OREGON
WATER RESOURCES
RESEARCH INSTITUTE

OREGON STATE UNIVERSITY • CORVALLIS

JUNE 1993 • VOLUME 3 NUMBER 3

Water-Related Research in Oregon's Universities

This issue of H_2O News is devoted to water-related research currently being conducted at Oregon State University, the University of Oregon, and the Oregon Graduate Institute. Although the summaries presented here are brief and by no means all-inclusive, they are representative of the breadth and depth of the activities at each institution.

Watershed Assessment

Though there is still much to learn about watershed assessment, current research about watersheds has evolved considerably in the past decade.

Answering the question "what is a healthy watershed?" initially involved looking at nutrients such as phosphorus and nitrogen, and sediments at the mouth of a river. Over time, this perspective grew to describing physical characteristics of streams: bank stability, flow patterns, erosion potential, and riparian zones. Further work on watershed assessment has included the biological functions of a stream, in part, using diversity as an indicator of biotic integrity. Combining these three methods—nutrients, physical characteristics, and biotic integrity—give a better picture of a watershed.

Another question arises, however: how can the potential of a watershed be determined? Scientists can describe a watershed, but how healthy is it? One way to determine relative health is to describe a baseline stream within an eco-region, for example, a relatively undisturbed stream in the Cascade Mountains. Biologists now look at macro-invertebrates, insects, as a measure of biotic functioning, and do not always regard diversity as the best indicator of a watershed's health. A watershed may have a number of exotic species—"trash fish"—that may indicate disturbance, and have replaced the few native species that indicated a healthier watershed.

Oregon has approximately 97,000 miles of streams; it would be impossible to get an "on the ground" assessment of any significance about watershed potential. And rivers such as the Willamette and the Columbia have such large watersheds, it is necessary to break them into smaller sub-watersheds and integrate those to get an idea of a large watershed's overall health.

Watershed assessment is developing along with GIS (geographic information systems) to display information on streams. With the GIS information, scientists can perform an on-the-ground reconnaissance of a particular stream, the first stage in identifying a problem. For example, are the riparian zones intact? Is water temperature too high?

(Continued on page 2)

Watershed Assessment

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These procedures provide better information about the health of a watershed, but they are still developing, and different agencies in different regions have varying definitions of watershed assessment and watershed health. In addition, watersheds and political boundaries seldom coincide: some land within a watershed may be a combination of federal, state, tribal, and private. Issues about the degree to which private land use is regulated can arise. Though still in its infancy, watershed assessment does represent a more integrated approach to managing a variety of resources, and as it develops, scientists will better be able to answer the question "what is a healthy watershed?"

Tualatin River Study

The Tualatin River Study, which ran from December 1991 to April 1993, is now complete. The study's purpose was to make recommendations about removing nonpoint sources of certain nutrients, specifically phosphorus, that contributed to algal growth in the mainstem Tualatin. The recommendations will consist of reports by a number of researchers from Oregon State University and Portland State University, as well as an overall summary document.

The research team studying the Tualatin integrated different disciplines from the two universities, including civil engineers, computer specialists, wildlife biologists, agricultural economists, soil scientists, and hydrologists. In addition, a number of local, state, and federal agencies were involved: U.S. Geological Survey, Oregon Department of Environmental Quality (DEQ), Washington County, U.S.D.A. Soil Conservation Service, Tualatin Valley Irrigation District, Unified Sewerage Agency of Washington County, and several environmental-interest groups.

The comprehensive study found that changes in the Tualatin River's water quality are long term: in the last fifty years, land use in the Tualatin has changed considerably, but even before cropland began to make way for urban development, the nature of the Tualatin River had been altered. Fertilized cropland and urban runoff continue to contribute to nonpoint phosphorus loading in the over-allocated river. The combined change in river characteristics, lower water flow in the summer, and warm, sunny summer days all contribute to continued algal growth.

Soil "smoothes" the levels of phosphorus entering the river, but it is not yet possible to tell precisely how much phosphorus has entered the system from crop application, forest harvesting, or animal manure, and how much was naturally in the ground.

The process to improve the Tualatin will continue; further work and study will be pursued. As an immediate next step, the DEQ is scheduling a series of public hearings to reassign the Total Maximum Daily Load of phosphorus in the Tualatin River.

Oregon State University Agricultural and Resource Economics

Groundwater Quality in Malheur County

A number of projects have been conducted by faculty in Agricultural and Resource Economics focused on groundwater quality issues in Malheur County. The research effort began in 1989 with support from a USDA-CSRS Groundwater Quality Initiatives Grant. This study examined the tradeoffs bewteen groundwater quality and economic cost to farmers. Different technologies were considered as alternatives to current practices, with a farm-level mathematical programming model used to identify the most

Groundwater Quality
(*continued*)

cost-effective technologies to reduce nitrate leaching into Treasure Valley aquifers. Working with graduate students, professors Greg Perry, Rich Adams, and Tim Cross found that significant reductions in leaching can be attained at a small cost, but elimination of all nitrate leaching would be an economic disaster for farmers. This analysis is currently being updated to include recently developed technologies and a wider range of farm settings. A second study considered the tradeoffs involved when trying to control two environmental externalities (nitrate leaching and soil erosion), both of which are significant problems in the Malheur County area. The research suggests policymakers need to be aware of both environmental problems when designing cost share arrangements, farm plans, etc. For example, some technologies designed to reduce erosion add to nitrate leaching problems and vice versa. Technologies do exist, however, that are not as cost efficient in reducing erosion but which have no negative impact (or perhaps a positive impact) on leaching.

Current work is focusing on a more aggregate understanding of irrigation systems, soils, crops and practices for Treasure Valley as a whole. Using a mathematical modelling approach, researchers hope to simulate the interactions and dependencies between farms and irrigation companies across the Treasure Valley. A better understanding of irrigated agriculture in this valley will be useful in examining changes in how irrigation water is managed by farmers and irrigation districts, as well as state and federal government.

Stream Team

The Stream Team was formed nearly thirty years ago to study watersheds in the Pacific Northwest on an ecosystem level. The members of this interdisciplinary research team, which includes foresters, fish and wildlife biologists, geologists, entomologists, and other scientists, have changed over the years, but the Stream Team is still working toward a better understanding of watershed ecosystems and developing approaches to integrated watershed management.

Much of the research conducted by the Stream Team occurs at the H.J. Andrews Forest, a Long-term Ecological Reserve. As an old-growth forest, the area is used to determine baseline conditions in watersheds. Scientists also study regrowth and second-growth forest watershed conditions, and have worked at Mount St. Helens following its eruption. One of the determinations made by the Stream Team: large woody debris in streams is an important element of a healthy watershed.

Inventorying Aquatic Insects—The aquatic insect component of the Team, led by OSU professor Norman H. Anderson, continues to inventory insect species and study their life history. Anderson is also inventorying aquatic insects in headwater streams and summer-dry streams to determine their contribution to mainstem rivers. Though the extent of this effect is currently unknown, a Ph.D study by Martin Deterich in OSU's McDonald Forest revealed that at least 10 of the 200 species inventoried have not yet been described. The Systematic Entomology Laboratory at OSU holds over 2.5 million specimens, reflecting a century of insect collecting and inventorying, yet it is apparent that even on a local scale, the number of described insects is incomplete.

Stream Team
(continued)

A "River Continuum": the Changing Biology of Rivers—Anderson is also studying a concept called a "river continuum." The idea attempts to demonstrate how the composition of various insects changes from a river's headwater to its mouth based on the source of food. For example, the community of aquatic insects in a river's headwaters will be comprised mostly of species that feed on leaf litter because the inflowing creeks are heavily shaded. In mid-sized streams, where more sunlight is available, living plants (especially diatoms and other algae) become a main food source. At the mouth of a river nearly all the aquatic insects are collectors of fine particles of organic material that has been transported downstream by the current.

Oregon State University **Department of Forest Engineering**

Summertime Stream Temperatures in the Upper Grande Ronde River, Oregon

Populations of spring chinook salmon have decreased sharply over the past several decades due to a combination of up- and downstream passage problems and habitat destruction. Historically, the Upper Grande Ronde River has contained 5–7 percent of the Snake River run: in 1957, spawning escapement was estimated to be 12,200 in the subbasin, but by 1990, that number had fallen to 725.

An estimated 52 percent of the streamside vegetation has been reduced by sheep and cattle grazing, mining, timber harvesting, and road building. This loss of vegetation has resulted in increased stream temperatures.

The current two-year study is part of a protection plan involving the Wallowa-Whitman National Forest and other entities. The study has several objectives. The first is to accurately characterize the summertime stream temperature patterns throughout the watershed. The second, to investigate the relationships between vegetation and channel morphology that affect stream temperatures.

To accomplish these objectives, thirty thermographs will monitor temperature, and intensive surveys will evaluate riparian vegetation, channel morphology, and geomorphology. The data will be used in TEMP86, a stream temperature prediction model. Once a determination of the accuracy of this model's ability to predict downstream temperatures is made, the next step will be to use the model to provide a method of assessing the degree to which proposed stream rehabilitation projects will reduce stream temperatures within the Upper Grande Ronde watershed.

Oregon State University **Department of Bioresource Engineering**

Constructed Wetlands Research Projects

Oregon State University's Department of Bioresource Engineering has two research projects on wetlands near Corvallis. The first is a two-year-old project at Pope and Talbot's pulp mill in nearby Halsey, and the most recent is a constructed wetland at the University's dairy. The planting patterns are similar at both facilities, so professor James Moore, working with a number of graduate students, can compare treatment efficiencies of bulrush and cattail in very different wastewaters.

(continued on page 7)

Oregon State University **Agricultural Chemistry**

Topics currently being researched in Agricultural Chemistry include a study of surface active agents in groundwater, pesticide transformation through conjugation with naturally-occurring thiols, and the development of alternative environmental sample preparation techniques.

Surfactants in the Environment

Natural gradient tracer tests are being conducted to determine the transport and transformation of surface active agents under in-situ conditions of a sewage-contaminated groundwater. Current field studies are focused on determining the biogeochemical processes that control surfactant biodegradation in groundwater.

The toxicity and persistence of so-called "inert" ingredients in pesticides is becoming an increasingly important topic in agricultural chemistry. Inert ingredients encompass a wide range of chemicals and materials, including surfactants such as nonylphenol polyethoxylates, which may be of greater ecotoxicological significance than some active ingredients in pesticides. It is important to understand the behavior of surfactants in estuaries, groundwater, and surface water, as well as their impact on receiving waters and ecosystems.

Ongoing research includes the development of accurate analytical methods to determine the identity of surfactants and their metabolites in environmental samples.

Pesticide Conjugation with Naturally-Occurring Thiols

Conjugation reactions between naturally-occurring thiols and agricultural chemicals such as chloroacetanilide herbicides is recognized as a principal detoxification pathway for crops such as corn and soybeans. Conjugation reactions also impact the fate of herbicides in soils because the water-soluble metabolites of herbicides have been identified in groundwater. Research is under way to improve our understanding of this natural detoxification pathway, the sources of thiols (for example, plant, microbial, or fungal) in agricultural soils, their rate of reaction with pesticides, and fate and transport of water-soluble sulfur-containing metabolites in groundwater.

Supercritical Fluid Extraction

Conventional techniques to determine polar pesticides in soils and sediments typically require multi-step, time-consuming procedures that involve the use of rather hazardous reagents such as diazomethane. Alternative analytical techniques that are rapid, quantitative, and minimize or eliminate organic solvents are being developed.

Use of supercritical fluid extraction (SFE) results in fewer preparative steps that minimize sample preparation time, solvent use and disposal. SFE is particularly well-suited for determining organic compounds associated with solid samples such as sediments and soils. For many types of agrochemicals, solid-phase extraction (SPE) using membranes is a viable alternative to liquid-liquid extraction because SPE requires very small volumes of organic solvents. Membrane SPE is being used in the laboratory to determine aqueous concentrations of pesticides in groundwater. Solid-phase micro extraction (SPME), which uses fibers rather than organic solvents, is currently being used to determine volatile flavor and fragrance compounds associated with crops such as hops, apples, and pears.

Contact: Jennifer Field, Agricultural Chemistry, OSU.

Oregon State University
Oak Creek Laboratory

Northern Cascades National Park Complex, Washington

Researchers led by William J. Liss and Gary L. Larson are studying over 65 lakes within the Park complex to determine baseline environmental conditions: lakes are being classified according to location within the Park, elevation, and extent of lake basin vegetation development.

The scientists are trying to determine how the water chemistry, habitat, and fauna of the lakes differ, and what the effect of stocking trout has been on native fauna. In the vertebrate community, salamanders have been native predators, but the trout compete with salamanders for food and habitat, and prey on them as well. Researchers speculate that complex physical and biological factors, including the presence of fish, affect the distribution of fauna throughout the Park complex. The study began in 1988 and continues through 1995.

Fish Growth in Waldo Lake, Oregon

Waldo Lake is an ultraoligotrophic lake in the central Oregon Cascades whose stocked fish appear to be able to sustain high growth rates: marked brook trout grew to over 12 inches in two years. The research, conducted by William J. Liss, Gary L. Larson, and others, is being conducted to better understand ecosystem interrelationships that can sustain this growth rate. Variables being evaluated include fish diet, fish growth, allocthonous organic input, benthic macroinvertebrate community structure, salamander distribution and abundance, and ecosystem organization. The study runs through 1994.

Additional Research at Oak Creek Laboratory

Ecological Studies

- Life history organization of Yellowstone cutthroat trout in Yellowstone Lake in reference to anthropogenic activities.
- Description of the influence of groundwater and intergravel flow on temperature patterns in Northeast Oregon.
- Research associated with protection and restoration of freshwater habitat of Northwest anadromous fish.

Toxicological Studies

- Effects of hardness, pH, and organic acids on aluminum toxicity in rainbow trout.
- Modulation of lipid metabolism by organochlorines in rainbow trout.
- Bioacummulation and biological effects of contaminants in arctic ecosystems.
- Bioaccumulation of PCB's following chronic dietary exposure in rainbow trout.

Constructed Wetland Research

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Pope and Talbot Pulp Mill

Researchers have studied pilot cells at the Pope and Talbot facility for one year. The wetlands team at OSU is working toward the goal of determining, depending on the characteristics of the wastewater, the type of treatment (rocks, bulrushes, or cattail) that might be most effective. The project goals include evaluating the effectiveness of wetlands to treat pulp mill effluent, to make recommendations regarding the design of full-scale constructed wetland treatment systems, and to add to the body of knowledge about these systems so other pulp and paper producers will have information about constructed wetlands for wastewater treatment. Some of the data will be applicable to assist in design and management of effluent from sources other than pulp mills.

The wetland facility consists of 10 ponds, 75 feet wide and 215 feet long, or about one-third acre each. Wastewater treatment over the past year has been limited to secondarily treated pulp mill effluent, but during 1993 the wetland ponds will receive stronger effluent.

All ponds have wastewater flowing 18 inches deep. One pond is filled with large rocks; the water flows through the rocks with a 2-day retention time. One is unvegetated; the other eight are vegetated. Researchers have found that the rock pond yields by far the best suspended solids and BOD treatment. But questions remain about nutrient removal in the rock pond: how long will the treatment be effective before the system must be cleaned, and what does recovery involve? Since the rocks cost about $8,000, replacement, if necessary, may be prohibitive, especially on a larger scale.

Two ponds are planted with bulrush, and the other six have cattail. Two of the cattail ponds receive no effluent, only clean water, in an effort to determine the strength of decaying material contributed to the pond effluent. Of the six receiving effluent, two cattail ponds have 2-day retention times, and two cattail ponds have 10-day retention times. The purpose is to determine what effect, if any, the additional retention time has on water treatment. The two bulrush ponds receive effluent and have 2-day retention times. Our studies have found that overall, the bulrush ponds remove more BOD than the cattail ponds; but the cattail ponds remove more suspended solids than the bulrush ponds. Researchers suspect the greater removal of suspended solids is a function of greater cattail plant surface area, and the bulrushes perform better with BOD because they pump more oxygen into the system.

OSU Dairy

The constructed wetland at the OSU dairy was planted with cattails and bulrushes approximately one year ago. The dairy wetland has been planted three times; nutria have been a problem here as well as at the Pope and Talbot site. Nutria swim and nest in wetlands, and are fond of both bulrush and cattail as a food source. Ultimately, a fence was constructed around the perimeter of the wetland to prevent nutria from entering and eating the plants. There is no water quality data as yet from the dairy wastewater wetland.

Other Wetlands Research

A three-year study of monitoring constructed wetlands for treatment of livestock wastewater has been funded through the Soil Conservation Service (SCS). Two other projects, one in Wisconsin and one in Alabama, are working in concert to develop design criteria for treating dairy wastewater in wetland systems.

Oregon State University **Stream Projects in the Department of Civil Engineering**

The Department of Civil Engineering has a variety of water-related research projects under way. Some examples given here are lake restoration, gravel management, erosion and sedimentation studies, and human waste management.

Sturgeon Lake Restoration

A restoration project at Sturgeon Lake on the Columbia River's Sauvie Island included a first phase to reduce sedimentation by increasing lake flushing. The current monitoring work performed by professor Peter Klingeman includes:

- Monitoring current sedimentation rates.
- Characterizing the lake's present system of water/sediment/contaminant circulation.
- Analyzing how sediment transport and associated water quality have changed in response to restoration efforts.

Maintenance dredging requirements for Dairy Creek, which flows into Sturgeon Lake, is a corollary project to protect the natural flushing of the lake. In addition, Klingeman is evaluating the potential shoaling problems at the Columbia River entrance to Dairy Creek, as these contribute sand to the creek.

The monitoring program includes flow measurements, comparisons with phase I data, suspended-sediment sampling, water depth soundings, and bathymetric measurements of the lake as well as Dairy Creek and Gilbert River to determine if sufficient water exchange is occurring—and that the sedimentation in Sturgeon Lake has been halted or reversed, thus improving the lake's water quality. Funding agency: Oregon Department of Environmental Quality.

Gravel Management to Protect River Uses

One aspect of managing Western rivers includes regulating sediment to protect other river uses, particularly fish habitat. In Oregon's coastal streams, sand and gravel extraction is limited to bar scalping rather than deeper dredging. Critical questions about this extraction have emerged:
Is gravel removed faster than natural recruitment, causing loss of sufficient spawning gravel?
Does bar scalping cause loss of deeper pools in the river?
Is gravel removal affecting river channel and bank stability?
Is Oregon's gravel mining revenue affected?
Is river boating affected?

Research objectives of Klingeman's project:

- To determine how sediment supply, transport and renewal function on coastal streams that have important anadromous fish runs;
- To determine cumulative effects of river gravel bar scalping on sediment transport, sediment input-output balance, channel morphology, bank stability, fish habitat, and other river uses.
- To provide technical guidance to Oregon agencies to reassess sediment management practices and regulations.

Rogue River Study on Erosion and Deposition

The 27-mile Hellgate Recreation Section of the Rogue River, managed by the Bureau of Land Management, provides a range of land- and water-based recreation with few regulations. This section of the river is used for a variety of jet boats, including motorized tour boats, and guided float trips and fishing. A growing public interest in river recreation has resulted in a significant increase in visitor use, as well. Wave and wake action from motor boats may

be causing erosion and stirring bottom sediments and gravels, which may contribute to turbidity and a loss of fish spawning habitat. A study from April 1992 to September 1993 will determine whether watercraft have an adverse impact on riverbank and river bottom soil erosion and deposition.

Rogue River *(continued)*

Human Waste Management in Mount Rainier National Park

About 16,500 visitors camp overnight in the wilderness and backcountry of Mount Rainier National Park; disposal of human waste is one of the most critical management problems. Fecal waste often contributes to disease, causes alterations to aquatic ecosystems, and creates aesthetic problems. Of the 48 pit toilets in the area, many are too close to surface water and some are located within groundwater levels—and are not in compliance with Wilderness Standards.

The objectives of professor Nelson's and Klingeman's study include:

- Developing criteria for siting pit toilets;
- Developing a priority list of pit sites that need to be removed or replaced based on those criteria;
- Developing management alternatives for waste disposal systems where pit sites are unavailable.

The study, being completed in June 1993, is funded by the National Park Service.

Johnson Creek Rehabilitation Project

University of Oregon **Department of Landscape Architecture**

A studio class of fifth-year and graduate students studied urban stream rehabilitation for the Johnson Creek Corridor Committee, a citizens' and multi-jurisdictional body seeking to rehabilitate the creek through a long-term plan of projects.

Johnson Creek is a 24-mile long daylighted perennial stream that flows through southeast Portland, Gresham, Milwaukie, Happy Valley, and unincorporated parts of Clackamas and Multnomah Counties. It has a history of serious flooding, poor water quality, parallels the Springwater Corridor regional trail, and its problems are exacerbated by the continued urbanization of its watershed and the lack of planning to maintain the creek's functional values.

The students performed regional analyses of the creek's basin and sub-basins to identify constraints and opportunities in solving flood control, water quality, habitat restoration and recreation problems. They identified the best landscape rehabilitation projects that might be performed to solve the worst problems in each. Some of these projects, including flood detention areas, constructed wetlands, flood diversion channels, stream buffering, land use changes in floodplains and recreation areas with environmental interpretation were selected for intensive design development.

Goodman Creek Watershed Landscape Studies

A fourth-year class undertook the creation of a set of alternative forest management plans for the Goodman Creek watershed in the Willamette National Forest. The students analyzed watershed characteristics such as vegetation, soils, slopes, hydrology, roads and trails, and microclimate, and assimilated the relevant information for use in decision making.

Each student team created a set of goals and objectives, based on their predilections and synthesis of a watershed landscape analysis and other information. Each team then applied those goals in developing forest management plans projected 200 to 250 years into the future. What is most noticeable about the plans is how dissimilar they are from one another.

The plans range from regional habitat diversity or connectivity, to a specific focus on local spotted owl habitat, to mixed use, to an emphasis on ground vegetation diversity. Most of the plans strive for mixed resource use, while others are very goal specific. Several have even considered the possibility of global warming. Contact: Dr. Robert Ribe 346-3648.

Oregon Graduate Institute of Science and Technology
Department of Environmental Science and Engineering

Sediment phosphorus chemistry—Researchers are examining the sediment chemistry that controls phosphorus desorption into and adsorption from solution. Sediment cores along the lower Tualatin River and some of its tributaries are being sampled. Desorption is measured over a weekly period using ion exchange sinks. Funded by Unified Sewerage Agency (USA).

Long term stream water quality monitoring in the West Fork of Dairy Creek—Temporal and spatial fluxes in water chemical and physical properties in a portion of the West Fork of Dairy Creek are being followed. This part of the basin is dominated by agricultural activities which include nurseries, annual crops, perennial crops, and pasture. Researchers measure a suite of parameters every two weeks throughout the year, including stream flow, pH, dissolved oxygen, temperature, electrical conductivity, alkalinity, nitrate, soluble and total phosphorus, and total suspended solids. Funded by ODEQ and USEPA.

Synoptic sampling in the Rock Creek Basin—Scientists conduct intensive sampling of 24 sites within the Rock Creek basin every 3 months. This basin is dominated by urban development. The parameters measured include stream flow, pH, dissolved oxygen, temperature, electrical conductivity, alkalinity, nitrate, soluble and total phosphorus, and total suspended solids. The results from this study are combined with those from the West Fork of Dairy Creek to provide a comparison between the impact of urban and agricultural land use practices. Funded by USA.

Soil characterization in the Tualatin Basin—In collaboration with the Soil Conservation Service Hydrologic Unit Area project in Dairy/McKay Creeks, researchers are examining soils of the Tualatin Basin and their potential importance as a nonpoint source for phosphorus entering the stream. They have examined the soil phosphorus chemistry of nine soils that constitute 50 percent of the Tualatin Basin area. Funded by USA.

Geographic Information System for the Tualatin Basin—Soil, hydrology, water quality parameters (both surface and groundwater), and land use practice layers are being loaded into a GIS system (GRASS) for the Tualatin Basin. The resulting maps provide an easy reference for researchers and managers on the interactions between the landscape and water quality. Funded by USA.

Groundwater testing in the Tualatin Basin—Scientists are monitoring the groundwater within the Tualatin Basin using domestic wells. The parameters measured include pH, dissolved oxygen, redox, sulfides, electrical conductivity, alkalinity, nitrate, soluble and total phosphorus, iron, and total suspended solids. Funded by USA and ODEQ.

Integrative analysis of landfill impact on its environment—The water/land connection at the recently closed St. John's landfill Tualatin River system twice a year. The data is quality controlled by the USA and OGI water quality laboratories and the uploaded into a student-accessible data base. Funded by NSF.

Faculty Contacts:

Mary Abrams	690-1346	Wes Jarrell	690-1183
Antonio Baptista	690-1147	Rick Johnson	690-1193
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		Paul Tratnyek	690-1023

Seminars, Conferences, and Workshops

MARK YOUR CALENDAR FOR NOVEMBER 3 and 4—The SIXTH ANNUAL OREGON STATE UNIVERSITY WATER QUALITY CONFERENCE

The 1993 conference theme is **"Management of Over-Utilized Streams: Lessons from the Tualatin Watershed."**

Increasing use of our rivers, resulting from new uses and from population growth, has exceeded the capacity of many rivers to perform the function we expect from them. How do we manage these streams for instream and out-of-stream uses?

The conference will be held in Corvallis at the LaSells Stewart Center November 3rd and 4th. The conference program will provide historical, technical, political, and sociological perspectives on managing over-utilized water resources. Programs will be available early September. For more information, call Ron Miner at (503) 737-6295.

A tour of the Tualatin Watershed on the afternoon of Tuesday, November 2 is being tentatively planned for those interested in seeing the complexities of the watershed.

"THE SALMON RECOVERY PLAN: ENDANGERED SPECIES AND ECONOMICS"—Topic of Fall 1993 Seminar Series

The Oregon Water Resources Research Institute will offer a ten-week seminar series beginning September 30, 1993, on the water uses and economic issues of salmon habitat and the role of the Endangered Species Act. Some recovery measures are being implemented; others are planned. How will it affect our lives in the Pacific Northwest?

Ten speakers, experts in their areas, will discuss different aspects of this issue. The weekly seminars are free to the public or can be taken for credit through Oregon State University or the University of Oregon. For Further information, call Patricia Easley at (503) 737-4023.

CORVALLIS WETLANDS—CHARTING THE FUTURE

Federal and State laws prohibit development on a wetland. About one-third of the land within the City of Corvallis Urban Growth Boundary has hydric soils (one of the three indicators of a wetland site). This is a potential conflict with the City's current zoning since most of the existing land use designations assume that lands within the City will eventually be developed.

This creates uncertainty for property owners. They don't know whether or not they can develop their lands even though the property is zoned for development. In addition, Corvallis has not inventoried its wetland resources to determine which lands the community feels should be protected and which should be developed.

The Community Development Department will sponsor a **wetland presentation and workshop to be held July 20, 1993 at 5:30 p.m. at the Corvallis Benton County library (6th St. and Monroe Ave., Corvallis) Library Meeting Room.** The workshop is to help the community determine what options and opportunities exist in the current wetland controversy. The City Council will review these options in September and will identify a course of action.

Speakers at the workshop will include representatives from Oregon communities that have completed wetland plans and from developers that have utilized wetland planning successfully. Ken Bierly from the Division of State Lands will present some of the options available to communities and related funding opportunities.

"GROUNDWATER QUALITY, GRANTS PLANNING WORKSHOP" at Oregon State University. November 4, 1993, 1:30 to 5:00 pm. This follows the Water Quality Conference (see above.)

Discussion with State agency personnel responsible for research grants, and research people interested in applying for funding in December, 1993. Contact Patricia Easley at OWRRI, (503) 737-4023.

U.S. Geological Survey Water Data Sources Directory

The U.S. Geological Survey has recently established the Water Data Sources Directory (WDSD) database for use on personal computers. The WDSD, which is maintained by the National Water Data Exchange (NAWDEX), contains information about organizations that collect, store, and disseminate water and water-related data.

The database includes the following information:

- The type of each organization.
- The major orientation of water-data activities conducted by each organization.
- The types of data held by each organization and the geographic locations within which these data have been collected.
- The names, addresses, and telephone numbers of offices within each organization from which water data may be obtained.
- Alternative sources of an organization's data.
- The designation of liaison personnel in matters related to water-data acquisition and indexing
- The volume of water data indexed for the organization.
- Information about other types of data and services available from the organization that are pertinent to water-resource activities.

The Oregon Water Resources Research Institute has a computer program, WDMAIN, which simplifies the process for retrieving data from the WDSD for points 1, 2, and 3 above.

For more information about this database, contact:
Chief, National Water Data Exchange, U.S. Geological Survey, 421 National Center Reston, VA 22092. (703) 648-5684 (FTS 959-5684).

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Editor: Heidi Van Zee
Oregon H_2O News is published by the Oregon Water Resources Research Institute with funds provided in part by the U.S. Geological Survey, Department of the Interior, as authorized by the Water Resources Research Act of 1984.

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