Interior Forest Site Rehabilitation Workshop
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ABSTRACTS

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Four presentation topics were selected for this year' s IFSR Conference and the abstracts are arranged under these topic titles:

- *Restoration activities: Priorities, Trade-offs, and Fragmentation* will look at our experience with restoration plans.
- *Prescriptions: Finding solutions that Fit the Site* will examine this critical aspect to finding site-specific solutions. Speakers will present successes, failures, and why spectacular results in one area may fizzle in another.
- *Road Deactivation: Balancing Resource Protection with Use* will look at how we manage roads as both assets and liabilities.
- *Restoration Activities: Benefits to Fish and Water Quality?* will examine the links between restoration and improved fish habitat.

Restoration Activities: Priorities, Trade-offs, and Fragmentation

Effectiveness Evaluation in Trapping Creek Watershed: The State of Recovery, October 2000

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Trapping Creek Watershed covers 145 km^2 and lies 40 km southeast of Kelowna in the Okanagan Highlands. The watershed has been extensively logged, including much of the riparian forest. Since logging began, Trapping Creek and its larger tributaries have experienced increased bank erosion, channel widening, and loss of trout habitat. Anecdotal evidence from local anglers indicates a corresponding decrease in trout populations. The forest licensee, Pope and Talbot Ltd., initiated an FRBC watershed restoration program in 1995. Upslope and in-stream restoration works were implemented in 1997 and 1998. Upslope works were generally intended to lessen the hydrologic impacts of logging and road-building and to reduce sediment supply from roads and hillslopes. In-stream works were generally intended to stabilize streambanks and large gravel bars and to create or augment trout habitat features such as pools and woody debris cover.

In October 2000, Northwest Hydraulic Consultants Ltd. and LGL Ltd. carried out an effectiveness evaluation of watershed restoration works in Trapping Creek Watershed. Our goal was to evaluate the effectiveness of the restoration works at restoring trout habitat in Trapping Creek. Our first step was to familiarize ourselves with the watershed, the nature of the disturbed processes operating in the watershed, the objectives of the restoration work, and the works implemented. We found it necessary to clarify restoration objectives – especially for the upslope works – in order to link site-specific restoration activities and objectives to the overall objective of habitat restoration. In mildly impacted stream reaches where habitat features can successfully be constructed, direct measurement of restored habitat quantity is possible. However, in more severely impacted reaches and in upslope areas, the work carried out aims to modify processes that in turn are assumed to lead to habitat recovery. This applies to bank and bar stabilization, hillslope rehabilitation, and road deactivation works. It is imperative that the nature of the disturbed processes be understood and the objectives and assumptions inherent in restoration prescriptions be clearly stated before evaluation can proceed.

We intend our evaluation, summarized below, to be a snapshot of watershed recovery taken in October 2000.

We found that upslope works have been successful in achieving the hydrology and sediment objectives addressed. However, the hydrologic impact of harvested areas will continue to affect hydrology for years to come, presumably causing spring freshets in Trapping Creek to be more powerful and disruptive than if the watershed had not been logged. Only forest regeneration will eventually mitigate the harvesting-related hydrologic impacts. ▲

Terrestrial Ecosystem Restoration Program, New Opportunities on the Land

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The Forest Renewal BC Environment Committee has established the Terrestrial Ecosystem Restoration Program to support the development and adoption of sound terrestrial ecosystem restoration practices in B.C.

Restoration is a priority for investment. To date, Forest Renewal BC has invested significant funds through the Watershed Restoration Program. Efforts through the Watershed Restoration Program (WRP) have focused on riparian and aquatic ecosystems, and in particular, salmonid spawning and rearing habitat. The Terrestrial Ecosystem Restoration Program (TERP) addresses the need for ecosystem restoration inclusive of both terrestrial and aquatic ecosystems.

The program goal is to restore the capacity of ecosystems to provide the natural diversity of processes, habitats and species where they have been significantly negatively impacted by past forest management or harvesting practices. This approach emphasizes overall management of biodiversity, rather than the management of single species, and focuses on ecosystem management rather than population or habitat management.

Investment in the TERP began in 1998/99, with the first year of project funding in fiscal year 2000/2001.

This past fiscal year saw $383,000 invested in 22 diverse projects across the province; in this fiscal year project investment will increase to approximately $1.5 million. A directed call for proposals went out March 5th with a deadline of April 16th, 2001. The proposals selected for funding will be based on priorities developed in regional workshops concluded in November 2000. Given the scope of the program relative to the need for ecosystem restoration activities, investment will target a limited number, but broad variety, of high priority areas and projects.

The scientific basis for the program is outlined in a report: *An Ecological Foundation for a Proposed Ecosystem Restoration Program* (Holt, 2000), which, along with the results of the regional workshops, is available on the internet (the web-page will be provided at the workshop). For further information on the TERP please contact Tanis Douglas at tanis.douglas@gems6.gov.bc.ca. ▲

Enhancement Techniques to Maintain Biodiversity and Role of Key Species For Ecosystems in Forested Watersheds

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With the disappearance of old growth ecosystem and its associated species, many links have been broken between the uplands, riparian and aquatic systems. A consequence of the loss of old growth is the decrease in the number of species that maintain ecosystem functions. There are various techniques for enhancing terrestrial, forest canopies, vertical structure, trees, snags and horizontal structures (i.e. downed wood). Enhancement structures create habitat for wildlife and plants, which facilitate nutrient loading and transfer; seed dispersal, germination and fungal dispersal. Large and small mammals, amphibians, birds and invertebrates play an important role in nutrient transfer, seed dispersal and pollination. Maintenance and generation of habitat for vegetation, wildlife and aquatic associated organisms is key to nutrient loading in upland, riparian and aquatic systems. We also discuss techniques of installing woody debris into streams using blasting and whole tree techniques, and show and demonstrate techniques used in various sites from all over North America. Finally, we demonstrate maintaining ecosystems in addition to restoring upland, riparian and aquatic systems. ▲

Keynote Presentation: Restoration Choices: Thinking Like a Fish, Like a Stream, or Like a Watershed?

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Demands for landscape products have overwhelmed the ability of landscapes to continue to provide ecological services, in many instances. Recognition has lead to restoration, often to compensate or mitigate for one product loss, such as fish, for another product harvested, such as timber. Experience with restoration initiatives might suggest solutions have to embrace the concept of ecological health, in contrast to single purpose mitigation. To do so will require restorationalists to expand beyond fish habitat enhancement, and reach-specific stream rehabilitation, to a watershed level of engagement that looks upstream, downstream, and offstream. This presentation reviews, from personal experience, aspects of fish habitat enhancement, at a site and at a reach level, and reflects on the lessons learned. Despite our ability to develop habitat structures that have grown in size and complexity, our efforts will still remain transitory. The reasons relate first to the dynamic nature of stream/river systems where, with few exceptions, structural additions have short life spans. Second, downstream restoration, often to compensate for the cumulative effects of upstream perturbations, is akin to fighting gravity. A strategic approach is suggested, at a watershed level, using ecological functions and processes as a checklist for restoration efforts. Six thoughts on how this might be accomplished include:

- prevent potential problems, rather than treat symptoms;
- repair small problems before they become large problems;
- reconnect severed linkages and minimize fragmentation;
- enhance natural recovery processes;
- evaluate success and failure, and use the findings to improve restoration; and
- do no harm!

We need to create a legacy of wise decision-making and a quality environment; if we do not, we will leave behind, for subsequent generations, a list of repairs rather than a functioning, healthy landscape. ▲

Fish Passage Restoration Using Two Types of Arch Culverts in Neighbouring Watersheds in the Cariboo

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Fish habitat values are high in the Scot Creek and Brown Creek watersheds, both of which are located west of Bonaparte Lake in the 100 Mile House Forest District. Fish passage studies in 1999 identified barriers to fish passage at two road crossings in the Scot Creek watershed and one in the Brown Creek watershed. The sites were surveyed, and bottomless arch culverts were recommended to improve fish passage. Design and construction took place in summer and fall 2000. A Dur-A-Span[1]™ aluminum (structural plate) forestry arch was installed at each of the two Scot Creek sites, and a used Mini-Span II[2]™ steel (multi-plate) forestry arch was installed at the Brown Creek site.

Since the Scot Creek sites are both located on a Forest Service Road (FSR) with a wide running width, a bridge option was rejected because of high costs and relatively small life span. Although relatively unknown, the Dur-A-Span™ aluminum structures were chosen for their overall light weight, open bottom feature (they have no scour guards or cross struts), and light-weight aluminum footings. A Mini-Span II™ structure was chosen for the Brown Creek site because such a suitable structure had recently been removed from an adjacent site, and was available at low cost. Internal rock weirs were incorporated into the design of each culvert, which allowed integration of finer natural bed material within the large angular material required to protect the bed and structure from design peak flows (the 100-year return period instantaneous discharge was used for design). Approximately 2.5 days were required for construction at each crossing. The total cost of design and construction (including material) for each Dur-A-Span™ structure was $32,600. Access has been restored to 13 km of stream within the Scot Creek watershed. The cost of design and construction for the Mini-Span II™ was $28,000. Access has been restored to 2.5 km of stream. Basic effectiveness monitoring will include an inspection in spring 2001, and maintenance and/or ongoing monitoring could be considered at that time.

Both structure types presented advantages and disadvantages. The Dur-A-Span™ is very light and mobile; however, following installation, both arches appeared to sag at the centre, which caused some concern for those unaccustomed to these structures. During a post-construction inspection, the manufacturer provided assurances that the sag was normal. The Mini-Span II™ was heavier and less mobile, and retained its shape in place. The Mini-Span II™ has scour guards and cross struts across the bottom which make it more difficult to pre-place bed material prior to placing the structure. This would be a definite disadvantage if bedrock were encountered at a site. Unlike the Mini-Span™, more than one assembled Dur-A-Span™ can be transported by lowbed at a time. Both types of structures can be re-used, and have a longer lifespan than a bridge or log box culvert.

The project was carried out by Ainsworth Lumber Ltd., and funded by Forest Renewal BC (FRBC). Inland Timber Ltd. of Williams Lake identified the fish passage barriers in 1999, and Summit Environmental Consultants Ltd., in partnership with the Bonaparte Indian Band, completed the design and construction.

1) We found that direct habitat restoration – by construction of habitat structures in mildly impacted stream reaches – has been moderately successful, with success improving in the second year of implementation.

2) We found that stabilization of streambanks and gravel bars has not been as successful. Eroding banks and bars continue to pose the greatest risk to trout habitat in Trapping Creek, especially in light of the residual hydrologic impacts. We have some recommendations for technique improvements and request that workshop participants offer suggestions as well. ▲

1 Dur-A-Span™ aluminum (Structural Plate) forestry arch is manufactured and supplied by Atlantic Industries Ltd., Armstrong, B.C.

2 Mini-Span II™ steel (Multi-plate) forestry arch is manufactured and supplied by Armtec Ltd., Prince George, B.C.

Prescriptions: Finding Solutions that Fit the Site

Sediment and Erosion Control for Habitat Restoration Projects

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The sediment control objectives that we achieved as part of our restoration projects in the Southern Interior meet or exceed our department's requirements. Our goal is to have zero sediment discharge from our work site and to ensure there is minimal or no erosion after construction.

There are several factors considered during the planning stage of any restoration project. Budget is one of the largest constraints as sediment control is a costly part of construction, typically averaging 10% of the total project budget. Timing is one factor that affects the level of controls that are required, as there is generally greater tolerance for sediment releases during the in-stream construction work window than other times of the year during more sensitive life stages. Site conditions also factor in as pumping and diversions are common techniques of sediment control and require space or gravity. Weather is also a factor as relying on discharge-laden water to go to ground in freezing conditions is not realistic. The type of water, either sediment-laden or clean, must also be considered as there is usually less problem during the actual construction when clean water is diverted rather than relying on sediment-laden water to settle somewhere. The type of sediment control equipment that can be used relates to budget but also availability. For example, during fire season, which is usually the construction work window, large pumps can be difficult to get.

There are several basic techniques to control sediment during construction. Working in the dry is the easiest form of sediment control. With groundwater channels, excavation is usually carried out to just above water table level first to minimize the duration that wet material is to be dealt with. Diversions are effective during instream projects where materials need to be keyed in to help ensure their structural integrity. Sediment curtains have a variety of uses at almost every stage of construction. They help mark out the boundary of the work site with a visual barrier, control surface run-off, and can be used in conjunction with pumps to maintain clean work sites. Pumps can reduce the volume of clean water coming into a site as well as remove sediment-laden water to the settling pond area. After construction is completed, disturbed areas are seeded and mulched, either with straw or geotextile, to prevent immediate surface run off and aid in the rate of revegetation.

Other equipment that is on-site includes oil spill kits in case of hydraulic hose break, and screen material for any of the pump intakes to prevent entrainment of debris and fish. Competent operators also aid in making the work go more efficiently and as they become more familiar with the requirements avoid potential sediment-causing situations.

Case Study

In the summer of 1999, flooding on the Adams River breached a berm separating the river from a groundwater fish habitat complex, constructed by Fisheries & Oceans in 1990. This breach created a perched and near static water table within the complex. As a result, the channel did not function as originally designed.

In March 2000, construction repairs were carried out to re-align the lower portion of this channel complex to the Adams River Mouth. Weather, water, and funding conditions at this time of the year were most favourable for carrying out this work. However, this time period is outside the instream work window, during a sensitive life stage and in a high profile location. An unprecedented 20% of the budget for this fish habitat restoration project was for sediment control. ▲

Bioengineering/Riparian Restoration on Challenging Sites: Case Study, Akolkolex River F.S.R. Km 21

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Case Study: Akolkolex River F.S.R. Km 21 Sites 1, 2, 3

In the spring and fall of 1999 and spring of 2000, Global Forestry Consulting undertook stabilization of three different sites within the Akolkolex River drainage, southeast of Revelstoke.

Objectives

Site 1

- Restore riparian and in-stream fish habitat by establishing vegetation to provide shade and small organic debris input.
- Stabilize the site by draining excess moisture and establishing pioneer species.
- Reduce erosion and sedimentation sources from the road into the stream.

Site 2

- Stabilize a slope failure by draining out the excess moisture and re-establishing vegetation.
- Keep the ditch line and the road clear from falling materials, flowing mud and rocks.

Site 3

- Maintain the road width by stopping erosion of the road edge.
- Reduce surface erosion and stream sedimentation created by the road system.
- Stabilize a failed slope caused by underminin.g
- Protect the stream bank from high flows and create fish habitat by establishing riparian vegetation to create shade and small organic debris input.

Methods

Various bioengineering techniques developed by David Polster of Polster Environmental Services were applied on these sites in combination with hard engineering methods such as rip-rap and concrete block retaining wall. Techniques used: live smiles, live smile/ LaREWs, wattle fences, live pole drains, brush layers, modified brush layers, live staking and live gully breaks. Species used were willow, black cottonwood and red osier dogwood. Other treatments used were broadcast seeding using a cyclone seeder, and hydro seeding.

Results

Site 1

- Overall growth was good, site was drained very well, minor failure and moderate mortality.
- Failure of two live smiles and a short section of wattle fence located in the northeast section of the site; nineteen dead or partially dead live smiles, of a total of forty installed.
- Cause: high snow pack creeping down slope, very dry site, south aspect.
- Average growth, second growing season: Live pole drain: 55 cm; Live smiles: 35 cm; Brush layers: 50 cm.

Site 2

- Overall growth was good, site was drained very well, some failure and mortality.
- Failure of two live smiles and a short section of wattle fence located northeast of the site; separations of a section of live pole drain #1.
- Cause: High snow pack creeping down slope, low density of structures on steep terrain (85 to 100% slope), very dry site, south aspect.
- Average growth, second growing season: Live pole drain: 40 cm; Live smiles: 25 – 30 cm; Wattle fence: 25 – 30 cm.

Site 3

- Overall good survival and vegetation establishment, some failure and mortality.
- Failure of ten live smiles concentrated in the southwest area of the site (a total of 117 live smiles were installed during fall 1999); undermined structures and minor structural breakage.
- Cause: High snow pack creeping down slope, low density of structures on very steep terrain (~110%).
- First season, spring growth: Overall average 10 – 15 cm.

Maintenance and repair work was carried out during the spring of 2000 on all three sites.

Recommendations

Based on personal research, experience, and results obtained using the same techniques in drier parts of the Kootenays region over the last four years, the following planning at the prescription level would improve the success/survival rate of bioengineering projects.

- At the prescription phase, assess each site's most limiting factor (e.g., moisture regime, aspect, soils, % slope, snowfall accumulation, flooding, raveling, etc.) in order to prescribe techniques and species suited specifically to the site.
- Use a higher percentage of black cottonwood within structures (unless cottonwood cannot be used, e.g., on dikes or road curves due to visibility restrictions): results show a higher survival rate and faster rooting and shoot formation than willow or red osier dogwood.
- Soak all live materials at least 24 hours before installation to stimulate growth hormone.
- Use contour or drain fascines. These structures are partially buried and should be more resistant to summer drought, and they will act as a sediment trap by catching surface flowing sediment as the row of woody vegetation grows from the fascines.
- Planning an irrigation system is sometimes necessary to insure structures are properly established.
- Pruning of first-year shoots, leaving ~7 buds/stem, forces root growth, avoiding stem desiccation.
- Follow-up monitoring, maintenance and repair are essential to success of these projects.
- Trim all fines from live cuttings to avoid stem desiccation.
- Apply a mix of 50% latex paint and 50% water on the exposed end of live stakes and modified brush layer stakes, to avoid desiccation and disease entry. ▲

Practical Solutions From a Committee of Stump Sitters

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The overall theme of this presentation is that often a committee containing a wide range of expertise generates the best solutions for a problem. To do this, it takes broadminded, knowledgeable people to thoroughly examine the site, identify the problems, and look for opportunities.

A "Committee of Stump Sitters" developed the prescriptions for the two projects we are presenting. This means that the basis for the prescriptions were developed on site, where those involved could discuss the issues and opportunities and revisit questionable areas if necessary.

The projects are as follows:

1. THE CHASE CREEK PROJECT:
Location - Upper Chase Creek, Salmon Arm Forest District.
Year of Project - 1999
Problem - The toe of Slide # 35 was continually being washed away and was, particularly during high water, depositing considerable sediment into Chase Creek. This slide is relatively large, and still active. The area is very steep and the problems associated with the slide are deep-seated and difficult to remedy.

Suggested preliminary solutions - Some solutions had been suggested such as rock buttressing, buttressing with wood and others. All were recognized to be very expensive and / or unlikely to solve the problem for any length of time. Because of this, proposed works associated with this slide were put on hold.

A committee of "Stump Sitters" examined the area in August of 1999. The committee included Brian Nuttall, the WRP technician for MoELP, Bernie Teufele of EBA Engineering, Jim Webster, a hydrologist from the US Forest Service in Oregon and Bob Pointer, FRBC Supervisor, Riverside Forest Products. Jim Webster was on an information exchange trip to B.C. and we were fortunate to have him visit the site and help with the prescription for the project. This committee examined the site, discussed possible solutions, re-examined the site, and came up with the final solution before leaving the field.

Final Solution - From the examination of the site it was apparent that any buttressing work would be very expensive and would soon become ineffective. An old channel adjacent the affected channel was looked at over and over again as part of the possible solution. Eventually measurements of the channel were taken and capacities roughly calculated. The committee decided that reopening this channel afforded the best possible solution to reducing the sedimentation to Chase Creek.

Works - The final design and works were carried out by EBA Eng. in September of 1999.

Cost - Considering the enormity of the problem, the works were very cost effective. An excavator, swamper and supervisor completed the project in just over one week, including some stream complexing structures.

Results - The site has been revisited many times and the new channel is functioning well. The slide is still active, having moved across and obliterated most of the old channel. However, it will eventually find its stable angle of repose. The slide is no longer contributing large amounts of sediment to Chase Creek.

2. KINGFISHER CREEK PROJECT:
Location - Kingfisher Creek at the confluence of Danforth Creek
Year of Project - 1999-2000
Problem - A rain on snow event in the spring of 1997 caused the infilling of a section of Kingfisher Creek and a channel avulsion occurred.

Preliminary suggested solutions - Excavate and haul away the material that in-filled the channel and close off the new channel. This was suggested in 1998.

A committee of "Stump Sitters" visited the area in July of 1999. Those included were Phil Epp and Brian Nuttall of MoELP, Patricia Carlson of FOC, Neil Brookes of the Kingfisher Environmental Interpretive Centre, Loretta Eustache of the Spallumcheen Band and Bob Pointer, FRBC Supervisor, Riverside Forest Products.

Final Solution - It was recognized that the forming of new channels is natural event of nature. The forming of this new channel was accepted by most/not all of the committee a being like a natural event.

The committee decided to leave the creek in its new channel. It was proposed to do some riparian planting and install some debris catchers where the new channel intersected the BC Hydro powerline right-of-way. So basically the solution was "leave as is". What the committee did recognize was the opportunity to enhance the fish habitat by reworking the old channel and creating a protected off-channel rearing habitat. Patricia Carlson of the Department of Fisheries and Oceans provided the off-channel habitat design.

Works - Works were carried out in 1999-2000. An excavator was used to open up the eleven remnant pools and join these with riffle channels. Members of the Spallumcheen Band added complexing to the riffle channel and pools through handwork.

Results - Soon after construction, small fish could be seen in most of the pools. Fish trapping (necessary to complete construction) in the upper most pool in 2000 yielded forty coho fry as well as a small bull trout. ▲

Road Deactivation: Balancing Resource Protection with Use

Impacts of Forest Road Deactivation on Mineral Exploration

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The back-country road network provides essential infrastructure for individuals and corporations involved in all phases of mineral development. Therefore, forest road deactivation often has negative impacts on the mining industry. However, it is in the early stages of mineral exploration, when budgets are small and four-wheel-drive vehicles are relied on, that the impacts are most significant. The consequences of these impacts are felt throughout the entire mining industry, because exploration is critical to sustaining the industry.

Forest Service Roads, permit roads and non-status roads facilitate vehicular access to mineral tenures and areas with mineral potential. In many cases the existence of a logging road creates the opportunity for mineral discovery, and for subsequent claim-staking and evaluation. In other cases, roads were initially built to provide access to mineral prospects, mines, and mining camps. Some of the latter group, which can be broadly termed “mining roads”, have later been upgraded and used for forestry access, or have been replaced by overlapping or adjacent logging roads, but the mining industry feels a sense of ownership and an inherent right of continued use of these access routes.

Mineral exploration is not a predictable industry and its interests do not always fit well into the land-use planning approach used in British Columbia. Exploration activities fluctuate in response to changes in commodity prices, development of new geological models or interpretations, improvements in exploration technologies, and other factors. This, in combination with the fact that minerals are a hidden resource, leads to the general land-use planning policy in B.C. to provide for access opportunities to all lands which are not under Protected status, for mineral exploration and development. Furthermore, explorationists whose projects are at an early stage are discouraged from constructing new roads. At the same time, however, there are programs and strategies in place which encourage the deactivation of existing roads in order to meet other resource management objectives. The explorationist is affected by these apparently conflicting policies and practices, and often feels frustrated and powerless.

There are currently no universal solutions to these apparent conflicts, but if licensees or contractors work directly with prospectors and other explorationists, compromise options can sometimes be found. These might include evaluation of modified prescriptions, use of gates, or temporary postponements. The key factor in all successful cases is consultation. There are good tools available, such as the “MapPlace” Internet site, to facilitate identification of mineral tenure holders and to help begin the dialogue. ▲

The Yalakom – A Valley, A River, and A Road: Doing Our Best to Maintain Access in High Consequence Terrain

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For reasons of geography and geology, some forest road corridors have and will continue to be located in very unforgiving terrain, if there is to be any access to forest lands and resources. In previous decades, the primary concerns with difficult roads usually related to their construction, and once built, to keeping them open for people to use. Today's society requires a broader approach, yet suited to a specific site, so that a road corridor does not inadvertently impact the integrity of the ecosystem elements it passes or provides access to.

This presentation provides a case history of recent work conducted by the Ministry of Forests in the Yalakom River watershed, studying the interaction of a forest road corridor, a dynamic river channel in a geologically immature valley, and the stability of slopes in between the two. In this study, consideration of consequence of terrain instability, rather than hazard or risk, was used as the primary criteria for assessment of the performance of the road corridor and individual structures. Based on the consequence ratings developed, and the requirement of maintaining the integrity of the roadway in the long term, prescriptions were developed for a variety of remedial treatments to mitigate perceived concerns.

This presentation focuses on the range of treatment options and prescriptions considered to mitigate particular situations at the site, and the rationale used in their selection by the assessment team. The main element of the study was a combined channel and terrain stability field assessment along the road corridor, conducted jointly by a terrain hazard specialist and a hydrologist. The outcome of the study was to provide the Forest Service an improved strategy for managing liability risk and terrain instability consequence, along a road corridor which traverses very challenging terrain in the Interior of British Columbia. ▲

Deactivation in Multiple Use Areas – A Balancing Act

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Typically, when addressing Watershed Restoration projects, we find that there is an obvious or standard solution to the problems we face.

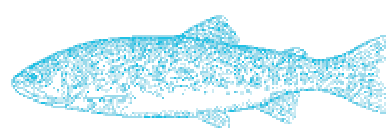
As the years and the program have progressed, the number of roads deactivated have increased, in many instances drastically reducing access for non-forestry based resource extractors. In the Spring of 1996, Atco Lumber Ltd. began what was to be a simple exercise in the deactivation of non-status roads. What transpired was an education in the extensive historical use of the areas under review, particularly in addressing concerns of a large and very active mining community that dated back to the late 1800's. The network of roads that we viewed as liability and of very little value, were viewed by the mining community as their lotto ticket to the next big mineral boom. To a lesser degree, the recreation groups brought up strong concerns over their user needs.

The issue at hand was balancing liability concerns with the stakeholder needs – not a simple problem when faced with roads that hung on 70% slopes, built upon unstable fill – on a mountainside that had been burnt clean at the turn of the century for mineral exploration.

The approach we chose to take involved much greater public referral, indicating a genuine interest in the stakeholders needs. We took the time required to understand their feelings of futility and anxiety in regards to the public referral process – past examples had proven that their concerns were nice to have on file but would not likely be considered in the end. We have proven through example that we can achieve Permanent Deactivation while maintaining 4X4 and equipment access in many situations.

Key issues:

- User groups have valid concerns that in many instances require far greater contact than a letter or advertisement;
- What we consider a huge liability and an excellent candidate for deactivation, another may view as access to the next great mineral claim;
- On a one-to-one basis, it is easier to convey the restrictions forest licensees and Districts are facing as well as understand the other sides of the issues;
- Carry out your plans as agreed upon, following up with the individual affected if your plans have had to be modified that in any way alter the access level;
- Public involvement provides a greater sense of ownership and understanding for all parties involved.
- Sometimes what appears on the surface to be a straight forward deactivation measure has hidden connotations. ▲



Open Stream Crossings – An Adaptive Management Approach

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Since the Watershed Restoration Program was initiated in 1994, there have been many opportunities for heuristic feedback to field practitioners, with very little evidence of uniform and well-developed effectiveness evaluation (EE) and documentation procedures. A recent shift in evaluation of WRP activities has permitted a shift in evaluation methods from ad hoc to more rigorous and standardized requirements for evaluation design. This project represents such an evaluation.

Concurrent with the development of a more focused EE process, there have been recent environmental directives in the Cariboo Forest Region (CFR) regarding *Open Stream Crossings* (OSCs, also call *fords*). These directives have eliminated options that managers have in using OSCs on forestry roads. Such directives appear to be based on a incomplete knowledge of the interactions of OSCs and fish and fish habitat, decisions based on general principles and anecdotal evidence.

The EE of OSCs project is modeled around the principles of adaptive management, and has been initiated to help address the lack of substantive knowledge or evidence on the impacts of OSCs on fish streams. The project has been actively designed to ensure reliable feedback. Results will provide managers with information and evidence to assist in the management of multiple values – the conservation of aquatic resources while maintaining access.

The project is developed based on the principles of adaptive management, focusing on target resource values, optimization, and cost effectiveness. A variety of operation techniques were implemented at eight sites in the CFR. Baseline data was collected following construction which can be compared to subsequent years' evaluation results.

The presentation focuses on the Adaptive Management process and how it was implemented in the above mentioned project. Successes and failures in the use of adaptive management will be discussed with a view to improve its implementation in WRP. ▲

Restoration Activities: Benefits to Fish and Water Quality?

Keynote Presentation: Watershed Restoration Programs, In Need of Some Common Currency

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The term watershed restoration has been in the public vogue and the focus of considerable management attention along the West Coast of the United States and throughout British Columbia since the mid-1990's. Various U.S. and B.C. watershed restoration programs have been developed and implemented over the past 5-7 years, in an attempt to protect or improve watershed assets or values. Evaluating and comparing the success or failure of these various endeavors is difficult because there exist little or no common language or "currency" for approaching and applying watershed restoration.

What is meant by the restoration of the assets and values of watersheds? Is it restoration, reclamation, rehabilitation, renovation, improvement, or enhancement? All of these terms have been used in the watershed science and associated natural resource fields over the past few decades. Depending upon an individual's formal education/training, professional field affiliations, and job-related knowledge/field experience, these terms have different definitions and meanings in theory and application. Without a common, widely acceptable currency for dialogue, communicating the purpose and need as well as the results of watershed restoration in the Pacific Northwest and in British Columbia has been inconsistent, and un-comparable.

The variables involved in watershed restoration application are also problematic. The legitimacy and need for restoration action/activities versus protection and natural recovery is not always justified and documented. What is meant by watershed? How is watershed restoration related to upslope, road, riparian, and in-channel/fish habitat restoration? Does watershed restoration imply only aquatic based restoration? Spatial and temporal aspects of watershed restoration are not clearly identified nor sequenced and linked together. Restoring watershed assets and values usually requires multiple applications and combinations at the site, patch, reach, segment, watershed, or river basin scales. Over time, multiple years are usually required for restoration application due to the stochastic nature of coastal and interior watersheds.

The challenge for various watershed restoration programs, today and tomorrow, will be to agree on more common currency to approaching, defining, and applying this developing field of applied science. This needs to begin with the way we, the watershed restoration practitioners, communicate the design, development, progress and results of our endeavors. For example, does the title and content of this workshop promote and advocate for a more common currency and understanding for approaching, defining, and applying watershed restoration? This presentation attempts to shed some light and generate discussion on this question. ▲

Use Of Sediment Budgets To Assess Forest Development Impacts In Interior B.C. Streams

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A major concern in forest management is the effect of forest roads and forest harvesting on suspended sediment and turbidity in streams. A sediment budget approach is one way to quantify and track the introduction of fine-grained sediment from forestry roads to streams and to evaluate its impact to the annual sediment yield of a watershed. This approach was used in eleven separate sub-watersheds in the West Kootenays in 1997 and 1998.

We measured sediment input using a Rapid Road Erosion Survey Technique (RREST) that estimated quantities of sediment that were eroded from roads and transported into the stream system. We measured output in the same sub-watersheds by measuring suspended sediment, turbidity, and streamflow and by using these measurements to calculate sediment yield in nine of the eleven basins.

The results show that although sediment input from roads varied over three orders of magnitude, sediment output at the mouth of watersheds was within the same order of magnitude and usually within a factor of two. The output of sediment ranged from 1.3 to 5.7 tonnes/ km^2/year, which is within the range of published results at other interior watersheds and at the low end when compared to other published sediment yields within British Columbia. Water was also generally of high quality, using turbidity as the criteria, at study watersheds over the two-year research period. Turbidity levels rarely exceeded 5 NTU during the spring freshet period and never exceeded 5 NTU at low flows.

Despite a wide range in the level of watershed development, including road density, ECA, road on unstable terrain, and also different levels of road deactivation, the sediment yield at watershed outlets were very similar to each other and to sediment levels at unlogged watersheds in the study. This indicates that the sediment yields measured over the two- year period were close to background values. The technique used in this study indicates that in general roads are a relatively small part of the annual sediment budget and that natural sediment sources dominate the sediment regime. It is unlikely that road rehabilitation efforts would result in a significant or detectable sediment yield reduction at the outlet, except where water quality impacts are greater in comparison to background levels. ▲

Rock Creek – A Study in Adaptive Restoration and Management

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The project is a fifteen-year study in adaptive restoration. It involves several cycles of restoration and evaluation on this 7,000 acre watershed on the eastern flanks of the Cascade mountains. Most of the watershed was severely burned by wildfire in 1973; salvage logged in 1974-1976, and grazed in 1976-1994. Pre-project conditions included limited pool development, extensive bank instability, elevated stream temperatures, channel down cutting and severely limited, coarse wood loading in the stream channel and on the active floodplain. Following a watershed assessment, specific restoration objectives were established. These targeted specific habitat and floodplain attributes including pool area and volume, percent stable stream banks, stream temperature and stream shading, fish abundance and riparian area condition. Initial treatment was initiated in 1984. This involved installation of 85 large wood/ boulder complexes, floodplain fencing, pull-back and stabilization of more than 1000 lineal feet of vertical streambanks and extensive floodplain and riparian area revegetation. A network of photo points and a project area survey documented pre-project conditions.

Regular monitoring, linked to project objectives, has guided maintenance and additional treatments, the most recent including helicopter placement of more than 100 whole trees to the flood plain (1999). Monitoring has included periodic project area surveys (physical and biological) and annual photo documentation. The network of photo points has captured the dramatic response of the treatment area over a 15 year period. Increased roughness has prompted formation of numerous jams and begun channel rebuilding. Pool area/volume has more than tripled. Bank instability has been decreased five fold. Shading has more than doubled. Many interesting lessons for the successful planning, restoration and evaluation of stream and riparian area function are provided. ▲

Effectiveness of Large Wood Restoration at a Large Stream in the Southern Interior of British Columbia

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Please note that this entire article is produced beginning on page one of this Streamline issue.

Concerns with stability of large wood have led to limited efforts being directed at restoration of habitat of adfluvial trout in large alluvial streams in which LWD is the dominant structural feature. Yet many of these rivers were historically cleared or logged to streambanks, which resulted in a gradual loss of natural channel structure, otherwise maintained by recruitment of mature trees. The West Kettle River was selected as a demonstration site for rehabilitation of habitat of larger interior streams in British Columbia. A 2 km section was rehabilitated with a total of thirteen ballasted LWD structures. Channel dimensions are greater than large wood restoration projects undertaken previously in the Pacific Northwest, or an average channel width of about 40 m and a maximum flow of 120 $m^3 \cdot s^{-1}$ in spring. Between 1996 and 1998, three designs of large log structures, triangular, box and single logs, were introduced to re-establish lateral log jams that are evident in undisturbed sections of the river. Structural stability, functionality and abundance of juvenile and adult rainbow trout were systematically examined, the latter by underwater counts before, during and after habitat rehabilitation, compared to a control section located 3 km upstream. Selected sites for thirteen large wood structures were lower gradient hydraulic units, including shallow pool locations on the outside of bends. Quantity of ballast followed hydraulic engineering guidelines developed by D'Aoust and Millar (1999). Triangular structures (seven in total) were most stable during bankfull floods, shifting only up to 1 m, whereas two of four box structures shifted 10 to 150 m, one remaining functional. Drifting debris accumulations, largely on triangular structures, formed lateral jams that caused scouring of lateral pools; size of pools was related to the amount of drifting woody debris amassed by structures. Eighty five percent of trout in the treated section were associated with structures. By 2000, an estimated 366 trout per km inhabited the rehabilitated section versus 68 trout per km in the control, or a five-fold difference, yet before treatment (1990) both sections had similar very low densities of 2-6 trout per km. Larger rainbow trout, 30 to 45 cm in length, also responded to habitat rehabilitation by 1999. Triangulated structures were most effective in achieving both high functionality and high trout utilization. ▲