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OREGON WATER RESEARCH NEWS

Water Resources
Research Institute
Oregon State University

RESEARCH PROGRAM OF THE WATER RESOURCES RESEARCH INSTITUTE

Most of the federal funds received by the WRRI go to support research projects within Oregon's Universities. A request for research proposals is sent each year to the Universities research community. They are urged to cooperate with State, federal and private groups in their research projects. The projects are evaluated by the WRRI Board, with the help of representatives of State agencies. Evaluations are based on scientific merit, relevance to the important water issues in Oregon, and the likelihood that the grant will enable the researcher to obtain outside funding to continue the research. Federal support for the WRRIs has remained constant over the past years and the amounts available are small relative to the cost of research projects. Our research grants are therefore seen as seed money, with priority given for support of graduate students. This money requires a 2:1 match with non-federal funds, which is difficult for many researchers to achieve.

The specific projects that WRRI has supported have changed in response to changing needs. Some of the early work helped to start watershed studies in Oregon. Understanding of fish habitat has always been an important issue for management of Oregon waters, as has the recreational use of streams. Recently water quality, of both surface and groundwater, has become an important issue. Projects have looked at physical, biological, and engineering aspects of water, as well as the economics and management of water in Oregon. The support for graduate students on these projects furthers one of the objectives of the WRRI-to assure that professionals in water research and management will be available in the future.

The WRRI publications are based upon research supported with these funds. It is important that the research results are available to the users. This newsletter is one means we use to let you know about the research work being done and research results available. Contact us with any questions or comments on this program.

Benno P. Warkentin, Director
Water Resources Research Institute

In This Issue

Recently Completed Research Projects, 1989 - 1990

Riparian and Geomorphic Regulation of Salmonids in Northwest Streams

Stan Gregory
Fisheries and Wildlife
Oregon State University

This study looked at the abundance of rainbow and cutthroat trout in the Middle Santiam River to determine the influence of valley floor landforms, undisturbed riparian zones, riparian zone alteration by timber harvest, and natural and land-use related disturbance on fish populations.

Some of the preliminary conclusions are:

1. Geomorphic processes and landforms strongly influence the distribution and abundance of trout in the Middle Santiam River.
2. Abundance of trout per length of stream decreases from the headwaters to the lower river.
3. Trout abundance is greater in stream reaches associated with natural disturbances (i.e., landslides and earthflows).
4. Local channel changes caused by landslides override local riparian vegetation influences on fish abundances, creating locally higher abundances as a result of the greater channel roughness and cover provided by large, geomorphic features delivered by the landslide.

Cumulative Impact of Riparian Cover on Thermal Loading, Trophic Processes, and Juvenile Steelhead Trout

Gary Lamberti, Hiram Li, and John Buckhouse, Fisheries & Wildlife, Rangeland Resources
OSU

This study investigated riparian zone impacts on stream productivity and fish populations in the John Day Basin. Researchers evaluated the cumulative effects of removal of riparian vegetation on stream quality with respect to the production of juvenile steelhead trout.

Increased solar radiation in stream reaches with reduced riparian cover led to higher populations of algae and invertebrates. Although this increased trout food sources, the high summer water temperatures reduced fish production by decreasing the amount of fish habitat. Overall, trout density was lower in downstream reaches suggesting cumulative habitat deterioration. The results of this research have applications for riparian management programs in Eastern Oregon.

Ongoing Research Projects, 1990 - 1991

Fate and Transport of the Herbicide Dacthal in Groundwater

Jack Istok
Civil Engineering
Oregon State University

This project is determining rates of degradation, sorption, and desorption of the herbicide Dacthal (DCPA) in soils and in groundwater. An alluvial aquifer in northern Malheur County is contaminated with this pesticide. This research project will combine new experimental data on DCPA degradation with hydrogeologic knowledge gained in previous studies of the area to predict future concentrations of DCPA in groundwater and to evaluate effectiveness of proposed alternative management practices.

Biochemical Analysis of Acetylenic Compounds as Nitrification Inhibitors

This study is surveying a group of acetylene compounds, seeking potential nitrification inhibitors. Nitrogen fertilizers are often ammonium or urea based compounds: the nitrification process microbially converts these compounds to nitrates which are easily leached to

Daniel J. Arp
Botany & Plant Pathology, OSU

groundwater. Nitrification inhibitors applied with fertilizers would decrease nitrate contamination of groundwater. This research will characterize the chemical factors which promote or limit the effectiveness of acetylenes as nitrification inhibitors.

Quantifying Losses of Nitrogen from Land-Applied Dairy Manures
Dave Myrold & James Moore
Crop & Soil Science, Bioresources Engineering, OSU

This project is investigating losses of N from dairy manures applied to fields in Benton and Tillamook Counties. Quantitative information on the magnitude of denitrification, nitrate leaching and nitrogen runoff will help develop improved manure management practices and nitrogen loading rates to ensure meeting groundwater standards and to decrease eutrophication of surface waters.

Mass Balance Study of the Collier Glacier, Oregon
Peter Clark
Geosciences, OSU

This is the second year of a study to determine the mass balance of the Collier Glacier in the Cascade Mountains of Oregon. This study will provide baseline information necessary to monitor the impact of global climate change on glaciers in Oregon. Since glaciers are an important reservoir of water this information will be important for water supply agencies predicting storage and yield changes.

1988 and 1987 Research Projects

Title	Principal Investigator and Publications
Effect of Riparian Vegetation on Groundwater Hydrology and the Annual Hydrograph of Rangeland Streams	Robert L. Beschta and Stuart W. Childs Oregon State University and Cascade Earth Sciences
The Workability of Water Markets: Economic and Legal Alternatives and Consequences	Olvar Bergland, Frederick Obermiller, Richard Lovett Oregon State University Publications: Lovett, R.A. and O. Bergland. Property Tax and Water Marketing: Mitigating Interjurisdictional Shifts in Local Tax Base". Willamette Law Review, vol. 25, no.4, 1989, pp 777-806.
Analysis of Whitewater Recreation on the Clackamas River, with Applications for a Regional Model of River Recreation	Bo Shelby and R.L. Johnson, Oregon State University Publications: WRRI-108. B. Shelby, R.L. Johnson, M. Brunson. Comparative Analysis of Whitewater Boating Resources in Oregon: Toward a Regional Model of River Recreation. 1989.
Laboratory Study of In-situ Reclamation Process for Metals-Contaminated Soils	P.O. Nelson and J.E. Baham, Oregon State University
Bioenergetics of Grass Carp: Water Quality Implications	L.J. Curtis, Oregon State University Publications: WRRI-101. Bioenergetics of Grass Carp: Water Quality Implications. Z. Cai, L.R. Curtis. 1988.

Effects of Simulated Land-use Practices on the Productive Capacity of Streams

C.D. McIntire, Oregon State University
Publications: DeNicola, D.M. and C.D. McIntire. 1990. Effects of Substrate Relief on the Distribution and Abundance of Periphyton in Laboratory Streams. I. Hydrology. J. of Phycol. 26: 624-633.
Ibid. 1990. Effects of Substrate Relief on the Distribution of Periphyton in Laboratory Streams. II. Interactions with Irrradiance. J. of Phycol. 26: 634-641.
WRRI-109. C.D. McIntire, D.N. DeNicola. Effects of Simulated Land-use Practices on the Productive Capacity of Streams. In press.

Geostatistical Analysis of Pesticide Contamination in Groundwater Aquifers

J.D. Istok, Oregon State University
Publications: WRRI-102. J.D. Smyth, J.D. Istok . Multivariate Geostatistical Analysis of Groundwater Contamination by Pesticide and Nitrate. 1989.

Behavior of Runoff-Derived Metals in a Well Defined Paved Catchment/Retention Pond System

W. Fish, Oregon Graduate Institute, Beaverton.
Publications: WRRI-103 Behavior of Runoff-Derived Metals in a Well Defined Paved-Catchment/Retention Pond System. W. Fish. 1988.
Karel Mesuere and William Fish. Behavior of Runoff-Derived Metals in a Detention Pond System. Water, Air, and Soil Pollution, 47: 125-138, 1989.

Theses and dissertations related to the above research projects

Forbes, Steven. Modifying Regional Input-Output Models for Price and Structural Changes: An Oregon Water Market Application in Grant County. OSU MS thesis, 1990, 82 p.

Bean, Gregory R. Adsorption of Hexavalent and Trivalent Chromium to a Clayey Silt Soil: Batch Kinetics and Equilibrium Studies. OSU MS thesis, 1990, 93 p.

DeNicola, D.M. Effects of Substrate Relief, Light Intensity, and Herbivory on the Distribution and Abundance of Periphyton in Laboratory Streams. OSU, MS thesis, 1990, 176 p.

Smyth, Jeffrey D. Multivariate Geostatistical Analysis of Groundwater Contamination by Pesticide and Nitrate. OSU MS thesis, 1989, 83 p.

Cai, Zheng Wei. Energy Utilization by Young Grass Carp Fed Different Diets. OSU PhD dissertation, 1989, 137 p.

American Institute of Hydrology - The New Professional Society on the Block

by Richard A. Cassidy, President, Oregon Section, AIH

AIH sets up national certification program for hydrologists and hydrogeologists

Do you think that hydrology and hydrogeological professionals should be nationally certified or registered statewide? In 1981, the American Institute of Hydrology (AIH) established a national certification program with the singular purpose of strengthening the hydrology and hydrogeological professionals in the public interest. A need to protect the public interest concerning hydrologic and hydrogeological issues has been repeatedly expressed by several groups within the scientific community. For example, a 1979 Ad Hoc Committee of the Association of University Watershed Scientists recommended standardizing the quality of hydrology professionals.

Since 1981, AIH has grown steadily. As of September 1990, there are 775 professional members and 26 associate members. The growth rate continues at an average of 13% annually. AIH members are found in all 50 states of the Union, including 4 U.S. possessions. Certification has also been issued to hydrologists and hydrogeologists in 6 Canadian provinces and 33 other countries. Currently, the major employment categories of the AIH members are consulting firms, government service and academia. Approximately 42% of the AIH membership are consultant employees; 33% are government employees, and 18% are from academia.

AIH members come from consulting firms, government, and academia.

The largest statewide membership is 83, from California. The state of Washington has 31 members. The largest nationwide gain in membership during the last two years occurred here in Oregon, currently with 22 members.

Certification requirements include post-degree work experience, publications, and by examination.

AIH certification requirements are similar to other professional requirements such as for engineers and geologists. Competency is demonstrated through education, professional experience, publication, integrity, and examination. Education requirements include having an academic degree in hydrology, engineering, or a physical or natural science, of which 37 quarter or 25 semester hours must be in hydrology or hydrogeology. An individual must also have 8 years of work experience beyond the BS degree, or 6 years beyond the MS degree, or 4 years beyond the PhD. degree. Publication requirements include authorship or contributing authorship in technical journals, symposia proceedings, professional publications, agency reports, or consultant reports. Integrity requirements include obtaining references from professional colleagues concerning an individual's technical qualifications, professional conduct, and moral character. A two-part examination is required covering basic principles and applied problems. Examination can be exempt for registered professional engineers and registered geologists with proper academic backgrounds and professional experience. Each individuals' certification is reviewed by a national committee every 5 years.

Send your comments on the pros and cons of state certification to AIH in Portland.

The Oregon section is also interested in your opinion on whether an AIH-type national certification is sufficient to protect the public interest or whether pursuit of a state registration program is in order. Please write to Richard A. Cassidy, AIH, PO Box 40271, Portland, OR 97240-0271.

The New Alsea Study: Hydrologic Recovery and Cumulative Effects Assessment

by John D. Stednick

Dr. John Stednick was on sabbatical August 1989-August 1990 with the National Council for Air and Stream Improvement (NCASI, Corvallis) and the Forest Engineering Department at Oregon State University. Dr. Stednick can be reached at the Department of Earth Resources, Colorado State University, (303) 491-7248. Locally, contact Paul Adams at OSU Forest Engineering(737-3527) for informationn on the New Alsea Study.

Studies under virtually every environmental condition indicate that vegetation removal results in increased annual water yield; full re-occupation by vegetation leads to hydrologic recovery, though at different rates for each climatic zone. The longest period of post-harvest measurement of annual water yield for conifer stands in the Pacific Northwest was documented at the H. J. Andrews Forest in the Oregon Cascades. Results there suggest that increased water yield decreases linearly with time.

The original Alsea Watershed Study was the first long-term watershed study to evaluate the effects of logging on stream physical and biologic properties. Three small watersheds, tributary to the Alsea River in Oregon, were studied from 1959 to 1973. Deer Creek (304 ha) was patchcut in three cuts of about 25 ha each with a vegetation buffer strip left along the main stream channel. Needle Branch (71 ha) was completely clearcut without stream protection. Flynn Creek (203 ha) remained undisturbed as a control area. Roads were constructed in 1965 and logging took place from March through October of 1966. Post-logging monitoring continued until the fall of 1973.

Annual water yield was increased over 51 cm, a 26% increase, by clear cutting and broadcast burning in Needle Branch. Annual water yield increased by lesser amounts at Deer Creek.

Needle Branch experienced increases in annual water yield, stream temperatures, and sediment concentrations after logging.

Elevated stream temperatures were among the most dramatic effects observed for Needle Branch, where streamside vegetation was removed. By 1973, temperatures had returned to pre-logging values. No temperature changes were observed on the patchcut watershed, where riparian shade remained intact.

Suspended sediment concentrations were variable in time and space. Suspended sediment concentration significantly increased over expected values during the first winter after slash burning on Needle Branch. Sediment yields declined to near-normal levels four years later. Increases were also observed on the patchcut watershed, but the source was attributed to periodic road-fill failures which persisted for one year.

Monitoring efforts have begun again after new harvest activity in the Deer Creek watershed.

Since 1973 when monitoring for the original Alsea study stopped, Flynn Creek has been made a Research Natural Area by the Forest Service. In the Deer Creek drainage three more units have been logged; 20.2 ha in 1978, 14.5 ha in 1987, and 8.4 ha in 1988. There was some pre-commercial thinning in Needle Branch in 1981.

An equation developed at the H.J. Andrews Forest predicts that Needle Creek annual water yield will return to pretreatment levels in 1991.

Although equations from the H. J. Andrews predict that Needle Branch will hydrologically recover in 1991, streamflow data for water year 1990 for Needle Branch suggest that hydrologic recovery will not occur until 1999 or later. Precipitation and streamflows were slightly below average for 1990, however summer lowflows were some of the lowest on record. It has not been determined if these lowflows are from the lack of summer precipation, or an increase in evapotranspiration efficiency.

1990 monitoring also evaluated impacts on water quality.

Water quality data for 1990 show chemical variability within and between the watersheds. The nitrate-nitrogen flux from Flynn Creek was over 3 times greater than the same flux from Needle Branch. Nitrate-nitrogen losses from Deer Creek were lower but comparable to Flynn Creek. Nitrogen fixation by red alder (Alnus rubra) stands in each basin could be the source, but streamflow generation and routing mechanisms need to be identified. Phosphorus values were usually below the detection level.

The new monitoring program will help assess cumulative effects of harvest on coast range streams.

One can assess the potential environmental impact of land-use activities by monitoring changes in water resources. The effects of land use on water yield are relatively easy to measure. Streamflows from the small Alsea watersheds reflect soil-vegetation-water interactions as well as chemical differences in water quality which would be diluted downstream. Continuation of the Alsea water resources monitoring network will identify potential long term effects on soil and water resources from silvicultural activities.

Good estimates of loading from forest lands are hard to make. To estimate the impact of a management practice requires information on background stream water quality and quantity, as well as knowledge of the system response to a given set of controls. Quantifying total maximum daily loads (TMDLs), per Section 303 of the 1987 Clean Water Act, requires accounting for the natural variability of the soil and water system. A better understanding of soil chemistry, water quality, and streamflow dynamics in forests is one prerequisite.

Editors note: for more on the original Alsea study, see Geological Survey Water -Supply Paper 2037, 1977.

Calendar

February 22, 23

"Designing, Maintaining and Restoring the Native Landscape III", a conference in Portland. Topics include restoration of wetlands and Willamette Valley grass prairies. Call Mark at 503-222-0134 or Tami at 503-236-0395.

February 18-22, September 9-13

Short courses in groundwater modeling sponsored by the International Ground Water Modeling Center, Holcomb Research Institute, Butler University, 4600 Sunset Ave. Indianapolis, IN 46208. 317-283-9458, FAX 317-283-9519. "Introduction to Groundwater Modeling" and, later, "Applied Groundwater Modeling".

March 20-21

"Nonpoint Source Pollution: The Unfinished Agenda for the Protection of Our Water Quality". Tacoma, WA. Contact Washington Water Research Center, Washington State Univ., Pullman, WA 99164-3002. 509-335-5531.

March 28 thru May 30

WRRI Spring Quarter seminar series, "Pacific Northwest Salmon: An Endangered Future?" Thursdays at 3:30. Call WRRI for a schedule (737-4022). At OSU.

May 13-17

Short course, "Watershed Rehabilitation", Fort Collins, CO. Sponsored by the BLM and Forest Service Watershed Rehabilitation. Contact Office of Conference Services, Rockwell Hall, Colorado State Univ., Fort Collins, CO 80523.

Announcements

March 18 deadline

National Research Initiative Competitive Grants Program is accepting grant proposals for a new program area, Water Quality and Forest/ Range/Crop Ecosystems. Program Description is available at university Research Offices or from Proposal Services Branch, Cooperative State Research Service, USDA, Room 303, Aerospace Center, Washington DC 20250-2200; 202-401-5049.

March 31 deadline

Proposals to GWEB for watershed restoration and enhancement projects should be submitted by March 31. Information at GWEB, 3850 Portland Rd. NE, Salem, OR 97310. 378-3739.

WRRI message

We have now sent out all the extra copies of WRRI publications. Please note that all publications are now $4.00. Please send payment with requests or call WRRI at 503-737-4022.

Water Resources Research Institute

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