrub and sedge production, we did not witness significant increases in bunchgrasses and forbs.

Bunchgrass response is unexpected and disappointing, given its importance as forage for grazing cattle and elk. Lack of bunchgrass response could be due to several factors: variations among sites, the complexity of grassland ecology, and impacts of grazing.

"The acid test of our understanding is not whether we can take ecosystems to bits and pieces of paper, however scientifically, but whether we can put them together in practice and make them work." (A.D. Bradshaw, 1983)

DIGITAL AGE MONITORING. Leanne Colombo, range specialist with the Rocky Mountain Natural Resource District, and Kari Stuart-Smith, forest scientist with Canadian Forest Products, field test an iPad to collect monitoring data. (Randy Harris photo)

LITERATURE CITED

Bradshaw, A.D. 1983. The reconstruction of ecosystems. *Journal of Applied Ecology* 20:1–17.

Machmer, M., H.N. Page and C. Steeger. 2002. *East Kootenay Trench Restoration Effectiveness Monitoring Plan*. Submitted to: Habitat Branch, Ministry of Water, Land and Air Protection. Forest Renewal British Columbia Terrestrial Ecosystem Restoration Program. Pandion Ecological Research. Nelson, BC. 50p.

Many Trench monitoring reports are available from the online research library at the ER Program website.

The increase in shrub production, on the other hand, is good news for a variety of wildlife species. Shrubs have high nutritional value for browsing wild ungulates, especially mule and white-tailed deer, and are vital as winter forage. Shrubs also provide nesting and foraging opportunities for birds, and habitat for insects that birds eat.

In the case of non-natives and forbs, a significant decline in cover was observed, but no equivalent decline in production. Currently the data cannot explain this, but it could simply be that some plants which are common post-restoration may not occupy a large amount of space, but still have biomass. This apparent discrepancy will have to be examined further.

Despite some unexpected results, the significant decline in non-native species cover across all sites is encouraging. This indicates that restoration activities are not leading to an increase in non-native species, which was a common concern among restoration practitioners.

WHAT DID THE DATA NOT TELL US?

Examination of these data is in the early stages. The data are not telling us why the response to treatment is so variable among sites. The results have to be distilled further to clarify what effect BEC zone and treatment type have on the understory plant community, and how individual species are responding.

There is also no indication what effect cattle and wild ungulate grazing is having on the response and recovery of these plant communities. The lack of consistent overstory (tree) data, a critical measure, has significantly limited determination of cause and effect in this analysis.

Despite its deficiencies, this data set reflects the operational reality of ecosystem restoration at the landscape level. Soil, slope, aspect and other ground conditions vary widely among sites, and there are also many external factors that can influence plant response to treatment.

Keep in mind that this analysis was narrowly focused, and did not report on positive benefits such as decreased fire hazard on the landscape, increased water available for wetlands, and forests more resilient to a changing climate.

LESSONS LEARNED & NEXT STEPS

An impressive amount of monitoring data has been collated, standardized and analyzed. These data provide a general indication of understory species composition and abundance across the Trench. The data set is valuable to ecologists conducting research, and is an important first step in tackling fundamental questions that need answers.

» Is restoration meeting the stated understory objectives?

» Is restoration having any negative impact on the understory plant community?

» What effect does the BEC zone have on understory plant community response?

Moving forward from this point, it is imperative to use consistent data collection methods to ensure that data can be summarized from all sites. Monitors should ensure they have an accurate characterization of treatment intensity (stem density before and after treatment). In order to add value to the existing data set, plots where stem density was not measured can be re-assessed to quantify how many trees were removed. Re-measuring may result in clearer, more consistent response trends.

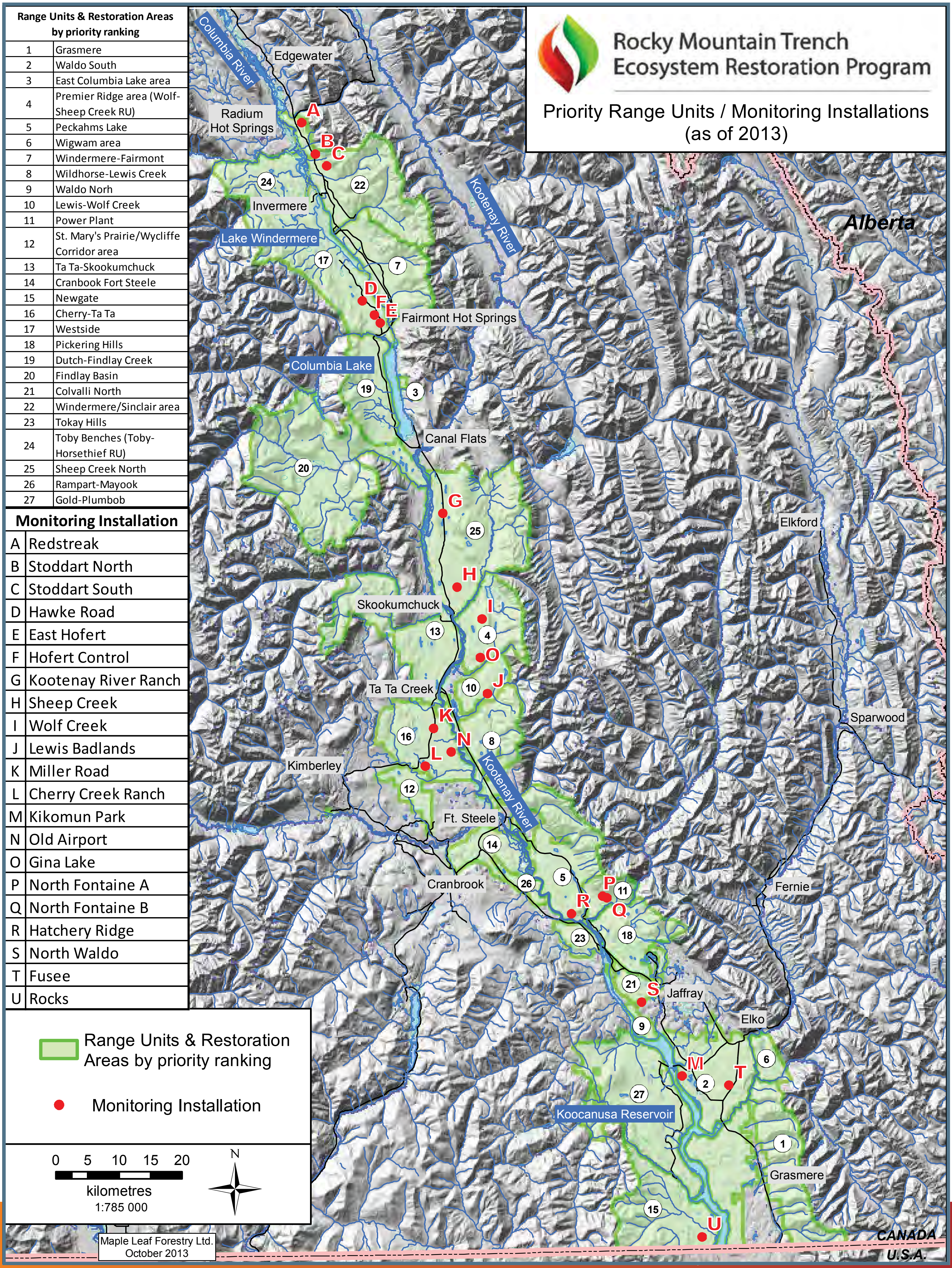
The ER Science Committee is currently working on refining both the intensive and routine monitoring protocols to ensure they can be used in tandem to determine plant community response to restoration. Intensive monitoring at select sites – combined with complementary routine monitoring at all sites – and linked to a subset of academic-level research will give the best answers.

As the next era of monitoring proceeds in the Trench, the ER Program is facilitating standardization and ease of data collection by moving into the digital age.

As part of ongoing monitoring improvements, the program is creating standard data sheets in which data fields match the fields in the ER monitoring database. Monitors will be able to record data on printed sheets or on electronic tablets. Digital data will be uploaded directly into the database.

The data fields will cover the 4 high-priority objectives set by the Steering Committee and will also include additional protocols for monitoring soil condition and wildlife habitat use.

Based on this preliminary analysis and review, the Rocky Mountain Trench Ecosystem Restoration Program can move ahead with a renewed focus on collecting data that will add value to the current data set and improve the quality of data through refined protocols and new technology.


Rocky Mountain Trench Ecosystem Restoration Program
Priority Range Units / Monitoring Installations (as of 2013)
Range Units & Restoration Areas by priority ranking
1 Grasmere
2 Waldo South
3 East Columbia Lake area
4 Premier Ridge area (Wolf-Sheep Creek RU)
5 Peckahms Lake
6 Wigwam area
7 Windermere-Fairmont
8 Wildhorse-Lewis Creek
9 Waldo Norh
10 Lewis-Wolf Creek
11 Power Plant
12 St. Mary's Prairie/Wycliffe Corridor area
13 Ta Ta-Skookumchuck
14 Cranbook Fort Steele
15 Newgate
16 Cherry-Ta Ta
17 Westside
18 Pickering Hills
19 Dutch-Findlay Creek
20 Findlay Basin
21 Colvalli North
22 Windermere/Sinclair area
23 Tokay Hills
24 Toby Benches (Toby-Horsethief RU)
25 Sheep Creek North
26 Rampart-Mayook
27 Gold-Plumbob
Monitoring Installation
A Redstreak
B Stoddart North
C Stoddart South
D Hawke Road
E East Hofert
F Hofert Control
G Kootenay River Ranch
H Sheep Creek
I Wolf Creek
J Lewis Badlands
K Miller Road
L Cherry Creek Ranch
M Kikomun Park
N Old Airport
O Gina Lake
P North Fontaine A
Q North Fontaine B
R Hatchery Ridge
S North Waldo
T Fusee
U Rocks
Range Units & Restoration Areas by priority ranking
Monitoring Installation
0 5 10 15 20
kilometres
1:785 000
N
Maple Leaf Forestry Ltd.
October 2013
Alberta
Columbia River
Edgewater
Radium Hot Springs
Invermere
Lake Windermere
Kootenay River
Fairmont Hot Springs
Columbia Lake
Canal Flats
Elkford
Skookumchuck
Ta Ta Creek
Kimberley
Sparwood
Ft. Steele
Cranbrook
Fernie
Jaffray
Elko
Koocanusa Reservoir
Grasmere
CANADA
U.S.A.

THE MILLER ROAD PROJECT 1996–2012

BY DON GAYTON, MSC, PAG

"You can't manage if you don't monitor" is a slogan we take seriously. It is not enough to simply report on hectares treated and dollars spent; the ER Program has an obligation to observe and record the actual, on-the-ground impact of restoration treatments.

Dry ecosystems respond slowly, so monitoring must span multiple years, even decades, to show end results. The Miller Road project, tracked over a period of 16 years, is our longest-monitored site.

The project was launched just as the concepts of fire-maintained ecosystem restoration were being introduced here. Sponsored by the Rocky Mountain Trench Natural Resources Society, Miller Road was designed to demonstrate that restoration of fire-maintained ecosystems was operationally and economically feasible, and had a sound scientific basis.

The project site (Site K on map page 41) encompassed 80 hectares of dry forest of varying stand density. Many of the trees were juvenile Douglas-fir. The remnant bunchgrass understory indicated that the site was previously an open grassland with widespread, predominantly ponderosa pine veteran trees.

Conditions at Miller Road were typical of many similar problem locations in the Trench.

The site was divided into four 20-hectare blocks with the intention of producing verifiable results from three different restoration treatments: Harvest Only, Burn Only and Harvest & Burn. The fourth block was a Control where no treatments were applied.

Initial vegetation measurements were taken on all four blocks in Fall 1996 by Tim Ross, a local agrologist with years of range and restoration experience in the Trench.

Galloway Lumber Co. of Jaffray, the timber licensee, logged the Harvest Only and Harvest & Burn blocks in Winter 1997. Hand slashing followed in Summer 1997.

BC Forest Service staff, with assistance from volunteers, completed prescribed fires on the Burn Only and Harvest & Burn blocks in Spring 1998.

Annual vegetation monitoring continued until 2000 and resumed in 2012. Tim's 2012 measurements provided some interesting and unexpected results when compared against 1996 pre-treatment monitoring.

By 2012, for instance, production of rough fescue, the key forage grass, had increased at only one site. In 1996 rough fescue was the leading species at all sites. By 2012 Richardson's needlegrass and pinegrass were the leading species.

The untreated Control site shows how rapidly forest cover is increasing at this typical Trench valley-bottom site – roughly half a per cent per year. And, like bank interest, this rate compounds. Of the three treatments, Harvest Only was the most effective in reducing tree cover, Burn Only the least effective.

Although not reflected in the data, increased levels of seedling and pole-sized trees, particularly Douglas-fir, were evident in all treatment blocks. This points to the importance of applying prescribed fire at repeated intervals, in conjunction with harvesting and slashing, to control tree regeneration.

Understory plant species response to the various treatments was mixed. Cover values for rough fescue were downward for all treatments. Idaho fescue and Richardson's needlegrass cover was higher at two treated sites, while no increases were found for bluebunch wheatgrass. Cover was lower at the Control for all bunchgrass species. In contrast, pinegrass cover decreased at the Harvest & Burn site, and increased at the Burn Only and Control sites.

In terms of total forage production between 1996 and 2012, increases were noted at the Harvest and Harvest & Burn sites. However, total forage production declined at the Burn Only and Control blocks.

Increased grazing by elk is a possible factor in bunchgrass decline. Bunchgrasses are important components of cattle and wildlife diets. Cattle grazing was intermittent through the years of

MILLER ROAD 2013. A field tour of the Harvest Only block in July, at left. The Harvest & Burn block in September, right. (Susan Bond photos)

	Forest Cover (%)			Rough Fescue (kg/ha)			Forage (kg/ha)		
Treatment	**1996**	**2012**	**Outcome**	**1996**	**2012**	**Outcome**	**1996**	**2012**	**Outcome**
Control	22	30	increase	132	65	decrease	752	574	decrease
Harvest Only	30	15	decrease	241	226	no change	502	590	increase
Burn Only	19	24	increase	285	147	decrease	698	501	decrease
Harvest & Burn	24	15	decrease	254	310	increase	528	642	increase

the project and stocking rates remained constant, but elk numbers in the vicinity – which is classed as ungulate winter range – increased significantly through most of the monitoring period.

Restoration treatments at Miller Road, in conjunction with extensive treatment of adjacent land in more recent years, likely have resulted in more forage. This attracts more elk and increases grazing pressure on forage species, particularly in early spring when emerging shoots are vulnerable to over-grazing.

Key findings from this study are:

» Tree cover is definitely increasing in the untreated area.

» Harvesting (partial cutting) is an effective way of reducing tree cover.

» Burn Only and Harvest & Burn were less effective than Harvest Only, but this deserves more study.

» Bunchgrass cover has increased with treatment on some sites.

» Bunchgrass cover has decreased with increasing forest cover and grazing pressure.

» Grazing and browsing may have confounded treatment effects on understory cover and forage production.

Tim Ross made some interesting observations when he presented his findings at 2013 field tours of the project.

"What I've learned is that we've still got a lot to learn," he said. "We used to think it was simple: reduce forest cover from 30% to 10% and we double forage production. Forage did double two years after treatment but now it's fallen below pre-treatment levels in some cases. We're seeing similar results at other restoration sites. It's not a straight-line increase at all. Miller Road points up the value of long-term monitoring, ideally on every restoration project site."

We have learned much since 1996. Monitoring impacts and testing new ideas is an ongoing process as we pursue ecosystem restoration in the Rocky Mountain Trench.

PREMIER RIDGE, below the Rockies, is a valuable winter range for elk, deer and bighorn sheep, and was one of the first areas in the Trench targeted for restoration. Treatments began in 1998 and were still ongoing in 2013. (Randy Harris photo)

PROGRESS AND LEARNINGS

Since its inception, the Trench ER Program has been a leader among fire-maintained ecosystem restoration practitioners in British Columbia. Our work is respected and emulated throughout the province. Yet in many ways the world of ER remains new territory for all of us.

As Don Gayton observes in the Ecology section, ecosystems are complex; restoring them is a slow and sometimes painful process that requires ongoing commitment and continuous learning.

"Adaptive management" is the process of continually improving outcomes by learning from experience. Adaptive management has been a guiding principle from the ER Program's beginning. As we approach the 20-year mark, the importance of adapting our policies and practices to reflect operational experience becomes ever more evident. Treatment techniques are improving, field operations are being re-assessed, and monitoring is providing measurable results.

Here in the Trench we know that dry ecosystems, degraded over decades, take decades to recover. So we plan, we implement, we monitor – and then we re-plan and re-implement and monitor again. We believe this continuous learning process will keep us on the right trajectory.

The job is far from done, but so long as all sectors continue to cooperate and work together, we will achieve our vision of a restored Trench landscape functioning at its ecological potential.

– THE STEERING COMMITTEE

NEW INITIATIVES

An evolving strategy, recent monitoring results, and concerns about restoration logging impacts all require new initiatives, guided by the principles of adaptive management. Over the next five years (2014-2018), the Steering Committee will pursue the following:

Strategy

» Identify and prioritize specific Open Range and Open Forest sites for full restoration treatment and continuing maintenance.
» Identify mid-elevation wildlife migration corridors for restoration.
» Continue to refine our range of treatments in response to emerging technologies and markets.

Monitoring

» All future intensive monitoring plots will follow the new protocol, and all data will be entered consistently in the ER Program monitoring database.
» Re-measure most existing intensive monitoring plots to gather: 1) BEC site series data, and 2) actual counts of trees removed and trees retained.
» Carry out a meta analysis of existing intensive data so that dissimilar methods of data collection will yield trends in vegetation response to treatment.
» The meta analysis will consider variables such as treatment timing, time elapsed since treatment, number of trees removed, and prescribed burn intensity.
» Re-write the routine monitoring protocol to more closely match the intensive protocol so that data from both routine and intensive monitoring plots can be entered in the ER Program database.

Operations

» Adopt the Best Management Practices to be recommended by the Operations Committee. Restoration logging practices have sometimes produced unacceptable outcomes related to soil disturbance and erosion, invasive plants, residual debris, and rehabilitation of roads, landings and skid trails. A new sub-committee of the Ops Committee is in process of developing a set of best management practices to address these issues. The intent is to produce an illustrated handbook for use by restoration prescription writers, harvesting planners, and logging and other contractors. As the Best Management Practices project progresses, developments will be reported in future issues of the ER Program newsletter and posted on the website.

ONGOING INITIATIVES

Adaptive Management

» Promote best planning, implementation, monitoring and management practices that incorporate current science, local and traditional knowledge and resources, efficiency and effectiveness.

Advocacy

» Advocate for improvements to existing practices, policies and legislation related to ecosystem restoration.
» Serve as a conduit for taking problems/issues raised by the Operations Committee forward for resolution at higher management levels.

Communication

» Promote public education and communication about the objectives and benefits of ecosystem restoration by maintaining an outreach/communications plan.
» Release an annual report to partners, stakeholders and the public summarizing the accomplishments of the previous year.

Planning & Operations

» Integrate all land management objectives – including First Nations traditional knowledge – within fire-maintained ecosystems.
» Carry out consultation, collaboration and discussion leading to broad-based support of ecosystem restoration objectives and methods.
» Promote synergies among agencies, stakeholder groups and First Nations by sharing knowledge, funding, resources and equipment.

Program Participation

» Invite membership by interested agencies, organizations, funding sources and First Nations that use or promote ecosystem restoration as a land management tool.

CHECKLIST OF 2006-2013 INITIATIVES

Completed

✔ Encourage and accommodate active participation by: Parks Canada (Kootenay National Park), BC Parks, BC Wildfire Management Branch, First Nations, The Nature Trust of British Columbia, Nature Conservancy of Canada and The Land Conservancy of BC.

✔ The Operations Committee will complete a "rolling" Five-Year Treatment Plan that identifies strategic project priorities and manages treatment regimens to ensure optimum results and timely follow-through. The committee will report on results and update the plan annually.

✔ The Operations Committee will complete a rolling Ten-Year Maintenance Plan.

✔ The Operations Committee will be responsible for long-term monitoring of sites to adopted standards, reporting out on results, and modification/refinement of restoration treatment practices in response to results.

✔ The Steering Committee will recommend to Rocky Mountain Forest District (now Rocky Mountain Natural Resource District) staff how the ecosystem restoration allocation in the allowable annual cut can be used most effectively to enhance the restoration program.

✔ Public education and awareness initiatives will continue and be expanded as resources permit.

In Process

✔ The Operations Committee will complete a database project to document and track restoration projects undertaken by all agencies and groups in the Trench. The deliverable will be an interactive web-based map and database, maintained bi-annually, that can be queried online by all interested parties.

✔ The Steering Committee will apply the learnings from the Rocky Mountain Trench Natural Resources Society's Waldo North project in other appropriate locations in the Trench.

Not Pursued

✘ If the Steering Committee secures dedicated Ministry of Forests (now Ministry of Forests, Lands and Natural Resource Operations) staffing and long-term funding for the program, annual treatment targets will be expanded, thus reducing the long-term 2030 treatment horizon.

✘ The Steering Committee will allocate funding to initiate forage productivity assessments to confirm and document the extent of forage production. Assessment data will be provided to the Rocky Mountain Forest District, which will devise and adjudicate a process to fairly allocate future forage increases to wildlife use and Crown range tenure holders.

RESTORATION SITE on Airport Pasture, Cherry-Ta Ta Range Unit, south of Ta Ta Creek. (Susan Bond photo)

STEERING & OPERATIONS COMMITTEE MEMBERS

STEERING COMMITTEE MEMBERS 1998-2013

(current member in **bold**, followed by previous members)

BC Ministry of Forests, Lands and Natural Resource Operations (FLNRO)

Rocky Mountain Natural Resource District

- Chair: **Steve Jablanczy**, Jamie Kroschel, Ray Morello, Greg Anderson
- Team Leader Ecosystem Restoration: **Randy Harris**

Fish & Wildlife Branch

- **John Krebs**, Doug Martin, Dave Dunbar, Irene Teske, Bob Forbes

Research Branch (no longer represented)

- Andre Arsenault

Additional BC Ministries

- Ministry of Agriculture: **Greg Tegart**
- Ministry of Environment/BC Parks and Protected Areas (position not currently filled)

First Nations

- Ktunaxa Nation Council (position not currently filled)
- aq'am/St. Mary's Indian Band (no longer represented): Julie Couse, Brian Watson
- Shuswap Band Council (position not currently filled)

Funders

- Fish and Wildlife Compensation Program (now represented by FLNRO): John Krebs

Industry

- Canadian Forest Products/Canfor (previously Tembec, Crestbrook Forest Industries): **Grant Neville**, Ken Streloff, Chris Stagg, Brian Dureski, Lloyd Havens
- Kootenay Livestock Association: **Jordy Thibeault**, Mike Malmberg, Lee Holm

Stakeholders

- East Kootenay Wildlife Association/BC Wildlife Federation: **Mark Hall**, Andy Pezderic, Glynn Killins
- FORREX (no longer represented): Don Gayton
- Parks Canada: **Jed Cochrane**, Rick Kubian, Derek Petersen, Kris McCleary, Edward Abbott
- Range Advisory Committee: **Lonnie Jones**
- Rocky Mountain Trench Natural Resources Society: **Dan Murphy**, Maurice Hansen (representing Cranbrook Archery Club, Cranbrook Community Forest Society, East Kootenay Wildlife Association, Kootenay Livestock Association, Rocky Mountain Naturalists, Southern Guides & Outfitters Association, The Land Conservancy of BC, Waldo Stockbreeders Association, Wildsight, Windermere District Farmers Institute)

OPERATIONS COMMITTEE MEMBERS 1998-2013

(current member in **bold**, followed by previous members)

- Chair: **Randy Harris**, Sue Crowley, Denis Petryshen, Darrell Regimbald, Dave White, Tom Hedin
- BC Ministry of Agriculture: **Darrell Smith**
- BC Ministry of Environment: Sue Crowley, Irene Teske, Gary Tipper
- BC Ministry of Forests, Lands and Natural Resource Operations: **Randy Harris**, **Rick Fraser**, **Allana Oestreich**, Dean Draper, Brent Lucas, Lloyd Bell, Paul White, Ray Morello, Denis Petryshen, Phil Burk, Darrell Regimbald, Dave White, Tom Hedin
- BC Parks: **Mike Gall**
- BC Range Branch: **Kenric Walburger**, **Shawna Larade**, Rae Haddow, Jodie Kekula, Rieva McCuaig, Anne Skinner
- BC Timber Sales: **Gerry Grady**
- BC Wildfire Management Branch: **Mike Morrow**, Dennis Heigh, Peter Hisch, Mike Daigle
- Canadian Forest Products/Canfor (previously Tembec, Crestbrook Forest Industries): **Ken Streloff**, Kori Vernier, Steve Temple, Barry Benson
- Fish and Wildlife Compensation Program: **Larry Ingham**, Doug Adama
- Galloway Lumber Company: **Randy Byford**, Cam Donaldson
- Grassland & Rangeland Enhancement Program: **Brian Zak**
- Kinbasket Development Corporation: **Brad Munroe**
- Ktunaxa Nation Council: Dan Wiggle
- Nupqu Development Corporation: **Scott Witbeck**, Brian Watson, Bill Redhead
- Rocky Mountain Trench Natural Resources Society: **Dan Murphy**, Maurice Hansen
- The Nature Conservancy of Canada: **Hillary Page**, Gary Tipper
- The Nature Trust of British Columbia: **Rob Neil**

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Dean Nicholson

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Tim Ross, PAg, MSc, CRMC

Patrick Stent, RPBio

Dave Struthers, PAg, BSc

Kari Stuart-Smith, PhD, RPBio

Kenric Walburger, PhD, PAg

Columbia Basin trust

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FISH AND WILDLIFE COMPENSATION PROGRAM

A partnership between BC Hydro, the Province of B.C. and Fisheries and Oceans Canada

This project is funded by the Fish and Wildlife Compensation Program (FWCP) in the Columbia region on behalf of its partners BC Hydro, the Province of BC, First Nations, and community groups, who work together to conserve and enhance fish and wildlife impacted by the construction of BC Hydro dams.

HABITAT CONSERVATION TRUST FOUNDATION

The Rocky Mountain Trench Ecosystem Restoration Program recognizes the Habitat Conservation Trust Foundation – and anglers, hunters, trappers and guides who contribute to the Trust – for making a significant financial contribution to support *Blueprint for Action 2013*. Without such support, this project would not have been possible.

BRITISH COLUMBIA

Ministry of Forests, Lands and Natural Resource Operations

NORTH CHERRY PASTURE on St. Mary's Prairie Range Unit before and after thinning. A Job Opportunities Program crew hand slashed, piled and burned small-diameter trees on 340 hectares here. Forest density was reduced from 3300-4600 stems per hectare to 168 mature sph. The site, near McGinty Lake north of Kimberley, is noted for its lupines, a native forb that grows in grasslands and open forests. (Randy Harris photos)

www.trench-er.com

Rocky Mountain Trench
Ecosystem Restoration Program

Restoring Nature's Balance.