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OREGON WATER RESEARCH NEWS

Water Resources
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Oregon State University

WATER RESEARCH AND EDUCATION IN OREGON'S COLLEGES AND UNIVERSITIES

This issue of Oregon Water Research News is devoted to the water research facilities and programs at Oregon's colleges and universities. Although brief, we hope these summaries convey some of the depth and breadth of the facilities, expertise, and programs available in higher education in Oregon. Not least of these commitments is the teaching curricula which will produce the next generation of water researchers and managers.

Eastern Oregon State College

Eastern Oregon has water-related student programs in biology and geography.

Lewis and Clark College

The Northwestern School of Law at Lewis and Clark has an extensive program in environmental and natural resources law, with numerous courses, conferences, and seminars open to the public. The Northwest Environmental Defense Center is a student-run environmental advocacy group located on campus which handles a large caseload of water-related issues.

Linfield College

Students and faculty at Linfield College are involved in studies of water resources in Yamhill County, in laboratory exercises, research projects, and honors research projects in ecology. The Rainbow Lake Watershed Enhancement project involved developing a master plan with trails and an interpretive center for research and environmental education. Contact Dr. Kareen Sturgeon at the Department of Biology.

Oregon Graduate Institute of Science and Technology

Approximately one dozen scientists who specialize in water quality issues work at the Oregon Graduate Institute of Science and Technology in Beaverton, a private graduate school for science and engineering education and research. Water resource programs in the ten-year old Department of Environmental Science and Engineering at OGI are nationally recognized, in part because of their unique interdisciplinary approach.

The Graduate Institute currently has strengths in five areas: groundwater, aquatic chemistry, estuarine and coastal water dynamics, land-water interactions, and global climate modeling.

Groundwater studies at the Oregon Graduate Institute focus primarily on organic contaminants (PCB's, pesticides). A series of large-scale artificial aquifers at OGI allow scientists to monitor how contaminants move in the underground environment. These tanks, part of the Large Experimental Aquifer Program at OGI, are providing realistic research results without the danger posed by deliberate spills in the field. So far, two aquifers have been built for the LEAP program. LEAP I, (30 feet by 30 feet and 10 feet deep) is used to study chlorinated solvents such as trichloroethylene. LEAP II, the world's largest artificial aquifer (70 feet by 30 feet and 15 feet deep) is used to simulate gasoline leaks from underground storage tanks. To a lesser extent, OGI scientists also study inorganic contaminants in groundwater, such as heavy metals (lead, cadmium, chromium, and zinc) and nutrients (nitrogen and phosphorus).

Graduate Institute scientists also teach and conduct fundamental studies in aquatic chemistry. OGI researchers are currently looking at the interaction between sediments and water, and how sediment affects water quality.

Preserving the complex environment of estuaries is one aspect of the estuarine and coastal water studies underway at OGI. Using innovative computer approaches that include special visualization tools as well as parallel processing, scientists employ sophisticated computer models to predict everything from tidal cycles to the probable path of waterborne contaminants. Future studies in this area will move away from estuaries in both directions: up the river to study watershed issues, and down from the river to consider regional coastal practices. To that end, OGI has recently formed a Center for Coastal and Land-Margin Research. The center will serve as a focal point for studies on land/water interactions, such as the work OGI is doing on Washington County's Tualatin River.

Another major water-related program at OGI falls under the area of global climate modeling. By modeling information such as rainfall, evaporation, and vegetation, scientists can predict how water will be distributed in the soil, and, therefore how much water will be available for vegetation to survive in desert ecosystems. Understand-

ing the chemistry of water vapor, a greenhouse gas, is one other important aspect involved when modeling climate. As the earth's temperature rises, water vapor increases, causing even more heat to become trapped and dry out the land and vegetation--a vicious environmental cycle.

Other growing areas of water-related expertise at OGI include: hydrology, sediment chemistry, soil chemistry, soil/plant/water relationships, hydrogeology, and microbiology.

Thirty full-time students currently take advantage of OGI's course offerings in the Department of Environmental Science and Engineering; roughly 60% are working toward M.S. degrees, which do not require a thesis and can be pursued on a part-time basis. The other 40% are working on Ph.D degrees, combining formal course work with research.

OGI students are involved in all aspects of departmental research and have ready access to modern computers and analytical instrumentation including gas, ion, and liquid chromatographs, a high resolution mass spectrometer, groundwater, rain, soil, and air sampling equipment, plus access to scanning electron microscopes and to a Raman spectroscopy facility.

Oregon Health Sciences University

Dr. William Morton, Professor and Head of the Division of Environmental Medicine at Oregon Health Sciences University, reports that their water program has focused on geographic correlations with health indices such as mortality rates for cardiovascular, renal, and neoplastic diseases and incidence rates for selected cancers. Of particular interest in Oregon is the prevalence of arsenic in groundwater. Only in Lane County has there been a systematic inventory of arsenic levels in well waters. The need for water measurement and health correlation studies exists in Douglas, Josephine, Jackson, Klamath and Lake counties as well as all along the eastern and western peripheries of the Willamette Valley north of Lane County. As the population densities and the demands on water resources increase, these questions will eventually have to be answered. The funds for such epidemiologic investigations have evaporated, but the need for study has not.

Oregon Institute of Technology

The Geo-Heat Center at the Oregon Institute of Technology is a major center studying use of geothermal water. The hydraulic characteristics of the Klamath Falls geothermal aquifer have been studied intensively in a cooperative program with Stanford University and the U. S. Geological Survey. The Geo-Heat Center, with Director Paul J. Lienau, has studied various applications such as down hole heat exchangers and use for domestic and industrial heating.

Oregon State University

Undergraduate and graduate courses related to water resources management are taught in several colleges. Some of the research programs are described in the following sections.

College of Agricultural Sciences

Programs in the College of Agricultural Sciences involve research and studies on management of water as a natural resource, and also water use for crop and animal production in agriculture and aquaculture. The impact of grazing on water quality, temperature, and stream structure are being investigated in studies on fish habitat. Technical aspects and the economic/institutional/social aspects of competing uses are studied in water allocation questions.

Specific research projects study the movement of the nutrients nitrogen and phosphorus within watersheds. Grazing and uses of riparian zones in rangeland are studied from a water quality perspective. Natural and constructed wetlands are studied as treatment systems and as part of the hydrological cycle. Analytical facilities are available to measure concentrations of synthetic pesticide chemicals in water, soils and biological tissues. Studies on toxicity of chemicals to plants and animals are part of these studies. Studies are carried out both in Corvallis and at branch experiment stations throughout the State.

Both extension and research activities are involved in 5-year hydrologic unit area projects as part of the Federal President's Water Quality Initiative. These projects address the impact of agricultural chemicals, nitrogen, and pesticides on groundwater quality in the Treasure Valley of Malheur County and the reduction of phosphorus from agricultural activities into the Tualatin River.

College of Home Economics

The College of Home Economics participates in the domestic water quality program as part of the interdisciplinary Extension Water Quality Initiative. The program considers drinking water quality, methods and costs of treating water to make it more suitable for domestic uses, and homeowner contributions to nonpoint source contaminants. Contact Mary Ann Sward, Extension Housing Specialist.

College of Oceanography

Oceanography has strong research and graduate teaching programs, with important work in estuaries that is of interest for fresh water studies. The reauthorization of the Coastal Zone Management Act, (public law 92-583) extends coastal zone interests into the watersheds near the coast.

College of Science

Most departments in the College of Science are involved in water studies. Wetlands studies include identification, hydrology, biological activities, study of processes and biological communities in various wetlands. Various ecological studies involve water, including biological cycles and activities of different organisms in streams. Fish habitat and fish diseases are an important component of the studies. The water balance at the earth's surface is studied in relation to atmospheric conditions. Meteorological and climatic data are analyzed for various applications, such as drought studies. The pollutants in fog are being characterized and their effect on plants studied. Studies on fluid flow in porous media relate to groundwater and to movement of contaminants. Water resources management under competing uses is studied and groundwater quality is related to land use.

College of Health and Human Performance

Students in the course Health 443/543 sample and test water quality in Oak Creek at five locations from the forested watershed to the mouth near the Mary's River. Contact Dr. Anna Harding in the Department of Public Health.

College of Engineering

The College of Engineering has always had major programs in water research and management, from early studies on cleaning the Willamette River to managing groundwater contamination. Much of the work involves detailed process studies and fundamental research, with broad environmental applications.

Water research emphasizes the hydrologic aspects of environmental problems. Current interests include hydrologic and biologic indicators of global climate change, resulting impacts on water-related development, wetlands mitigation and restoration, technical evaluation of fish habitat manipulation, cumulative dredging impacts on channel morphology, and reversal of lake sedimentation. A major new emphasis is research on groundwater movement in contaminated aquifers. Additional studies deal with advanced wastewater treatment systems and the mitigation of environmental impacts.

Another area of research focuses on the management and remediation of hazardous wastes. Investigations include degradation processes for chlorinated organic compounds, in situ remediation of metals-contaminated soils, and the transport and fate of hazardous substances in soils and groundwaters. The Department of Civil Engineering operates the Western Region Hazardous Substance Research Center with a U.S. EPA award and is developing a university-wide Hazardous Waste Management Institute to expand campus-wide involvement in such activities.

The O.H. Hinsdale Wave Research Laboratory is completing a major five-year expansion with an \$8 million University Research Initiative from the Office of Naval Research.

Courses are taught in surface and groundwater hydrology, hydraulic engineering, and in all aspects of environmental engineering.

College of Forestry

Water research and water management studies on streams in forested land include: the subsurface hydrology associated with forest riparian areas, long-term stream temperature changes in relation to streamside management practices, the occurrence of undercut banks and the role of forest vegetation, buffer strip effectiveness and the occurrence of blowdown, the transport of fine woody debris through forest streams, the occurrence and hydrologic significance of large woody debris to stream channel morphology and fisheries habitat, modelling of peak flows in forested watersheds for culvert and bridge design, effects of sediment influxes into streams on downstream channel morphology, the use of linear programming for evaluating sedimentation constraints on harvest patterns, and the hydrologic characteristics of forested wetlands.

Soil water studies have measured by-pass flow through large pores in unsaturated, clayey soils. This flow can carry contaminants to groundwater at rates much higher than predicted for uniform water flow through soils.

A NASA-sponsored research project is attempting to use remotely sensed variables to estimate daily rates of transpiration across a wide range of vegetation from Coast Range forests to juniper woodland. Results are compared with predictions from a simulation model that requires knowledge of soil water storage, plant cover, and summaries of daily precipitation, temperature, and radiation.

COPE, the Coastal Oregon Productivity Enhancement Program is a cooperative effort of the College of Forestry, the US Forest Service, BLM, other federal and state agencies, counties, and private industry interested in coastal forest resources. The program goal is to provide resource managers and the public with information relative to the management of coast range resources, such as fish, timber, water, and wildlife. COPE has an active program of studies and information transfer related to riparian zone management, fisheries, and water quality in coastal forests.

Hatfield Marine Science Center

The Hatfield Marine Science Center houses 20 OSU faculty members of various disciplines at its facilities in Newport. Others who require a coastal site use the Center's facilities. Programs at the center include the Coastal Oregon Marine Experiment Station, as well as EPA research facilities, and the marine region office of Oregon Department of Fish and Wildlife. Courses are offered for senior undergraduates and graduate students during winter and spring quarters. Summer quarter there is an extensive program for primary and secondary schoolteachers.

sia. A cooperative effort between the Geography and Biology Departments and the Oregon Department of Environmental Quality, under the direction of Drs. Richard Peterson (Biology) and Daniel Johnson (Geography) has led to the publication of the "Atlas of Oregon Lakes." This volume contains detailed information on the geographic location and physical, chemical, and biological characteristics of 202 lakes and reservoirs in Oregon. Currently Dr. Peterson is studying the recovery of Castle and Coldwater Lakes in the Mt. St. Helens National Volcanic Monument and is characterizing several lakes in the Mt. Hood National Forest.

Dr. Scott Wells of the Department of Civil Engineering is modeling the hydraulic and water quality parameters of rivers and estuaries. Current projects include assessment of management alternatives to deal with combined sewer overflows in the Columbia Slough. Another project involves modeling the hydraulics and salinity of the South Slough estuary, a tributary to Coos Bay and part of the National Estuarine Research Reserve System. The study's goal is to evaluate the effect on wetlands if water control dikes currently in place are removed. Dr. Ansel Johnson and students in the Geology Department are working with the Corps of Engineers to evaluate groundwater flow and temperature as it affects the development of water supplies for the new fish hatchery at Bonneville Dam.

Reed College

Reed College, in cooperation with The Nature Conservancy, has a continuing summer field research program in the Sandy River Gorge. The program involves monitoring a broad range of parameters in the basin including stream flow, water quality, and riparian habitat. At least sixteen research projects have been completed by Reed students to date. Contact Dr. Bert Brehm of the Biology Department.

Southern Oregon State College

Faculty and students at Southern Oregon State College in Ashland are involved in ongoing water studies, usually in cooperation with local entities. The Geology Department's Dr. Jad D'Allura, Dr. Monty Elliot, and Dr. William Purdom serve as geohydrology resource persons for the Jackson County Ground Water Advisory Committee.

Passive treatment of sewage effluent from the city of Ashland is being studied at Ashland Pond by Dr. Roger Christianson and interested students of the Biology Department. Students with Dr. Wayne Linn of the Biology Department monitor Bear Creek in cooperation with Eric Dittmer, the water quality coordinator for Rogue Valley Council of Governments. Bear Creek, a major tributary of the Rogue River, is one of ten streams in Oregon that are water-quality limited.

University of Oregon

Six departments at the University of Oregon conduct research and instruction on water-related issues.

The Department of Geography offers Geog 425/525, Hydrology and Water Resources (3 cr.), and its companion lab course, Geog 426/526, Hydrologic Analysis (2 cr.), which focus on surface water. Geog 427/527, Fluvial Geomorphology (4 cr.), and Geog 421/521, Advanced Climatology (3 cr.), cover topics closely related to surface water hydrology. Geog 463/563, Geography, Law, and the Environment (3 cr.), is concerned with water law and other aspects of environmental law and policy. Seminars offered as Geog 407 or Geog 607 may have water-related topics, such as "Geomorphic and Hydrologic Impacts of Greenhouse Warming" (Spring 1990). Several theses on water-related topics such as lake temperature and evaporation modeling, and watershed modeling, have been completed within the last few years. Geography faculty with water interests include Patrick Bartlein (climatology), Patricia McDowell (geomorphology, hydrology), and Alexander Murphey (political geography, environmental law and policy).

In the Department of Geological Sciences, Geol 410/510, Geohydrology (3-5 cr.), focuses on groundwater. Other water-related courses include Geol 310, Earth Resources and the Environment (3 cr.), Geol 427/527, Aqueous Geochemistry (3 cr.) and Geol 675, Hydrothermal Geochemistry (3 cr.). David Murphy, a hydrologist with the U.S. Geological Survey Water Resources Division and Adjunct Assistant Professor in Geological Sciences, studies regional groundwater systems in Oregon and the Pacific Northwest, and is involved in GIS applications in hydrology. Other Geological Sciences faculty with water interests include Sam Boggs (sedimentology) and Mark Reed (hydrothermal geochemistry).

The Ecology and Evolution Program in the Department of Biology offers Bio 142, Habitats: Freshwater Biology (4 cr.), Bio 155, Fishes: A Resource (4 cr.), Bio 475/575, Limnology (5 cr.), Bio 477/577, The Biology of Estuarine Systems (5 cr.), and other courses related to microbiology and ecology. Richard Castenholz specializes in algal and microbial ecology, and limnology.

The Institute of Marine Biology, a part of the Biology Department, is located at Charleston. Classes are offered for graduate and undergraduate students three quarters of the year. Research and classes include work on estuarine biology and ecology. One current project investigates introduced species from seawater ballast in the Coos Bay environment.

The Department of Planning, Public Policy and Management offers several courses on environmental planning and policy, such as PPPM 331, Introduction to Environmental Studies (3 cr.), PPPM 426/526, Environmental Planning (3 cr.), PPPM 443/543, Natural Re-

source Policy (3 cr.), and PPPM 467/567, Topics in Natural Resources Planning (3 cr.) that include water resources. John Baldwin (environmental sciences, resource management), Maradel Gale (legal issues in planning, environmental and resource planning) and Carl Hosticka (natural resource policy) have interests related to water issues.

The School of Law offers an outstanding program in environmental and natural resources law. Courses include Law 669, Water Resources Law (3 cr.), Law 670, Public Land Law (3 cr.), Law 676, Environment and Energy (3 cr.), and Law 686, Environment and Pollution (3 cr.). Faculty with interests in environmental law include Mike Axline (environmental law), John Bonine (environment and pollution, natural resource issues), Chapin Clark (water resources law), and Richard Hildreth (ocean and coastal law, urban land use law).

The University of Oregon offers an interdisciplinary M.S. in Environmental Studies, designed to combine theory and practice about environmental systems from the sciences, social sciences, humanities, and the fields of management, public policy, and design. The program is administered by a committee of faculty drawn from over ten departments throughout the university. A number of students in this program have pursued theses or masters projects on topics related to water, policy, and environmental management. Al Uruquhart is chair of the Environmental Studies Committee.

University of Portland

Programs are available in engineering, the physical and the life sciences. Contact Professor W. Wilson.

Western Oregon State College

Water related teaching programs are found in the Departments of Biology, Geology, and Economics. Drs. Guy Rooth and Ray Brodersen of Geology teach the Geology of Water. In Biology Dr. David McCorkle teaches Man, Water, and Environment and Dr. Lowell Spring teaches Ecology. In the Economics Department, Dr. Ronald Finster teaches Water Resource Management and Dr. Ajmer Singh teaches Water-Based Recreation.

Willamette University

The Geography Department at Willamette has study programs in wetlands. In the Economics Department, Tom Hibbard and Don Negri pursue water-related research topics. These projects include water project evaluation, crop mix response to changes in water price and availability, and the capitalization of water rights into land values.

Calendar

May 28, 29

"Genetics and Conservation Biology of Threatened Salmonids in the Pacific Northwest", May 28 and 29 at the LaSells Stewart Center, OSU, Corvallis. Sponsored by the OSU Department of Fisheries and Wildlife and the Agricultural Experiment Station. Call 503-737-1969.

May 29

"Saving the Wild Salmon" symposium will be Wednesday, May 29 from 8 am to 5 pm at the Red Lion Inn/Lloyd Center, Portland. Call the Columbia River Alliance for Fish and Commerce at 503-295-0911.

May 29, 30, 31

"Artificial Recharge of Groundwater" is a Symposium to be held May 29, 30, and 31 in Tucson, Arizona. Sponsored by the UA WRRC, USDA-ARS Water Conservation Laboratory, and the Salt River Project. Write: Water Resources Research Center, University of Arizona, 350 North Campbell Ave., Tucson, AZ 85721 or call 602-621-7607.

June 2-6

Symposium on **"Water Supply and Water Reuse: 1991 and Beyond"** will be held June 2-6, 1991 in San Diego. Sponsored by American Water Resources Association (AWRA), contact Steve Pearson, Woodward-Clyde Consultants, 1550 Hotel Circle North, San Diego, CA 92108, or phone 619-294-9400.

July 11-13

The fourth annual **"Country in the City"** symposium at Portland State University will be July 11-13. The subject is **"America's Greenways: Conserving and Restoring the Landscape"**. Write CIC IV, c/o Pacific Agenda, P.O. Box 10142, Portland, OR 97210.

July 22-26

The **"National Conference on Irrigation and Drainage Engineering"** and the **"Symposium on Groundwater in the Pacific Rim"** and the **"International Symposium on Lysimetry"** will all be held in Honolulu July 22-26, 1991. Sponsored by the Irrigation and Drainage Division of the American Society of Civil Engineers. Contact William Ritter, Agricultural Engineering Department, University of Delaware, Newark, DE 19717, 302-451-2468 or FAX 302-292-3651.

Sept. 7, 8

"Introduction to GIS for Water Resources Applications" is a short course sponsored by AWRA to be held Sept. 7-8, 1991. Contact AWRA, ATTN: Michael Fink, Meetings Manager, 5410 Grosvenor Lane, Suite 220, Bethesda, MD 20814-2192 or call 301-493-8600 or FAX 301-493-5844.

Oct. 21-24

An International Wetland Symposium on **"Constructed Wetlands for Wastewater Quality Improvement"** will be held in Pensacola, Florida Oct. 21-24, 1991. Sponsored by the Wetlands Research Laboratory and the Institute for Coastal and Estuarine Research. Contact G.A. Moshiri or C.D. Martin, Univ. of West Florida, 11000 University Parkway, Pensacola, FL 32514 or call 904-474-2754 or 474-2052.

New Publications

A Bioeconomic Analysis of Water Allocations and Fish Habitat Enhancements, John Day Basin, Oregon

by Richard M. Adams, Peter C. Klingeman, and Hiram W. Li

This is a case study of the relationship between stream condition and fish productivity, and the economic benefits and costs of stream improvements in the John Day River basin. Stream conditions are hypothetically altered by changing flow, structure, and vegetation. One conclusion is that water discharge and water temperature are the main limiting factors for salmonids in this drainage. The authors also conclude that improvement projects need to include the upper first and second-order tributaries which don't have fish populations.

This publication can be ordered from either WRRRI or NTIS. The WRRRI price is \$12.00, postage paid. To order from NTIS send \$26.00 for the paper copy or \$11.00 for a microfiche to US Department of Commerce, National Technical Information Service, Springfield, VA 22161. Refer to NTIS accession no. PB91-143123/AS.



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Director: B. P. Warkentin

Editor: Randy Selig

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**Water Resources Research Institute
Oregon State University
210 Strand Ag Hall
Corvallis, OR 97331**