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A NEWSLETTER OF THE CANADIAN COUNCIL ON ECOLOGICAL AREAS

www.ccea.org

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...From the CCEA Chair

This newsletter is the second for 2007, a year that marked the 25th anniversary of the Canadian Council on Ecological Areas. It has been a challenging but also a very satisfying year for CCEA. As example, the production of Council's *Northern Protected Areas Phase 2 Report* and the reprint of the very successful *Phase 1 Report* confirmed CCEA as an articulate information source for conserving protected areas ecological diversity in northern Canada.

Our CCEA colleagues, from Yukon to Newfoundland and Labrador, rolled up their sleeves this year to contribute ideas, text and discussion to the development of the *Canadian Guidebook for the Application of IUCN Protected Area Categories*. Upon translation, the report will be ready for printing early in 2008. It will serve as an important guiding document for ongoing international discussions, and it will immensely contribute to a standardized assessment of how much of Canada is protected.



Kim Pearson of the Nature Conservancy talks to workshop participants about the Waterton Front project, Canada's largest private land conservation initiative

CCEA's newsletter and the continuing improvement of CCEA's website, means that more Canadians and the protected areas community at large are becoming increasingly aware of Council's important partnership role with governments, environmental organizations and the scientific community to facilitate the establishment and management of protected areas in Canada. The recent collaborative Parks Canada-CCEA *Workshop on Ecological Restoration*

at Waterton Lakes, Alberta was a very successful gathering that heard from a host of presenters and provided an opportunity for CCEA to engage with representatives of Parks Canada, the Canadian Parks Council, and the Science and Management of Protected Areas Association (SAMPAA). In fact this newsletter is devoted entirely to a summary of proceedings from that workshop.

As we move into a new year, CCEA can be proud of its past achievements and optimistic that its work will make a significant difference for conservation in future. Council's activities in 2008 will include updating CCEA's business plan, issuing the IUCN Protected Areas Guidebook, continuing work on protected areas and climate change, communicating through the newsletter and website, and planning for the 2008 AGM and associated workshop. These and other initiatives will yield products and information that serve the protected areas community throughout Canada and beyond.

Workshop on Ecological Restoration Best Practices in Protected Natural Areas and CCEA Annual General Meeting, October 1-4, 2007

Over sixty people from Canada, the United States, and as far away as England gathered in spectacular Waterton Lakes National Park (include photo) for this year's Canadian Council on Ecological Areas (CCEA) annual general meeting and workshop. The workshop's primary focus was ecological restoration. It showcased the recently released Principles and Guidelines for

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Ecological Restoration in Canada's Protected Natural Areas and was co-hosted by Parks Canada and the CCEA.

These principles and guidelines were approved by ministers responsible for parks and protected areas in September 2007 as a pan-Canadian approach that may be adopted by individual jurisdictions and are intended to facilitate consistent, credible, informed decision-making regarding the management of common issues. The approved draft of the Principles and Guidelines can be downloaded from the CCEA web site at www.ccea.org. The final published version will be made available by Parks Canada and the Canadian Parks Council in both print and electronic formats in 2008.

Workshop Presentations

Workshop participants were energized by more than thirty high-quality presentations that showcased the groundbreaking work being done across Canada, and worldwide, to restore damaged ecosystems, create opportunities for enhanced visitor experience and public education, and support long-term community-based engagement for the conservation of our natural and cultural heritage. These presentations spanned a range of topics, from restoration of natural processes such as fire, control of invasive species, habitat recreation, species re-introductions, restoration of hydrological regimes, and landscape-scale restoration, to implications of climate change, and the roles of historical ecology, education, community engagement, cultural heritage value, and Aboriginal land care practices. Case study presentations illustrated the application of the principles and guidelines through restoration activities that were:

- *Effective* in restoring and maintaining ecological integrity
- *Efficient* in using practical and economic methods to achieve functional success
- *Engaging* through implementing inclusive processes and by recognizing and embracing interrelationships between culture and nature

Presentation abstracts are included in this volume and presentations are posted on the CCEA web site in PDF format at www.ccea.org.

Field Trips

Two stimulating (and windy!) field trips were arranged to local restoration sites. During the first, Parks Canada's Cyndi Smith and Barb Johnston shared their experiences in restoring native vegetation at a former trade waste pit within the park and discussed the complex challenges associated with the possibility of restoring a semi free ranging bison herd to the park. The second trip, led by the Nature Conservancy's Kim Pearson, took participants to the Waterton Front project, Canada's largest private land conservation initiative. In this working landscape on the park's doorstep, ranchers are working with other conservation partners towards exemplary land stewardship in which the health of the rangeland and riparian areas is maintained and enhanced.

Guest Speaker

Definitely one of the week's highlights – Dr. Jim Harris, Professor, Department of Natural Resources, Cranfield University, UK, and Chair of the Science and Policy Working Group of the Society for Ecological Restoration International, entertained and informed workshop participants with his discussion of the global context of ecological restoration – “Travels with my Auger”.

A spirit of cooperation

A spirit of cooperation permeated discussions. Participants agreed that collaboration across jurisdictions, through the Canadian Parks Council, has resulted in an approach to restoration that will have broad applicability. They pledged to continue to work together on its implementation.

The Future: Ongoing commitment and effective communication

Participants agreed that these Principles and Guidelines should be embedded in protected areas management activities and linked with other program areas such as monitoring, reporting, species recovery, public education and outreach, and visitor experience. They agreed to support the decision of parks ministers to adopt and apply them as appropriate to their particular program mandates, policies, and priorities.

They also explored a variety of formal and informal mechanisms for continuing to work together on developing ecological restoration guidance and tools and committed to convene around this issue again in the near future. They suggested that future guidance produced by this ongoing collaboration could include:

- a framework for identifying restoration needs and priorities
- ecological restoration guidelines for working landscapes
- background pieces on specific issues such as restoration and climate change adaptation, reference ecosystems/conditions, and setting restoration goals and targets, and
- web-based resources such as compilations of relevant literature.

Participants shared ideas for celebrating their restoration successes and learning from the many challenges that still exist. They felt that communication of their restoration stories in a publicly accessible, highly visual format would help build support for these activities and encourage long-term engagement. Follow-up work has begun to build upon the examples presented in Waterton Lakes National Park to develop an ecological restoration best practices compendium that will serve as an effective communications tool that can be used in Canada and around the world.

Participants encouraged each other to engage the public, partners, stakeholders and other sectors, including other government departments, non-government, academic, and community organizations, and major industrial sectors, in implementing this approach to ecological restoration nationally and internationally. Many of them signed written commitments to help promote the implementation of the Principles and Guidelines for Ecological Restoration within

their agencies and across their networks.

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Atelier sur les pratiques exemplaires en restauration écologique dans les aires protégées et assemblée générale annuelle du CCAE, du 1er au 4 octobre 2007

Plus de soixante personnes venues du Canada, des États-Unis et même d'Angleterre se sont réunies dans le magnifique parc national des Lacs-Waterton (photo) pour participer à un atelier et assister à l'assemblée générale annuelle du Conseil canadien des aires écologiques (CCAÉ). Coanimé par Parcs Canada et le CCAE, l'atelier portait principalement sur la restauration écologique et mettait en lumière une publication récente, *Principes et lignes directrices pour la restauration écologique dans les aires naturelles protégées du Canada*.

Les Principes et lignes directrices ont été approuvés par les ministres responsables des parcs et des aires protégées en septembre 2007. Ils proposent une approche pan-canadienne que toutes les instances peuvent adopter et visent à favoriser un processus décisionnel uniforme, crédible et éclairé pour la gestion d'enjeux communs. La version approuvée des Principes et lignes directrices peut être téléchargée à partir du site Web du CCAE, à l'adresse www.ccea.org. Parcs Canada et le Conseil canadien des parcs diffuseront la version définitive en format papier et électronique en 2008.

Présentations à l'atelier

Les participants à l'atelier ont eu droit à plus de trente présentations de grande qualité axées sur le travail novateur réalisé au Canada et dans le monde entier dans le but de restaurer des écosystèmes, de créer des occasions d'améliorer l'expérience du visiteur et l'éducation du public, et d'appuyer un engagement communautaire à long terme à l'égard de la conservation de notre patrimoine naturel et culturel. Ces présentations couvraient un vaste éventail de sujets : rétablissement de processus naturels comme le feu, contrôle des espèces envahissantes, récréation d'habitat, réintroduction d'espèces, restauration des régimes hydrologiques et restauration à l'échelle du paysage, incidences du changement climatique, rôles de l'écologie historique, éducation, engagement communautaire, valeurs du patrimoine culturel et pratiques de protection des terres des Autochtones. Des études de cas illustraient l'application des Principes et lignes directrices par le biais d'activités présentant les qualités suivantes :

- efficacité, pour restaurer et maintenir l'intégrité écologique;
- efficacité, par l'emploi de méthodes pratiques et économiques permettant la réussite fonctionnelle;

- engagement, par la mise en œuvre de processus inclusifs et par la reconnaissance et l'adoption des liens entre culture et nature.

Le présent volume renferme des résumés de ces présentations, lesquelles sont affichées sur le site Web du CCAE en format PDF (www.ccea.org).

Visites sur le terrain

Deux visites sur le terrain stimulantes (malgré le vent!) étaient prévues dans des sites de restaurations locaux. Au cours de la première visite, Cyndi Smith et Barb Johnston de Parcs Canada ont parlé de leur expérience de la restauration de la végétation indigène dans la fosse à déchets d'un ancien poste de traite à l'intérieur des limites du parc et des défis complexes que pose le rétablissement éventuel d'un troupeau de bisons à demi-sauvage dans le parc. La deuxième visite, dirigée par Kim Pearson de Conservation de la nature Canada, a mené les participants au site du projet de conservation du front est du parc Waterton, la plus importante initiative privée de conservation de terres au Canada. Dans ce paysage évolutif situé aux portes du parc, les ranchers et leurs partenaires de conservation collaborent à la création d'un programme exemplaire de gestion des terres permettant de maintenir et d'améliorer la santé des pâturages et des zones riveraines.

Conférencier invité

Très certainement l'un des moments phares de la semaine – M. Jim Harris, professeur au département des ressources naturelles de l'Université Cranfield, au Royaume-Uni, et président du Groupe de travail sur la science et la politique de la Society for Ecological Restoration International, a su à la fois divertir et informer les participants à l'atelier grâce à son exposé sur la restauration écologique dans le contexte mondial intitulé « Travels with my Auger » (Voyages avec ma tarière).

Un esprit de coopération

Un esprit de coopération a régné tout au long des discussions. Les participants ont convenu que la collaboration entre les instances, par l'entremise du Conseil canadien des parcs, a produit une approche de restauration d'une grande applicabilité et ils se sont engagés à continuer de collaborer à sa mise en œuvre.

L'avenir : engagement continu et communication efficace

Les participants ont convenu que les Principes et lignes directrices devraient être intégrés aux activités de gestion des aires protégées et liés à d'autres secteurs du programme comme la surveillance, l'établissement de rapports, le rétablissement d'espèces, l'éducation du public et la diffusion externe, et l'expérience du visiteur. Ils se sont mis d'accord pour appuyer la décision des ministres responsables des parcs de les adopter et de les appliquer au besoin, selon leur mandat, leurs politiques et leurs priorités propres.

Ils ont également examiné différents mécanismes officiels ou non qui leur permettraient de continuer à travailler ensemble à l'élaboration d'une orientation et d'outils sur la restauration écologique, et ils se sont engagés à se réunir de

nouveau à ce sujet dans un avenir rapproché. À leur avis, toute nouvelle orientation découlant de cette collaboration continue devrait inclure :

- un cadre pour cerner les besoins et les priorités en matière de restauration;
- des lignes directrices sur la restauration écologique des paysages évolutifs;
- des documents d'information sur des sujets particuliers, comme la restauration et l'adaptation au changement climatique, les écosystèmes/états de référence, et l'établissement de buts et de cibles de restauration;
- des ressources sur le Web, comme des compilations d'ouvrages pertinents.

Les participants ont échangé des idées sur la façon de célébrer leurs réussites en matière de restauration et de tirer des leçons des nombreux défis qu'il leur reste à relever. Ils considèrent que le fait de faire diffuser leurs récits de restauration sous une forme très visuelle et accessible au public pourrait aider à trouver des appuis pour ces activités et favoriser l'engagement à long terme. Pour faire suite à l'atelier et tirer parti des exemples présentés au parc national des Lacs-Waterton, on a entrepris de produire un recueil de pratiques exemplaires en restauration écologique qui constituera un outil de communication efficace utilisable au Canada et ailleurs dans le monde.

Les participants se sont encouragés mutuellement à mobiliser le public, les partenaires, les intervenants et d'autres secteurs (ministères gouvernementaux, organisations non gouvernementales, universitaires ou communautaires, grandes industries, etc.) afin d'appliquer cette approche de restauration à l'échelle nationale et internationale. Beaucoup d'entre eux se sont engagés par écrit à promouvoir la mise en œuvre des Principes et lignes directrices pour la restauration écologique au sein de leurs organismes et de leurs réseaux.

Abstracts of Presentations made at the Parks-Canada-CCEA Workshop on Ecological Restoration

Quantitative methods for identifying ecological benchmarks in Canada's Boreal Forest

Lee Anderson

Canada's boreal region contains a quarter of the world's remaining frontier forest, of which the majority is unprotected and publicly owned. This scenario offers Canada an unprecedented conservation opportunity. The establishment of new reserves designed to act as ecological benchmarks within a comprehensive, boreal-wide conservation network could help to conserve frontier forest and allow for adaptive resource management in areas identified for sustainable development. Ecological benchmarks conserve biophysical diversity, maintain large-scale ecological processes and enable adaptive resource management by serving as controls for understanding both the natural dynamics of ecosystems as well as their response to human activities. In the absence of such controls, we could fail to detect important changes

related to development activities that are masked by natural dynamics or we could wrongly attribute changes resulting from natural variation to development activities. In collaboration with the Canadian BEACONS Project (Boreal Ecosystem Analysis on Conservation Networks) and as part of my Master's research at the University of Alberta, I am developing quantitative methods for designing ecological benchmarks that incorporate natural disturbance, patch dynamics, connectivity and biophysical diversity. I apply these methods to a study area in southwest Yukon Territory.

Restoring plant communities at risk

Lynne Atwood

The South Okanagan Natural Gas Pipeline Restoration Project, conducted on the Vaseux-Bighorn National Wildlife Reserve, was one of the most complex native plant restoration projects in British Columbia. The ecological restoration project was a challenge because information on the South Okanagan native plant community was limited and dry-land restoration techniques rudimentary.

The restoration project consisted of five components: the collection of native seed and hand broadcast of herb and shrub seed; the salvage and transplant of perennial grasses, herbs, and shrubs; the collection and application of microbiotic crust; the hydroseeding of perennial native grasses, and; the control of noxious and invasive species.

The challenges, success, and best management practices for each of the five components will be discussed.

Restoration and natural recovery following wildfire

Lynne Atwood

The August, 2003 Vaseux Lake wildfire burned through shrub steppe and parkland forest in the Vaseux Provincial Park and Protected Area. The affected habitat is essential for many South Okanagan species at risk. A restoration project was initiated at two sites following the fire and goals were to (1) evaluate seeding options for natural burns and (2) monitor natural recovery.

Experimental plots were established to assess the success of five seed mixes and three annual cover crops and permanent transects were established to monitor natural recovery.

To date the experimental plot and transect data analysis has concluded the following:

- Sheep fescue (*Festuca ovina* - agronomic) and sand dropseed (*Sporobolus cryptandrus* - native) did very well in their seed mixes and natural regeneration of sand dropseed was high at both sites. The two species should be considered for seed mixes that are developed for South Okanagan habitats.

- Although results were dismal, fall rye was the most effective cover crop. However, site conditions and desired results should be considered carefully if fall rye is used. A heavy seeding is appropriate in intense burn areas where no seed bank regeneration is expected. The heavy seeding will reduce surface erosion. However, if natural regeneration is expected or if natural seeding will occur, a lighter seed rate should be used. Unfortunately, the lighter rate will have limited effect on weed suppression and erosion control.
- Mix 1 and Mix 4 at Leir site suppressed weeds, but why is unclear. The number of seedlings and the growth characteristics of the species could be responsible, but site factors may be influencing the result. This result should be retested.
- Three years after the fire, non-native grass and herb cover are twice that of native grass and herb cover at Brock site and native and non-native species are roughly equal at Vaseux site.
- The seeding experiments show seeding has little effect controlling weeds the year following fire and it is evident the most important restoration tool following severe wildfire is weed control.

Effective, efficient, and engaging Restoration for recovering and maintaining ecological integrity: Long Point World Biosphere Reserve Foundation Forest Restoration Program

Brian Craig, Paul Gagon and Steve Hounsell

Located in the heart of Carolinian Canada on the north shore of Lake Erie, the Long Point World Biosphere Reserve is home to over 50 species at risk. Many of these species depend upon large blocks of forest to sustain viable breeding populations. The Biosphere Reserve, blessed with over 25 percent forest cover and several large blocks of forest exceeding 500 hectares, initiated a program in 1995 to enlarge these blocks, and strengthen linkages between blocks and along riparian areas through forest restoration on protected areas and private lands. Since its inception the program has successfully restored over 400 hectares, and has developed thriving partnerships with the Long Point Region Conservation Authority and Ontario Power Generation, among many others.

This paper will describe the mechanisms that are contributing to the success of the restoration program—effectively illuminating the Canadian Parks Council's Principles and Guidelines for Ecological Restoration in Canada's Protected Natural Areas—including: natural and cultural heritage value identification; landscape condition assessment via landowner contact and involvement; goal and objective development; detailed restoration planning, implementation and monitoring via an inclusive and functional technical committee; and public engagement in the restoration activities. The paper will also briefly examine the technical aspects of ecological restoration in the Carolinian Forest Zone, including successional and canopy native species selection, planting regimes, weed control and survival assessment methods.

Ecological restoration activities in Ontario's regulated protected areas: Past, present, and future.

William J. Crins

Management activities intended to restore natural ecosystems have been conducted, at least on a limited scale, within certain protected areas in Ontario since at least 1979, when the first prescribed burn was conducted in the Ojibway Prairie Provincial Nature Reserve to restore tall-grass prairie and oak savannah. Since that time, various management techniques have been used to restore impacted ecosystems. Fire has been the predominant tool, primarily because of the rarity of tall-grass prairie and oak savannah ecosystems and the conservation concern over their retention and recovery. However, cutting of invasive woody vegetation, removal of invasive alien plants by various means, planting of native species, deer herd reductions to reduce excessive browsing, and fine-scale topographic manipulation also have been used in various protected areas in attempts to return ecosystems to states more similar to those that existed before settlement, disturbance, or invasion by alien or hyperabundant species. Examples of successful ecological restoration activities within protected areas (e.g., The Pinery, Rondeau, Turkey Point Provincial Parks) are portrayed, and lessons learned from the planning processes associated with these activities are summarized. These include the need for careful thought about the goals of the restoration activity, the need to involve and inform relevant stakeholders and publics, and the need for follow-up monitoring and adaptation of processes and methods based on that monitoring.

Mixed-severity fire regimes in the Montane Forests of the southern Rocky Mountain Trench

Lori Daniels, Jed Cochrane, Robert W. Gray

We used tree rings to reconstruct the fire history and quantify the climate conditions associated with historic fires in the montane forests of the southern Rocky Mountain Trench, including Kootenay National Park. Our work focuses on components of the landscape where historically a mixed-severity fire regime was dominant. All study stands included large-diameter western larch, Douglas-fir, or ponderosa pine trees and were in the Montane Spruce biogeoclimatic zone. Each stand was structurally complex with an upper stratum of veteran trees that established prior to 1870. Our goal is to provide baseline data on fire frequency that can be used to guide ecologically-based restoration of the historic fire regime and fuels mitigation.

Of the 30 fire history study sites, 10 sites were subjectively selected to represent old-growth forests and 20 sites were randomly selected to represent southerly, warm-aspect slopes ($n = 10$) and northerly, cool-aspect slopes ($n = 10$) in the landscape. Fire records were based on 249 fire scar samples that yielded 567 fire scars between 1509 and 2003. At the old-growth sites, the median fire intervals ranged from 10.3 to 25.6 years, with two to 123 years separating successive fires within sites. At the remaining sites, median fire return

intervals ranged from 15.5 to 77.5 years, with 5 to 138 years between fires within sites. Evidently, the old-growth sites represent a subset of the landscape in which historic fire frequency was relatively high.

Our fire scar records included only 6 fires since 1944. Time since last fire has exceeded the maximum interval between historic fires at 16 of 28 (57%) sites. Had fires burned and scarred trees as frequently throughout the 20th century as they did over the entire fire record, we would have expected 20 fire years between 1944 and 2004. The low incidence of fire scars is partly due to climate and largely due to fire suppression. Climate conditions were not conducive to fire from 1946 to 1966, but conditions suitable for fires have dominated since 1981. The low incidence of fire during the past 65 years suggests fire suppression is having a substantial impact on the fire regime of forests in the southern Rocky Mountain Trench.

We have two recommendations for managers:

1. Management decisions based on fire regime attributes must account for the full range of natural variation. In many montane forests, low to moderate severity fires burned on average every 15 to 75 years (range = 5 to 138 between fires).
2. Long fire free intervals during the 20th century are the result of climate variation and fire suppression. Where fire suppression has altered the fire regime, fuels likely have accumulated and may result in severe fires. Ongoing research in Kootenay National Park is designed to test for the impacts of fire suppression on forest composition, structure and fuels.

Restoration in action – Redstreak Restoration Project Kootenay National Park

Michael den Otter, Alan Dibb, Rick Kubian, Hilary Page Bruce Sundbo

The Redstreak Restoration project has been ongoing since 2001 with a broad objective of restoring habitat attributes of bighorn sheep (*Ovis canadensis*) winter range near Radium Hot Springs, B.C. Habitat change primarily driven by an interruption in the historic fire regime had resulted in densely stocked forests occurring on areas that had historically been occupied by open forest/grassland vegetation communities. In 2002 and 2003 we applied mechanical treatment methods to a 200 ha portion of traditional bighorn winter range in an attempt to improve habitat suitability. Treatment included timber removal with retention of clumps of veteran trees. After initial mechanical treatment the area was treated with a prescribed fire in spring of 2005. Wildlife and vegetation response were assessed. In addition to the ecological aspects of this project social response was considered through a public survey carried out in Redstreak Campground in 2003 and replicated in 2006. Results will be discussed with a focus on links to the draft Principles and Guidelines for Ecological Restoration in Canada's Protected Natural Area. In addition future directions for the project will be outlined.

Community engagement to restore and re-build Jasper's Trail Network

Jennifer Dubois

Trails connect visitors with protected areas in profound and personal ways, and are integral to a national park experience. At the same time, trail planning needs to be attentive to the very values for which protected areas exist. The Jasper Trails Project is an exciting new initiative challenged to reconfigure Jasper National Park's front-country trail network to better support ecological integrity while providing for the needs of 5,000 local community residents and 1.8 million visitors a year.

The town of Jasper and most of the park's tourism infrastructure are located in the most biologically diverse and ecologically important part of the Park. Due to site characteristics and type and level of use, a number of issues surround the 200 km trail network that radiates from the townsite. Park visitors now experience deteriorating trails that fail to take advantage of the best settings available; wildlife are displaced from once-secure movement corridors; sensitive habitats are disturbed; and trail users are often in conflict with one another. The Jasper Trails Project takes a collaborative approach by actively involving committed users, stakeholders and community residents in planning and implementing a renewed trail system through restoration, re-location and construction of trails.

Ecological restoration and ecosystems in change: The BC Parks experience

Lyle Gawalko

Recent, rapid climate change is altering weather and temperature patterns causing natural disturbances such as wildfires, floods, windstorms and insect infestations to increase in frequency, scale and intensity. In British Columbia the effects have been profound and include the provincial mountain pine beetle epidemic, the firestorm of 2003 and the windstorms of 2007. BC Parks recognizes that while ecosystems are always dynamic, the scale of recent change will require management to mitigate some of the effects of extreme natural disturbances.

Natural disturbances are allowed to take place unimpeded in BC Parks where possible. It is important; however, to ensure that natural processes do not threaten park visitors, park infrastructure, areas adjacent to parks or damage key park ecological values. The BC ecosystem management program works to proactively manage predictable natural disturbances such as wildfires so that they can take place without threatening park values or values adjacent to the park.

Parks and protected areas and areas adjacent to parks are assessed on a system level and a park level for potential risks from natural disturbances such as wildfires or forest health disturbances. Parks are also assessed for the impacts of wildfire exclusion and forest changes as a result of the mountain pine beetle infestation. When a risk or potential impact is identified, a management prescription to mitigate the risk or restore the ecosystem is prepared. Prescriptions may include mechanical fuel reduction for ingrowth removal,

tree removals for the establishment of fuel breaks and/or the application of prescribed fire for ecological restoration. To support ecosystem management activities in BC Parks, best management practices have been developed for tree removals and a working group has been engaged to design a standardized ecosystem management program.

Ecological restoration, must now consider unintended social and ecological impacts associated with climate change and rapidly changing ecosystems. The use of prescribed fire may be limited by smoke concerns, potential for invasive plants, and post fire bark beetle impacts. Forest restoration through tree removals must also consider blow down potential. Long-term climate change predictions must also be factored into restoration prescriptions. Ecosystem resilience, landscape connectivity and altered vegetation trajectories must also be considered.

To fully understand the impacts of climate change, it may be necessary to evaluate the role of the protected lands systems as serving as "lifeboats" for ecosystem resiliency. This would include undertaking resource assessments to identify the role of the parks system in climate change adaptation and reduction of ecological impacts across the landscape.

Ecological restoration in Gulf Islands National Park Reserve: Opportunities, challenges and lots of questions

Todd Columbia

Protected areas management in the Gulf Islands is atypical of most Canadian National Parks. Given that well over 90% of the park's land base is significantly modified in some way does not connote the "parkish" terms of pristine, wilderness, natural or ecological integrity. From the outset, Parks Canada has realized that ecological restoration will play a significant role in the management of those lands we are responsible for and, given the matrix of intensive land use and development pressures, the scale at which we work must include collaboration across jurisdictional boundaries while attempting to accommodate established and anticipated human demands throughout the landscape.

Since establishment in 2003, Parks Canada has initiated a range of ecological restoration projects including: Roesland beach (Seawall removal), Lyall Creek (riparian restoration and salmon recovery), Mount Warburton Pike Bluffs (removal of vehicle access), removal of invasive plants from selected sites as well as the removal of several buildings and associated infrastructure. Several of these examples will be outlined briefly to illustrate some restoration challenges and opportunities that have been identified to date and to provide an overall context for the ecological integrity program in Gulf Islands National Park Reserve.

Integrating ecological and cultural values: The evolution of Mallorytown Landing

Jennifer N. Harvey, B.L.Arch

Cultural landscapes pose interesting challenges for ecological rehabilitation. These active public areas require careful

thought, design and communication when planning changes to the environment or historic buildings within the landscape setting.

In 1904, a local family donated property to the Canadian government, for the sole purpose of establishing a national park within the famous Thousand Islands region in eastern Ontario. A picturesque pavilion was constructed on a granite island in the St. Lawrence River to mark the occasion. It was a popular spot with the local community and remained so for the next hundred years.

In 2004 however, the Landing was a very different place than what it was originally. The shoreline was hardened over time and the original pavilion changed to meet growing needs. For a long time the Landing had been manicured parkland with a constructed beach and boat launch. Cultural needs were changing and environmental concerns had put an emphasis on ecological integrity for Parks Canada. The Park had a new focus on becoming an environmental centre and a model for ecological stewardship. The hardened shoreline was no longer acceptable and the constructed beach had become a health hazard.

Over the last three years, major work was done at the Landing. The hardened shoreline has been transformed into a productive riparian zone. The pavilion has been revived and a naturalized landscape has been incorporated into a previously mown landscape. It is an example of changing values both in an aesthetic and ecological sense.

Restoration of smooth brome invaded areas in Grasslands National Park: a multi-phased approach

Darcy C. Henderson, John F. Wilmschurst, Mike Schellenberg, Robert Sissons

Grasslands National Park is the only Canadian National Park to conserve a portion of mixed-grass prairie. Prior to Park establishment much of the land was used for agricultural purposes, including flood-irrigated hay fields of smooth brome, crested wheatgrass and alfalfa. Smooth brome has subsequently spread throughout the Park, and now there is a desire to prevent further invasion and possibly restore smooth brome invaded and planted sites with native species. To help guide and evaluate the feasibility of this restoration process, it was first necessary to determine where and how smooth brome invades native plant communities, with the ultimate goal of identifying the underlying mechanisms. Through a descriptive field investigation, vegetation and soil data were collected from 47 sites where smooth brome was present or absent along soil, moisture and plant community gradients. Multivariate analyses helped determine the probability of smooth brome occurrence in various plant communities and soil landscapes, and this was qualitatively compared to maps illustrating the known distribution of smooth brome in the Park. The resulting gaps in distribution help identify native-dominant grasslands most at risk to invasion and which are high priorities for conservation actions. Simultaneously this analysis identifies the most suitable reference plant communities for evaluating restoration actions. The second phase of this research program was to use results

from the descriptive study to hypothesize on the mechanisms for invasion that could potentially be manipulated through cost effective management actions. A field experiment was designed to determine if the competitive edge for smooth brome was aboveground competition for light (manipulated by mowing), or belowground competition for moisture or nitrogen (manipulated by tillage and eradication of brome root competition). Transplanted native grasses are being monitored to determine how these factors affect survival and productivity. Mowing or grazing are inexpensive management tools that the park could easily apply to control smooth brome invasion, but tillage and eradication of smooth brome is a more expensive and destructive technique that may be less likely implemented on a large scale. Finally, a greenhouse experiment was also designed to determine if brome invasion alters the soil microbial community such that native shrub growth and survival was adversely affected. If changes in microflora are an important factor, expensive programs to eradicate smooth brome would also require some soil inoculation to further facilitate the restoration process.

The Mountain Legacy Project

Eric Higgs, Rick Arthur, Rick Kubian, Will Roush, Adrienne Shaw, Rob Watt, Graham Watt-Gremm

Ecological restoration by definition and practice depends fundamentally on history. Yet, the recent and fast-growing popularity of restoration has created a more fluid meaning for restoration that extends to almost any kind of project in which ecological principles are used to repair damage. History matters less as social, aesthetic, political, cultural and economic conventions fill the gap. Add to this rapid climate change and the value of history is further downgraded. Lessons we have learned from ecological restoration in some of Canada's mountain national parks suggest exactly the opposite conclusion. History provides an anchor for our judgments, offers insights into what might work best as a restoration strategy, tempers ambition and prevents us from making sweeping changes that violate the range of historical variation in a particular place. Working with the largest systematic collection of historical mountain photographs in the world--more than 70,000 survey images used to map the mountainous regions of western Canada in the late 19th and early 20th centuries--our team has undertaken select repeat photography to interpret and analyze the qualities and extent of change in Waterton Lakes and Kootenay national parks and the eastern slopes of the Rockies (more sites are planned). Our goal is providing finely resolved historical information for effective ecological restoration of vulnerable landscapes. This presentation provides an overview of the historical and repeat photographic surveys, the challenge presented to restoration planning by snapshots of historical information, and three specific projects based in part on the photography: disturbance regimes in subalpine forest communities of the upper Blakiston valley; mixed severity forested ecosystems in south Kootenay national park; and fire management intelligence for the vulnerable ecosystems and human communities in southwestern Alberta.

Overview of principles and guidelines for ecological restoration in Canada's protected natural areas

Karen Keenleyside, Catherine Dumouchel

Principles and Guidelines for Ecological Restoration in Canada's Protected Natural Areas were released for publication by Canada's Parks Ministers in September 2007. These Principles and Guidelines were developed on behalf of the Canadian Parks Council by a multi-jurisdictional, multi-functional working group, chaired by Parks Canada and composed of a diverse range of Canadian and international experts and managers. The document represents the first-ever Canada-wide guidance for ecological restoration practices. It promotes an integrated approach to ecosystem restoration, public education, and visitor experience.

Principles and Guidelines for Ecological Restoration in Canada's Protected Natural Areas sets out national principles for restoration that is ecologically effective, methodologically and economically efficient, and socially and culturally engaging. The principles are complemented by practical guidelines for a range of interventions as well as by a planning and implementation framework that serves as the basis for making consistent, credible and informed decisions regarding ecological restoration in protected natural areas.

These principles and guidelines describe an approach to restoration that will ensure that parks and protected areas continue to safeguard ecological integrity while providing opportunities for meaningful engagement and experiences that connect the public, communities, and visitors to these special places, and help ensure their relevance into the future. They constitute an important tool for making consistent, credible and informed decisions regarding the management of issues of common concern to parks and protected areas agencies in Canada and internationally. A companion document will be prepared that will present restoration case studies from various Canadian jurisdictions.

Lunch Creek: A case study of wilderness restoration adjacent to Going-to-the-Sun Road in Glacier National Park

Joyce A. Lapp

The Lunch Creek area is situated at an elevation of 6000 feet on the east side of the Continental Divide in northwest Montana. The creek drainage is bisected by the Going-to-the-Sun Road. In spite of its proximity to the road, the Lunch Creek drainage is managed as designated wilderness. The grandeur of high mountain peaks, cascading water falls and vivid carpets of wild flowers are extremely enticing to visitors. The rich mosaic of pristine subalpine vegetation is in close proximity to several of Glacier's state listed, sensitive plant species. Large bare areas of trampled ground are evident and there are a myriad of social trails which dead-end on slippery rock overhangs, presenting extraordinary safety hazards. The restoration of this area involved many innovative techniques to insure that our work was sustainable. We utilized a partnership with Montana State University to conduct visitor use surveys with visitors over a period of

several weeks. Some were given a GPS unit and their travel routes through the area were mapped. This allowed us to plan a trail through the area that provided safe opportunity for visitors to explore while safeguarding sensitive resources. We developed a method of producing sod mats composed of site-specific native forbs/carex/grasses that could be transported to the site and rolled into existing social trails to completely obliterate any evidence of their existence. We produced site-specific mycorrhizae to inoculate this sod and other containerized plants in our nursery, developed from propagules taken from the Lunch Creek area.

The role of Aboriginal landcare practices in contributing to effective ecological restoration.

Dennis Martinez

Parks Canada seems to me to be pursuing the long overdue task of recognizing Traditional Ecological Knowledge (TEK), both as an important component of Aboriginal culture and as of potential relevance to ecological restoration in protected areas. Parks Canada is moving beyond the older conventional Western equation of culture with material artifacts, structures, etc. But this is only part of the journey. I see a danger in the reification of traditional landcare practices into a kind of sanitized TEK--decontextualized and made understandable to Westerners speaking foreign languages like French and English--such that TEK may well be just another "product" by which aboriginal peoples can contribute to restoration standards and guidelines--but probably will not be allowed to implement in the field. The separation of TEK as a product from Traditional Landcare Practices (TLP), while satisfying current Canadian legal requirements to "consult" with tribes and thereby avoiding continual costly litigation, will not necessarily promote the continuance of TLP and, consequently, the cultural survival of Aboriginal peoples and the continuance of TEK as future tribal adaptive management strategy. TEK will only survive if it is allowed to be practiced on ceded ancestral lands. Relocation must be reversed. Co-management must be instituted--present legal barriers notwithstanding. Trust must be built. It is important for Parks Canada managers to understand the Native cultural landscape perspective: cultural activity carries more weight than the material cultural landscape that can be frozen in time. As Lisa Prosper has written (George W. Wright Forum, 24:2 2007), "...emphasis of spatial practices over material objects [or a reified TEK] allows for an approach that acknowledges the fluidity with which the relationship between culture and place is experienced over time and through space." (my italics and brackets). The most important first step in this direction for Parks Canada is to extend the current definition of "ecological integrity" (EI)--limited to abiotic environmental elements and non-human biological species--to include traditional landcare practices (TLP) as an ecosystem process as important as any other "natural" process. I will present my suggestion for amending the current EI definition based on the amended version I wrote in Sydney, B.C.

Challenges of ecosystem restoration in Ponderosa Pine, Okanagan Valley, British Columbia

Judy Millar

White Lake Grasslands Protected Area was designated in 2001 to protect red-and-blue listed wildlife species and associated habitats. These habitats include very hot and dry grasslands and open pine forests. The goal of the Project is to restore ecological resilience. The feature species of White Lake Grasslands Protected Area is the White-headed Woodpecker (WHWO) which provincially red-listed and ranked by COSEWIC as endangered. The White-headed Woodpecker requires mature ponderosa pine stands on benches and hills of the Okanagan Valley below 700 meters. Ecosystem restoration is required due to an absence of forest stand altering fire over the last century. Successful fire suppression has resulted in a shift from open forests with large veteran pines to dense forested stands of young pines and shade tolerant Douglas fir.

In addition, a risk assessment of 158 provincial parks in the southern portion of the province resulted in specific recommendations to reduce the fuel hazard in the interface area of the protected area. White Lake Grasslands was identified as a high priority with a total interface area of 3396 hectares. Interface treatment zones were identified and assessed and prescriptions were developed to create 'fuel reduced areas' within the treatment zones. This fuel treatment zones overlapped with the WHWO habitat restoration areas.

Restoration Objectives:

- To improve foraging and nesting habitats for the White-headed Woodpecker (WHWO);
- To increase ecosystem resilience against the western pine beetle.
- To reduce the forest fuel hazard in an identified wildland urban interface area.

In 2002, a restoration program was initiated to restore habitat for the WHWO. The total project area was assessed and areas were prioritized for thinning, pruning and prescribed fire. A total of 150 hectares were identified. Boundaries were marked, prescriptions were formulated, monitoring plots were established, impact assessments were completed and funds were allocated.

From 2003 to 2005 were thinned to bring the treated areas to 150 hectares. In the fall of 2005, the western pine beetle (WPB) began to infest numerous pines in the vicinity of the restoration. A survey results revealed total of 200 trees were either green attacked or red attacked (second year after initial attack).

WPB is a bark beetle which specifically attacks ponderosa pine trees and it is particularly attracted to fire or drought stressed trees. Populations of WPB have been building in the Okanagan due to a combination of low precipitation and fire stressed trees as a result of the 2003 fires.

Challenges:

Ecologically, the best option for restoring the Py/grassland community is to restore fire to the ecosystem through a series of prescribed fires that would ultimately result in approximately 150 hectares restored for WHWO and fuel reduction objectives being met to reduce wildfire impacts to a nearby community. This has substantial implications for the health of the remaining Py and associated species:

1. Non-native Invasive Plants: The treated areas are increasing being populated with invasive plant species. One of which is Sulphur Cinquefoil (*Potentilla recta*). Sulphur cinquefoil is unpalatable to grazing animals and very competitive with native plants, resulting in reduced forage for wildlife on native grasslands. It is a competitive, early successional species that can dominate sites and displace native plant species in both disturbed and undisturbed habits.
2. Western pine beetle: This bark beetle specifically attacks ponderosa pine trees and it is particularly attracted to fire or drought stressed trees. This may facilitate increasing the WPB population and ultimately decimating the remaining Py on site.

Ecological restoration in a working landscape: The Waterton Park Front Project

Kimberly Pearson

The Nature Conservancy of Canada's (NCC) Waterton Park Front (WPF) Project is Canada's largest private land conservation initiative. Approximately 30,000 acres of foothills parkland, foothills fescue grassland and montane natural subregions adjoining Waterton Lakes National Park have been conserved since 1998. The project area is maintained as a working landscape where cattle ranching continues as the dominant land use; one that has resulted in conservation of one of the highest levels of biodiversity on private land in Canada. The project also contributes to maintaining the integrity of the headwaters of the Oldman River watershed.

A national, non-profit, non-government conservation organization, NCC has secured WPF lands through two primary means. Approximately 70% of the conserved properties have been purchased by NCC; most are leased back to the original owners for cattle grazing. The remainder of the secured project area is under a number of conservation easements, which restrict the development rights on a property where the landowner retains ownership.

In addition to NCC's success in securing WPF ranchlands for long-term conservation, the project boasts a strong stewardship program in which NCC and its many partners collaborate on management challenges such as invasive species management and enhancement of range and riparian health. A large proportion of the area's native grasslands have been modified by long-term livestock grazing. Through prescription of and education on appropriate range management practices, we aim to turn those communities back toward their climax states. Off-site watering facilities are under development and riparian pastures have been created to improve the ecological health of riparian areas. Invasive plants

are inventoried annually, and control efforts are undertaken to minimize their distribution.

Long-term engagement of the local community is imperative to the success of these efforts. Since 2004, a focused extension program has engaged most of our local rancher partners and has resulted in several positive steps toward our goals of restoring and maintaining ecological integrity on the landscape. We have recently facilitated the formation of a small advisory group consisting of our on-the-ground lease and conservation easement holders to help guide our work and facilitate communications with the community. Ensuring ecological integrity and sustainable ranching in the WPF is a long-term venture. NCC and its partners are aiming toward an exemplary working landscape where agricultural and ecological values continue to thrive.

The importance of community engagement in a successful restoration project: The case of Junction Creek in Sudbury, Ontario

Carrie Regenstreif

Junction Creek runs through the City of Greater Sudbury, an urban area with a population of 150,000 people. In the early 20th century, the Sudbury landscape was devastated by logging and mining. With very few trees in the Junction Creek watershed, extensive erosion occurred and aquatic organisms became scarce.

Thirty years ago, the municipality and mining companies began a land reclamation program. With 17 million trees planted thus far in the area, water quality in Junction Creek has much improved. However, Junction Creek was still a long way from healthy when a small group of citizens organized a public forum in 1999 to discuss the possibility of restoring the waterway. About 150 people attended the event and a small group agreed to continue meeting on a regular basis, calling themselves the Junction Creek Stewardship Committee. The Committee has since received three awards, including the prestigious national Canadian Environmental Award from Canadian Geographic magazine.

Public activity has been crucial to the success of the project. Members of the committee have focused their attention on three key sectors: restoration and cleanup, education and trail accessibility. From the beginning, public involvement and empowerment has been a high priority, with members of the public taking part in planning and implementing restoration work. Hundreds of families have participated in the reintroduction of brook trout. The "Bug Search" program has been a popular component that involves school groups in monitoring water quality. Many of the same school groups also choose to participate in "Adopt-a-Creek," committing to annual clean-ups of an "adopted" section of the stream. Other community groups are also recruited for Adopt-a-Creek and for shoreline rehabilitation initiatives and trail creation. Direct contacts with schools, other community groups, local media and by cultivating a positive relationship with City councilors has resulted in the Junction Creek Stewardship Committee developing a strong, positive profile in the community.

Recent fluctuations in the alpine treeline environment: Are there implications for restoration science and practice?

William Roush

Fluctuations in treeline elevation and character over the past century globally and in the Canadian Rockies have varied in extent and magnitude. Recent climate changes are expected to have driven and continue to drive some of these changes in the alpine treeline ecotone; however localized site-specific conditions are thought to play an equal or greater role. Repeated-photographs are presented which record over a century of change in the treeline environment. These images reveal patterns of change but are unable to answer key questions concerning the reasons for the change or its temporal pattern except at a very coarse scale. Dendroecological studies from Glacier National Park, Montana, and Kootenay National Park, British Columbia provide a more detailed look at the causes and patterns of tree establishment within the alpine treeline ecotone. Restoration practice and science have rarely focused on the treeline environment and have not addressed issues posed by a rising treeline in the context of a changing climate. Initial thoughts on the subject are considered.

Understanding Vegetation Changes in Subalpine Meadows

Adrienne K. Shaw

The goal of this research is to assess tree establishment in subalpine meadow habitats in both Waterton Lakes National Park and the Castle Special Management Area. Through this investigation, historical reference conditions of subalpine meadows are evaluated through the examination of vegetation changes across the forest-meadow transition. The focus will be to identify:

1. ages of trees that have established in subalpine meadows and
2. effects of tree establishment on herbaceous meadow vegetation.

Over the past century the practice of successful fire suppression throughout the Rockies has been a factor in the advancement of forest in open meadow habitats (Barrett et al, 1999; Keane et al, 2002; Lepofsky, D. et al, 2003, Luckman, 1998; Rhemtulla et al, 2002). It is well documented that subalpine meadows have experienced a decline due to an increase in tree seedling

establishment over the past century due in part to climate change (Franklin et al, 1971, Lepofsky et al, 2003, & Magee and Antos, 1992). Subalpine meadow loss for wildlife and plant species is an ongoing concern. Wildlife presence, activity and movement throughout the landscape, particularly those of bighorn sheep and grizzly bears, are adversely affected by a reduction in both size and quality of habitat. Subalpine meadows are crucial not only for wildlife species but also for sustaining plant and landscape diversity. Despite the ensuing habitat loss and its powerful consequences, comprehensive long-term historical information detailing these changes in the southern Alberta Rocky Mountains remains

sparse. This research will provide a unique opportunity to document subalpine meadow changes for prospective ecological restoration strategies.

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Rehabilitation of the Trade Waste Pit in Waterton Lakes National Park: International cooperation in the art and science of ecological restoration

Cyndi Smith, Joyce Lapp, Dr. Anne Naeth

Waterton Lakes National Park is an area of high conservation value, uniquely located within the Crown of the Continent ecosystem, with high diversity of habitats as well as high species diversity. While it is a protected area, past activities within park boundaries have resulted in possible water and soil contamination and disturbance of native vegetation communities. One area identified as a high priority for restoration in was the Trade Waste Pit (TWP) area, located just east and north of the town of Waterton Park. The TWP was used as a dump site for a myriad of discarded materials including garbage, treated wood products, fuel, scrap metal, and other debris for over 50 years. Restoration goals for this and other contaminated sites in Waterton call for the restoration of native plant diversity and wildlife habitat, a significant reduction in the spread of invasive plants and overall to reduce the ecological footprint of park management activities. The surrounding grassland is dominated by rough fescue and oat grass, a vegetation community recognized in the Park Management Plan as an Ecologically Sensitive Area.

With those goals in mind Waterton biologists embarked on an aggressive program to undertake contaminated sites assessment and restoration planning for the TWP, in partnership with Dr. Anne Naeth, Department of Renewable Resources, University of Alberta, and Joyce Lapp from Glacier National Park's Native Plant Program. Initial work included the installation of water monitoring wells to provide ongoing soil/water contents/contamination analysis, removal or burial of waste materials, the collection and propagation of native plant materials for restoration plantings, and weed eradication. For two years prior to project implementation, crews from Glacier as well as volunteers and students assisted Waterton staff in the collection of many kilograms of native grass, forb and shrub seeds. These collections were taken from ecosites in Waterton that were similar to the TWP, to insure that the material would be ecologically matched to the

project site. This seed was taken back to Glacier, cleaned and stored for future seeding, or used to propagate containerised materials for planting into the site.

In the fall of 2006, staff from Waterton, Dr. Naeth and many graduate students worked with Glacier's revegetation crew to plant over 3600 plants in two days. All plants were mapped by species and location and their survival and growth will be rigorously monitored over the next several years. Monitoring will also be conducted to evaluate effectiveness of planting containerized material vs. seed, spring vs. fall timing and of several horticultural treatments, such as the use of fertilizer.

The knowledge gained in this restoration endeavour will enable both parks to pursue other restoration projects at much less cost, and will be transferable to other land managers

Prescribed fire in Alberta: Restoration of an ecological process

Chris Stockdale

Fire is the predominant historical disturbance in the majority of Alberta's ecosystems. Fires come from two primary sources: lightning and humans. While lightning fires have been a part of the evolution of vegetation complexes through all of history, human caused fires have been influential for only a fraction of this time. However, it is arguable that virtually every corner of the globe has been influenced by anthropogenic fire use directly or indirectly. In western North America, this process has largely been interrupted over the past hundred or more years, and we are only beginning to appreciate the impacts of fire suppression and exclusion on the landscape. Many fire dependent species and communities are on the decline. Fire dependence not only refers to serotiny in plants, but dependence upon the process of fire to maintain community structure. Treeline is found at higher elevation, and grasslands and meadows are disappearing in the face of forest encroachment. Late seral stage tree species are more dominant on the landscape today than a century ago. Not only does this result in the loss of the area available to species dependent upon fire-origin communities, but the connectivity of these patches begins to diminish, changing population structure dramatically. In areas that once would have been dominated by surface fire and mixed fire regimes, the increased connectivity of closed canopy, multi-layered forests shifts the potential disturbance to intense crown-fire regimes. Furthermore, these large contiguous stretches of lodgepole pine that originated following the era of landscape fire exclusion are now at risk to the mountain pine beetle epidemic that has swept across BC, and is poised to continue its eastward progression. While this may be viewed as a natural phenomenon, it is nonetheless a major management issue. Prescribed fire is one of several tools that are available for ecological restoration and forest health regulation. The prescribed burn program in Alberta has undergone significant changes in the past several years. While prescribed burning has been conducted for decades on a small scale for the purposes of hazard reduction in the wildland-urban interface and for grazing land improvement, the current thrust of the program is at the landscape scale.

The objectives of this program are to begin to restore historical fire regimes and to minimize landscape susceptibility to disease and insect epidemics. There are many barriers that hinder the implementation of prescribed fire plans. These barriers can be placed in three categories: 1) those related to gaining consensus, 2) creating the right prescription, and 3) operational constraints. This talk will focus on clarifying what these barriers can be, lessons we have learned in facing them, and how we have managed to overcome them

Jumping Through Hoops

Albert van Dijk

Aquatic ecosystem restoration is no simple matter. Parks Canada and other agencies evolve in a highly regulated environment involving numerous legal obligations. Improved science often means more complicated solutions. This presentation will show the process that lead to using rotenone to restore native fish populations in La Mauricie National Park of Canada (its legal, regulatory, scientific and public relations implications).

Consilience and ecological restoration in Banff National Park, Canada

Clifford A. White, Ian R. Pengelly and Jesse Whittington

Ecosystem management in Banff National Park (BNP) was initially premised on providing economic benefits through tourism, followed by a period natural regulation with minimal planned human interference or restoration. More recently, park management has followed an ecological integrity, long-term range of variability paradigm to restore ecosystems. The ecosystem management process involved four broad components: 1) Developing ongoing collaboration groups constituted from a wide-range of stakeholder interests; 2) providing groups with multi-disciplinary knowledge; 3) decision making based upon interdisciplinary understanding (consilience) provided through collaborative input to managers, and 4) implementation of actions through an adaptive management approach. Application of this process is described for restoring the montane ecosystem where indicators included human dimensions (economic and social), and distribution and densities of humans, grizzly bear (*Ursus arctos*), black bear (*U. americanus*), wolf (*Canis lupus*), cougar (*Felix americanis*), elk (*Cervus elaphus*), beaver (*Castor canadensis*), trembling aspen (*Populus tremuloides*) and willow (*Salix* spp.). Restoration actions included prescribed burning, mitigating highway effects with fences and wildlife crossing structures, and restoring wildlife corridors by facility relocation and human use management. The synergy created by a diverse and interested citizenry, well informed with knowledge from a variety of sources, and interacting with scientists and managers, was essential to adaptive management and innovative ecological restoration in BNP.