Columbia Mountians Institute of Applied Ecology

Summaries of Presentations

Fifth Annual Roads, Rails and Environment Workshop

March 13-14, 2001
Revelstoke BC

The Columbia Mountains Institute of Applied Ecology hosted this workshop. About 85 people attended the one and a half days of presentations at the Revelstoke Community Centre. Sponsors for this event included:

> Armtec Limited, Affected Areas and Communities Initiatives Program (Columbia Basin Trust), BC Rail, Canadian National Railway, Canadian Pacific Railway, CCI Industries/ Coast Masonry Supplies, EBA Engineering Consultants Ltd., Insurance Corporation of British Columbia, Parks Canada / Mount Revelstoke and Glacier National Parks, Summit Environmental Consultants Ltd.

Summaries are listed in the order that they were presented.

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1. Environmental Impacts of New Technology in Winter Maintenance

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The presentation explained the various new technologies being introduced in the Winter Maintenance community within British Columbia. This included explanations on: what is anti-icing; automated stationary systems; pre-wetting; and road weather information systems and how do they work. The presentation then moved into the various environmental studies conducted on these technologies around the world and in British Columbia. The presentation concluded with an update on what is currently being done in respect to environmental issues and winter maintenance.

2. Road Salt and Migratory Bird Mortality

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This research project is coordinated by Pierre Mineau, Environment Canada, pierre.mineau@ec.gc.ca

About 4240 kilotonnes of sodium chloride are used on roadways in Canada each year as a de-icing agent. Road salt is widely acknowledged to be an important factor in attracting large mammals to roads and it does appear to increase the frequency of vehicular collisions. Less well known is the fact that road salt also attracts several bird species, notably cardueline finches, to roads.

The evidence to date suggests that the ingestion of salt crystals increases the vulnerability of birds to car strike by causing impairment. Furthermore, intake calculations suggest that road salt may poison some birds directly, especially when water is not freely available during severe winters. This was verified in the laboratory by means of a dosing study with House sparrows. Furthermore, clinical signs observed in the laboratory match anecdotal reports and observations that have been made at roadside. This presentation will provide the basis of a risk assessment for road salt and cardueline finches and explore possible mitigation.

(See also the article titled “Honking Helps Highway Flyers” in the Park Perspectives section of the Columbia Mountains Institute web site, *www.cmiae.org*)

3. The Integration of Environmental Information into Daily Operations for CP Rail

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No abstract provided.

4. The Role of Disturbance in Lake Evolution and Littoral Development, and Implications to Restoration

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Disturbance (defined as a climatic, morphometric or edaphic phenomenon, which changes the minimal structure of the ecosystem) has long been recognized as an important factor affecting community structure and dynamics. Recent emphasis has

been placed on considering disturbance as a natural process that occurs at different spatial and temporal scales.

Although short-term detrimental effects to fisheries resources by disturbances such as mass loading are well documented, salmonids and other native fishes have co-existed with naturally occurring landslides for millennia after the last deglaciation, especially in areas of steep and unstable terrain.

This paper presented a discussion of lake succession and long-term effects to aquatic ecosystems (lakes in particular) of sediment loading and nutrient input from natural disturbances (e.g., debris torrents, landslides and rock falls). Drawing on evidence from long-term studies of landslides and of artificial reefs, the paper investigated the concept of disturbance and change as an integral and necessary part of lake ecosystem structure, function and evolution.

The premise of the argument relies on paradigms of stochastic change and elastic stability proposed and discussed by researchers who advocate a “nature evolving” view of ecological behaviour and the role of disturbance in the context of interrelated ecosystem functions (*exploitation, conservation, creative destruction*, and *mobilization*). Further, the paper reviewed the present status of ecosystem management and restoration within the context of the above paradigms. The need for an expansion of the frame of reference for ecosystem restoration was discussed together with new approaches being advocated by ecosystem managers, who stress the sustainability of ecological integrity (including structural, functional and landscape components).

5. The Use of Constructed Wetlands in Highway Runoff Treatment

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The quality of water that drains from highway surfaces begins to degrade when traffic volumes exceed 5,000 vehicles per day. As traffic volumes increase, the potential for worsening of pollutant levels in highway runoff also increases. This is a concern if the potentially polluted runoff is discharged directly to receiving waters that are sensitive to impact, whether they be fish-bearing waters or domestic drinking-water supplies.

The BC Ministry of Transportation and Highways made a commitment to address the environmental design of highway drainage at an early stage of the Vancouver Island Highway Project. Both pollution prevention and pollutant removal measures were considered by the Ministry. To effectively remove pollutants from highway runoff, water quality treatment systems were designed as part of the highway. Constructed wetlands are one of the water quality treatment systems used, with 36 constructed wetlands having been built along the Vancouver Island Highway to date and 18 planned for completion during the summer of 2001.

This presentation covered the environmental design of highway drainage and focussed on the use of constructed wetlands as a means of preventing the discharge of pollutants to sensitive receiving waters. The contaminants of concern during the operation of the highway, criteria for determining the need for this level of treatment, and design considerations were discussed.

6. Fish Habitat Protection and Right-of-Way Maintenance: A Regulatory Perspective

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The presentation focussed on two key maintenance activities - ditch and culvert maintenance. We gave some background on the various laws governing this type of work and permits required. The body of the talk looked at good and bad practices currently in use and an exploration of available mitigative techniques to perform these activities more sensitively.

7. Beavers: A Keystone Species

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Beavers are considered a keystone species, creating and enhancing much of the wetland habitat that formerly existed throughout North America. Wide-spread and apparently successful public education and stewardship programs about the very high value of wetlands have been implemented throughout North America. Parallel programs for streams stewardship and fish enhancement also exist. Despite the high and widely recognized value of wetlands to essentially all fish and wildlife, beavers continue to be viewed as nuisances - in terms of roads and other development in riparian areas, as well as a problem for sport fish production due to some dams blocking off access to spawning habitat.

The problem in coming to terms with beavers is probably the result of:

- Historical losses: beaver are still at remnant population levels, riparian zones are narrower and flood plains impoverished by the absence or relatively low numbers of beavers.

- Widespread development and alteration of riparian zones, particularly flood plains, beavers' primary habitat. Beaver damming activities then flood farm fields, settlement and road systems.
- A static view of fish habitat that is finally being replaced by one that recognizes the dynamic, changing nature of fish and other aquatic habitat. This new paradigm recognizes that natural processes, including infrequent landslides and floods and ongoing tree-fall, runoff events, debris jams and beaver impoundments, are essential to the creation and maintenance of productive salmonid and other aquatic habitats.

Streams are meant to meander in their flood plains, have infrequent, episodic inputs of debris and other material, and in the case of small low-gradient streams and the flood plains of larger streams and rivers, to be worked over intensively by beavers.

Beavers create a shifting mosaic of wetland habitat whose function changes as ponds mature, are abandoned, and become wet meadows. Beavers are constantly creating new impoundments or re-building old ones, with the overall result: habitat complexity for salmonids and wetlands for most fish and wildlife, not just typical riparian species, i.e. otter, muskrat, moose, waterfowl, but more species, including raptors, bats, migratory song-birds and others.

Studies have shown that wetland complexes created by beaver support many more species at much lower costs than engineered wetlands that also often have to be maintained at significant cost.

Conflicts with beavers are mostly the result of past and continued development in riparian zones, some inadvertent as beavers widen riparian zones through their activities, and by our assumption that rivers and streams will stay in the same place and not move, as they must in alluvial unconfined reaches of streams and rivers. Beavers do create major problems for roads and railways, but removal is not the answer as road networks may then become population sinks, reducing beaver populations throughout along with their major benefits e.g. wetland enchantment. Whenever possible, beaver problems should be avoided by keeping roads and other development out of alluvial flood plains and crossing streams and rivers in confined areas.

Where human development is unavoidable, culverts and bridges should be designed to avoid problems with beavers so removals are not necessary.

Beaver Ecology

Beavers have been estimated to have been around for more than 60 million years, perhaps as many as 400 million, occupying most of North America from the Arctic to the Sonoran Desert of Mexico. Trapping brought beaver close to extinction by the 1900s. Today beavers estimated to be 6-12 million, and probably increasing, but still at remnant population levels.

Beaver work smaller order streams, 1-4, where their dams transform the stream into a step-chair profile with a shifting mosaic of ponds in various stages of maturation. Beavers also intensively work the flood plains of larger streams and rivers, in both cases creating and enhancing riparian wetlands complexes. Flood plain wetland complexes created or enhanced by beaver are or were important over-wintering and juvenile salmon rearing habitats.

Beavers probably created or enhanced much of the wetlands formerly found throughout North America - the loss of which is associated with major loss of biodiversity, including ongoing reduction in some fish and wildlife populations.

Frequency of dams can be substantial if the local topography permits and food supply is adequate, as high as 8-16 dams per km, although 2-4 dams may be more “normal”. With 4-8 beaver per colony and 3 colonies per km on average, beaver populations can be very substantial in areas free of human influence.

Beaver dams should not be viewed individually. A complex of beaver dams at differing stages of development and maturation is required to achieve the full array of very major benefits from beaver activity. These include:

- trapping of large quantities of sediment and organic material in beaver ponds. Over centuries, entire river valley floors have been raised by the continued building of beaver ponds. Individual ponds may store 2,000-6,500 cubic m of sediment.
- accumulation of organic rich sediments, with its higher stream order invertebrate community, large biomass of organisms, aquatic plants, etc providing streams with nutrients, insects and benthic food of high benefit to fish and wildlife.
- retention of organic material that would otherwise be rapidly lost from the system- this is very important in the current nutrient impoverished reservoir system. Beaver ponds and large course wood debris accumulations were the major mechanism retaining salmon carcasses in inland ecosystems.
- water regulation and storage - beaver ponds are reservoirs, able to store water and released it during low flow periods, therefore providing major enhancement of flows for fish in drought years. Beaver ponds are often viewed as impediments to fish passage but are often accessible to fish during high flow periods, i.e. spring run-off and fall rains.
- beaver ponds raise water tables, increase the area of flooded soils, thus widening riparian zones via wetland creation.

Beaver ponds are part of the complex array of salmonids habitats, particularly over-winter and juvenile rearing habitats, the lack of which may be constraining some local populations. When accessible to fish, beaver ponds make excellent rearing habitat for salmonids, including Coho and chinook salmon, cutthroat, rainbow, grayling and char. Salmon of course no longer occur here due to dams on the lower Columbia since the 1930s and acute nutrient impoverishment in the Arrow and Kootenay Lake reservoirs is now threatening remaining resident fish and other aquatic life.

Beavers were very numerous in the riparian zones of larger tributaries and flood plains of the Columbia River. For example, before damming, the Revelstoke Reservoir impoundment area supported about 2,000 beaver, the Kinbasket Reservoir, about 3000 beaver (pre-dam estimates based on cursory work).

Use of many smaller tributaries entering these reservoirs may be constrained by steep gradients, though little work has been done in this area. Fluctuating water levels on the reservoirs are also likely severely constraining beaver activity due the resultant lack of vegetation in the drawdown zone and uncertain flows for winter survival.

Conclusions

Beavers are a keystone species whose habitat has been lost or altered by extensive valley bottom development in the Columbia basin. Reservoirs, extensive roads systems and other human development in riparian zones may constrain beaver recovery and associated wetland enchantment activities.

Achieving diverse aquatic objectives for sport fish and waterfowl production as well as general biodiversity are likely to require measures including:

- Avoiding human development in riparian zones as defined by the full potential flood-plain channel, including that resulting from beaver activity.
- Restoring natural processes that supply needed materials, including gravels, sediment and large course woody debris to rivers and streams.
- Accepting the short-term negative consequences of floods, debris flows, and some aspects of beaver.

8. Application of Construction Product Solutions for Stream Crossings

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This presentation focussed on product applications that address particular design and maintenance issues for stream crossings. Fords, culverts and open bottom arch structures were highlighted.

Fords:
Excessive Erosion - Tri-Lock and AMF Geotextile Culverts
Inlet/Outlet Issues:
Beavers Plugging the Inlet - Beaver Stops, Beaver Deceivers
Insufficient Capacity - Metal End Sections, Pro-Ecolite Headwalls
Scour - Non-Woven Geotextile & Rip-Rap, Tri-Lock & AMF Geotextile
Undercutting - Steel Cut-Off Walls

Culvert Surface Degradation - Tunnel Liner Plate, Ultra Flo Liner & Grout
Culvert Fish Passage - Fish Baffles
Open Bottom Arch Structures
Introduction to Multi-Plate Arches - Economical & Proven Technology
New Requirements - New Products:
Long Span & Low Rise Geometry Required - Bridge Plate Box Culvert Developed
Pre-assembled, Portable, Reusable Arch Required - Mini-Span Developed

9. Geosynthetic Solutions for Erosion Control

Phil Galonski, Nilex Inc.
Phil was not able to present his talk. He can be contacted at:
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The rising costs of highway corridor maintenance coupled with increasing environmental awareness have necessitated the introduction of various products such as wrapped face slope reinforcement systems that encourage vegetation, and erosion blankets for surficial erosion and re-vegetation. Other common applications are silt fences to prevent stream siltation from disturbed earth, and ditch maintenance products to precipitate fine soils out of run off ditches. Culvert replacement and maintenance require the specifying of various geotextiles. Ensuring the use of the proper geotextile is paramount as projects can differ greatly due to local conditions. With all the aforementioned products the purchase of the proper item is only half the job and correct installation is vital to ensure the success of the project.

10. Retrofitting Culverts for Fish Passage – What Works and What Doesn't

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Adult and young fish need to migrate throughout a stream system year-round in order to find suitable habitat. As stream flows increase and decrease, fish search for areas that meet their needs for feeding, resting, spawning, rearing young, etc. Artificial structures in a stream channel; including culverts, for example, may restrict or eliminate the ability of fish to move up and downstream.

Culverts are potential barriers to the movement of fish due to three primary factors:
1) an outfall drop too high for a resident or migratory fish to jump;
2) water velocity too high to permit fish movement upstream through the barrel and;
3) culvert water depth insufficient for fish passage.

Restoring fish passage at stream crossings may involve the removal and replacement of a fish-passable structure, removal for a ford site preparation, or retrofitting the existing crossing structure. This presentation focussed on options for providing fish passage at stream crossings including cost/benefit, where it works and where it does not. The legislative requirements for providing fish passage at stream crossings were also discussed.

Trans Canada Highway, Cache Creek to the Rockies: An Overview of the Environmental Program

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No abstract provided.

Wildlife Accident Mitigation Strategies for British Columbia Highways: Something Old, Something New, Something Borrowed, Something Red Hot!

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In British Columbia, wildlife accidents represent about 25% of all motor vehicle accidents reported on numbered provincial highway corridors each year. Since 1997, the Insurance Corporation of British Columbia has spent over $48.6 million for wildlife-related motor vehicle accident claims. In 1999 alone, is it estimated these accidents cost British Columbians over $20 million in terms of reported accidents, unreported accidents, accident clean-up, lost provincial hunting license revenues, and lost value of wildlife.

The Insurance Corporation of BC and the BC Ministry of Transportation and Highways are partnering to assess the effectiveness of current wildlife accident reduction strategies and to examine new technologies. A diverse range of low-cost, low tech to high-cost, high tech methods which include: improved fencing and warning sign design, wildlife reflectors, wildlife repellents, whistles, roadside brushing, taste aversion products, and infrared camera detection systems, are being examined.

Control of Noxious Weeds on Highway Rights-of-Way

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Transportation corridors such as highways are particularly susceptible to introduced noxious weeds. The subsequent spread of undesirable weeds along these lineal corridors can have far reaching implications for agriculture, forest health, recreation and natural biological diversity. It is important therefore, that effective strategies are employed to prevent the establishment of noxious weeds in the first place, and to control the advance of any existing populations.

The control of noxious weeds by MOTH on its right-of-way is incidental to standard maintenance activities carried out by its privatized road and bridge maintenance contractors. Routine operations such as mowing and brushing may, in some cases, provide limited noxious weed control benefit, but they are not generally done for this purpose. Such highway maintenance is primarily concerned with ensuring the safety of highway users and enhancing roadside aesthetics.

Noxious weed control is a program onto itself, and is implemented in conjunction with other maintenance activities that are managed within three distinct roadside management zones. An Integrated Vegetation Management program is the most effective way to satisfy long term weed prevention and control objectives. To the extent possible, the Ministry of Transportation & Highways takes this approach, and works in concert with other agencies to address the most problematic situations. The ultimate goal is to keep noxious weed populations low enough to prevent unacceptable spread and damage, and to encourage desirable vegetation to replace the unwanted weeds.

Noxious Weed Management on a Railway Right-of-Way: Biological Control as a Potential Tool

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The spread of noxious weeds is a concern throughout the East Kootenays. Manual as well as chemical controls are limited because of the large number of isolated areas and numerous waterways. CPR has 12 test biological control release sites targeting Dalmatian toadflax, Common toadflax and Houndstongue. These sites are being monitored with Agriculture Canada to determine characteristics that allow for the successful introduction of biological agents as well as their efficacy. Results of year two of the project appear promising.

Modifying Brushing Schedules to Reduce Roadside Browse Quality for Ungulates

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Current vegetation management practices within transportation corridors are aimed at increasing road safety. Unfortunately, such practices promote the creation of prime foraging habitat for ungulates such as moose. Increases in foraging activities within the rights-of-way increase the odds of encounter between moose and motorists. Moose-related vehicular collisions currently have significant negative impacts on populations of moose throughout many parts of their range. Although several countermeasures have been developed in an attempt to reduce the number of such collisions, few have proven effective and even fewer have considered possible links between roadside brush management practices, the quality of regenerating browse, and the use of roadsides by moose. To better understand these relationships, I reviewed the literature on ungulate-related vehicular collisions in combination with literature on plant response to mechanical damage. Many authors recognize the need to reduce the attractiveness of highway rights-of-way. To date, diversionary feeding, forage repellents, establishment of unpalatable species and elimination of roadside browses have been used to reduce rights-of-way attractiveness. Unfortunately, such techniques are ineffective or are not cost-efficient when applied at the landscape scale. It has been long recognized that plant response to mechanical damage is a function of the timing of damage. Current research suggests that the quality of regenerating growth for herbivores also depends of when plants are cut. Plants brushed in the middle of the growing season produce re-growth that is high in nutritional value for at least two winters following brushing when compared with plants brushed at other times of the year. Because mid-summer is generally the time of the year that roadsides are brushed, possible links between roadside vegetation management practices and winter peaks in ungulate-related vehicular collisions should be considered. I recommend brushing early in the growing season and underscore the need for collaborative long-term research to properly address this issue.