Streamside Runoff

CENTER FOR STREAMSIDE STUDIES

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The mission of the Center for Streamside Studies is to provide the necessary information for the resolution of management issues related to the production and protection of forest, fish, wildlife, and water resources associated with the streams and rivers in the Pacific Northwest.

Controls on Conifer Regeneration in Managed Riparian Forests: Effects of Seed Source, Substrate, Landform and Vegetation

Many CSS students and faculty have been studying the importance of large woody debris in streams. Large woody debris (LWD) is a critical element in forming good salmonid habitat and creating healthy streams in the Pacific Northwest. One element of large woody debris that has, until recently, received less attention is 'how does the wood get into the stream?' This has become a critical question and many scientists and agencies have concerns about the lack of large conifers in riparian areas. Past disturbances, including fires, floods and logging, has resulted in an abundance of non-coniferous species in many riparian areas.

Deciduous species, such as red alder (*Alnus rubrus*) and salmonberry (*Rubus spectabilis*), dominate many riparian areas and can inhibit colonization by conifers in the riparian zone. Eric Beach recently completed a thesis that investigated the conditions that help or hinder conifer establishment in riparian areas forested primarily by red alder. His results are summarized below.

A typical riparian area in Western Washington

Riparian zones in managed forests are the areas where stand management prescriptions may have a significant effect on stream conditions. The composition and structure of the adjacent riparian forest determine many in-channel responses. In order to provide a continuous supply of high quality LWD to the stream channel, conifers must be able to reestablish in streamside areas.

Factors influencing conifer regeneration in red alder dominated riparian areas on managed forests were investigated using a paired site study design. The study areas were located in the foothills of the Washington Cascades and in the coastal fog belt of southwestern Washington. Densities of conifer regeneration in alder dominated riparian leave areas were assessed along transects adjacent to remnant patches of "old growth" or mature conifers and compared to transects in the same alder dominated stand established >100m from the residual stand. The results suggest that conifer regeneration rates in managed forest riparian areas are controlled primarily by the availability of shade tolerant conifer seed. Riparian areas in close proximity to mature (>60 years) forest patches containing shade tolerant species had significantly higher rates of conifer regeneration than areas without such seed sources (e.g. areas dominated by cultivated stands of Douglas-fir (*Pseudotsuga menziesii*) in the adjacent upland forest). Under these conditions, shade tolerant species including western hemlock (*Tsuga heterophylla*), Sitka spruce (*Picea sitchensis*) and western red cedar (*Thuja plicata*) were able to continually establish under a deciduous overstory. Provided a source of seed was present, rooting substrates and understory vegetation were found to significantly alter the patterns and rates of regeneration. Coarse woody debris and mineral soil substrates were positively associated with regeneration success, while seedling establishment was less successful on litter. All shade tolerant species were able to successfully establish in areas of dense herb and shrub covers, albeit at rates lower than when herbs and shrubs were absent. The results suggest that green tree retention may be a more effective management strategy than vegetation control for increasing the conifer component of riparian areas.

(Eric Beach recently graduated with an M.S. in Forestry from the UW)

Other Research

Effects of River Regulation on the Growth and Condition of Resident Salmonids

In free flowing rivers in Western Washington, peak flow events establish channel morphologies by aggrading and scouring substrate, and repositioning large woody debris within the channel. Thus, they determine the physical template upon which biological processes occur. River regulation by water storage dams may substantially alter this physical template with subsequent impacts to the biota. When dams buffer high flow events, downstream reaches may exhibit riparian encroachment producing changes in LWD recruitment, water temperature as a result of shading, and the dynamics of carbon input, all of which have implications for instream biota. Additionally, the regulation of rivers by water storage dams directly alters the temperature regime of the downstream flow, thereby affecting the growth rates and life histories of the biota downstream. The timing and rate of the development of aquatic insects, critical components of salmonid diets, are largely driven by water temperature. As a result of discharge and temperature alterations, the abundance and composition of food available to fish as drift may be modified by river regulation.

The objectives of this study are to determine if the modification of discharge and temperature regimes by the water-storage dam on the South Fork of the Tolt River in Western Washington has influenced instream habitat, invertebrate drift, and ultimately the growth rates and condition of resident salmonids.

A steelhead smolt found in the Tolt River

Preliminary results indicate between-fork differences in discharge and water temperature regimes, salmonid stomach contents, and invertebrate drift density and composition. Analyses of covariance indicate that the length-weight relationships of salmonids in the two forks are statistically different - the trout in the North (free-flowing) Fork weigh more for their length than those in the South (regulated) Fork.

This study has implications for watershed, resource and fishery managers. According to the National Inventory of Dams, there are over 75,000 dams in the United States. Washington, Oregon and Idaho collectively have 1,845 dams, with 659 in Washington State. Dams on rivers adversely affect the continuity of the system, but it may be possible to minimize those effects once they are identified. Over the past seven years, several hundred thousand dollars have been spent on restoration and protection projects in the Tolt watershed to improve water quality and fish habitat for a declining run of steelhead. Because the majority of the habitat available to steelhead is in the South (regulated) Fork, it is critical to understand how the regulation of discharge and thermal regimes is affecting the growth rates and condition of juvenile steelhead. As the number of regulated rivers in the northwest increases, dam release rivers make up a growing percentage of the stream habitat available to wild rainbow trout and steelhead presmolts. It is important for managers to be able to anticipate the effects of river regulation on salmonid growth and condition.

(Jamie Glasgow recently graduated with an M.S. in Fisheries from the UW)

Lummi Nation Riparian Forest Restoration Project: Results and Recommendations

Over the past three years, Lummi Natural Resources has thinned (where possible) and interplanted about 116 acres of state and private riparian forests along the Nooksack River with mixed conifer seedlings. The project was designed to improve salmon habitat by encouraging the growth of mixed coniferous stands in riparian areas presently occupied by hardwoods such as red alder (*Alnus rubra*) and black cottonwood (*Populus trichocarpa*). The targeted northwest native conifers (Sitka spruce, western hemlock, and western redcedar) grow taller, are longer lived, and develop greater diameters than the existing softwoods, and thus provide increased buffering of stream temperatures and larger and more persistent woody debris. Lummi natural resources staff and displaced natural resource workers participating in the USFWS "Jobs in the Woods" program have collected annual seedling growth and planting site data. CSS and Lummi Natural Resources have sorted and analyzed the first three years of data from this project and produced a report titled "Lummi Natural Resources Riparian Zone Restoration Program: Preliminary Report on Seedling growth and Survival." The report also includes a proposed study design and data collection protocol, and suggests possible areas for further investigation. Copies of the report are available from Jim Hansen at the Lummi Natural Resources Department. A smaller document containing the proposed data collection protocols and field sheets are available on the CSS website.

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Lummi Nation Penthouse Variable Thinning Project

The Center for Streamside Studies is working in partnership with the Lummi Natural Resources Department to examine the impacts of variable thinning regimes on wood quality and understory vegetation development in a riparian and riparian/upland transition zone. Initiated in 1997, the Lummi Natural Resources Department established the Penthouse Variable Thinning Project on 35 acres of floodplain, first terrace, and hillside adjacent to the Nooksack River in Whatcom County. The project site, owned by Seattle City Light, was harvested and re-planted with 700-800 Douglas-fir seedlings per acre in 1982. The newly planted seedlings were heavily browsed by elk later that year and, fearing that many would die as a result of the browsing, the same number of seedlings were planted again in 1983. In time, the initial plantings recovered so that by the time of project initiation the area was occupied by an extremely dense stand of 1400-1500 small-diameter trees per acre. Lummi Natural Resources staff divided the area into 6 blocks and performed pre-commercial thinnings to 75, 100, or 150 trees per acre on five of the blocks, leaving the 6th block as a control site. Thirty-five study plots were also established, and baseline data was collected on tree heights, diameters, and understory vegetation composition. The Center for Streamside Studies is now working with the Lummi Natural Resources Department to establish a long-term study design, and has worked with Lummi Natural Resources field staff to establish additional study plots and refine the field data collection protocols.

Second Annual Urban Stream Temperature Survey

The Center for Urban Water Resources Management (CUWRM) and the Center for Streamside Studies held the second annual urban stream temperature survey on August 4th. Approximately 100 people from agencies, community groups, and the University of Washington gathered air and stream temperature data for urban creeks in King, Pierce, Kitsap, and Snohomish counties between 3 PM and 5 PM (capturing the peak of summertime high temperatures). The sites are the same ones that volunteers sampled last year* in order to provide information about the effects of human influences on fish-bearing and tributary to fish bearing streams. Last year's points have been loaded up on a four county GIS system to help examine the relationship between land use, geology and watershed areas. For more information on this project, contact Derek Booth at the CUWRM, (206) 543-7923 or look on the CUWRM website at http://weber.u.washington.edu/~cuwrm/

Graduate students Jay Camemayer and Sandra Clinton (and a dry Hylebos Creek)

APPRECIATION

A heartfelt thanks goes to **Scott Elliott** for creating artistic flyers for the Tuesday Morning Seminars. **Stephanie Innis** and **Holly Coe** will be making the flyers for the upcoming academic year's seminars. Thanks also to **Jen O'Neal** for writing the successful proposal to the Northwest Indian Fisheries Commission monitoring guidelines RFP.

**See the last issue of Streamside Runoff "Regional, Synchronous Field Determination of Summertime Stream Temperatures in Western Washington: 600 Sites in 120 Minutes".*

CSS Funding

Eastside Stream Temperature Project

CSS received money from the Upper Columbia Timber Growers Coalition to work on a two year project studying stream temperatures on the eastside of Washington State. Gardner Johnson, an incoming student, and Jenna Scholz (who created a database for the Forest Service on stream temperatures) will work on the project. The primary goal of the study is to characterize stream temperature variability in mid to low elevation streams in Eastern Washington in order to discriminate between water temperatures arising from "natural" or background conditions and those altered by natural resource management activities. This characterization will then be used to develop a methodology to identify streams with biophysical characteristics (beyond canopy closure and elevation) that predispose them to warmer water temperatures.

Monitoring Pilot Project

The Northwest Indian Fisheries Commission and Timber, Fish and Wildlife funded CSS to evaluate the Watershed Monitoring Pilot Project. A group of students from Fisheries, Forestry and Quantitative Ecology Resources Management met weekly in a seminar class to discuss the project and faculty provided comments as well. Their input was critical for the final report, which is available from CSS.

New Riparian Research Funds

The Washington Fly Fishing Club has awarded CSS money for research on riparian issues. The funds will be made available to students on a competitive basis. CSS is grateful for their support.

Announcements

CONGRATULATIONS

CSS would like to congratulate four CSS affiliated graduate students on the completion of their research. In the College of Forest Resources the following people received M.S. degrees: **Jeff Bash**, *Survey of Stream Restoration and Fisheries Enhancement Monitoring in Washington State*; **Eric Beach**, *Controls on Conifer Regeneration in Managed Riparian Forests*; and **Dan Peplow**, *Chemical and Biological Indicators of Mine Effluent Impacts on Alder Creek, North Cascade Mountains, Washington*. Dan will go on to do a doctorate in the same area. **Jamie Glasgow**, from School of Fisheries, received his M.S. degree for his work on *Effects of River Regulation by a Water Storage Dam on the Growth and Condition of O. mykiss*.

CSS can send copies of the abstracts to interested people, however, due to the cost of printing we can not make copies of the entire thesis. Most abstracts are available on the website.

CALENDAR OF EVENTS

September 20-24, 1999 - **Watershed Training Workshop**, UW, Seattle, WA. Contact Engineering Professional Programs at (206) 543-5539 for more information.

September 29 - December 2, 1999 - **CSS Tuesday Morning Seminars**, 22 Anderson Hall, UW, Seattle, WA. Seminars run every Tuesday 8:30 - 9:30 AM. If you would like a schedule mailed to you, contact Leslie Wall at cssuw@u.washington.edu or (206) 543-6920.

January 21, 2000 - **10th Annual Review**, HUB West Ballroom, UW, Seattle, WA. More information will be mailed out in December.

January 24-28, 2000 - **Ecology and Management of Wood in World Rivers: Creating a Framework for Translating Information Across Geographic Regions**, Oregon State University, Corvallis OR.

June 21-23, 2000 - **Watershed Management Conference**, Fort Collins, CO. Check out http://www.asce.org/gsd/sections/colorado/wm2000/ for more information. Abstract submission deadline is August 31, 1999.

August 27-31, 2000 - **Riparian Ecology and Management in Multi-Land Use Watersheds**, Portland, OR. For more info, see http://www.awra.org/meetings/Portland/Portland.html

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