OREGON STATE UNIVERSITY

OAK CREEK

Research and Teaching in OSU's Home Watershed

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Welcome to the Oak Creek Website!

Website Mission:

To enhance communication and provide background information for the managers, students, residents, and researchers of the Oak Creek Watershed.

The Oak Creek Watershed is the 8300 acre (33 square kilometer) home basin for Oregon's land grant university, Oregon State University (OSU). The University manages about 40% of the basin for multiple uses including: The McDonald-Dunn Experimental Forest, OSU's Dairy and Sheep Centers, stadiums, and the University's urban campus.

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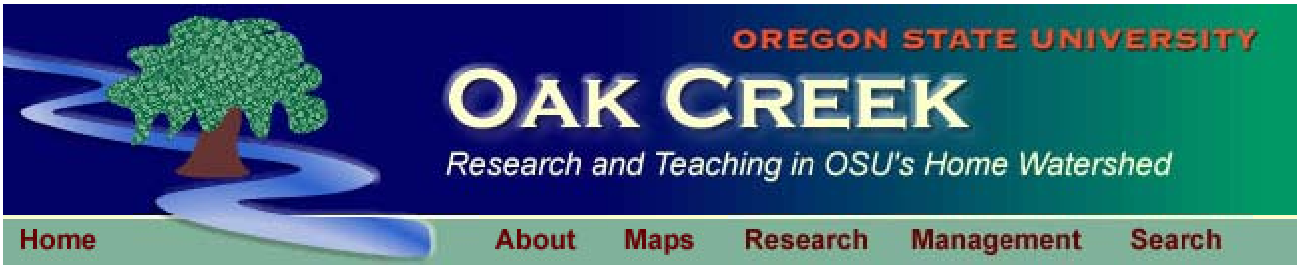
Center for Water and Environmental Sustainability (CWESt)
Please Note: CWESt was closed in 2005 and replaced by the OSU Institute for Water and Watersheds
210 Strand Agricultural Hall
Oregon State University
Corvallis, OR 97331-2208

Email: iww@oregonstate.edu
Web: http://water.oregonstate.edu



About Oak Creek and its Watershed

Description of the Oak Creek Basin from the Oak Creek Action Team Report, June 2000

The Oak Creek basin is forested in its headwaters and shifts to a mosaic of agricultural fields, residential areas, and urban areas in the lower portion in the Willamette Valley floor. Oak Creek is a fourth-order stream with an average discharge of approximately 0.5 cfs in summer and more than 5 cfs in winter, with flood discharges exceeding 100-200 cfs. Oak Creek originates in the headwaters in McDonald-Dunn Forest and enters the Marys River just before the confluence of the Marys and Willamette River. Oak Creek has been part of the town of Corvallis since its inception and has been an important resource for the community. Survey notes from the 1850s indicate that the reach below 35th Street was mostly prairie, and a riparian forest of ash, maple, alder, and cottonwood lined the stream from that point to its headwaters.

The University manages roughly 40% of the entire Oak Creek basin, with private lands interspersed in the lower portion of the basin. Road densities are greatest in the lower third of the watershed, and stream drainage and flooding have been modified by the community and University over the last century.

Oregon State University is responsible for several distinct management areas, including 1) McDonald-Dunn Forest, 2) the Wilson Sheep ranch, 3) the agricultural complex of the Equestrian Center, dairy, poultry farm, swine research area, beef research area, and miscellaneous livestock, and 4) the campus. Campus, agricultural, and forestry operations have modified Oak Creek and its basin. Some modifications (e.g., buildings, stadium, parking lots, roads, culverts) are relatively permanent, but others can be changed readily through revised land use practices. Many existing practices may be compatible with a long-range basin plan, if such a plan is developed by the University.

Basin Statistics (calculated by Aileen Buckley, Geosciences Graduate Student, 1994)

Basin Area:	8299 acres; 13.0 square miles (34 sq. km; 3360 hectares) (approximately)
Sub-basin Areas:	See Map for locations of sub-basins Willamette Plains Sub-basin -- 1818 acres; 2.84 sq. mi. (7.4 sq. km.; 727 hectares) Coast Range Foothills Sub-basin -- 2522 acres; 3.94 sq. mi. (10.2 sq. km.;

	1009 hectares) Oak Creek Main Stem Sub-basin -- 2507 acres; 3.92 sq. mi. (10.2 sq. km.; 1003 hectares) Alder Creek Sub-basin -- 1555 acres; 2.43 sq. mi. (6.3 sq. km.; 622 hectares) (approximately)
Mean Annual Precipitation:	40-45 " (101 - 114 cm)/year in lower portion of watershed; 70-75 " (178-191 cm)/year in upper portion
Elevation Range:	2155' (657 m) to approximately 240' (73 m); elevation difference 1915' (584 m)
Geology:	Volcanics in upper half of watershed; Quaternary terrace deposits in lower half, Corvallis fault divides the two
Stream Density:	34.8 miles / 13.0 sq miles = 2.68 miles per sq miles (56 km / 34 sq km = 1.66km per sq km)
Road Density:	44. 0 mi/ 1 3.0 mi2 = 3.4 ni/mi2 (71 km/34 km2 = 2. 1 km/km2)
Vegetation:	Upper portion is primarily conifer-doniinant, with some deciduous, mainly along stream channels. Middle portion is primarily agricultural with some areas of oak-alder, especially along riparian areas. Lower portion is mainly urban with ornamentals in residential areas and oak-alder-maple-some willow-some poplar in riparian areas.
Land use:	Willamette Plains: Agriculture, pasture and urban, some university campus Coast Range Foothills: Agriculture, pasture and residential, some urban Oak Creek Main Stem Sub-basin: Forested with logging and recreational activities Alder Creek: Forested with logging and some private residential
Major land owners:	Largest percentage of land is owned by Oregon State University. Private land owners own the next largest percentage, followed by followed by private timber companies (Starker Forests and Willamette Industries, respectively).
Water supplies:	A dam is located on the main stem of Oak Creek near the intersection of 53rd Street and Harrison Boulevard. This dam is used in the spring to collect water which is later released for irrigation. Another impoundment is on the Witham Hill Branch just east of the housing development at the end of Ponderosa Avenue. Impounded wetlands are indicated on National Wetland Inventory (NWI) maps at the lower end of this same branch near just upstream of its confluence with the main stem of Oak Creek.
Major capital improvements:	Aside from bridges on main roads, none.
Fisheries resources:	Cutthroat trout have been documented throughout the basin. Previous research suggests migration of salmon upstream to an eight foot escarpment on the main stem, along the Corvallis Fault. Other non-game fish are present throughout the basin, but their

	abundance and distribution are uncertain.
Wildlife resources:	Beaver activity is evident in some reaches, primarily in the MacDonald-Dunn Forest. Nutria activity is evident, particularly in agricultural reaches in the basin. Northern Spotted Owl have been observed in the forested higher elevation regions of the basin.

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Maps

Places to Look for Downloadable Maps

Website or Link	Area Covered	File Format
College of Forestry	McDonald-Dunn Forest, roads and trails	jpg
Benton County	Benton County, roads, public facilities, construction projects	pdf
This site	Map of Oak Creek watershed and lands managed by OSU	jpg
This site (see below for georeferenced version, available from the Oregon Geospatial Data Clearinghouse)	Corvallis Quadrangle, USGS 1:24,000 DRG	tif

Sources of GIS Data (This table current as of June 2002)

Contact Information	Available Layers
OSU College of Forestry	
Geographic Extent: McDonald-Dunn Forest Projection: NAD27?, State Plane, Oregon North Zone, Clarke 1866, U.S. feet Metadata: No, some info in readme files written in 2000 Format: ArcView Shapefiles and images Available for download: Some yes, http://www.cof.orst.edu/resfor/gis/purpose.sht Contact person: Debora Johnson, GIS Program Coordinator, 541.737.6388, debora.johnson@orst.edu	Forest Boundary, Contours, Stand Information, Roads, Streams, Trails, Soils, and more
City of Corvallis	

Geographic Extent: Corvallis Urban Growth Boundary
Projection: NAD27, State Plane, Oregon North Zone, Clarke 1866, U.S. feet
Metadata: No, some info in readme files written in 2000
Format: ArcView Shapefiles and images
Available for download: Yes, http://www.ci.corvallis.or.us/pw/transport/gis/giscds.html
Contact person: Alice Gruzca, City of Corvallis GIS Coordinator, 541.754.1742, alice.grucza@ci.corvallis.or.us

Transportation, Property Boundaries, City and Urban Growth Boundaries, Zoning, 1996 Aerial Photos and derivative products, Streams, Floodplains, Utilities, Wetlands, and more

Benton County

Geographic Extent: Benton County, some layers exclude the data covered by the City of Corvallis
Projection: NAD 83/91, State Plane, Oregon North Zone, Clarke 1866, U.S. feet
Metadata: Yes
Format: ArcView Shapefiles
Available for download: No, more info at http://www.co.benton.or.us/irm/gis/GISpage.htm
Contact Person: Doug Sackinger, GIS Coordinator - Benton County, Oregon, 541.766.6601, douglas.a.sackinger@co.benton.or.us

March 2000 Aerial Photos and derivative products including a DTM, Zoning, Transportation, benchmarks, bridges and culverts, and more

Coastal Landscape Analysis Modeling Study (CLAMS)

Geographic Extent: Oregon Coast Range
Projection: UTM, Zone 10, Clarke 1866, meters
Metadata: Yes
Format: Arc/Info Coverages
Available for download: Yes, http://www.fsl.orst.edu/clams/
Contact person: Keith Olsen, Corvallis Forestry Sciences Lab, 541.750.7279, clamsweb@fsl.orst.edu

10m DEMs, 30m DEM, 6th/7th Field Watersheds, Streams (derived from 10m DEM), 1996 Vegetation, 1988 Vegetation

Pacific Northwest Ecosystem Research Consortium

Geographic Extent: Willamette Valley
Projection: UTM, Zone 10, Clarke 1866, meters

Transportation, Land Ownership, Population, Hydrology, Geology, Soils, Ecoregions, 30m

Metadata: Yes Format: Arc/Info Coverages Available for download: Yes, http://www.fsl.orst.edu/pnwerc/wrb/access.html Contact person: Kelly Wildman, OSU Administrative Specialist, 541.737.1091, kelly.wildman@orst.edu	DEM and derivative products, Land use/land cover ca. 1990, 1851 Vegetation, Future land use/land cover projections, Willamette Watershed Boundary and more

Oregon Geospatial Data Clearinghouse

Geographic Extent: Statewide Projection: NAD83, Lambert, International feet, link to more projection info Metadata: For some layers Format: Arc/Info Export Files, ArcView Shapefiles, and images Available for download: Yes, http://www.sscgis.state.or.us/ Contact person: GIS Data Adminstrator, 503.378.2166, gis@web1.css.das.state.or.us	Most at a scale of 1:100,000 or smaller, Transportation, Boundaries, Hydrology, Geology, Ecoregions, Census Data, DRG's, and more

Other GIS Resources on Campus

- Corvallis Forestry Sciences Laboratory Spatial Data Management Links
- OSU GIS Software and Links

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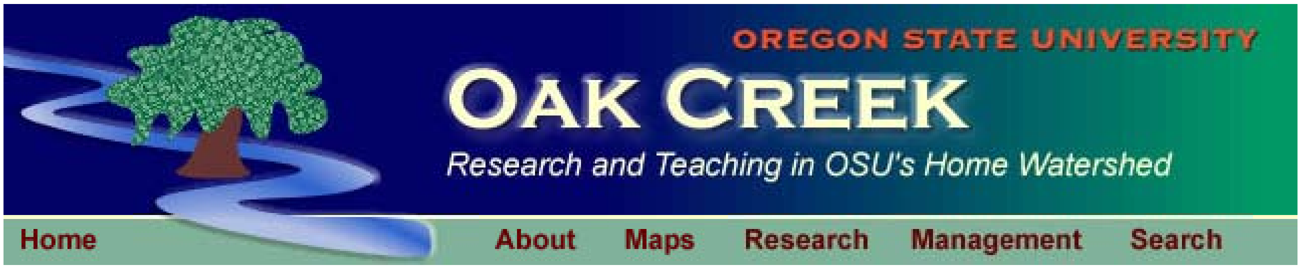

Research

Because of its proximity to campus, many students and professors have carried out research projects in the basin. This website includes short summaries of key research efforts, bibliographic references to theses and publications, links to tabular datasets when they are available, and contact information for professors who spearheaded major research projects. Please note, this site was created in 2002.

Topic areas include:

Agriculture	Entomology	Forestry	Sediment Transport
Climate	Fisheries	Geology	Watershed Analyses
Hydrology and Water Quality		History and Social Science	

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Jump to subtopics:

Historical Overview

Source: Oldfield, J.E., 1994, In Service to Animals, The Evolution of the Department of Animal Sciences at Oregon State University, 60 p.

Date: Spring 2002

Agriculture forms the roots of Oregon State -- when the university was established in 1868 it was as the Oregon Agricultural College. On-site agriculture facilities began near the central campus and gradually moved westward as new lands were acquired and the urban campus expanded. At the turn of the century agricultural buildings were near the current central campus and included a dairy building, a horse barn that housed draft breeds, a beef cattle barn, silos, and a piggery. By 1929 a sheep barn was built on the SE corner of campus way and 35th St and a large hog barn near the present location of the EPA Water Lab. The hog barn had 29 group pens, bins for 6300 bushels of grain and space for 40 tons of straw bedding. In 1936 the dairy moved to its current location and into a new building built by the Civilian Conservation Corp.

In the late 1940's OSU acquired several hundred more acres of land in the Oak Creek watershed. This new land included 500 acres near the current Sheep Center, 50 acres south of Highway 20 that became South Farm, 50 acres north of Harrison across from the dairy, and E.E. Wilson's farm of 250 acres which was along Oak Creek Road. Professor Oldfield noted that ownership of the Wilson farm gave OSU "virtually complete" water rights to Oak Creek.

Today there are five agricultural units within the basin:

Unit	Area	Number of Animals (approximate)

The Dairy Center	180 acres (220)*	170 in the dairy heard with 20-140 heifers
Campus Beef Facility	(30 acres) (two additional ranches are outside of the Oak Creek Basin)	(50 animals)
The Horse Center	200 acres (120)	70 horses (80)
The Poultry Center	(100)	(5000 broilers)
The Sheep Center	600 acres (300)	475 ewes (325)
The Swine Center	-	"10 White Line sows mated to Yorkshire or terminal sires"

values for area and animal numbers are from the Department of Animal Science website
*numbers in parentheses are those given in the Oak Creek Task Force Report.

OSU News Stories about the Research Farms

1/9/2002 - Concerns about budget reductions...

6/25/2001 - Field day features robotic milking machine...

Spring 2000 - Sheep barns breed Dorper sheep...(scroll down on page)

7/2/1999 - OSU holds public meeting on Oak Creek problems...

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Student Theses

Drew, A. D., 2000, Effects of livestock grazing and small mammal populations on endangered Bradshaw's desert parsley (Lomatium bradshawii) at Oak Creek, Willamette Valley, Oregon [M.S. Thesis], Oregon State University, 65 p.

Drew, J. L., 1964, Economic analysis and adjustment opportunities of grade A dairy enterprises in Benton County, Oregon [MS Thesis]: Department of Agricultural Economics, Oregon State University, 90 p.

Available: OSU Valley Library OSU Valley Library LD4330 1964 44

Yamaguchi, K., 1992, see reference on History page.

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Reports and Publications

Appleby, Arnold, 1999, 50 years of The OSU Weed Control Program, A history and memoirs: Oregon State University Printing Office, Corvallis, OR, 88 p.

Available: OSU Valley Library LD4343.A671 1999

Courtney, E. W., c1984, Agricultural education : history of the department: Oregon State University, Corvallis, OR, 216 p.

Available: OSU Valley Library LD4349.5 .C681 1984

Notes: Focuses mainly on faculty chronology.

Oldfield, J.E., 1994, In Service to Animals, The Evolution of the Department of Animal Sciences at Oregon State University, 60 p.

Available: OSU Valley Library LD4349.5 .A5051 1994

Notes: Information about faculty chronology, land acquisition, building construction.

Southern Pacific Company and Corvallis Commercial Club (Or.), 1912?, see reference on History page.

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Research: Climate

Datasets and Class Projects

There are several rain gages in the Oak Creek basin:

Arne Skaugset (OSU Assistant Professor of Forest Engineering) began operating three gages in the McDonald-Dunn Forest in 2002 as part of study investigating the impact of forest roads.

The Environmental Protection Agency Corvallis Lab operates a rain gage. This data is not available for public distribution until it has been through Quality Control procedures. Contact: Ron Waschman (Waschmann.Ron@epamail.epa.gov).

The OSU Dairy Center operates a rain gage. Contact: Ben Krahn, Unit Supervisor (541.737.3275).

There is U.S. Weather Service weather station at Hyslop Farm, an OSU research facility between Corvallis and Albany (off of U.S. Highway 20 and Lewisburg Road). Records are available from 1948 through the present. Some daily records are available online as are historical summary tables. Contact: George Taylor, Oregon State Climatologist (541.737.5705, oregon@oce.orst.edu).

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Research: Entomology

Jump to subtopics:

- Historical Overview
- Datasets and Class Projects
- Student Theses
- Reports and Publications

Historical Overview

Source: Conversations with Norman Anderson, OSU Professor Emeritus of Entomology (andersn@bcc.orst.edu, 541 737 5494)

Date: Spring 2002

Norm Anderson and his students carried out many aquatic entomology studies from the mid-1960's to 1995 in Oak Creek and in Berry Creek, another stream in the McDonald-Dunn Forest, Soap Creek Drainage (near Adair Village). Two classes used Oak Creek for class exercises. The Aquatic Entomology class collected specimens in Oak Creek but tended to focus on identification skills rather than field studies. The Ecological Methods class had a field component that studied a single site on Oak Creek annually for about 30 years (1965-1995). This course was co-taught by Peter McEvoy and Norm Anderson. The site was located about 500 meters above the West Fork of Oak Creek, within McDonald-Dunn Forest. Norm suggests that Peter may have student papers from the class.

Norm made the following comments about changes at the West Fork study site:

> "Major changes that have occurred during the study interval are the increase in beaver activity, and the spread of the introduced grass, false brome (*Brachypodium sylvaticum*). Beavers have extensively modified the riparian area both by building dams and by felling trees; where ponds have filled with sediment or dams have failed plant succession has been reset to the earliest stages of colonization. Brachypodium has become the dominant vegtation not only in the meadow upslope from Oak Creek, but as the understory in the riparian area and in the upland conifer stand."

Another focus of Norm and his student Martin Dieterich was on summer-dry headwater streams. Norm says that one quarter of Oak Creek's aquatic insect biodiversity is in these small headwater streams that go dry annually. These are unpredictable habitats and the organisms are adapted for dispersal. Norm and Martin tried to revisit some study sites about five years after their initial work but the sites were already difficult to locate.

Norm made the following comments about a related on-going study:

> "In a companion study for the last ten years, Norm has collected from three temporary streams in his backyard on the Witham Branch of Oak Creek. This work is mostly unpublished as species-level identifications are still required for much of the fauna. (Hopefully, future students will be involved in these biodiversity studies). In this remnant patch of Oak savanna we know of at least two undescribed species of aquatic insects and expect that there are several other new species."

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Datasets and Class Projects

Ecological Methods (1963-1995), Instructors Peter McEvoy and Norman Anderson, Department of Enotomology

> See above for details.

FW456/556 Limnology and FW580 Stream Ecology

> Since the 1980's the limnology class has studied the stream and carried out group project on water quality, limnology, fisheries, and entomology. Reports generally make comparisons between three stream reaches : forested, agricultural, and urban. These reports were archived by Kathy Staley's students (OSU Fisheries and Wildlife Department) in the 1990's and are available in the Fisheries and Wildlife Library (Nash Hall, Room #104). There is no digital index of these reports at this time but they are sorted into binders by topic.

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Student Theses

Azam, K. M., 1969, Life history and production studies of Sialis californica Banks and Sialis rotunda Banks (Megaloptera : Sialidae) [Doctoral Dissertation]: Department of Entomology, Oregon State University, 111 leaves, bound p.

> Available: OSU Valley Library LD4330 1969D .A9

Ball, E. E., 1946, The seasonal succession of stoneflies (Plecoptera) on Willamette valley trout streams [MS Thesis]: Department of Entomology, Oregon State College, 54 leaves, bound p.

Available: OSU Valley Library LD4330 1946 2

> Notes: Kerst, 1970 compared the results of this study with new sampling. Norm Anderson commented that it would be great to do another study and have a 30 and 60 year comparison.

Dieterich, M., 1992, Insect community composition and physico-chemical processes in summer-dry streams of Western Oregon [Doctoral Dissertation]: Department of Entomology, Oregon State University, 191 p.

Available: OSU Valley Library LD4330 1993D .D54

Abstract: Seven streams, one of them permanent, were studied in western Oregon, USA. The research was designed to assess the value of summer-dry headwaters for conservation oriented landscape management. Streams were categorized primarily according to exposure (forest versus meadow sites) and secondarily according to flow duration (ephemeral = short-flow versus temporary = long-flow sites). Ephemeral streams have discontinuous flow and last less than three months annually. Temporary streams have continuous flow for more than five months each season.

Ephemeral forest streams were highly efficient at filtering road-generated sediment. Uptake lengths for suspended sediment were short (36 m-105 m) at moderately elevated input concentrations. As a result of the filtration mechanism, filtration efficiency is expected to increase as annual flow duration decreases.

Injection experiments yielded nitrate uptake rates of almost 1% per m of temporary stream channel. Exchange with subsurface flow was the most important route for nitrate removal from the water column. Biological uptake was insignificant in a light-limited forest stream, whereas a considerable amount of nitrate was retained by the biota in a nutrient-limited meadow channel.

At least 207 insect species were collected from the summer-dry streams. Species richness recorded from temporary forest streams exceeded that in an adjacent permanent headwater and there was high overlap between the fauna of the permanent and the temporary streams. Species richness in ephemeral channels was only 1/4 to 1/3 of that in long-flow forest streams.

Multivariate analysis of community structure revealed flow duration and microhabitat pattern (riffle - pool) as the most important environmental factors determining faunal composition in temporary forest streams. Summer drought conditions at the sample sites also were important.

By providing habitat and contributing to water quality in permanent downstream reaches, summer-dry streams have the potential to serve multiple purposes in conservation management. Their value from a conservation perspective is unexpectedly high. Landscape management therefore should be directed toward the preservation and protection of ephemeral and temporary streams.

Furnish, J. L., 1989, Factors Affecting the Growth Production and Distribution of the Stream Snail Juga silicula (Gould) [Doctoral Dissertation]: Department of Entomology, Oregon State University, 216 p.

Available: OSU Valley Library LD4330 1990D .F87

Abstract: The abundant stream snail, Juga silicula, was studied for four years in Oak Creek, a stream draining the eastern foothills of the Coast Range, Benton County,

Oregon. A series of field and experimental investigations were conducted to examine how physical and biotic variables interact to determine the snail's growth and abundance. Temperature, population density, and food quantity and quality were of primary importance in determining snail growth rates and activity. Growth rates were depressed by cool water temperatures in the winter, by a high population density, and poor food quality. Positive growth on a variety of foods was observed, however highest growth was achieved on periphyton. Snail abundance was highest at current velocities <30 cm/sec, on coarse substrates and in unshaded patches. Snails of different sizes and ages were also segregated according to these physical variables. When the biomass of J. silicula was reduced by a factor of six, from a normal density of 13.3 to 2.1 grams per square meter, the production:biomass ratio was higher by a factor of about five in the low-density population (0.566 vs. 0.115). Production for the population maintained at high density was 1529 milligrams per square meter per yr compared to 1188 milligrams per square meter per yr for the low density population. These results provide strong evidence that snail growth may be limited through intraspecific, exploitative competition for food. Dispersal was stimulated by warm water temperature, high population density and food limitation. The knowledge gained from these studies of the seasonal abundance and distribution of J. silicula was also used to interpret patterns of distribution for benthic insects and to predict when snails are expected to have a significant impact on food resources and community structure. The snail exerts an impact on stream communities by exploitative competition through its ability to depress the available foods of both autochthonous and allochthonous origin. Its grazing activity results in interference competition, that mainly disturbs sedentary species. Grazing by J. silicula significantly reduced standing crop of chlorophyll a during 7 out of 12 months, and shredding by snails almost doubled the rate of weight loss of alder leaf packs. These studies illustrate how a single, abundant species responds to variation in the physical environment, as well as how it exerts a pervasive influence on the availability of food resources, habitat patches and stream community structure.

Kerst, C. D., 1970, The Seasonal Occurance and Distribution of Stoneflies (Plecoptera) of a Western Oregon Stream [MS Thesis thesis]: Department of Entomology, Oregon State University, 80 p.

Available: OSU Valley Library LD4330 1970 .K47

Abstract: Plecoptera were collected from four sampling stations selected to represent a range of conditions on Oak Creek, a small woodland stream originating in the foothills of the Oregon Coast Range. The elevation of Site I was 700 ft while the lowest site was located at 225 ft. Monthly benthos samples were taken for one year from a riffle and glide section at each site using a stovepipe sampler (6 in. dia.) and a standard tropical fish net. Samples were sorted in the laboratory and Plecoptera identified and placed into 1 mm size classes. Emergence of adults was measured for 13 months using a tent-shaped trap (1 m2) at each site. Traps were checked once or twice weekly.
Forty-two species of Plecoptera were found in Oak Creek. The number of species is very large when compared with other studies. The stonefly fauna is fairly similar to that reported 35 years ago.
Thirty-seven of the 42 species complete emergence during the spring. Temporal separation is marked in the emergence periods of Nemoura and Leuctra. Examples of

split emergence periods and early emergence of males were found. Life cycle information is given for a number of species and genera.
Using the Shannon-Wiener function, diversity of emerging adults ranks by season as: Spring > Summer > Winter > Fall. The diversity of the sites on a yearly basis is: II > I > III > IV. Using a percentage of similarity index it is concluded that Sites I and II are very similar. Site III is intermediate while Site IV is quite different.
A number of examples of restricted distributions are cited. These examples illustrate that differences in longitudinal distribution are important in ecological segregation. Herbivorous stoneflies (sub-order Filipalpia) comprise a greater proportion of the fauna at the upper site while predaceous stoneflies (Setipalpia) predominate in the lower areas.
Water depth and amounts of leaves and silt are important factors in determining the distribution of stoneflies. Most species are abundant in leaf drifts. Microhabitat selection does not appear to be rigorous.

Lehmkuhl, D. M., 1969, Biology and downstream drift of some Oregon Ephemeroptera [Doctoral Dissertation]: Department of Entomology, Oregon State University, 110 leaves, bound : p.

Available: OSU Valley Library LD4330 1969D .L44

Muller, H., 1990, The role of sediment abrasion in leaf decomposition processes: A comparison of leaf degradation rates due to mechanica and biological processing in temporary streams: Diplomarbeit am Institut fur Physische Geographie/Hydrologie, Albert-Ludgwigs-Universitat Freiburg, Germany.

Notes: Norm Anderson was the research supervisor

Reed, T. L., 1995, Drift, wood, and grazing cattle : macroinvertebrates in managed streams [M.S. Thesis]: Department of Entomology, Oregon State University, 107 p.

Available: OSU Valley Library LD4330 1978 .P37

Speir, J. A., 1969, Biological and ecological aspects of the black flies of the Marys River drainage system (Diptera: simuliidae) [MS Thesis]: Department of Entomology, Oregon State University, 80 leaves, bound : p.

Available: OSU Valley Library LD4330 1969 .S66

Speir, J. A., 1975, The ecology and production dynamics of four black fly species (Diptera:simuliidae) in western Oregon streams [Doctoral Dissertation]: Department of Entomology, Oregon State University, [17], 297 leaves, bound : p.

Available: OSU Valley Library LD4330 1976D .S68

Wold, J. L., 1973, Systematics of the genus Rhyacophila (Trichoptera:Rhyacophilidae) in western North America with special reference to the immature stages [MS Thesis]: Department of Entomology, Oregon State University, [10], 229 leaves, bound : p.

Available: OSU Valley Library LD4330 1974 .W64

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Reports and Publications

Anderson, N. H., 1997, Phenology of Trichoptera in summer-dry headwater streams in western Oregon, USA, *in* Holzenthal, R.W. and Flint, O.S. Jr (eds) The 8th International Symposium on Trichoptera: Ohio Biological Survey, p. 7-13.

Abstract: Studies of the temporary-stream fauna in western Oregon were expanded by establishing permanent plots in 1992 in two streams draining an oak savanna near Corvallis, Oregon. Drought conditions in 1993-1994 interrupted larval development in the short-flow channel (Outgate Beck) which dried completely. Seeps and hyporheic flow in Oak Burn enabled the caddis community to persist despite a decreased flow period. About 17 species of Trichoptera were recorded from benthos collections and emergence traps. The odontocerid Nerophilus californicus (Hagen) and the hydropsychid Parapsyche almota Ross were two of the relatively common species in the oak savanna streams that were not recorded in our earlier lists from temporary headwaters of forested streams.

Anderson, N. H., and Bourne, J. R., 1974, Bionomics of three species of glossosomatid caddis flies (Trichoptera: Glossomatidae) in Oregon: Canadian Journal of Zoology, v. 52, p. 405-411.

Abstract: The life cycles of three species of caddis flies of the family Glossosomatidae, Anagapetus bernea Ross, Agapetus bifidus Denning, and Glossosoma penitum Banks, are compared based on monthly collections from Oak Creek and Berry Creek, Benton County, Oregon. Glossosoma penitum, the most abundant species, is bivoltine with overlapping summer and winter generations. Anagapetus bernea and A. bifidus is more common in the slower water of glides, whears G. penitum and A. bernea occur chiefly on the riffles. Anagapetus bernea is more restricted to the headwater regions and small side branches than is G. pentium.

Anderson, N. H., and Dieterich, M., 1993, The Trichoptera fauna of temporary headwater streams in Wester Oregon, USA, in Otto, C., ed., Proceeding of the 7th International Symposium on Trichoptera, 1992: Leiden, Backhuys Publishers, p. 233-237.

Anderson, N. H., and Hansen, B. P., 1987, An annotated check list of aquatic insects collected at Berry Creek, Benton County, Oregon 1960-1984: Systematic Entomology Laboratory, Department of Entomology, Oregon State University, Occasional Publication Number 2.

Abstract: This report summarized collection records of aquatic insects from Berry Creek for over 25 years. General collecting and about 20 research projects have resulted in a list of over 325 taxa for the site. Eight orders and 63 families are represented; almost one third of the species are Chironomidae.
Berry Creek is a second-order woodland stream of low gradient in the eastern foothills of the Oregon Coast Range (altitude 120 m). The stream is underlain by basaltic rocks with some sandstone and siltstone. The water is cool (<20 degrees C), low in calcium carbonate and nitrates, and has a pH range of 7.1-7.8.
The check list is based primarily on collections from a reach with flow (0.003-0.015 cubic meters per second) controlled by a dam and bypass canal constructed in 1958. Excluding records of species collected only in an intermittent tributary (about 20

species) and also excluding Trichoptera from black lights (16 species), considered transients rather than a local population, reduced the current taxa list for Berry Creek to slightly under 300 species.

Notes: Berry Creek is another small steam within the McDonald-Dunn forest. It is within the Soap Creek Drainage.

Anderson, N. H., and Lehmkuhl, D. M., 1968, Catastrophic drift of insects in a woodland stream: Ecology, v. 49, p. 198-206.

Abstract: The effect of early fall rains on the downstream drift or displacement of insects was studied for two seasons by collecting the entire streamflow at one point through a drift net. Drift rate increased within 24 hr after the start of each rainy period, with the increase approximately proportional to the increase in stream flow. Freshets due to less than 1 inch (2.5 cm) of rain caused a fourfold increase in numbers and fivefold to eightfold increase in biomass. Major components of the drift were Ephemeroptera, Plecoptera, Diptera and terrestrial insects.

Plecoptera and Ephemerotpera retained the day-night periodicity of behavioral drift during freshets, but drift of Chironomidae (Diptera) was attributed to catastrophic and constant drift. Mean weight per individual of several taxa was greater at night than day, in freshet than nonfreshet periods, and in drift compared with benthos samples.

Though catastrophic drift due to fall freshets displaced large numbers of individuals, the standing crop of the benthos increased during the fall because of hatching. The drift may be beneficial in dispersing aggregations of young larvae. Removal of allochthonous food by increased water flow could be more detrimental to benthos populations than the direct mortality caused by catastrophic drift.

Anderson, N. H., and Wold, J. L., 1972, Emergence trap collections of Trichoptera from an Oregon stream: Canadian Entomology, v. 104, p. 189-201.

Abstract: Adult Trichoptera of 39 species representing 11 families were collected from four emergence traps in Oak Creek, Corvallis, Oregon, between May 1968 and December 1970. Glossosomatidae and Limnephilidae were the most abundant families, but Rhyacophilidae was represented by the most species. Relative abundance, season occurrence, sex ratio, and ecological segreation of related species are discussed.

Azam, K. M., and Anderson, N. H., 1969, Life history and habits of Sialis rotunda and S. californica in Western Oregon: Annals of the Entomological Society of America, v. 62, no. 3, p. 549-558.

Abstract: Comparative ecological studies of Sialis rotunda Banks and S. californica Banks (Megaloptera: Sialidae) were made in western Oregon from 1966 to 1968. Techniques were developed for rearing both species, and the duration of the life cycles was determined in aquaria, in a laboratory stream, and in the natural habitats. It was found by rearing individual larvae that there are 10 larval instars, and measurements were recorded of body length and head width of all stadia. The duration of each of the life stages was determined.

Dieterich, M., and Anderson, N. H., 1995, Life cycles and food habitats of mayflies and stoneflies from temporary streams in Western Oregon: Freshwater Biology, v. 34, p. 47-60.

Dieterich, M., and Anderson, N. H., 1998, Dynamics of abiotic parameters, solute removal and sediment retention in summer-dry headwater streams of Western Oregon: Hydrobiologia, v. 379, p. 1-15.

Dieterich, M., and Anderson, N. H., 2000, The invertebrate fauna of summer dry streams in Western Oregon: Archiv fur Hydrobiologie, v. 147, no. 3, p. 273-295.

Available: OSU Valley Library OSU Valley Library QH301 .A77

Dieterich, M., Anderson, N. H., and Anderson, T. M., 1997, Shredder-collector interactions in temporary streams of Western Oregon: Freshwater Biology, v. 38, no. 2, p. 387-393.

Hawkins, C. P., and Furnish, J. L., 1987, Are snails important competitors in stream ecosystems?: Oikos, v. 49, p. 209-220.

Kerst, C. D., and Anderson, N. H., 1974, Emergence patterns of Plecoptera in a stream in Oregon, USA.: Freshwater Biology, v. 4, no. 3, p. 205-212.

Kerst, C. D., and Anderson, N. H., 1975, The Plecoptera community of a small stream in Oregon, U.S.A.: Freshwater Biology, v. 5, no. 2, p. 189-203.

Lehmkuhl, D. M., and Anderson, N. H., 1970, Observations on the biology of Cinygmula reticulata McDunnough in Oregon: The Pan-Pacific Entomologist, v. 46, no. 4, p. 268-274.

Lehmkuhl, D. M., and Anderson, N. H., 1972, Microdistribution and density as factors affecting the downstream drift of mayflies: Ecology, v. 53, p. 661-667.

> Abstract: During high volume of flow in a stream that has considerable seasonal fluctuation, the microdistribution of five species of mayflies was determined by displacement of individual by drift from rapid current areas to those with gentle or no current. The major effect of drift was dispersal, not depletion, of the mayfly population. Occurrence in drift is determined by a species-specific complex of interdependent factors including life cycle, micro-distribution (both before and after the effect of spates), and the behavioral characteristic of individual species.

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Research: Fisheries

Jump to subtopics:

Historical Overview

Source:

There are two main sources of fisheries studies in and around Oak Creek. The first is the presence of the Oak Creek Biology Laboratory which has been a center for fisheries experiments since the 1950's (see McIntire's historical review below). Ocassionally Oak Creek fish became experimental subjects (see Nickelson below) but most research was confined to the laboratory and didn't involve the creek directly. A second source of fisheries and other stream ecology studies in Oak Creek comes through Stan Gregory's (OSU Professor of Fisheries and Wildlife) Stream Ecology (FW580) and Limnology (FW456/556) classes.

Date: Spring 2002

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Datasets and Class Projects

FW456/556 Limnology and FW580 Stream Ecology

> Since the 1980's the limnology class has studied the stream and carried out group project on water quality, limnology, fisheries, and entomology. Reports generally make comparisons between three stream reaches : forested, agricultural, and urban. These reports were archived by Kathy Staley's students (OSU Fisheries and Wildlife Department) in the 1990's and are available in the Fisheries and Wildlife Library (Nash Hall, Room #104). There is no digital index of these reports at this time but they are sorted into binders by topic.

A table of fish species found in Oak Creek is available on-line through the department of Fisheries and Wildlife (contact: Kelly Wildman). It includes images of each fish type.

URL: http://www.orst.edu/dept/oakcreek/files/species.htm

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Student Theses

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Reports and Publications

McIntire, C. D., 1993, Historical and other perspectives of laboratory stream research: Journal of the North American Benthological Society, v. 12, no. 4, p. 318-323.

Abstract: In the first section of this chapter, I present a brief history of laboratory stream research in the late 1950s and 1960s, a period that represents the beginning of the approach as we know it today. This history has a strong bias towards work performed at the Oak Creek Laboratory of Biology, Oregon State University, under the direction of Charles E. Warren. In the next section, I express my own views of the advantages and limitations of laboratory stream research, emphasizing such problems as temporal and spatial scale, the lack of natural reproduction and a realistic age structure in experiments involving animals, and trade-offs between replication and treatment diversification. The chapter concludes with a brief description of a strategy for optimizing research progress by integrating the results of laboratory experiments with field work and modeling.

Notes: Conference Symp. on Research in Artificial Streams: Applications, Uses and Abuses, at Annu. Meet. of the North American Benthological Society, Louisville, KY (USA), 29 May 1992

Nickelson, T. E., and Larson, G. L., 1974, Effect of weight loss on the decrease of length of coastal cutthroattrout: Progressive Fish-Culturist, v. 36, no. 2, p. 90-91.

Abstract: 25 yearling coastal cutthroat trout, Salmo clarki, were collected from Oak Creek, near Corvallis, Oregon, and starved in aquaria for 7 wks. Fork lengths and wt were measured at 0, 2,4, and 7 wks. Results confirm that wt loss of this sp is at times accompanied by loss of length. The most extensive wt loss occurred during the 3rd and 4th wks when water temps were highest. It is concluded that these changes tend to maintain the length-wt ratio and therefore reduce the possibility of error if only 1 parameter is known. However if the ratio is used as a measure of the condition of the fish starved specimens could fit into the standard graph of younger healthy fish. Therefore the length-wt relation ship should be determined as frequently as possible.

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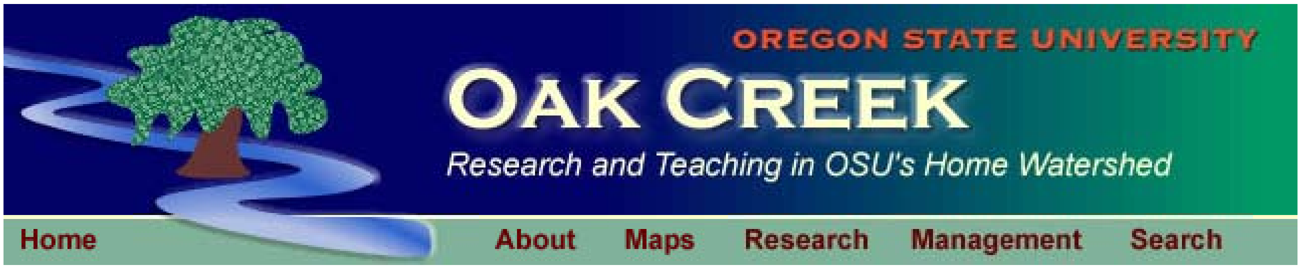

Research: Forestry

Link

About 23% of the Oak Creek Watershed is within the McDonald/Dunn Research Forest and is managed by the OSU College of Forestry. Their website contains links to maps, GIS data, research reports, and a searchable database of studies carried out in the forest.

URL: http://www.cof.orst.edu/resfor/mcdonald/purpose.sht

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OAK CREEK

Research and Teaching in OSU's Home Watershed

Research: Geology

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Historical Overview

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Datasets and Class Projects

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Student Theses

Goldfinger, C., 1990, Evolution of the Corvallis fault and implications for the Oregon coast range [MS Thesis]: Department of Geosciences, Oregon State University, 129 p.

Available: OSU Valley Library LD4330 1991 .G65

Notes: Chris is now on the faculty of the College of Oceanic and Atmospheric Sciences, view his professional page.

URL: A map of the Corvallis fault that was derived from Chris' work is available as a pdf file. http://cwest.orst.edu/oakcreek/research/geology/pdf_files/corvallis_faultmap.pdf

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Shively, D., 1989, Landsliding processes occurring on a McDonald-Dunn Forest hillslope [MS Paper]: Oregon State University, Department of Geosciences.

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Reports and Publications

Bela, J. L., 1979, Geologic hazards of eastern Benton County, Oregon: Bulletin - State of Oregon, Department of Geology and Mineral Industries, v. 98, p. viii, 122 pages.

Glasmann, J. R., 2000, see reference on Hydrology and Water Quality page.

Wang, Z., Graham, G. B., and Madin, I. P., 2001, Earthquake Hazard and Risk Assessment and Water-Induced Landslide Hazard in Benton County, Oregon: Oregon Department of Geology and Mineral Industries.

Available: From Benton County or as a pdf file.

URL: http://cwest.orst.edu/oakcreek/research/geology/pdf_files/equake and lanslide dogami.pdf

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Research: Sediment Transport

Jump to subtopics:

Historical Overview

Source: Conversations with Peter C. Klingeman, OSU Professor of Civil Engineering, 1966-2002.
Date: Spring 2002

In the late 1960's Pete Klingeman led a group in the design and construction of sediment sampling facilities on Oak Creek. Their site was located near the downstream boundary of the McDonald-Dunn forest (see map) (watershed area ~7.0 km2 (2.7 mi2)). The facilities were designed to measure sediment yields from forested, mountain watersheds. Studies focused mainly on bedload transport but also included some studies of suspended load (see publications below by Beschta).

The major feature of the sampling facilities was a vortex bedload sampler. It included a flume, rectangular weir, off-channel sampling pit, and a bypass flume. By opening flow gates, the flume created a vortex and extracted bed load from the stream so that transport rates could be measured. For a complete description, refer to Klingeman, 1979.

The sediment transport studies were some of the first to make detailed measurements of bedload in a gravel bed stream. The creek size, sampling design, and study duration also made the studies unique. For example, the small channel dimensions (~4 m wide with flows up to 6 m3/s) and the vortex sampling design allowed bedload to be measured across the whole streamwidth rather than with spot sampling. Researchers were also some of the first to carefully measure bedload throughout the rising and falling limbs of storm hydrographs and to look at the size fractions of bedload.

Other researchers have since used the Oak Creek datasets in their analyses of sediment transport processes such as incipient motion (when does transport of bedload first begin?) and calculations of the dimensionless Shield's parameter (a parameter used in sediment transport equations). For example, Gary Parker (Parker and Klingeman, 1982; Parker et al, 1982; Andrews et al, 1987) combined the Oak Creek data and merged it with bedload data from larger streams to develop generalized theories for equal mobility.

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Datasets and Class Projects

Pete Klingeman has many of the original data records from sediment transport studies at Oak Creek. Few of these are digital. Summaries and analyses of these data can be found in the many of the theses, reports and publications listed below.

Student Theses

Matin, H.,1994, Incipient motion and particle transport in gravel-bed streams, Doctoral Dissertation, Department of Civil Engineering. Corvallis, OR, Oregon State University**:** 268 p.

> Available: OSU Valley Library, LD4330 1995D .M38

> Abstract: The incipient motion of sediment particles in gravel-bed rivers is a very important process. It represents the difference between bed stability and bed mobility. A field study was conducted in Oak Creek, Oregon to investigate incipient motion of individual particles in gravel-bed streams. Investigation was also made of the incipient motion of individual gravel particles in the armor layer, using painted gravel placed on the bed of the stream and recovered after successive high flows. The effect of gravel particle shape was examined for a wide range of flow conditions to determine its significance on incipient motion. The result of analysis indicates a wide variation in particle shapes present. Incipient motion and general transport were found to be generally independent of particle shape regardless of particle sizes. A sample of bed material may contain a mixture of shapes such as well-rounded, oval, flat, disc-like, pencil-shaped, angular, and block-like. These are not likely to move in identical manners during transport nor to start motion at the same flow condition. This leads to questions about the role of shape in predicting incipient motion and equal mobility in gravel-bed streams. The study suggests that gravel particles initiate motion in a manner that is independent of particle shape. One explanation may be that for a natural bed surface many particles rest in orientations that give them the best protection against disturbance, probably a result of their coming to rest gradually during a period of decreasing flows, rather than being randomly dumped. But even when tracer particles were placed randomly in the bed surface there was no evident selectively for initiation of motion on the basis of particle shape. It can be concluded from analysis based on the methods of Parker et al. and Komar that there is room for both equal mobility and flow-competence evaluations. However, the equal mobility concept is best applied for conditions near incipient motion and the flow-competence concept is best applied for larger flows and general bedload transport. Furthermore, with an armored bed, such as that at Oak Creek, there is a tendency for a more-nearly equal mobility (or equivalent) for the normalized transport rates for the various size fractions when incipient motion and moderate bedload transport occurs.

McArdell, B. W. (1997). Field experiments on the controls of downstream fining in gravel-bed rivers, Doctoral Dissertation, The Johns Hopkins University, Baltimore, MD**:** 137 p.

> Abstract: The influence of two primary controls of downstream fining in gravel-bed

rivers, the durability of the gravel particles and the streambed aggradation rate, is investigated in field experiments where the rate of downstream fining is compared among rivers with a large variation in one control and only small variation in the other controls. In the durability field experiment, the rate of downstream fining is compared between two streams in the Oregon Coast Range that differ significantly only in the durability of the gravel. The durability of Flynn Creek gravel, measured in the ERC abrasion mill, is an order of magnitude weaker than the Oak Creek gravel. The rate of downstream fining is nearly two orders of magnitude more rapid in Flynn Creek than in Oak Creek, clearly demonstrating the influence of particle durability. In the aggradation field experiment, the rate of downstream fining is compared among three similar streams in the Canadian Rocky Mountains, where the influence of aggradation rate is large compared with the estimated influence of particle durability and other controls. When the duration of aggradation is assumed to be identical among the streams, Peyto Creek, which is aggrading 5.6 times more rapidly than the North Saskatchewan River, fines at a rate 3.7 to 5.1 times more rapid. Both the rate of fining and the aggradation rate are intermediate for the Sunwapta River. Comparison of the aggradation rate-downstream fining rate trend with data from South Coldwater Creek, WA, corroborates the results, but only for the largest sizes present in the gravel. The combined influence of aggradation rate and particle durability is investigated by comparing the field results with predictions of downstream fining made with the ACRONYM4 computer model, which incorporates both wear and sorting processes. When the aggradation rate is expressed in terms of an extraction ratio, the results may be generalized to allow for prediction of downstream fining within one order of magnitude. The difference between the forecast and observed downstream fining illustrates the potential importance of other controls, such as excess bed shear stress and grain size sorting.

Milhous, R. T. (1973). Sediment transport in a gravel-bottomed stream. Doctoral Dissertation, Department of Civil Engineering. Corvallis, OR, Oregon State University**:** 232 p.

Available: OSU Valley Library, LD4330 1973D .M54

Moret, S. L. (1997). See listing on Watershed Analysis page.

Paustian, S. J. (1977). The suspended sediment regimes of two small streams in Oregon's Coast Range. MS Thesis, Department of Forest Engineering. Corvallis, OR, Oregon State University**:** 122 p.

Available: OSU Valley Library, LD4330 1978 .P37

Shih, S.-m. (1989). Hydraulic control of grain size distributions and differential transport rates of bedload gravels Oak Creek, Oregon. MS Thesis, Department of Oceanography. Corvallis, OR, Oregon State University**:** 74 p.

Available: OSU Valley Library LD4330 1990 .S55

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Reports and Publications

Andrews, E. D., Parker, G., Thorne, C. R., Bathurst, J. C., and Hey, R. D., 1987, Formation of a coarse surface layer as the response to gravel mobility, *in* Thorne, C. R., Bathurst, J. C., and Hey, R. D., eds., Sediment transport in gravel-bed rivers, John Wiley & Sons, Chichester, United Kingdom, p. 269-325.

Bakke, D., Basdekas, P. O., Dawdy, D. R., and Klingeman, P. C., 1999, Calibrated Parker-Klingeman model for gravel transport: Journal of Hydraulic Engineering, v. 125, no. 6, p. 657-660.

Abstract: The Parker-Klingeman (P-K) model is a state-of-the-art approach to prediction of gravel transport in river channels. This technical note describes the P-K model in simple terms and presents a practical method for local calibration of model constants by procedures that minimize variance and bias. Using site calibration rather than modeling constants from the literature extends the range of applicability of the P-K model in terms of stream slopes and substrate sizes. Model prediction capability becomes less contingent on having stream characteristics that match the streams used in model development.

Beschta, R. L., 1980, Turbidity and suspended sediment relationships, *in* Watershed Management Symposium, Boise, ID, p. 271-282.

Notes: cited in Beschta 1981 as having sed transport data from Oak Creek

Beschta, R. L., 1980, Modifying automated pumping samplers for use in small mountain streams: Water Resources Bulletin, v. 16, no. 1, p. 137-138.

Notes:cited in Beschta 1981

Beschta, R. L., 1981, Patterns of sediment and organic matter transport in Oregon Coast Range streams, *in* Erosion and Sediment Transport in Pacific Rim Steeplands, Christchurch, New Zealand, p. 654 pages.

Beschta, R. L., 1983, Sediment and organic matter transport in mountain streams of the Pacific Northwest, *in* D.B. Simons Symposium on Erosion and Sedimentation, Ft. Collins, Colorado, p. 1-69 to 1-89.

Beschta, R. L., O'Leary, S. J., Edwards, R. E., and Knoop, K. D., 1981, Sediment and organic matter transport in Oregon Coast Range streams: Oregon Water Resources Research Institute, 70.

Abstract:Bedload transport, particulate organic matter transport, total suspended solids concentration, and turbidity were monitored during storm runoff at Flynn Creek and Oak Creek in central Oregon's Coast Range. Flynn Creek drains a 2.2. km2 watershed and Oak Creek drains a 7.5 km2 watershed; the dominant vegetative cover in both watersheds is Douglas-fir. Winter precipitation amounts were relatively low during the 1976-1980 water years investigated during this study. Frequency analyses

indicated that peak flows had recurrence intervals of less than two years. Rating curves were developed between particulate transport (Y) and streamflow (!Q) using the equation form: Y - a Q^b. Exponential increases of 3.5 to 4.5 in bedload transport rates with increasing flows were measured using both votex tube and Helley-Smith bedload samplers. The median particle diameter (d50) of bedload sediments averaged less than 0.5 mm and less than 2 mm for Flynn Creek and Oak Creek respectively. Coarse particulate organic matter (>0.2 mm) represented an important bug variable component of the total material in transport along the streambed. Channel cross-section measurements indicated localized scour and fill was common during periods of storm-generated runoff. Rating curves of total suspended solids with streamflow were highly variable but exponential increases in total suspended solids concentrations with increasing flow were generally 1.1 to 1.6 when a wide range of flows were sampled. Total suspended solids concentrations were influenced by (1) streamflow, (2) hydrograph characteristics, and (3) the sequence of storm events. Total suspended solids averaged approximately 60% inorganic sediments and 40% organics. Total suspended solids concentration was found to be highly correlated with turbidity. Turbidities (and total suspended solids concentrations) returned to relatively low levels within 24 hours after peak flows had occurred.

Glasmann, J. R., 2000. See listing on Hydrology and Water Quality page.

Heineke, T., 1976, Bedload transport in a gravel bottomed stream: Oregon State University.

Notes:not in OSU library database, this citation is from Beschta 1981

Helland-Hansen, E., Klingeman, P. C., and Milhous, R. T., 1974, Sediment Transport at Low Shields-Paramter Values: Journal of the Hydraulics Division, v. 100, no. HY1, p. 261-265.

Notes:Klingeman says this paper was based on an MS project by Helland-Hansen, since it was not a thesis it is not archived in the OSU library.

Klingeman, P. C., 1970, Evaluation of bed load and total sediment yield processes on small mountain streams: Oregon State University, Final Sub-Project Report.

Notes: P. Klingeman thought that this summarized suspended load and bedload work.

Klingeman, P. C., 1971, Oak Creek vortex bed-load sampler, Eos, Transactions, American Geophysical Union, p. 434.

Klingeman, P. C., 1973, Engineering Hydrology: Oregon Water Resources Research Institute. Final Project Report to Office of Water Resources Research, US Department of the Interior.

Klingeman, P. C., 1979, Sediment Transport Research Facilities, Oak Creek, Oregon: Oak Creek Sediment Transport Report F1, Oregon Water Resources Research Institute. 24 p.

Available: Klingeman_1979.pdf

Klingeman, P. C., 1987, Discussion of Chapter 3 River Bed Gravels: Sampling and Analysis, *in*

Hey, R. D., Bathurst, J. C., and Thorne, C. R., eds., Sediment Transport in Gravel-Bed Rivers, John Wiley & Sons, p. 81-83.

Klingeman, P. C., 1987, Discussion of Chapter 4: Bed Load Sampling and Analysis, *in* Thorne, C. R., Bathurst, J. C., and Hey, R. D., eds., Sediment Transport in Gravel-Bed Rivers, John Wiley & Sons, p. 116.

Klingeman, P. C., 1987, Discussion of Chapter 19, Bed Load Transport Measurements by Vortex-Tube Trap in Virginia Creek, Italy, *in* Thorne, C. R., Bathurst, J. C., and Hey, R. D., eds., Sediment Transport in Gravel-Bed Rivers, John Wiley & Sons, p. 606-607.

Notes: P. Klingeman says that the Italian sampler was based on Oak Creek -- they visited to see the sampler here before designing theirs.

Klingeman, P. C., and Emmett, W. W., 1982, Gravel bedload transport processes, *in* Hey, R. D., Bathurst, J. C., and Thorne, C. R., eds., Gravel-bed Rivers, John Wiley & Sons Ltd., p. 141-179.

Notes: Short description of Oak Creek bedload vortex sampler and comparison of sediment data from Oak Creek to other measured streams in the Pacific Northwest. Emphasis is on the variability of bedload transport and the difficulties of predicting transport rates from stream discharge.

Klingeman, P. C., Krygier, and Brown, 1971, Studies on effects of watershed practices on streams: Schools of Forestry and Engineering, Oregon State University, US EPA Research Series 13010 EGA 02/71.

Klingeman, P. C., and Milhous, R. T., 1970, Oak Creek vortex bedload sampler, *in* 17th Annual Pacific Northwest Regional Meeting, American Geophysical Union, Tacoma, WA.

Klingeman, P. C., Milhous, R. T., and Heinecke, T. L., 1979, Oak Creek vortex bedload sampler, Oak Creek Sediment Transport Report F2: Oregon Water Resources Research Institute.

Komar, P. D., 1989, Flow-competence evaluations and the non-equal mobility of gravels in Oak Creek, Oregon, *in* Third scientific assembly of the International Association of Hydrological Sciences Eos, Transactions, American Geophysical Union, Baltimore, MD United States, p. 320.

Komar, P. D., 1989, Flow-competence evaluations and the non-equal mobility of gravels in Oak Creek, Oregon: National Aeronautics and Space Administration (NASA), Washington, DC, United States, No: 4130.

Komar, P. D., and Carling, P. A., 1991, Grain sorting in gravel-bed streams and the choice of particle sizes for flow-competence evaluations: Sedimentology. Oxford, v. 38, no. 3, p. 489-502.

Abstract: Flow-competence assessments of floods have been based on the largest particle sizes transported, and yield either the mean flow stress, mean velocity, or discharge per unit flow width. The use of extreme particle sizes has potential problems in that they may have been transported by debris flows rather than by the flood, it may be difficult to locate the largest particles within the flood deposits, and there are questions concerning how representative one or a few large particles might be of the transported sediments and therefore of the flood hydraulics. Such problems

would be eliminated for the most part if competence evaluations are based on median grain sizes of transported sediments, or perhaps on some coarse percentile that is established by a reasonable number of grains. In order to examine such issues, the gravel-transport data of Milhous from Oak Creek, Oregon, and of Carling from Great Eggleshope Beck, England, have been analysed in terms of changing grain-size percentiles with varying flow stresses.

Komar, P. D., and Shi, S.-M., 1989, Grain-size variations during transport and the equal mobility of gravels in Oak Creek, Oregon: Reports of Planetary Geology and Geophysics Program, 1988 NASA Technical, v. Memorandum, p. 367.

Komar, P. D., and Shih, S.-M., 1988, Grain-size variations during transport and the equal mobility of gravels in Oak Creek, Oregon: AGU 1988 fall meeting Eos, Transactions, American Geophysical Union, v. 69, no. 44, p. 1217-1218.

Komar, P. D., Shih, S.-M., Billi, P., Hey, R. D., Thorne, C. R., and Tacconi, P., 1992, Equal mobility versus changing bedload grain size in gravel-bed streams, John Wiley & Sons, New York, NY, p. 73-106.

Komar, P. D., Shih, S.-M., and Carling, P. A., 1992, Sorting patterns and grain-size distributions of gravels in streams: 13th international sedimentological congress; abstracts International Sedimentological Congress, v. 13, p. 280.

Matin, H., and Klingeman, P. C., 1993, Incipient Motion in gravel-bed rivers, *in* Hydraulic Engineering '93, ASCE Hydraulics Division National Conference, San Francisco, CA, p. 707-712.

Milhous, R. T., Klingeman, P.C., 1973, Sediment transport system in a gravel-bottomed stream, *in* Hydraulic Engineering and the Environment, 21st Annual Hydraulics Division Specialty Conference, Bozeman, MT, p. 293-303.

Notes:Cited in Beschta et al, 1981 as having Oak Creek bedload transport data. Also cited in Klingeman and Emmett 1982.

Milhous, R. T., Hey, R. D., Bathurst, J. C., and Thorne, C. R., 1982, Effect of sediment transport and flow regulation on the ecology of gravel-bed rivers, *in* 13th international sedimentological congress: International workshop on engineering problems in the management of gravel-bed rivers, p. 819-842.

Milhous, R. T., and Klingeman, P. C., 1971, Bed-Load Transport in Mountain Streams, *in* ASCE Hydraulics Division Specialty Conference, Iowa City, Iowa.

Mohammadi, A., and Klingeman, P. C., 1990, Flushing of fine sediment from a coarse-bed stream, *in* Third International Iranian Congress of Civil Engineering, University of Shiraz, Shiraz, Iran, p. 41-42.

Owusu, Y. A., and Klingeman, P. C., 1984, Flow and scour patterns around gabion structures, *in* ASCE Hydaulics Division Specialty Conference, Coeur d'Alene, ID, p. 281-285.

Parker, G., and Klingeman, P. C., 1982, On Why Gravel Bed Streams are Paved: Water Resources Research, v. 18, no. 5, p. 1409-1423.

Parker, G., Klingeman, P. C., and McLean, D. G., 1982, Bedload and size distribution in paved gravel-bed streams: Journal of the Hydraulics Division, v. 108, no. HY4, p. 544-571.

Paustian, S. J., and Beschta, R. L., 1979, The suspended sediment regime of an Oregon Coast Range stream: Water Resources Bulletin, v. 15, no. 1, p. 144-154.

Notes:cited in Beschta 1981

Rosenfield, C. L., and Pearson, M. L., 1994, Field estimation of resistance coefficients for gravel-bedded stream channels, *in* Streams above the line; channel morphology and flood control; U. S. Army Corps of Engineers workshop on Steep streams, Seattle, WA United States, p. 18.1.

Shih, S. M., and Komar, P. D., 1990, Hydraulic controls of grain-size distributions of bedload gravels in Oak Creek, Oregon, USA: Sedimentology, v. 37, no. 2, p. 367-376.

Abstract:Grain-size distributions of gravels transported as bedload in Oak Creek, Oregon, show systematic variations with changing flow discharges. At low discharges the gravel distributions are nearly symmetrical and Gaussian. As discharges increase, the distributions become more skewed and follow the ideal Rosin distribution. The patterns of variations are established by goodness-of-fit comparisons between the measured and theoretical distributions, and by Q-mode factor analysis. Two end members are obtained in the factor analysis, having (respectively) almost perfect Gaussian and Rosin distributions, and the percentages of the two end members within individual samples vary systematically with discharge.

Shih, S.-M., and Komar, P. D., 1990, Differential bedload transport rates in a gravel-bed stream: A grain-size distribution approach: Earth Surface Processes and Landforms, v. 15, no. 6, p. 539-552.

Abstract: The grain-size distributions of bedload gravels in Oak Creek, Oregon, follow the ideal Rosin distribution at flow stages which exceed that necessary to initiate breakup of the pavement in the bed material. The distributions systematically vary with flow discharge and bed stress, such that at higher flow stages the grain sizes are coarser while the spread of the distribution decreases. A differential bedload transport function for individual grain-size fractions is formulated utilizing the dependence of the two parameters in the Rosin distribution on the flow stress. Successful reproduction of the measured fractional transport rate and bedload grain-size distributions in Oak Creek by this approach demonstrates its potential for evaluations of transport rates of size fractions in gravel-bed streams.

Shively, D., 1989, Landsliding processes occurring on a McDonald-Dunn Forest hillslope: Oregon State University, Department of Geosciences.

Wilcock, P. R., 1997, The components of fractional transport rate: Water Resources Research, v. 33, no. 1, p. 247-258.

Wolcott, J., 1988, Nonfluvial control of bimodal grain-size distributions in river-bed gravels: Journal of Sedimentary Petrology, v. 58, no. 6, p. 979-984.

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Center for Water and Environmental Sustainability (CWESt)
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Research: Watershed Analyses

Jump to subtopics:

Historical Overview

Source: Conversations with Bob Beschta, OSU Professor Emeritus of Forest Engineering, Donna Schmitz, Benton Soil and Water Conservation District, and references listed below.
Date: Spring 2002

Several watershed analyses and synthesis documents were written on the Oak Creek Basin during the 1990's. Reports were authored by students, OSU faculty, and consultants to the Marys River Watershed Council. Below are some notes about these reports:

In 1994, two groups of students in Bob Beschta's Watershed Analysis course (FE530/630), carried out studies of the Oak Creek Basin (Augerot et al, 1994; Buckley et al, 1994). The structure of these reports were based on Washington State's Watershed Analysis Manual and included sections on mass wasting, surface erosion, hydrology, riparian, stream channel, fish habitat and water quality. These reports were prepared over a several week period by graduate students in Civil Engineering, Fisheries and Wildlife, Forest Engineering, and Geosciences.

In 1999, Toby Hayes, then Vice Provost for Research, created an Oak Creek Action Team and appointed four faculty members to evaluate the major management issues in the basin and make recommendations for corrective actions. Stan Gregory served as chairperson with Bob
Beschta, Jim Moore, and Ken Williamson making up the rest of the team. Team meetings were open to the public and their report was made available through an Oak Creek website. OSU issued a press release about the Task Force in 1999.

Also in 1999, the Marys River Watershed Council hired Ecosystems Northwest to conduct a preliminary assessment of the Marys River Watershed. The Oak Creek Basin makes up about 4% of the Mary's River Basin.

In Spring 2002, the Benton Soil and Water Conservation District (Donna Schmitz) began and additional assessment as part of the development of a Farm Plan for the OSU livestock operations.

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Datasets and Class Projects

Augerot, X., Cain, B., Larsen, E., Lee, Y., Perkins, R., and Rogers, V., 1994, Watershed analysis of Oak Creek Watershed, Coast Range Mountains, Oregon: Oregon State University.

Available: Bob Beschta has a copy of this report.

Abstract or Excerpt: This watershed analysis was conducted as part of a graduate course (FE530/630) in the Forest Engineering Department at OSU. The approach used for this analysis of the Oak Creek watershed was based on Washington State's Watershed Analysis Manual. However, their methodology was modified where necessary. The watershed analysis was initiated in the middle of October and was completed in a bout six weeks.

The first step in the process was to identify key issues in the watershed. Several OSU administrators, faculty members, and students from a variety of natural resource-related departments were interviewed. The key issues they identified are summarized in Table I-1. We were able to examine and address most of these issues but time constraints and insufficient data limited the number and the types of issues we addressed. Water supply, wildlife, and some of the water quality issues were not addressed for these reasons.

Each individual in the analysis group was assigned to a particular module. Eric Larsen collected and analyzed information on mass wasting in the watershed. Brendan Cain was responsible for surface erosion. Reed Perkins examined the watershed's hydrologic characteristics. Val Rogers looked at riparian functions. Xan Augerot examined stream channel conditions and some water quality data. Yu Man lee evaluated fish habitat. Aerial photographs, topographic maps, soil and geology maps, unpublished OSU research reports and firsthand field data were used during the resources assessment process. The information we collected during this process was compiled during the synthesis stage and was used in determining resource vulnerability (i.e.e, channel sensitivity and fish habitat potential), the likelihood of input factors impacting resources, and management recommendations (i.e., rule calls) for three indicator areas in the watershed.

Notes: Cited in Moret, 1997.

Buckley, A., Castro, J., Jodice, P., Sherer, R., Villanueva, V., and Williams, K., 1994, Oak Creek Watershed analysis: Oregon State University.

Available: Bob Beschta has a copy of this report.

Abstract or Excerpt: See pdf file.

Moret, S. L., Allen, M., and Jacek, L. L., 1995, Relative analysis of stability and land use in the Oak Creek drainage, Benton County, Oregon: Oregon State University.

Notes: Cited in Moret, 1997.

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Student Theses

Moret, S. L. (1997). An assessment of a Stream Reach Inventory and Channel Stability Evaluation: predicting and detecting flood-induced change in channel stability. MS Thesis, Department of Geosciences. Corvallis, OR, Oregon State University**:** 130 p.

Available: OSU Valley Library, LD4330 1998 .M64

Abstract: Pre-flood (1995) and post-flood (1996) channel stability surveys were conducted on 22 reaches along Oak Creek, Benton County, Oregon in an effort to note if the flood of February 1996 altered the channel and if the channel stability survey that was being used accurately predicted the channels resistance to change resulting from a flood. The channel stability survey that was used was the method described in "Channel Stability Evaluation and Stream Reach Inventory" designed by the USDA Forest Service, Northern Region, in Colorado (Pfankuch, 1978).
This was a non-parametric study, based on an opportunity to reoccupy survey locations from a previous study. A model was proposed to describe the 1995 ratings as predictions for change that occurred as a result of the 1996 flood in order to test he surveys ability to accurately predict change. Changes in the survey totals, the 15 channel stability indicator items that compose the survey, and the sediment distribution were evaluated within and between years at the reach, station and stream scale.
An increase in the percentage of fine gravel occurred at all scales when post-flood and pre-flood sediment distribution was compared. Except for an increase in fine gravel, the stream remained similar to its pre-flood state.
In 1995, the stream's channel stability was rated as "fair", indicating that a moderate amount of change should take place if a flood occurred. The 1995 predictions for change did not match the actual change observed after the February 1996 flood at the three scales when defined by the survey totals. When independently evaluating the fifteen individual channel stability indicator items, a considerable amount of change was detected at the reach level. Although change occurred in the indicator items, a considerable amount of change was detected at the reach level. Although change occurred in the indicator items at each reach, the stream average for each of the independent indicator items was similar between the two years. This may indicate that, although change occurred at the reach level, the stream maintained its physical diversity after the flood.
The survey method was unable to accurately predict changes to Oak Creek incurred by the February 1996 flood when viewed at the entire stream level, yet it may be more applicable at the reach level when viewing specific changes to channel stability indicator items. In general, the Stream Reach Inventory and Channel Stability Evaluation is designed for observational efficiency but does not have sufficient scientific basis or measurement precision to accurately

predict the extent or type of channel change.

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Reports and Publications

Ecosystems Northwest, 1999, Marys River Watershed, Preliminary Assessment. [Watershed Assessment prepared for the Marys River Watershed Council], 158 p.

Available: Online on the Mary's River Watershed Council website.

Abstract or Excerpt: This document is the product of a preliminary watershed assessment for the Marys River Watershed. The purpose of the document is to describe what is known about the condition of the Marys River Watershed, and to present a list of prioritized issues for the Marys River Watershed Council for their use in the development of strategies for further assessment and subsequent watershed protection and restoration. The assessment examined land use history, water quality, aquatic and terrestrial habitats, soil conditions, and social and economic conditions. The assessment followed the guidance provided by the Oregon Watershed Assessment Manual (NonPoint Solutions 1998) where practical. In some instances, diversions were made from the Assessment Manual based on discussions and direction from the technical steering committee of the Council. Examples of divergence includes the addition of a chapter on social or economic conditions, inclusion of upslope conditions such as soil erosion processes, and the initiation of an annotated bibliography. This assessment, in general, did not collect new data, did not perform channel typing, and did not perform aerial photographic assessments of riparian zones. The main focus of the assessment was a synthesis of existing data sets and studies pertaining to the Marys River Watershed to provide a better picture of the watershed at this point in time.

Gregory, S., Beschta, R. L., Moore, J., and Williamson, K., 2000, Report of the Oak Creek Action Team to Oregon State University, Submitted to Office of Research Oregon State University: Oregon State University.

Available: action_team_report.pdf

Abstract or Excerpt: In May 1999, Oregon State University formed a team of scientists to explore potential impacts of land uses on University lands in the Oak Creek basin. The University asked the Oak Creek Action Team to explore management issues that 1) caused severe environmental degradation, 2) were illegal, or 3) impacted the teaching and research potential of the University lands. The Action Team identified six critical issues for assessment:

Manure application and water quality
Riparian condition and water quality
Water withdrawal
Dams and barriers
Storm water drainage
Toxic waste storage and handling

Critical actions that are recommended by the Action Team are summarized in the Introduction of the report.

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OREGON STATE UNIVERSITY
OAK CREEK
Research and Teaching in OSU's Home Watershed

Research: Hydrology and Water Quality

Jump to subtopics:

Historical Overview

Source: Conversations with Pete Klingeman, OSU Professor of Civil Engineering, Bob Beschta, OSU Professor Emeritus of Forest Engineering, and references listed below.

Date: Spring 2002 (note below in red added in November 2008)

Water Quantity

There is no long term record of stream discharge in the Oak Creek Basin. However, there are discontinuous records from the 1970's when sediment transport studies were taking place and more recent (2001-2002) efforts to extensively gage flow throughout the basin.

Records from the 1970's were taken at the sediment transport facility near the downstream boundary of McDonald-Dunn Forest. The gage was usually only operated during winter months when sediment sampling was taking place. However, during the 1980 water year, continuous records were kept (Pete Klingeman gave these records to Jeff McDonnell, OSU Professor of Forest Engineering, in 2000). In 1994, two groups of students in Bob Beschta's Watershed Analysis course (FE530/630), carried out watershed analyses of the Oak Creek Basin. Refer to the Watershed Analysis Section of the website for the report abstracts and reference information. For a section on Basin Hydrology, Civil Engineering student Valiant Villanueva compiled daily peak flow data from Pete Klingeman's 1980 records. He then used this record to develop a correlation between USGS Gaging Station No. 14171000 on the Mary's River and the Oak Creek gage. Villanueva's table of Water Year 1980 data for the Mary's River and Oak Creek sites are available for download as an excel file (see below).

In 2001, Arne Skaugset (OSU Assistant Professor of Forest Engineering) began a hydrologic study looking at the impact of forest roads. As part of this project, his group gaged flow at the sediment transport facility from the 1970's and through culverts throughout the McDonald-Dunn Forest. Data from this project (2001-2006) is available through the Forest Science data bank. The database includes discharge at the sediment transport facility, air temperature, relative humidity, wind speed, rainfall at four sites around the basin. The data and the meta data are in the Forest Science data bank.

Water Quality

As with discharge, there has never been a comprehensive long term water quality monitoring program in the Oak Creek Basin. However, there have been several periodic monitoring efforts. The most complete record comes from the City of Corvallis who have measured bacteria and several other parameters once a month at one station (near Oak Creek's confluence with the Marys River) since 1988. These records have been reviewed and compiled by many students including James Cassidy, Crop and Soil Sciences graduate student, who created a graph of bacteria data for the web. This graph demonstrates that bacteria is one of Oak Creek's principal water quality issues. Bacteria levels have repeatedly been out of compliance with state standards. Over the years, bacteria contamination has been traced to leaking sewers and manure spills at the OSU Dairy Center (see excerpts from the City of Corvallis' annual water quality reports in the excel file below).

OSU and Corvallis High School classes have also collected water quality data. This data was collected more sporadically (depending on when school was in session and classes were taught) but covers several intervals over the last three decades. Refer to the list below for more details.

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Datasets and Class Projects

1980 Water Year, discharge

Data author: unknown, (Pete Klingeman and students?), data later compiled by Valiant Villanueva for FE530/630

Dates Collected: October 1, 1979-September 30, 1980

Study Location: Oak Creek Sediment Transport facility (watershed area ~7.0 km2 (2.7 mi2))

Available: Records compiled by Villanueva are available for download as an excel file. The file also includes discharge data from the USGS Gaging Station No. 14171000 on the Marys River for the same interval. Pete Klingeman gave the original Oak Creek hard copy discharge records to Jeff McDonnell, OSU Professor of Forest Engineering, in the late 1990's. Data for the Marys River gage near Philomath is available online from the USGS.

URL for file: http://cwest.orst.edu/oakcreek/data/1980_discharge.xls

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Average Total Coliform Counts measured by the FE535 Water Quality Lab, 1975-1993

Data author: Bob Beschta and students, data later compiled by Rob Sherer for FE530/630

Study Location: Eleven locations from near the McDonald Forest gate to Oak Creek's confluence with the Marys River. Refer to Sherer's sketchmap for approximate locations.

Dates Collected: Annually in November 1975-1993. Some years are missing and data was not collected at all sites each year.

Sampling Method: Total coliform determined using various methods (Filtered and Field Monitored).

Available: Records compiled by Sherer are available for download as an excel file. Steven Schoenholtz, assistant professor of Forest Engineering, now has the hard copy files of data collected by the FE535 class.

URL for file: http://cwest.orst.edu/oakcreek/data/FE535_WQ_data.xls
Map: http://cwest.orst.edu/oakcreek/data/FE535_WQ_locations.pdf

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Water Quality data collected the Public Health class H443/543 (Environmental Sampling and Analysis), 1993-present

Data author: Anna Harding and students and Caragwen Bracken (OSU Department of Public Health, 541-337-4069) who began teaching H443/543 in 2002(?), fecal coliform data later compiled by Rob Sherer for FE530/630.

Parameters: Total Coliform, Fecal Coliform, Alkalinity, Color, Conductivity, Dissolved Oxygen, Nitrate HR, Nitrogen, Ammonia, pH, Phosphorus, Turbidity, Temp

Study Location: Four to six locations, several near the headwaters in McDonald Forest and several near the Covered Bridge. Locations are described in the excel and html files listed below. Rob Sherer (FE530 student, see Buckley, 1984) created a sketchmap for locations where data was collected during 1994.

Dates Collected: Annually in the Spring 1973-1997. Data was not collected at all sites each year.

Sampling Method: unknown

Available: Data through 1997 was compiled by the OSU Stream Team and is available online or as an excel file (see link below). Caragwen Bracken (OSU Department of Public Health, 541-337-4069) has the hard copies of records collected over the years.

URL for html file: http://www.orst.edu/dept/oakcreek/files/table1.html
URL for excel file: http://cwest.orst.edu/oakcreek/data/public_health_classes.xls
(This file contains the same data as the html file but is in a spreadsheet format. It also includes a table of more detailed data collected by the H443 class in 1994. This data was compiled by Rob Sherer in Buckley, 1984.
Map: http://cwest.orst.edu/oakcreek/data/H443_WQ_locations.pdf (Map locations were sketched by Rob Sherer and apply to data collected during 1994.)

Water Quality Data collected by the City of Corvallis, 1988-present

Data author: City of Corvallis, Public Works.

Parameters: E. Coli (1996-present), Fecal Coliform (1988-1991; 1993-1995), Enteroccocus Bacteria (1992), Temperature, pH, DO, Conductivity, Turbidity, TSS, CBOD5, COD

Study Location: One location at the Hwy 20 bridge.

Dates Collected: Monthly 1988-present.

Sampling Method: Grab samples were taken once a month. Bacteria sampling changed several times depending on current state standards. Please see the downloadable note for a detailed explanation of the City's monitoring objectives and the changes in bacteria analyses.

Available: The City of Corvallis archives data in tables and in monthly and annual water quality reports. The reports include notes on incidents such as manure spills.

Data collected between 1996-2001 is available for download as an excel file from this website. The file also includes a table of incidents recorded by the City. Data collected between 1988-1995 was provided by the city, however the file is corrupted and as of May 2002 could not be opened.

James Cassidy (james.cassidy@orst.edu), OSU graduate student in Crop and Soil Sciences, compiled the City's bacteria data for 1988-1999 in graphical form. Is is available on-line through the Fisheries and Wildlife Oak Creek Website.

URL for excel file: http://cwest.orst.edu/oakcreek/data/corvallis/Streamdatabase.xls
URL for explanatory note: http://cwest.orst.edu/oakcreek/data/corvallis/Notes_on_Corvallis_City_Data.pdf

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Water Quality Data collected by Corvallis High School students with support by Steve Griffith, USDA-ARS

Author: Corvallis High School students and teachers Steve Griffith, Research Plant Physiologist at the USDA Agricultural Resource Service, National Forage and Seed Production Research Center, Corvallis.

Parameters: Nitrate, Ammonia, Orthophosphate, DOC, DON, some turbidity, sediment concentration, pH

Study Location: Seven locations along Oak Creek downstream of Walnut Blvd, one location on the Oak Creek tributary that runs through Walnut Park.

Dates Collected: Fall and Winter months, October 2000-February 2002.

Sampling Method:

Available: Contact Steve Griffith.

Water Quality Data collected by the Marys River Watershed Council, 2001-2002

Author: Marys River Watershed Council, Monitoring Committee, contact Sandra

Coveny, Council Coordinator (MRWC@peak.org) for more information.

Parameters: Nitrate, Ammonia, Orthophosphate, DOC, DON, some turbidity, sediment concentration, pH

Study Location: 13-different sites along the Marys River and a couple on Oak Creek.

Dates Collected: Monthly, 2001-2002?

Sampling Method: unknown

Available: As of June 2002 this data was not available in report form, contact the Council for more information.

Synoptic Water Quality Sampling, Fall 2001

Data author: Stephen D. Sebestyen, Graduate Student, State University of New York College of Environmental Science & Forestry (e-mail: sdsebest@syr.edu) (visited OSU Dept of Forest Engineering, Fall Quarter, 2001)

Study goal: To determine how water quality constituents vary with scale in a mesoscale watershed (for more details, e-mail Steve).

Parameters: fluoride, chloride, nitrate, phosphate, sulfate, sodium, potassium, calcium, magnesium, total sulfer, aluminum, iron, zinc, manganese, barium, strontium, silica, DOC, TKN, ammonia, nitrite, total phosphorous.

Study Location: 36 samples taken at different locations in Oak Creek Watershed.

Dates Collected: 11/27/01

Sampling Method: 1 l grab samples were collected in Nalgene HDPE acid washed bottles, samples were filtered through Pall Gelman 0.7 micrometer glass fibre filters in Millipore glass filter holders within 72 hours of collection, samples were refrigerated prior to filtering and then frozen until analyzed.

Available: contact Stephen D. Sebestyen (e-mail: sdsebest@syr.edu)

URL for graphic map: Sebestyen.pdf

Physical hydrology and meteorology of the Upper Oak Creek Watershed in Western Oregon, 2001-2006

Data Author: Arne Skaugset, OSU Forest Engineering, Resources, and Management

Study Goal: The overall objective of this study (not presented in this database) was to determine the distribution and magnitude of surface runoff from individual road segments in a forested watershed. A sub-objective was to provide watershed level information in the Upper Oak Creek Watershed of the McDonald-Dunn Research Forest of the College of Forestry at Oregon State University.

Parameters: Data presented includes water discharge, wind speed, solar radiation, air temperature, relative humidity, and precipitation.

Study Location: Water Discharge and Stage measurements at the Oak Creek Weir in the McDonald-Dunn Forest. Rainfall binned hourly at four rain gauge locations in watershed.

Dates Collected: Nov 12 2001 - Sep 30 2006

Sampling Method: See metadata for details.

Available: http://andrewsforest.oregonstate.edu/data/abstract.cfm?dbcode=HF022&topnav97

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Student Theses

Bolf, R. B., 1979, Origin, incidence, and survival of Salmonella in a rural watershed [MS Thesis]: Department of Microbiology, Oregon State University, 53 p.

Available: OSU Valley Library, LD4330 1980 .B59

Notes: Material from this thesis is summarized in Siedler, 1979.

Lamka, K. G., 1979, Specific indicator organisms can define the magnitude and origins of non-point pollution in rural environment [MS Thesis]: Department of Microbiology, Oregon State University, 82 p.

Available: OSU Valley Library LD4330 1980 .L29

Notes: Material from this thesis is summarized in Siedler, 1979.

Williams, J. C., 1975, Urbanization of upper Oak Creek Basin, Corvallis, Oregon [MS Paper]: Department of Geosciences, Oregon State University.

Notes: Referenced in water quality section of Augerot et al, 1994.

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Reports and Publications

Glasmann, J. R., 2000, Stream Turbidity and Suspended Sediment Mineralogy During the 1998/1999 and 1999/2000 Winter Rainy Seasons, Marys River Watershed: Willamette Geological Service, WGS090001.

Available: http://www.marys-river-wc.peak.org/projects/index.htm

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Pearcy, W.G. (ed.), 1999, Temperature Monitoring and Modeling of the Marys River Watershed for The Marys River Watershed Council and The Oregon Watershed Enhancement Board, OWEB Project # 98-034.

Available: http://www.marys-river-wc.peak.org/projects/index.htm

Abstract: This was a study to better understand the temperature patterns of the Marys River watershed, how they may affect the distribution of native cutthroat trout during the summer, and where opportunities may exist for improvement of stream temperatures. This report is in two parts. Chapter 1 summarizes the results of monitoring stream temperatures, and Chapter 2 describes a modeling study of stream temperatures. Monitoring was based on the placement of 42 temperature data loggers during the summer of 1998 and 26 during the summer of 1999. Seven day moving averages of maximum water temperatures for August indicated that most tributaries had temperatures that were favorable for cutthroat trout. However, the main channel of the Marys River downstream from the confluence of the Tumtum and Marys rivers, and the lower portions some tributaries, had temperatures that often approached or were above 69º F, temperatures considered unsuitable for cutthroat trout. Segments of streams were identified where reduced temperatures would provide major benefits for native trout. The general trend for downstream warming was similar during both years, with most rapid rate of warming occurring in headwater tributaries. However, some sites were consistently warmer or cooler than expected. These deviations are explained by variations in stream shading, groundwater and tributary influxes, and stream channel morphology. All these factors contributed to the natural warming in the lower reaches of the watershed. Stream temperatures in a section of the Marys River near Wren were accurately predicted with a temperature model that used in situ measurements of air temperature and relative humidity and incorporated factors for hydrology, channel geometry, meteorology, and riparian shade. The results suggested that increased riparian shading could effectively improve habitat conditions for rearing of cutthroat trout in this portion of the Marys River.

Roberts, M. C., and Klingeman, P. C., 1972, The relationship of drainage net fluctuations and discharge, in International Geography 1972, 22nd Annual Geographical Congress, Canada, p. 189-191.

Notes: P. Klingeman says that this was a study of hillslope hydraulics looking at ephemeral stream channels during storm events.

Seidler, R. J., 1979, Point and non-point pollution influencing water quality in a rural housing community: Oregon Water Resources Research Institute, WRRI-64.

Available: Center for Water and Environmental Sustainability Library, 210 Strand Ag Hall, Oregon State University

Abstract: The origin and extent of surface water pollution resulting from rural population growth was documented. It was found that total coliforms and fecal bacterial counts in a stream originating in a protected watershed increased ten-fold as that stream flowed through a populated valley. Only during the "first flush" effect of a

storm event did the surface waters in the forest exceed suggested recreational water standards of 200 fecal coliforms per 100 ml. The only time that these standards were not exceeded in the downstream portion of the creek was during the winter months when the steady state flow rate was much higher than in the summer. Under all weather conditions, numbers of fecal coliforms were found to correlate very well with numbers of fecal streptococci and stream turbidity. Only during hte first flush of heavy precipitation did the relative changes in fecal coliform densities correlate with stream flow rate.

Distinct differences in the streptococcal biotypes could be demonstrated between the protected area and the area receiving runoff affected by man's activity. In the runoff from the nonprotected area, a large proportion of the biotypes were Streptococcus salivarius and S. mitis, organisms found in this and other studies to arise only from human fecal contamination. These two species were isolated on only one occasion in the limited access forest. The isolation of S. bovis was indicative of domestic livestock and wildlife pollution. Enterococci, ubiquitous in distribution, were of no use in defining the origin of non-point contamination. The fecal coliform to fecal streptococcus ration, useful interpreting the origin of point sources of pollution, was nearly always less than 1.0 in the creek, even when the human biotype was prevalent, and so o f no use in identifying sources of non-point pollution. It was concluded that the large increase in bacterial counts below the protected watershed could be attributed to the use of septic tanks in soils unsuitable for use as drainfields.

Fecal indicator organisms as well as the incidence and origin of the pathogen Salmonella were determined to be components of non-point sources of pollution in this watershed. Isolation of Salmonella only occurred once in the protected part of the watershed, while downstream th isolation rate by the Moore swab technique ranged from 75 to 100% at several stations. This increase paralleled increases in fecal coliform and fecal streptococcus counts. A sheep herd grazing adjacent to the creek had a carrier rate for S. arizonae of 38.6%. However, this S. arizonae serotype was only isolated from Oak Creek on one occasion. S. give was the most common serotype found in the creek (82.7% of all Salmonella isolates). Other isolates included S. bareilly and three serotypes of S. arizonae. Salmonella MPNs below the community ranted from <0.3 to 14 Salmonella/liter. To ascertain the degree of persistence of these salmonellae in Oak Creek, survival experiments were done. These pathogens survived longer in this environment than fecal coliforms. The survival time of Salmonella was inversely related to temperature. It was concluded that the bacterial quality of this watershed was significantly affected by non-point runoff from the rural community as measured by both indicator organisms and Salmonella. Grazing livestock in the area contributed negligible numbers of Salmonella to surface water in this study basin.

Notes: This report is largely based on Microbiology theses written by Bolf, 1979 and Lamka, 1979.

Thruston, A. D., Jr., 1970, A fluorometric method for the determination of lignin sulfonates in natural waters: Journal - Water Pollution Control Federation, v. 42, no. 8, p. 1551-1555.

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Center for Water and Environmental Sustainability (CWESt)
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OREGON STATE UNIVERSITY

OAK CREEK

Research and Teaching in OSU's Home Watershed

Research: History and Social Science

Jump to subtopics:

Historical Overview

Source: References listed below.

A number of student theses and papers have studied different aspects of the Oak Creek Basin's history. Patricia Benner's 1984 class paper provides a good synopsis and references useful maps and aerial photographs. Documents used to publicize Corvallis in its early years also provide perspective on the basin's settlement. Refer to the Agriculture section of this website for information about Oregon State's acquisition of land in the basin for animal science education.

Date: Spring 2002

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Datasets and Class Projects

Benner, Patricia, 1984, The Historical Record of Oak Creek, Benton County, OR, Report for Fisheries and Wildlife Limnology (FW 556), OSU.

Available: Online through the Fisheries and Wildlife Oak Creek Website

URL: http://www.orst.edu/dept/oakcreek/files/about.html

Notes: This is good synopsis of prior land use along Oak Creek and includes information about channelization, dams, mills, and homesteads.

Mary's River Oral History Project

Data author: students at Philomath High School

Dates Collected: October 1, 1979-September 30, 1980

Study Location: Mary's River Watershed

Available: A project description is available on-line through the Marys River Watershed Council.

URL for file: http://www.marys-river-wc.peak.org/projects/index.htm

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1851 Land Cover

Author: Pacific Northwest Ecosystem Research Consortium

Parameters:

Study Location: Entire Willamette Valley.

Dates Collected: Monthly, 2001-2002?

Sampling Method: The GIS coverage is based on the Public Land Survey records that created land boundaries for homesteading.

Available: http://osu.orst.edu/dept/pnw-erc/

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Student Theses

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Available: OSU Valley Library LD4330 1933 16

Longwood, F. R., 1940, A land use history of Benton County, Oregon [MS Thesis]: College of Forestry, Oregon State College, 136p.

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Rowland, C., 1965, Subdivision of land : Benton County, Oregon, Pierce County, Washington [MS Paper]: College of Forestry, Oregon State University, 21 p.

Available: OSU Valley Library SD144.O7 1965 .R67

Thomas, G. M., and Schroeder, G. H., 1936, see reference on Forestry page.

Wales, Robert, W., 1965. The Corvallis, Oregon Rural-Urban Fringe: Conceptualization, Delineation, and Land Use [M.S. Thesis]: Department of Rangeland Resources, Oregon State

University, 111 p.

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Yamaguchi, K., 1992, Historical land use and its impact on Oak Creek, Oregon [M.S. Thesis]: Department of Rangeland Resources, Oregon State University, 43 p.

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Reports and Publications

unknown, 1980, Cultural resource inventory, Benton County, Oregon: Corvallis, Oregon: Volume 1, Department of Anthropology, Oregon State University.

Available: OSU Valley Library F882.B4 C81

Baker, V. W., and Mumford, D. C., 1942, Land settlement in the Willamette Valley with special reference to Benton County, Oregon: Station bulletin / Oregon Agricultural College Experiment Station, v. 407, 46 p.

Benton County Citizens' League, 1904, Benton County, Oregon. Illustrated, 16 p.

Available: OSU Valley Library F882.B4 B4

Courtney, E. W., 1931-, c1984, see reference on Agriculture page.

Fagan, D. D., 1885, A history of Benton County, Oregon including its geology, topography, soil and productions: Oregon, Walling, A. G., 532 p.

Available: OSU Valley Library F882.B4 F2

League of Women Voters of Corvallis (ed.), 1980, This is Benton County Oregon: Corvallis, Oregon, 29 p.

Available: OSU Valley Library F882.B4 L45

Moore, J. C., Mrs., 1947, Enumeration of the inhabitants of Benton County, Oregon Territory as taken by Charles Wells, assessor for the year 1854; copied from the original in the Benton Co., Ore. courthouse, Daughters of the American Revolution.

Available: OSU Valley Library F874.5 B4

Nelson, M. N., 1946, The economic base for power markets in Benton County, Oregon:

Bonneville Power Administration, Division of Industrial and Resources Development, Market Analysis Section.

Read, R. T., 1984-1996, Historical overview of the Soap Creek, Fairmount, and Corvallis 1 precincts of Benton County, Oregon: Benton County Historical Society.

Notes: Cited in Moret, 1997

Southern Pacific Company and Corvallis Commercial Club (Or.), 1912?, Corvallis and Benton County, Oregon: Portland, Oregon, James, Kerns & Abbott Co., 32 p.

Available: OSU Valley Library F884.C6 C6

Corvallis (Or.). Board of Trade and Yaquina City (Or.). Board of Trade, 1890, Benton County, Oregon : the heart of the famous Willamette Valley: Portland, Oregon, Lewis & Dryden Printing, 24 p.

Available: OSU Valley Library F882.B4 C6

University of Oregon, Bureau of Municipal Research and Service, 1965, A plan for land use and major streets, Benton County, Oregon: Eugene, Bureau of Municipal research and Service, University of Oregon, 28 p.

Available: OSU Valley Library NA9127.B3 O7

Notes: "Preparation for this report was financially aided through a federal grant from the Urban Renewal Administration...Project No. Oregon P-50."

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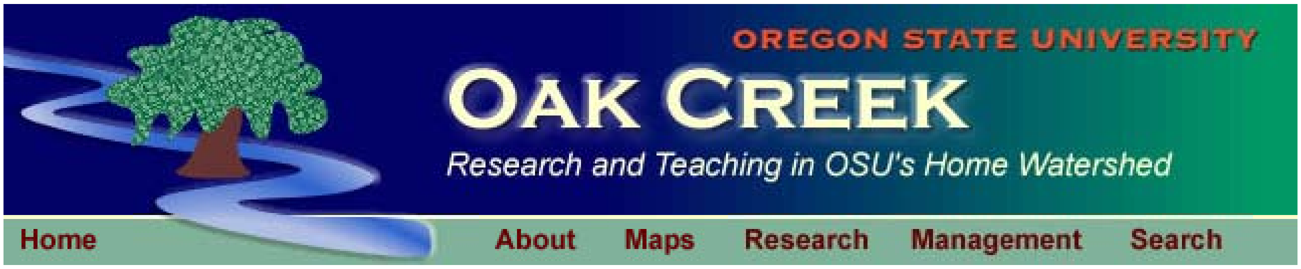

Management

Jump to subtopics:

- Management Entities and Organizations
- Table of OSU Management Responsibilities
- Management Issues

Management Entities and Organizations

Several entities have responsibility for land management within the Oak Creek Watershed.

Entity/Organization	Role or Jurisdiction
Government	
Benton County	Entire watershed is within the County. County zoning covers the upper 2/3 of the basin which are outside of the City of Corvallis.
City of Corvallis	The lower 5 km of Oak Creek are within city limits as is a portion of the NE headwaters. The urban growth boundary extends outward to cover about half the watershed. The City of Corvallis is developing an Endangered Species Act Response Plan in response to the federal listing of the chinook salmon.
Land Owners	
Oregon State University	OSU manages about 40% of the watershed, see table below for details.
Private Timber Companies (Starker Forests, Weyerhaeuser (formerly Willamette Industries))	These companies manage portions of the NE headwaters of the basin -- their holdings are about 15% of the watershed's area.
Other Private Landowners	The rest of the basin is managed by other smaller land owners for timber, pasture, and rural residential uses.

Conservation Organizations

Benton Soil and Water Conservation District	Benton SWCD provides technical assistance to area land owners. It is led by seven volunteer directors.
Marys River Watershed Council	The Mary's River Watershed Council is a nonprofit organization encouraging watershed conservation. Oak Creek is a tributary of the Marys River. They have carried out a watershed assessment, monitoring programs, and encourage restoration projects.
Corvallis Environmental Center	The Corvallis Environmental Center is a nonprofit organization encouraging public participation in environmental conservation. In the past, they have participated in the City of Corvallis' water quality monitoring programs.

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OSU Management Responsibilities

Several Colleges are responsible for lands managed by OSU.

Description	OSU Manager	Area (acres)	Area (hectares)	Percent of Basin Area
McDonald-Dunn Forest	College of Forestry	1867	755	23%
Oak Creek Laboratory of Biology	College of Agriculture	17	7	<1%
OSU agricultural and pasture lands	College of Agriculture	1042	422	13%
OSU main campus	Facilities Services	358	145	4%
Total of OSU Managed Lands		**3283**	**1329**	**40%**

*Area calculations are based on GIS maps prepared by Aileen Buckley, 1994 and GIs data from Benton County.

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Management Issues Identified by the Oak Creek Action Team, June 2000

In 1999, Toby Hayes, then Vice Provost for Research asked four OSU professors to serve on an Oak Creek Action Team to identify critical management issues on OSU lands within the Oak Creek Basin. Stan Gregory served as chairperson with Bob Beschta, Jim Moore, and Ken Williamson making up the rest of the team. Team meetings were open to the public and their final report was made available through an Oak Creek website. OSU issued a press release about the Task Force in 1999.

Below is the Team's summary of critical issues and proposed solutions with an update of progress as of June 2002.

1. Appoint an OSU Oak Creek Governing Body

Description: A 9 member body will be comprised of faculty members from 1) College of Forestry, 2) Department of Animal Sciences, 3) Department of Fisheries & Wildlife, 4) Department of Civil Engineering, 5) faculty member at large, 6) a staff member from facilities services, 7) member at large (local citizen) to be appointed by the mayor of Corvallis, 8) citizen or staff from Marys River Watershed Council or Corvallis Environmental Center, and 9) Chairperson appointed by the Vice-Provost of Research and the President of the University.

Tasks: Manage and coordinate all educational and research activities that occur on OSU land along Oak Creek. The governing body will be responsible for providing guidance and oversight to such activities. This group will also provide an annual report of the ongoing activities and the state of the health of Oak Creek to the Vice Provost's office. This report could be shared at the Vomocil Water Quality Conference in November each year. This group can appoint subcommittees to address special needs (e.g., monitoring committee, committee to address livestock grazing in the riparian zone).

Rationale: Today there are many activities on OSU lands along Oak Creek. Few of these activities are coordinated or consistent in term of management practices. To better able serve students, faculty, and the general public this body will serve as a governing committee. Resources required: It is requested that this group be initially funded at the level of $50,000 and at a level appropriate in future years to support needed monitoring, cost share projects within the stream corridor, and partner with others on needed research and educational projects.

Status as of June 2002: *This forum has not been established, however, the College of Agriculture has formed a management committee who are developing a Farm Conservation Plan for the university farms.*

2. Establish an Oak Creek Riparian Study Area

Description: OSU is the land manager of the riparian zone along approximately 8 miles of Oak Creek. There are other private property owners interspersed between OSU lands. This area runs from the developed urban site near the football stadium, along and through several different rural and agricultural uses, up to the headwaters of the creek in Dunn Forest. The Riparian Study Area will extend 500 ft (150 m) out from the high flow channel of Oak Creek. This area would be wider than a simple riparian buffer and would include the area of direct riparian influence on the stream and a small amount of the upland terrestrial habitat that borders the riparian area. The University would acknowledge the high potential for its activities in this area to adversely impact riparian, aquatic, and other public resources. Furthermore, this area provides distinct teaching and research opportunities. University managers would demonstrate that activities proposed for this area would be consistent with maintain or restoring riparian functions, and any potential adverse activities would be monitored and documented. The Oak Creek Riparian Study Area would be dedicated to teaching, research, demonstration sites, and public outreach.

Tasks: The governing body would serve to coordinate and provide guidance to all OSU land uses in this study area. It would encourage long-term studies of alternative landuse practices that focus on riparian and aquatic systems. It would ensure the establishment of sustainable stewardship practices and require that all activities address and evaluate their impacts on these systems. In essence, the governing body would be charged with monitoring the overall health of

Oak Creek and its associated riparian zone.

Rationale: Recent and current interests in the state have brought attention to the need to broaden and expand our understanding of the role and function of the riparian zone as they relate to a wide variety of natural resources issues. Faculty at OSU have been and will continue to be involved in educational efforts, demonstrations, and research projects that relate to, utilize and expand our understanding of riparian zones. The establishment of the Oak Creek Riparian Study Area will enhance this educational commitment and further establish our reputation as a leader in the broad area of natural resources.

Status as of June 2002: *The riparian study area has not been established.*

3. Develop environmental monitoring sites and systematic measurements in the Oak Creek Riparian Study Area

Description: Responsible management of the Oak Creek watershed requires direct measurement of environmental and ecological trends on University lands. Monitoring data are necessary to 1) document the status and trends of resources on the University lands and 2) verify the effectiveness of management practices and policies.

Tasks: To establish long-term monitoring stations to document water quantity and water quality. To develop systematic surveys of environmental and ecological components of the Oak Creek Riparian Study Area on a recurring basis (time intervals between measures would depend upon specific components).

Rationale: OSU needs accurate environmental and ecological information to design policies and practices for resource protection and to document the success of failure of these measures. The University will be able to adapt to resource trends or future environmental concerns if it establishes a rigorous information base of ecological and environmental conditions.

Status as of June 2002: *The University has not implemented a monitoring plan. However, several monitoring studies are under way as part of the Mary's River Watershed Council's activities and research activities within the Department of Forest Engineering (contact: Jeff McDonnell) and the Department of Civil Engineering (contact: Pete Nelson). Refer to the Hydrology and Water Quality Section of this website for more information.*

4. Conduct an analysis of winter manure spreading

Description: The practice of winter spreading of livestock waste can result in runoff leaving the field, typically during periods of extended rainfall. Evaluation of this practice requires input data on the rate and volume of wastewater generation, the soil infiltration rate and water holding characteristics, and the weather pattern during the winter season. An analysis of this data will determine the volume of storage capacity required to hold the wastewater during times of unfavorable/saturated soil conditions.

Tasks: Assemble existing data on animal numbers and wastewater generated at the facility. Some, if not all of this information is currently available. Collect existing characteristics of the soil types found on the dairy farm. Obtain records of long-term rainfall amounts, frequency, and intensity to provide statistical return frequency for nonrain periods that allow soil drainage/drying, followed by wastewater applications in acceptable cases. Sum these opportunities for spreading livestock wastes and match against the production characteristics of the OSU dairy.

Rationale: All of the animal production units on OSU lands were considered as to their potential negative impact on the water quality in Oak Creek. The dairy operation, with the need to spread several time during the winter poses the greatest potential to impact water quality. Conducting the above described analysis will allow an evaluation and determination of the needed storage capacity to hold the wastewater during times when spreading could result in runoff. Coordinated management and planning will provide public documentation of these assessments and subsequent monitoring for effectiveness.

5. Develop a policy of evaluating all structural development in the Oak Creek Study Area

Description: Establishment of the Oak Creek Study Area will allow the governing body to review all activities that occur in the area. One of these will be the placement and construction of building, activity areas, and other land use activities. The governing body will also considered the need to remove existing structures. It is important to establish and evaluate these land use activities with the long-term view in mind.

Tasks: To put in place a review process that evaluated the long-term protection and use of the land in the study area. This is not to imply that land uses or structural developments are not allowed. But it is very important that each situation be reviewed and evaluated with the health and management of this area in mind.

Rationale: If we are to develop and evaluate land use management practices that are consistent with our goal of protecting our natural resources, it is important to field test those practices. The use of the Oak Creek Study Area provides us a perfect place to conduct that evaluation. Having this laboratory will allow us to use the Study Area in many educational programs and research activities.

6. Remove dams and stop water withdrawal from Oak Creek

Description: Currently OSU withdraws water from Oak Creek at two locations; on the dairy near 53rd street and at the Entomology Research Laboratory on 35th. The first is permitted by Oregon Water Resources Department and the second is not.

Tasks: The Department of Animal Sciences is responsible for maintaining the dam and irrigation facilities as they use the water to irrigate pastures associated with the dairy. They are open to substituting a ground water source for this irrigation, if the issue of permits can be resolved. The second dam should be removed as it is not permitted.

Rationale: Regardless of the legality, the withdrawal of substantial volumes of water during low flow periods is likely to be detrimental to the aquatic communities in Oak Creek. Flows during the mid to late summer are well under one cubic feet per second. The need for irrigation is high during this warm and dry growing season. During low-flow periods with the dams in place, withdrawals both threaten aquatic life and create barriers to fish passage.

Resources required: Assuming the permits can be obtained to allow a ground water withdrawal, the cost of the new installation and permits will cost approximately $15,000. The removal of the two dams could cost $5,000.

7. Incorporate assessment of storm drains into University policies for hazardous waste management

Description: Storm drains are potential routes for delivery of toxic materials into Oak Creek. Loading docks, storage sheds, and other areas where toxic materials are held temporarily are sites where accidental spills can release chemicals into the storm drain network. In addition, cross-contamination of sewers and storm drains can deliver other pollutants into Oak Creek.

Tasks: To develop a policy to eliminate discharge of contaminants from OSU properties/facilities into stormwater drains. To increase monitoring and enforcement of 1) best-management practices for activities on campus in areas that are susceptible for erosion, 2) best-management practices for washdown activities that lead to stormwater drains, and 3) contractual requirements for non-point sources of pollutants for outside contractors. To inventory all chemical storage units on campus and develop containment structures such that spills cannot directly reach the stormwater or sanitary systems. To undertake a long-term testing program with the City of Corvallis to determine cross-connections between sanitary and stormwater systems.

Rationale: Teaching and research activities of universities are potential sources of environmental pollutants. Rigorous waste management planning and monitoring are necessary to conduct teaching and research in an environmentally sound manner. This requires explicit assessment of potential surface water contamination associated with campus activities and waste disposal systems. OSU is a leader in environmental education and we should strive to demonstrate our leadership through environmentally sound practices.

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