

CHRISTOPHER J. EARLE

Forest Ecologist

9043 Dibble Ave. NW
Seattle, WA 98117

EDUCATION

Ph.D., 1993, University of Washington, Forest Ecology
M.S., 1986, University of Arizona, Geosciences
B.A., 1978, Whitman College, Biology and Geology

MEMBERSHIPS

Ecological Society of America
Xi Sigma Pi Forestry Honorary

EXPERIENCE

JONES AND STOKES ASSOCIATES, 11820 Northup Way, Bellevue, WA 98005. 40+ hours per week. 1999 to present. Have primarily been involved in preparing habitat conservation plans, biological assessments and environmental impact statements addressing endangered salmon and other species of concern. Other projects include riparian reserve description and impact assessment; development of a forest roads maintenance plan; design of a watershed health monitoring plan; inventory and description of watershed restoration projects; wetland assessment and design of wetland mitigation plans; assessment of project impacts on sensitive plant communities; application of dendrochronological techniques to various problems; design of bioengineered river control structures and salmon habitat features; noxious plant surveys and control strategies; effects of wastewater on salmon and their habitat, and on other aquatic species; design and construction of stormwater management facilities; evaluation of stormwater effects on aquatic systems; design and environmental impact evaluation for major port facilities; and the effects of agricultural activities on aquatic systems. Project experience detailed below.

BEAK CONSULTANTS INCORPORATED [Kirkland, WA; defunct]. 40+ hours per week. 1993 to 1999. Was primarily involved in developing and implementing techniques for watershed analysis per protocols established by the Washington Department of Natural Resources. This work included:

- Performing riparian function assessments in eight watershed analyses and participating in periodic review and revision of riparian function assessment protocols.
- Performing water quality assessments in five watershed analyses, acting as an instructor in DNR water quality assessment training courses, and conducting studies testing scientific assumptions incorporated in the protocols.
- Performing public works/water supply assessments in five watershed analyses.

- Performing a stream channel assessment in one watershed analysis.

Also conducted similar assessments of riparian function and channel function in two British Columbia watersheds using protocols set forth under the Forest Practices Code of BC. Additional projects at Beak included wetland delineations, rare plant surveys, support for the preparation of habitat conservation plans, and various more esoteric tasks in ecological consulting.

UNIVERSITY OF WASHINGTON, Seattle, WA. 40+ hours per week. 1986 to 1994. Forest Ecologist and Paleoecologist. Supervised field crews of up to 12 people and managed expedition logistics for fieldwork in China, Alaska, Oregon, Washington and Wyoming. Designed, acquired funding, conducted and reported research on problems including charcoal deposition in lake sediments, effects of climate change on timberline forests, long-term climate change in eastern Siberia, long-term climate and vegetation change in Alaska, land use and climate variation in subalpine forests of eastern Tibet, air pollution effects on tree growth in the Puget Sound basin, and forest recovery after subalpine fire in western Washington. Principal techniques used included dendrochronology, image analysis, and multivariate statistical analysis.

UNIVERSITY OF ARIZONA, Tucson, AZ. 40+ hours per week. 1984 to 1986. Dendrochronologist. Proposed and executed a tree-ring based reconstruction of Sacramento River streamflow since before 1600 A.D. This work involved application of multivariate statistics, including multiple linear regression and ARMA modeling on several computer systems using statistical software to analyze and produce reconstructions of streamflow from instrumented streamflow and tree ring-width data.

WASHINGTON PUBLIC INTEREST RESEARCH GROUP, Seattle, WA. 40+ hours per week. 1983 to 1984. Project Manager. Provided technical review of hydrogeologic aspects of a proposal to store high-level nuclear waste at the Hanford Reservation in Washington. Coordinated all Hanford-related activities at WashPIRG, including media relations, volunteer management, lobbying, giving testimony at state House and Senate Committee meetings, writing newsletter articles and other informational material, negotiating with U.S. Department of Energy and Westinghouse Hanford representatives, and coordinating with salaried WashPIRG staff on legal issues.

PUBLICATIONS

Earle, C.J. [in press]. Photographs of *Pinus roxburghii* used in a textbook on the History of Synthesis from natural products by Professor K.C. Nicolaou, Chairman, Dept. of Chemistry at The Scripps Research Institute in La Jolla, California.

Earle, C.J. 1997-2007. Gymnosperm Database. <http://www.conifers.org>.

Ambrose, A., S. Sillett, G. Koch, R. Van Pelt, C. Earle, M. Antoine, J. Spickler, C. Williams and T. Dawson. 2006. Limits to tree height: within-crown structural and physiological gradients in *Sequoiadendron giganteum*. Poster presentation at the annual meeting of the Ecological Society of America.

Earle, C.J. 2006. Screenshot of Gymnosperm Database home page used in chapter 8 of Kinnear, J. & M. Martin. Nature of Biology. Book 1, 3rd edition. John Wiley & Sons Australia Ltd (Jacaranda).

- Earle, C.J. 2002. "How old is that tree?" *Douglasia* 26(1):xx-xx (reprinted in 2002 in *Menziesia* and the *Bulletin of the Native Plant Society of Oregon*).
- Earle, C.J. 2000. Numerous short articles about conifer species, prepared for the Forestry Compendium. CaliforniaB International, ISBN 0 85199 483 0.
<http://tree.cabweb.org/efctext.htm>
- Earle, C.J. and M.D. Wolanek. 2000. Elevational variation in riparian function at a Cascades ski resort [Poster]. Program & abstracts for AWRA's Summer 2000 Specialty Conference: Riparian Ecology and Management in Multi-Land Use Watersheds. August 28-31, 2000, Portland, Oregon. American Water Resources Association, Middleburg, Virginia.
- Earle, C.J. 1998. Factors affecting peak stream temperature in the southern Washington Cascade Range [Abstract]. Program & abstracts for the seventy-first annual meeting of the Northwest Scientific Association, Olympia, Washington.
- Earle, C.J. and S.W. Madsen. 1997. An assessment of variation in channel geomorphic units described under watershed analysis [Abstract]. Program & abstracts for the seventieth annual meeting of the Northwest Scientific Association, Spokane, Washington.
- Earle, C.J. 1997. Lower North River watershed analysis water quality assessment appendix G. In Vesta-Little North Watershed Analysis. Weyerhaeuser Company, Federal Way, Washington.
- Earle, C.J., L.B. Brubaker and P.M. Anderson. 1996. Charcoal in northcentral Alaskan lake sediments: relationships to fire and late-Quaternary vegetation history. *Review of Palaeobotany and Palynology* 92: 83-95.
- Earle, C.J. 1995. A reconstruction of presettlement forest and fishery habitat in the valley of the South Fork Nooksack River, Washington, USA [Abstract]. *Bulletin of the Ecological Society of America* 76(2): 71-72.
- Earle, C.J., L.B. Brubaker, A.V. Lozhkin and P.M. Anderson. 1994. Summer temperature since 1600 for the Upper Kolyma region, northeastern Russia, reconstructed from tree rings. *Arctic and Alpine Research* 26:60-65.
- Earle, C.J. 1993. *Forest dynamics in a forest-tundra ecotone, Medicine Bow Mountains, Wyoming*. Ph.D. Dissertation, University of Washington, Seattle, WA.
- Earle, C.J. 1993. Asynchronous droughts in California streamflow as reconstructed from tree rings. *Quaternary Research* 39:290-299.
- Earle, C.J. 1992. Evolution of a forest-tundra landscape in the Medicine Bow Mountains, Wyoming [Abstract]. Regional landscape change: impacts of climate and land use, the seventh annual U.S. Landscape Ecology Symposium, p. 57.
- Brubaker, L.B., S. Vega-Gonzalez, E.D. Ford, C.A. Ribic, C.J. Earle and G. Segura. 1992. Old-growth Douglas-fir in western Washington. Pages 333-364 in: Olson, R. K., D. Binkley and M. Böhm, eds. 1992. *The response of western forests to air pollution*. Springer-Verlag, New York, NY.
- Earle, C.J. 1991. Spatial and temporal patterns of tree establishment near timberline, Medicine Bow Mountains, Wyoming [Abstract]. *Bulletin of the Ecological Society of America* 72: 105.
- Earle, C.J. 1985. Science in political debate: nuclear waste in Washington state [Abstract]. Programs with abstracts of the 66th annual meeting, Pacific Division, AAAS, p.27.

SPEAKER

- Earle, C.J. 4 Feb 2007. Ecology of Redwood. Invited address at meeting of the Stolte Grove Land Trust.
- Earle, C.J. 18, 19 Nov 2002. HCP Workshop. Administered by Jones & Stokes at locations in Bellevue, WA and Portland, OR.
- Earle, C.J. 2002. Dendrochronology and Surveying. Invited address at annual meeting of the Land Surveyor's Association of Washington.
- Earle, C.J. 1998. Factors affecting peak stream temperature in the southern Washington Cascade Range [Abstract]. Program & abstracts for the seventy-first annual meeting of the Northwest Scientific Association, Olympia, Washington.
- Earle, C.J. and S.W. Madsen. 1997. An assessment of variation in channel geomorphic units described under watershed analysis [Abstract]. Program & abstracts for the 70th annual meeting of the Northwest Scientific Association, Spokane, Washington.
- Earle, C.J. 1992. Evolution of a forest-tundra landscape in the Medicine Bow Mountains, Wyoming [Abstract]. Regional landscape change: impacts of climate and land use, the seventh annual U.S. Landscape Ecology Symposium, p. 57.

REPORTS (listed in reverse chronological order)

- Jones & Stokes Associates. 2007. Biological assessment for Nationwide Permit 48 implementation in Washington. Prepared for U.S. Army Corps of Engineers, Portland, Oregon.
- HDR Engineering. 2007. Northern Columbia Basin Railroad Project fish, wildlife and vegetation discipline report. Prepared for Washington Department of Transportation, Olympia, Washington.
- Steward Associates and Jones & Stokes Associates. 2007. City of Woodinville Sustainable Development Project R-1 Area environmental report. Prepared for the City of Woodinville, Washington.
- Jones & Stokes Associates. 2007. Port of Vancouver Rail Access Project biological assessment. Prepared for Port of Vancouver, Vancouver, Washington.
- Jones & Stokes Associates. 2007. Integrated Draft Comprehensive Plan Amendments and Draft Environmental Impact Statement, Ferry/Gateway District and Waterfront Park [Plants and Animals section]. Prepared for City of Bainbridge Island, Washington.
- Jones & Stokes Associates. 2006. Overwater structures and non-structural piling white paper. Prepared for Washington Department of Fish and Wildlife, Olympia, Washington.
- Jones & Stokes Associates. 2006. Water crossings white paper. Prepared for Washington Department of Fish and Wildlife, Olympia, Washington.
- Jones & Stokes Associates. 2006. South Naches Irrigation District Comprehensive Irrigation District Management Plan. Prepared for South Naches Irrigation District, Washington.
- Jones & Stokes Associates. 2006. Programmatic Biological Assessment for Conveyance Construction. Prepared for King County Wastewater Treatment Division, Washington.
- Jones & Stokes Associates. 2006. Biological Assessment for the Brightwater Treatment System: Orca Addendum. Prepared for King County Wastewater Treatment Division, Washington.

- Earle, Chris, Rick Oestman and Jill Sunahara. 2005. Use of reclaimed water at Brightwater facilities. Regional Reclaimed Water Conveyance Facilities Design Contract E43010E. Prepared for King County Wastewater Treatment Division, Washington.
- Jones & Stokes Associates. 2005. Port of Vancouver Columbia Gateway Action Description Document. Prepared for the Port of Vancouver, Washington.
- Jones & Stokes Associates. 2005. Section 3.3 (Streams, Wetlands, Water Quality and Water Quantity) of the Draft EIS for the Elliott State Forest HCP. Prepared for the U.S. Fish and Wildlife Service, Portland, Oregon.
- Earle, Chris and Lisa Grueter. 2004. City of Lynnwood Best Available Science Review. Prepared for City of Lynnwood, Washington.
- Earle, Chris and Lisa Grueter. 2004. Regulatory Options and Strategies for the City of Lynnwood Critical Areas Ordinance. Prepared for City of Lynnwood, Washington.
- Earle, Christopher and Lisa Grueter. 2004. Commentary on City of Marysville Draft Best Available Science Review. Prepared for City of Marysville, Washington.
- Jones & Stokes Associates. 2004. Biological Assessment for Brightwater Treatment System. Prepared for King County Wastewater Treatment Division, Washington.
- Jones & Stokes Associates. 2004. Draft Biological Assessment and Essential Fish Habitat Analysis Coast Seafoods Mariculture Operations in Humboldt Bay California. Prepared for Coast Seafoods, Eureka, California.
- Jones & Stokes Associates. 2004. Draft Southwestern Snohomish County Habitat Conservation Plan. Prepared for Snohomish County Department of Public Works, Washington.
- Jones & Stokes Associates. 2004. Chelan County Natural Resource Program Final Wenatchee River Channel Migration Zone Study - Phase II. Prepared for Chelan County Natural Resource Program, Washington.
- SE Group. 2004. Crystal Mountain Master Development Plan Final Environmental Impact Statement. Prepared for USDA , U.S. Forest Service Mt. Baker-Snoqualmie National Forest, Washington.
- Jones & Stokes Associates. 2003. Biological Assessment: Flood Control Projects Maintenance Inspection Program, Western Washington. Prepared for U.S. Army Corps of Engineers, Seattle District.
- Jones & Stokes Associates. 2003. Biological Assessment: Flood Control Projects Maintenance Inspection Program, Eastern Washington. Prepared for U.S. Army Corps of Engineers, Seattle District.
- Jones & Stokes Associates. 2003. Wenatchee River Channel Migration Zone (CMZ) Study. Prepared for Chelan County Natural Resource Program, Washington.
- Jones & Stokes Associates. 2003. Draft King County Wastewater Treatment Division Habitat Conservation Plan. Prepared for King County Wastewater Treatment Division, Washington.
- Jones & Stokes Associates. 2002. Biological Assessment: Microchip Technology Incorporated NPDES Permit Renewal. Prepared for U.S. Environmental Protection Agency, Region 10.
- Jones & Stokes Associates. 2002. Final Fisheries Technical Report Bonneville Power Administration Kangley-Echo Lake Transmission Project. Prepared for Bonneville Power Administration, Portland, Oregon.

- Jones & Stokes Associates. 2002. Draft Compensatory Mitigation Site Assessment Proposed Trust for Public Lands Site. Prepared for Bonneville Power Administration, Portland, Oregon.
- Jones & Stokes Associates. 2002. Brightwater Facilities Draft Environmental Impact Statement Appendix D Draft Endangered Species Act / Essential Fish Habitat Evaluation for Draft EIS Action Alternatives. Prepared for King County, Washington.
- Jones & Stokes Associates. 2002. Biological Assessment, Pacific Northwest Rail Corridor Vancouver Yard Upgrades. Prepared for Washington State Department of Transportation, Washington.
- Bonneville Power Administration. 2001. Shelton-Kitsap Transmission Line Rebuild Final Environmental Assessment and Finding of No Significant Impact. Bonneville Power Administration, Portland, Oregon.
- Earle, C.J. 2001. Report of Investigation: Bearing Tree Stump. Prepared for Cairncross & Hempelmann, P.S., Washington.
- Jones & Stokes Associates. 2001. Natural Resources in the Proposed Wastewater Treatment Division Habitat Conservation Plan Coverage Area. Prepared for King County Wastewater Treatment Division, Washington.
- Jones & Stokes Associates. 2001. Operations and Maintenance Activities of the King County Wastewater Treatment Division. Prepared for King County Wastewater Treatment Division, Washington.
- Jones & Stokes Associates. 2001. Construction Activities of the King County Wastewater Treatment Division. Prepared for King County Wastewater Treatment Division, Washington.
- Jones & Stokes Associates. 2001. Species Selection for the King County WTD HCP. Prepared for King County Wastewater Treatment Division, Washington.
- Jones & Stokes Associates. 2001. King County WTD Habitat Conservation Plan Species Memoranda Volume 3: Nonfish Species. Prepared for King County Wastewater Treatment Division, Washington.
- Jones & Stokes Associates. 2001. King County Wastewater Treatment Division Habitat Conservation Plan Brightwater Facilities Siting. Prepared for King County Wastewater Treatment Division, Washington.
- Jones & Stokes Associates. 2001. Survey of Undesirable Plants, Kangley–Echo Lake and Raver–Echo Lake Transmission Lines. Prepared for Bonneville Power Administration, Portland, Oregon.
- Jones & Stokes Associates. 2001. Final Fisheries Technical Report Bonneville Power Administration Kangley-Echo Lake Transmission Project. Prepared for Bonneville Power Administration, Portland, Oregon.
- Jones & Stokes Associates. 2001. Final Biological Assessment Bonneville Power Administration Kangley-Echo Lake Transmission Project. Prepared for Bonneville Power Administration, Portland, Oregon.
- Jones & Stokes Associates. 2001. Road Management Plan for Crystal Mountain Master Development Plan. Prepared for U.S. Forest Service Mt. Baker-Snoqualmie National Forest, Washington and Crystal Mountain, Inc., Washington.

- Jones & Stokes Associates. 2001. Monitoring Framework Plan for Crystal Mountain Master Development Plan. Prepared for U.S. Forest Service Mt. Baker-Snoqualmie National Forest, Washington and Crystal Mountain, Inc., Washington.
- Jones & Stokes Associates. 2001. Survey of Undesirable Plants, Tanner Tap Transmission Line. Prepared for Bonneville Power Administration, Portland, Oregon.
- Jones & Stokes Associates. 2001. Biological Assessment, Pacific Highway South HOV Lanes Project. Prepared for City of Kent Public Works Engineering Department, Washington.
- Jones & Stokes Associates. 2001. Biological Assessment, Silver Creek Fish Passage Barrier Removal. Prepared for Washington State Department of Transportation Southwest Region, Washington.
- Jones & Stokes Associates. 2001. Biological Assessment for Operations and Maintenance 2002-2011, Mud Mountain Dam. Prepared for U.S. Army Corps of Engineers, Seattle District.
- ARCADIS Geraghty & Miller Inc. 2000. Environmental Assessment, Seattle Processing and Distribution Center. Prepared for United States Postal Service, Denver, Colorado.
- ARCADIS Geraghty & Miller Inc. 2000. Biological Assessment, Seattle Processing and Distribution Center. Prepared for United States Postal Service, Denver, Colorado.
- Jones & Stokes Associates. 2000. Biological Assessment, Shelton-Kitsap Transmission Line Rebuild. Prepared for Bonneville Power Administration, Portland, Oregon.
- Jones & Stokes Associates. 2000. Survey of Undesirable Plants, Shelton-Kitsap Transmission Lines. Prepared for Bonneville Power Administration, Portland, Oregon.
- Jones & Stokes Associates. 2000. Kitsap County Emergency Services Readiness Center Environmental Assessment. Prepared for State of Washington Department of General Services for Military Department.
- Jones & Stokes Associates. 2000. Vegetation and Wildlife Discipline Report, Pacific Northwest Rail Corridor Project, Vancouver Yard Upgrades. Prepared for Washington State Department of Transportation, Washington.
- Jones & Stokes Associates. 2000. Wetlands Discipline Report, Pacific Northwest Rail Corridor Project, Vancouver Yard Upgrades. Prepared for Washington State Department of Transportation, Washington.
- Jones & Stokes Associates. 2000. Biological Assessment, Farm to Market Road, Part 2. Prepared for Skagit County Public Works Department, Washington.
- Jones & Stokes Associates. 2000. Biological Assessment, Rocky Reach Trail. Prepared for Washington State Department of Transportation, Wenatchee, Washington.
- Jones & Stokes Associates. 2000. Biological Assessment, SR5 Ridgefield to East Fork Lewis River. Prepared for Washington State Department of Transportation Southwest Region, Washington.
- Jones & Stokes Associates. 2000. Final Environmental Impact Statement, Maury Island Glacier Northwest Gravel Mine. Prepared for King County Department of Development and Environmental Services, Washington.
- Jones & Stokes Associates. 2000. Biological Assessment: South 212th Street Pavement Rehabilitation Project. Prepared for City of Kent Public Works Engineering Department, Washington.

- Earle, C.J. 1999. Appendix G. Middle Hoh River Watershed Analysis Water Quality Assessment. In Middle Hoh Watershed Analysis. Washington Department of Natural Resources, Olympia, Washington.
- Jones & Stokes Associates. 1999. Species to be Included in the King County Wastewater Treatment Division Habitat Conservation Plan. Prepared for King County Wastewater Treatment Division, Washington.
- Jones & Stokes Associates. 1999. Biological Assessment, Tilton River Barb Installation. Prepared for Washington State Department of Transportation Southwest Region, Washington.
- Jones & Stokes Associates. 1999. Biological Assessment, Thurston Way Interchange. Prepared for Washington State Department of Transportation Southwest Region, Washington.
- Jones & Stokes Associates. 1999. Biological Evaluation, Parsons Creek Fish Passage Project. Prepared for Skagit County Public Works, Washington.
- Jones & Stokes Associates. 1999. Biological Assessment, Everett Water Pollution Control Facility Outfall Maintenance. Prepared for Water Pollution Control Facility, Everett, Washington.
- Jones & Stokes Associates. 1999. Portland to Seattle Fiber Optic Corridor Biological Assessment. Prepared for Williams Communications, Oklahoma.
- Beak Consultants. 1998. Illabot Divide Road Construction Project Biological Evaluation. Prepared for Mt. Baker-Snoqualmie National Forest, Mt. Baker Ranger District, Washington.
- Beak Pacific. 1998. Fisheries Habitat and Riparian Habitat Assessments of the Narcosli Creek Watershed. Prepared for Tolko Industries Ltd., Quesnel, British Columbia.
- Earle, C.J. 1998. Chapter 10. Water Quality. In Silver Creek Watershed Analysis. Murray Pacific Timber Company, Tacoma, Washington.
- Earle, C.J. 1998. Chapter 11. Public Works. In Silver Creek Watershed Analysis. Murray Pacific Timber Company, Tacoma, Washington.
- Earle, C.J. 1998. Chapter 7. Riparian Function. In Silver Creek Watershed Analysis. Murray Pacific Timber Company, Tacoma, Washington.
- Earle, C.J. 1997-2003. Gymnosperm database. <http://www.conifers.org>.
- Earle, C.J. 1997. Appendix D. Clearwater-Middle White Watershed Analysis Riparian Assessment. In Clearwater-Middle White Watershed Analysis. Weyerhaeuser Company, Enumclaw, Washington.
- Earle, C.J. 1997. Appendix H. Griffin-Tokul Watershed Analysis Public Works/Water Supply Assessment. In Griffin-Tokul Watershed Analysis. Weyerhaeuser Company, Snoqualmie, Washington.
- Earle, C.J. 1997. Chapter 7. Acme Watershed Analysis Riparian Assessment. In Acme Watershed Analysis. Trillium Corporation, Bellingham, Washington.
- Earle, C.J. 1997. Chapter 9. Acme Watershed Analysis Public Works/Water Supply Assessment. In Acme Watershed Analysis. Trillium Corporation, Bellingham, Washington.
- Earle, C.J. 1997. Chapter 10. Water Quality. In Nineteen Creek / West Fork Tilton Watershed Analysis. Murray Pacific Timber Company, Tacoma, Washington.
- Earle, C.J. 1997. Chapter 7. Riparian Function. In Nineteen Creek / West Fork Tilton Watershed Analysis. Murray Pacific Timber Company, Tacoma, Washington.

- Earle, C.J. 1997. Chapter 12. Public Works. In Nineteen Creek / West Fork Tilton Watershed Analysis. Murray Pacific Timber Company, Tacoma, Washington.
- Earle, C.J. 1997. Chapter 11. Water Quality. In Mineral and North Fork Mineral Watershed Analysis. Murray Pacific Timber Company, Tacoma, Washington.
- Earle, C.J. 1997. Chapter 8. Riparian Function. In Mineral and North Fork Mineral Watershed Analysis. Murray Pacific Timber Company, Tacoma, Washington.
- Earle, C.J. 1997. Chapter 8. Riparian Function and Water Quality. In Connelly Watershed Analysis Five-Year Review. Murray Pacific Timber Company, Tacoma, Washington.
- Beak Consultants. 1996. 1996 Annual Monitoring Report, Weyerhaeuser Regional Landfill Facility, Cowlitz County, Washington. Prepared for Weyerhaeuser, Washington.
- Beak Consultants. 1996. Grossman Creek Watershed Analysis. Prepared for Boise-Cascade, La Grande, Oregon.
- Earle, C.J. 1996. Hanson Reservoir Inundation Zone Revegetation Plan. Prepared for U.S. Army Corps of Engineers, Seattle District.
- Earle, C.J. 1996. Chapter 7. Riparian Function. In Kosmos Watershed Analysis. Murray Pacific Timber Company, Tacoma, Washington.
- Earle, C.J. 1996. Chapter 10. Water Supply and Public Works. In Kosmos Watershed Analysis. Murray Pacific Timber Company, Tacoma, Washington.
- Earle, C.J. 1996. Chapter 12. Public Works. In Mineral and North Fork Mineral Watershed Analysis. Murray Pacific Timber Company, Tacoma, Washington.
- Beak Consultants. 1995. 1995 Annual Monitoring Report, Weyerhaeuser Regional Landfill Facility, Cowlitz County, Washington. Prepared for Weyerhaeuser, Washington.
- Beak Pacific. 1995. Norrish Creek Riparian Assessment Project Report. Prepared for CanFor Ltd., British Columbia.
- Earle, C.J. 1995. Assessing and Mitigating Windthrow in Riparian Buffer Zones. Prepared for Weyerhaeuser, Federal Way, Washington.
- Brubaker, L.B., E.D. Ford, C.J. Earle, S. Vega-Gonzalez and C. A. Ribic. 1989. Growth variations in old-growth Douglas-fir forests of the Puget Sound area. EPA Project No. CR-814271-01-0, Final Report.
- Earle, C.J. and H.C. Fritts. 1986. Reconstructing riverflow in the Sacramento basin since 1560. Laboratory of Tree-Ring Research, University of Arizona, Tucson. 122 p.
- Brubaker, L.B., E.D. Ford, C.J. Earle, S. Vega Gonzalez and C. A. Ribic. 1989. Growth variations in old growth Douglas fir forests of the Puget Sound area. EPA Project No. CR 814271 01 0, Final Report.
- Baird, B. and C. J. Earle. 1984. High-level nuclear waste disposal at Hanford: a geologic critique. Washington Public Interest Research Group, Seattle, WA. 34 p.

SPECIAL SKILLS AND EXPERTISE

Endangered Species Act implementation
 Forest ecology
 Forestry/fishery interactions
 Habitat Conservation Planning

Riparian ecology
Watershed analysis
Fluvial geomorphology
Tree-ring analysis
Salmonid life history and habitat
Climate change
Wetland delineation and mitigation
Rare plants and noxious weeds.

EXPERIENCE: OVERVIEW

Jones & Stokes Associates, Inc., Bellevue, WA. Senior Environmental Scientist. May 1999-now. Worked extensively on strategy, structure, content, and negotiations for a major Habitat Conservation plan addressing municipal wastewater treatment in much of King County. Project manager and task leader on a wide array of environmental compliance and permitting projects, chiefly focused on Endangered Species Act implementation and project effects on salmonid fishes. Marketed and managed project budgets up to \$350K and coordinated/managed project teams of up to 8 people. Prepared over 20 biological assessments and portions of numerous environmental assessments and environmental impact statements for projects including fish habitat enhancement, ski area expansion, port facility development, highway construction and repair, railroad construction, power line construction and repair, wastewater treatment plant operations, wastewater outfall and conveyance construction, industrial facility siting and construction, and fiber optic cable installation. Managed biological assessments, vegetation surveys, wetland delineations and wetland mitigation projects, primarily for federal, state and local government clients.

Beak Consultants Incorporated, Kirkland, WA. Terrestrial Ecologist. October 1993-February 1999. Primarily worked as task leader on watershed analyses and as project manager on small-scale projects in wetland delineation and mitigation and specialized ecological research questions. Marketed and managed project budgets up to \$30K and coordinated/managed project teams of up to 3 people. Developed and implemented techniques for watershed analysis per protocols established by the Washington Department of Natural Resources. Performed riparian function, water quality, public works/water supply, and stream channel assessments for watershed analyses. Participated in periodic review and revision of riparian function assessment protocols. Taught DNR water quality assessment training courses, and conducted studies testing scientific assumptions incorporated in the protocols. Also performed wetland delineations, rare plant surveys, support for the preparation of habitat conservation plans, and other tasks in ecological consulting.

University of Washington, Seattle, WA. Forest Ecologist and Paleoecologist. Research Associate/May 1993-September 1993; Research Assistant/June 1986-December 1992. Supervised field crews of up to 12 people and managed expedition logistics for fieldwork in China, Alaska, Oregon, Washington and Wyoming. Designed, acquired funding, conducted and reported research on problems including charcoal deposition in lake sediments, effects of climate change on timberline forests, long-term climate change in eastern Siberia, long-term climate and vegetation change in Alaska, land use and climate variation in subalpine forests of eastern Tibet, air pollution effects on tree growth in the Puget Sound basin, and forest recovery after subalpine fire in western Washington. Principal techniques used included dendrochronology, image analysis, and multivariate statistical analysis.

University of Arizona, Tucson, AZ. Dendrochronologist. Research Assistant/August 1984-June 1986. Proposed and executed a tree-ring based reconstruction of Sacramento River streamflow since before 1600 A.D. This work involved application of multivariate statistics, including multiple linear regression and ARMA modeling on several computer systems using statistical software to analyze and produce reconstructions of streamflow from instrumented streamflow and tree ring-width data.

Washington Public Interest Research Group, Seattle, WA. Radioactive Waste Program Coordinator/June 1983-August 1984. Provided technical review of hydrogeologic aspects of a proposal to store high-level nuclear waste at the Hanford Reservation in Washington. Coordinated all Hanford-related activities at WashPIRG, including media relations, volunteer management, lobbying, giving testimony at state House and Senate Committee meetings, writing newsletter articles and other informational material, negotiating with U.S. Department of Energy and Westinghouse Hanford representatives, and coordinating with other WashPIRG staff on legal issues.

Exlog-Smith Geothermal, Cobb, CA. Geologist/October 1981-May 1983. Monitored geological data and collected samples during drilling on geothermal exploration and production wells.

Western Washington University, Bellingham, WA. Research Assistant/March 1980-June 1981. Miscellaneous tasks chiefly associated with processing and cataloging geological samples.

BLURBS

①Dr. Christopher Earle is an environmental scientist with Jones & Stokes, a Sacramento-based consulting firm specializing in environmental planning and natural resource management. His 15 years of professional experience includes management of watershed-level studies of forestry and grazing impacts to channel morphology and riparian ecosystem function, design and implementation of forestry-related water quality monitoring programs for streams, and diverse assessments of development-related impacts to salmonid habitats. He has provided scientific assessments of riparian function, wetlands, water quality and fluvial geomorphology for 16 watershed analyses conducted under various protocols (Oregon, Washington, British Columbia).

Dr. Earle is currently managing the Lower Skykomish River HCP and leading the technical analyses on the King County Wastewater Treatment HCP. He has previously contributed to three forest practices HCPs, many programmatic and non-programmatic biological assessments for infrastructure facilities, and 15 watershed analyses addressing forest-fish interactions in British Columbia, Washington and Oregon. Dr. Earle teaches water quality assessment classes for the Washington Department of Natural Resources. He also manages the Gymnosperm Database at www.conifers.org.

Before joining Jones & Stokes, Dr. Earle performed research on climate change, forest ecology, paleoecology and dendrochronology at the University of Arizona, Tucson and the University of Washington, Seattle. Dr. Earle received a Ph.D. in forest ecology from the University of Washington.

②Christopher Earle is an ecologist specializing in Endangered Species Act issues, watershed analysis, salmon habitat assessment and related terrestrial/ aquatic ecosystem interactions, and conifer biology. His 15 years of professional experience includes management of watershed-level studies of forestry and grazing impacts to channel morphology and riparian ecosystem function, design and implementation of forestry-related water quality monitoring programs for streams, and diverse assessments of development-related impacts to salmonid habitats. He has provided

scientific assessments of riparian function, wetlands, water quality, and fluvial geomorphology for 16 watershed analyses conducted in the Pacific Northwest and for four Habitat Conservation Plans addressing wastewater treatment, agriculture, and commercial forestry. Dr. Earle has taught water quality assessment classes for the Washington Department of Natural Resources. He received a Ph.D. in forest ecology from the University of Washington, Seattle, Washington, in 1993; an M.S. in geosciences from the University of Arizona, Tucson, Arizona, in 1986; and a B.A. from Whitman College, Walla Walla, Washington in 1979.

③ Christopher Earle is an ecologist whose 15 years of professional experience includes managing and negotiating salmon-focused habitat conservation plans, managing watershed-level studies of forestry and grazing impacts to stream channels and riparian ecosystems, designing and implementing stream water quality monitoring programs, and assessing development impacts to salmon habitat.

④ Key Skills

Endangered Species Act Implementation – Chris has worked on negotiation and implementation of four habitat conservation plans affecting almost 600,000 acres in Western Washington. Currently he is project manager for one HCP addressing management of the lower Skykomish River, and is senior scientist for two other HCPs for management of the King County wastewater treatment system and construction of transportation and drainage projects in Snohomish County. He has prepared numerous project and programmatic biological assessments for a variety of projects including road and railroad construction and rehabilitation, reservoir and levee management, and diverse utility/infrastructure development projects.

Scientific Expertise – With an M.S. in geology and a Ph.D. in ecology, Chris is a recognized regional expert in riparian systems ecology, forest ecology, and several more obscure fields (such as tree-ring analysis). He has taught water quality classes as part of the DNR Forest Practices watershed analysis program and has led workshops on habitat conservation planning.

⑤ Dr. Earle has been a project manager for six years, supervising up to 5 technical staff on projects having a budget of up to \$75,000. He has also had task management responsibilities associated with larger projects for supervision of up to 12 technical staff and allocation of funds in excess of \$100,000 per year. He is currently project manager for the Brightwater ESA Compliance, a project requiring negotiation and preparation of complex permitting documents. In the past, he has managed the Mud Mountain Dam Biological Assessment for Operations and Maintenance, numerous biological assessments, the Narcosli and Norrish Creek Watershed Assessments, and numerous minor projects in areas including rare plant surveys, noxious weed control, dendrochronology, forest ecology, and wetland restoration.

EXPERIENCE: SELECTED PROJECTS

Habitat Conservation Plans

HCP-1 Mineral Tree Farm Habitat Conservation Plan Monitoring Program (Murray Pacific/West Fork Timber Corporation), Morton, WA. 1994-1999. Reference: Scott Swanson (253) 383-5871. Designed and conducted stream temperature assessment program to test validity of certain assumptions about the effects of tributary temperature and stream shading on stream temperature. This monitoring program generated one of the most comprehensive stream temperature monitoring databases available in the Pacific Northwest.

HCP-2 Hamilton Tree Farm Habitat Conservation Plan (Crown Pacific Corporation), Hamilton, WA. 1998-1999. Reference: Marty Vaughn. Researched and wrote portions of

Environmental Assessment and Habitat Conservation Plan addressing water quality, riparian reserves and sensitive plant species.

HCP-3 Habitat Conservation Plan for WTD Activities (King County Wastewater Treatment Division), Washington. 1999-2005. Reference: Steve Gilbert (206) 684-1243. A lengthy effort in research, preparation, and negotiation phases of the King County HCP, the first large-area HCP to be centered on a major metropolitan area. Conducted screening level analysis of 83 species, including many salmonids and marine fish, to evaluate potential for affects from WTD activities. Authored four issue papers detailing King County's construction, operations and maintenance activities. Conducted analysis to determine the magnitude and types of habitat disturbance which could occur over the 40 year term of the HCP. Assisted in the evaluation of potential affects of secondary treated discharges to freshwater and marine environments. Assisted in technical information and negotiations with the services. Primary author of much of the HCP, including species selection and development of species information, description of covered activities and their effects in a programmatic context, definition of objectives, design and implementation of conservation measures and adaptive management and monitoring measures, and analysis of HCP effects.

shorter: Ongoing participation in preparation and negotiation of a habitat conservation plan addressing potential impacts to 25 species, including many salmonids, due to operation of King County's wastewater treatment system. This is the first large-area HCP to be centered on a major metropolitan area. Lead author on analyses of species selection for the HCP, effects of sewer overflows, effects of construction activities, and effects of Brightwater treatment plant siting.

HCP-4 Habitat Conservation Plan (Lower Skykomish River Habitat Conservation Group), WA. 2002-ongoing. Reference: John Sayre (360) 588-1917. Project manager and principal architect of this HCP, which was designed to provide for flood control and salmonid habitat enhancement on approximately 8,000 acres of farmland in the lower Skykomish and Snoqualmie River valleys. It would have been the first HCP to address agricultural management of floodplains in Washington. Coordinated development of HCP goals and landowner education program, and supported negotiations between landowners and Services via strategic consultation and preparation of preliminary draft HCP documents.

HCP-5 Habitat Conservation Plan (Snohomish County Public Works), WA. 2003-2004. Reference: Dave Campbell (425) 999-9999. Jones & Stokes' project manager of this HCP, which was designed to provide programmatic implementation of transportation and drainage maintenance and construction in the North Lake Washington tributary watersheds of Snohomish County from 2005 to 2025. It would have been the first HCP to address transportation-related suburban growth inducement in Washington. Dr. Earle's specific tasks included coordinating HCP sections dealing with environmental baseline and species descriptions, development of conservation strategies and an adaptive management program, participation in strategic project planning and negotiations with the Services, and overseeing development of ancillary analyses ("white papers" and preparation of a tracking database).

HCP-6 Habitat Conservation Plan (Port of Vancouver), WA. 2004-2006. Reference: Patty Boyden (360) 992-1103. Jones & Stokes' task lead for this HCP, which was part of

a larger master plan for Port development, and which addressed projected impacts on bald eagles, salmonids, and sandhill cranes. Dr. Earle's specific tasks included coordinating preparation of a document detailing the proposed action and its impacts, outlining and coordinating preparation of the HCP document, participation in strategic project planning and negotiations with the Services, and overseeing development of ancillary analyses (white papers).

HCP-7 Comprehensive Irrigation District Management Plan (South Naches Irrigation District), WA. 2004-ongoing. Reference: Paul Kauzlarich (509) 653-2408. Project manager and lead author for this plan, which is designed to secure Endangered Species Act and Clean Water Act compliance for a variety of activities carried out by the irrigation district, such as operation of a river diversion, use of aquatic herbicides, operation of fish screens, and maintenance of ditches. Species addressed included a variety of salmonids; additional work included plan development and negotiation with a wide range of regulatory agencies and stakeholders.

Watershed Studies

WS-01 ***Narcosli Fisheries and Riparian Habitat Assessment (Tolko Industries Ltd.), Williams Lake, British Columbia.*** 1997. Reference: [REDACTED]. Conducted riparian function assessments on the Narcosli, a 175,000-hectare wetland-dominated watershed in the Fraser Plateau of British Columbia. The assessment included a critical evaluation and revision of the British Columbia riparian assessment protocols (RAPP). Results were used to prioritize sites for habitat restoration projects and develop recommendations for appropriate projects.

WS-02 ***Middle Hoh Watershed Analysis (Hoh Indian Tribe), Forks, WA.*** 1999. Reference: Jill Silver (360) 374-6735. Researched, prepared reports and maps and spoke at public meetings relating to a Water Quality Module assessment performed under Washington DNR protocols.

WS-03 ***Lower North Watershed Analysis (Weyerhaeuser Company), Willapa Bay, WA.*** 199[REDACTED]. Reference: Jim Stark (541) 741-5239. Conducted water quality analysis under proposed Washington Department of Natural Resources protocols. The assessment, the first to be performed under these protocols, produced new scientific findings that were used to revise and extend the subsequent final protocol.

WS-04 ***Clearwater-Middle White Watershed Analysis (Weyerhaeuser Company), Enumclaw, WA.*** 199[REDACTED]. Reference: Jim Stark (541) 741-5239. Conducted a riparian function analysis under Washington DNR protocols (Version 3.1). Unique features of the analysis included extensive comments on controlling windthrow in riparian buffers, assessment of riparian shade and groundwater effects as stream temperature controls, and data for use in preparing a TMDL for threatened spring chinook salmon runs on the White River.

WS-05 ***Canyon Lake-Porter Watershed Analysis (Trillium Corporation), Bellingham, WA.*** 199[REDACTED]. Reference: [REDACTED]. Conducted a public works/water supply analysis under Washington DNR protocols (Version 3.1). Provided supplemental water quality assessment incorporating extensive stream temperature monitoring data.

WS-06 ***Connelly Watershed Review (Murray Pacific Corporation), Morton, WA.*** 199[REDACTED]. Reference: Scott Swanson (253) 383-5871. Developed and then implemented draft assessment protocols and a draft riparian function analysis for this, the first 5-year watershed analysis review to be conducted.

WS-07 ***Mineral-North Fork Mineral Watershed Analysis (Murray Pacific Corporation), Morton, WA.*** 199. Reference: Scott Swanson (253) 383-5871. Conducted riparian function, public works/water supply, and water quality analyses under Washington DNR protocols (Version 2.1). Provided a supplemental water quality assessment incorporating multi-year monitoring of stream temperatures at stations throughout the two watersheds.

WS-08 ***Kosmos Watershed Analysis (Murray Pacific Corporation), Morton, WA.*** 199. Reference: Scott Swanson (253) 383-5871. Conducted riparian function and public works/water supply analyses under Washington DNR protocols (Version 2.1), and provided supplemental water quality assessment.

WS-09 ***Grossman Creek Watershed Analysis (Boise Cascade), LaGrande, OR.*** 1996. Reference: Domine Glass. Assessed logging and grazing impacts on channel morphology (Rosgen classification) and riparian vegetation function for a logged and grazed watershed in northeast Oregon. Coordinated synthesis efforts to develop a conceptual model of sediment flux and hydrologic change within the watershed, using these findings to suggest management strategies to minimize impacts from forest practices on fish habitat. Analysis methodology based on Washington DNR protocols modified for Rosgen and Hankin & Reeves survey protocols.

WS-10 ***Norrish Creek Fisheries and Riparian Habitat Assessment (Canadian Forest Products), British Columbia.*** 199. Reference: . Assessed hydrologic regime, stream channel morphology (Montgomery and Buffington system) and riparian vegetation function in relation to logging impacts in a watershed used to supply public water in southwest British Columbia. Results were used to prioritize sites for habitat restoration projects.

WS-11 ***Griffin-Tokul Watershed Analysis (Weyerhaeuser Company), Snoqualmie, WA.*** 199. Reference: . Conducted public works/water supply analysis under Washington DNR protocols (Version 2.1).

WS-12 ***Chehalis and Willapa Watershed Analyses (Weyerhaeuser Company), WA.*** 199. Reference: . Assisted with riparian function field analyses, summarized data and assisted with report preparation.

WS-13 ***Acme Watershed Analysis (Trillium Corporation), Bellingham, WA.*** 199. Reference: . Conducted riparian function, public works/water supply and water quality analyses under Washington DNR protocols (Version 2.1). The analyses made extensive use of historical data to reconstruct settlement history of the watershed and associated impacts to the river floodplain.

WS-14 ***Silver Creek Watershed Analysis (Murray Pacific Corporation), Morton, WA.*** 199. Reference: Scott Swanson (253) 383-5871. Conducted riparian function, water quality and public works/water supply analyses under Washington DNR protocols (Version 4.0). Extensive data on stream temperature and floodplain riparian conditions were used to identify areas where hyporheic flows and groundwater exchange are dominant controls on stream temperature. Temperature and water chemistry variation in a subalpine lake were also evaluated. Results were used to develop a site-specific model of potential logging impacts on stream temperature regimes.

WS-15 ***Crystal Mountain Ski Area Master Plan NEPA EIS (Sno.engineering), Crystal Mountain, WA.*** 199. Reference: . Project included numerous proposed development actions at a major ski area adjoining Mt. Rainier National Park. Performed analysis of current condition and likely project impacts affecting riparian reserves and aquatic habitat, including

mitigation measures needed to ensure compliance with Aquatic Conservation Strategy Objectives of the Northwest Forest Plan. Developed road monitoring and maintenance plan for use on all private roads at the Crystal Mountain ski area. Work required close collaboration with USFS and other concerned agencies.

Biological Assessments

BA-01 Tilton River Barbs Biological Assessment (Washington State Department of Transportation, Southwest Region), Morton, WA. 1999. Reference: [REDACTED]. Prepared biological assessment for a proposal to place 11 rip-rap barbs in the Tilton River to reduce road erosion. Species addressed included salmonids, bats, spotted owls, marbled murrelets and amphibians. Project included salmonid habitat mitigation.

BA-02 I-5 Repaving Biological Assessment (Washington State Department of Transportation, Southwest Region), Ridgefield, WA. 1999. Reference: [REDACTED]. Prepared biological assessment for a proposal to repave several miles of Interstate 5 and perform incidental maintenance. Species addressed included salmonids, bats and amphibians.

BA-03 Parsons Creek Biological Assessment (Skagit County Public Works), Skagit County, WA. 1999. Reference: [REDACTED]. Prepared BA for a proposal to replace a major culvert, reroute a stream channel, install instream structures permitting chum salmon passage, and conduct native vegetation plantings. Species addressed included salmonids, bats, bald eagle and amphibians.

[LONG FORM] As part of an on-call services contract, Jones & Stokes assisted the Skagit County Public Works Department with preparation of an Endangered Species Act biological assessment (BA) as part of the U.S. Army Corps of Engineers (Corps) Section 404 (Clean Water Act) permit application for Parsons Creek flood improvements. The project consisted of reconstructing 100 feet of channel and replacing a culvert to remove a hydraulic obstruction during high-flow events. Jones & Stokes addressed impacts to chinook and coho salmon and bull trout associated with project construction activities. The BA addressed specific salmonid impact concerns defined by the regulatory branch of the Corps. Jones & Stokes coordinated closely with the Washington Department of Fish and Wildlife, Swinomish Tribes, National Marine Fisheries Service, and the Corps.

BA-04 Thurston Way Interchange (Washington State Department of Transportation), Vancouver, WA. 1999. Reference: Mike Clark (360) 905-2110. Prepared biological assessment addressing salmonid impacts for a project to construct an interchange at the junction of two major roads.

BA-05 Everett Diffuser Biological Assessment (Everett Public Works), Snohomish County, WA. 1999. Reference: Carl Baird (425) 257-8222. Prepared biological assessment and JARPA application for work replacing equipment and clearing wood and sediment accumulated around two diffusers on the bed of the Snohomish River. Species addressed included salmonids.

BA-06 Farm-to-Market Road Biological Assessment (Skagit County Public Works), WA. 1999-2001. Reference: Luis Ponce (360) 336-9333. Prepared biological assessment, JARPA application, wetland mitigation plan and fish-wildlife habitat assessment for widening two miles of a two-lane arterial roadway. Species addressed included salmonids, bald eagle, bats, lampreys and songbirds.

BA-07 Portland to Seattle Fiber Optic Corridor Biological Assessment (Williams Communications), WA and OR. 199█. Reference: █. Prepared salmonid sections and edited overall structure of a biological assessment addressing construction impacts along a 176-mile corridor featuring over 300 stream crossings. Species addressed included salmonids, other fish, bald eagles, bats, amphibians, and pond turtles.

BA-08 Rocky Reach Trail Biological Assessment (Washington State Parks and Recreation Commission), WA. 199█. Reference: █. Prepared biological assessment addressing potential impacts along a 5-mile paved trail corridor adjoining the Columbia River near Wenatchee. Species addressed included salmonids, bald eagle, sharp-tailed grouse, and spotted frog.

BA-09 Vancouver Rail Yard Bypass Biological Assessment (Washington State Department of Transportation), WA. 199█. Reference: █. Prepared biological assessment addressing potential impacts of a rail line and sidings being built to provide high-speed service past the existing Vancouver Rail Yard. Species addressed included salmonids and bald eagles.

BA-10 Kitsap County Emergency Services Biological Assessment (Washington Military Department), WA. 199█. Reference: █. Prepared biological assessment addressing construction impacts for a Bremerton facility providing support and training for fire fighting and other emergency services. Species addressed included salmonids and bald eagles.

BA-11 Seattle Processing & Distribution Center Biological Assessment (U.S. Postal Service), WA. 199█. Reference: █. Prepared biological assessment addressing potential impacts from road and stormwater treatment system construction and operation associated with renovation of the main processing center for Seattle-region mail, which adjoins the Duwamish River. Species addressed included salmonids, lampreys, and bats.

BA-12 Shelton-Kitsap No. 2 Line Upgrade Biological Assessment (Bonneville Power Administration), WA. 2000. Reference: Gene Lynard █. Prepared biological assessment addressing construction impacts associated with tower replacement and road repairs along a 31-mile power transmission line corridor on the Kitsap Peninsula. Species addressed included salmonids and bald eagles.

BA-13 South 212th Street Repaving and Lane Addition Biological Assessment (City of Kent Engineering Department), WA. 2000. Reference: Mark Howlett (253) 856-5523. Prepared biological assessment addressing construction impacts for repaving and constructing a right-turn lane along 0.5 mile of roadway in northern Kent. Species addressed included salmonids, bald eagles, bats, and lampreys.

BA-14 Pacific Highway South HOV Lanes Biological Assessment (City of Kent Engineering Department), WA. 2000-2001. Reference: Mark Howlett (253) 856-5523. Prepared biological assessment addressing construction impacts for extensive repairs and lane additions along 3 miles of highway in Kent and Des Moines. Species addressed included salmonids, bald eagles, bats, and lampreys.

BA-15 Kangley-Echo Lake Transmission Project Biological Assessment (Bonneville Power Administration), WA. 199█. Reference: Gene Lynard █. Prepared biological assessment for proposed construction of a 9-mile transmission line across portions of the Cedar River and Raging River watersheds in King County. Main issues were forest clearing and road construction. Species addressed included salmonids, bald eagles, spotted owls, marbled murrelets, grizzly bear, wolf, and lynx.

BA-16 Mud Mountain Dam Biological Assessment (U.S. Army Corps of Engineers, Seattle District), Washington. 2001. Reference: Ken Brunner (206) 764-3479. Project Manager. Jones & Stokes prepared a biological assessment and essential fish habitat assessment covering all operations and maintenance activities at Mud Mountain Dam in King and Pierce Counties, Washington, for the period 2002-2011. Mud Mountain Dam is a flood control dam that normally conveys all flows and sediment for the White River through two tunnels beneath the dam, but that sometimes needs to impound a large pool to avoid flood damage to extensive urban and suburban lands downstream. Potential effects to species dealt with flow and sediment management, with operation of a trap-and-haul facility to transport migrant salmonids above the dam, and with an array of relatively minor effects. Species addressed in the biological assessment included bull trout, chinook salmon, spotted owl, marbled murrelet, Canada lynx, grizzly bear, and grey wolf; those addressed in the essential fish habitat assessment included chinook and coho salmon. Preparation of the analysis required field surveys, extensive interviews with operations personnel at the U.S. Army Corps of Engineers, and negotiations and meetings with National Marine Fisheries Service and U.S. Fish and Wildlife Service representatives. Work was completed precisely on schedule and well within budget.

BA-17 SR 12 Fish Passage Barrier Removal Biological Assessment (Geoengineers/WSDOT), WA. 2002. Reference: [REDACTED]. Prepared biological assessment for replacement of a passage barrier culvert with a natural-channel box culvert on a Mayfield Lake tributary stream. Main issues dealt with potential effects of in-water work. Species addressed included salmonids, bald eagles, spotted owls, marbled murrelets, grizzly bear, wolf, and lynx.

BA-18 Microchip Outfall NPDES Permit Renewal Biological Assessment (Microchip Technology Incorporated), Puyallup, Washington. 2002-2003. Reference: Mari Chesser (509) 669-5503. Prepared biological assessment for renewal of National Pollutant Discharge Elimination System (NPDES) permit for outfall discharging effluent from a semiconductor plant on the Puyallup River. Main issues dealt with water quality effects, especially ammonia and organic solvent discharges; and with complex agency structure (Microchip, Services, EPA, Puyallup Tribe). Species addressed included salmonids and bald eagles.

BA-19 Biological Assessment for the Levee Maintenance Program — U.S. Army Corps of Engineers Seattle District, Washington. 2002-2003. Reference: Matt Bennett (206) 764-3428. Prepared programmatic biological assessment for maintenance of 20 authorized flood control works in eastern and western Washington. Significant issues included assessing the impact of these activities on threatened and endangered salmonid species, determining an appropriate way to characterize the environmental baseline for levees built prior to the listing of these species, and developing programmatic mitigation for ongoing impacts related to levee maintenance. A negotiation process has addressed these issues within the Corps, but Services negotiations are ongoing.

BA-20 Biological Assessment and Essential Fish Habitat Assessment for the Brightwater Facilities—King County Wastewater Treatment Division, Washington. 2003-2005. Reference: Susan Kaufman-Una (206) 684-1271. Project manager and lead scientist for this major analysis addressing the potential effects of constructing and operating a new regional wastewater treatment plant, conveyance lines to and from the plant, and a deep marine outfall. Potentially affected species included salmonids, marine mammals, many marine fishes, leatherback sea turtles, and bald eagles. Supervised staff in preparation of a biological assessment, essential fish habitat assessment, and supporting documents. Negotiated terms with Services representatives; secured a biological opinion ahead of schedule and continued negotiation and consultation through consultation reinitiation in response to subsequent project changes and new species listings (orca).

BA-21. Coast Seafoods BA.

NEPA/SEPA

NEPA-01 ***Crystal Mountain Ski Area Master Plan NEPA EIS (Sno. engineering), Crystal Mountain, WA.*** 1999-2003. Reference: [REDACTED]. Project included numerous proposed development actions at a major ski area adjoining Mt. Rainier National Park. Performed analysis of current condition and likely project impacts affecting riparian reserves and aquatic habitat, including mitigation measures needed to ensure compliance with Aquatic Conservation Strategy Objectives of the Northwest Forest Plan. Developed road monitoring and maintenance plan for use on all private roads at the Crystal Mountain ski area. Work required close collaboration with U.S. Forest Service and other concerned agencies.

NEPA-02 ***Vancouver Rail Yard Bypass Technical Reports (Washington State Department of Transportation), WA.*** 199[REDACTED]. Reference: [REDACTED]. Prepared fisheries, wildlife, vegetation and wetlands technical reports supporting a client-prepared EIS for a rail line and sidings proposed to provide high-speed service past the existing Vancouver Rail Yard.

NEPA-03 ***Kitsap County Emergency Services Environmental Assessment (Washington Military Department), WA.*** 199[REDACTED]. Reference: [REDACTED]. Prepared fisheries portions of the EA for a Bremerton facility providing support and training for fire fighting and other emergency services.

NEPA-04 ***Seattle Processing & Distribution Center Environmental Assessment (U.S. Postal Service), WA.*** 2000. Reference: [REDACTED]. Prepared fisheries and sensitive species portions of the EA for proposed extensive renovations to the main processing center for Seattle-region mail, which adjoins the Duwamish River.

NEPA-05 ***Shelton-Kitsap No. 2 Line Upgrade Environmental Assessment (Bonneville Power Administration), WA.*** 2000. Reference: Gene Lynard (503) 230-3790. Prepared and coordinated fisheries, wildlife, wetlands and sensitive species portions of an EA addressing construction impacts associated with tower replacement and road repairs along a 31-mile power transmission line corridor on the Kitsap Peninsula.

NEPA-06 ***Kangley-Echo Lake Transmission Project EIS (Bonneville Power Administration), WA.*** 199[REDACTED]-2002. Reference: Gene Lynard (503) 230-3790. Prepared fisheries technical report supporting an EIS for a proposed 500-kV power line along a 9-mile corridor through the Cedar River and Raging River watersheds. Reviewed draft and final EIS with regard to fisheries questions, responded to comments on the draft EIS, and performed fisheries review of a proposed compensatory mitigation site.

Ecological Research and Assessment

ECO-01 ***Land Exchange Project (U.S. Forest Service/Weyerhaeuser Company), Enumclaw, WA.*** 1993-1994. Reference: [REDACTED]. Conducted rare plant surveys.

ECO-02 ***Illabot Divide Biological Evaluation (Crown Pacific Corporation), Hamilton, WA.*** 1998. Reference: [REDACTED]. Conducted field assessment and prepared text for biological evaluation on a proposal to construct a road across a parcel of Forest Service land.

ECO-03 ***Demonstration of Ecosystem Management Options (University of Washington), Seattle, WA.*** 1994. Reference: Charles Halpern (206) [REDACTED]. Supervised field crew of 12 people establishing and inventorying botanical and forest structure survey plots. Administered all logistic support for the 3-month field project.

ECO-04 ***Windthrow Effects Analysis (Weyerhaeuser Company), Tacoma, WA.*** 199. Reference: Jeff Light (206) [REDACTED]. Surveyed literature and conducted interviews assessing the feasibility of incorporating windthrow risk assessment in DNR watershed analysis protocols. Provided additional technical consultation in regard to proposed revisions of the DNR Riparian Function Module.

ECO-05 ***Charcoal in Alaskan Lake Sediments (University of Washington), Seattle, WA.*** 199. Reference: Linda Brubaker (206) [REDACTED]. Organized expedition logistics, conducted sampling, devised and tested analytical methodology, conducted analysis, and published findings for a study of modern and fossil airborne charcoal deposition in lake sediments of central Alaska.

ECO-06 ***Various Research Projects (University of Washington), Seattle, WA.*** 1986-1993. Reference: Linda Brubaker (206) [REDACTED]. Supervised field crews of up to three people and managed expedition logistics for fieldwork in China, Alaska, and several western states. Designed, acquired funding, conducted and reported research on problems including long-term climate change in eastern Siberia, long-term climate and vegetation change in Alaska, land use and climate variation in subalpine forests of eastern Tibet, and air pollution effects on tree growth in the Puget Sound basin.

ECO-07 ***Shelton-Kitsap Transmission Corridor Noxious Weed Survey (Bonneville Power Administration), WA.*** 2000. Reference: Kathy Stephenson kwstephenson@bpa.gov. Performed field surveys and prepared report documenting occurrences of invasive weed species along a 31-mile power transmission corridor on the Kitsap Peninsula. Also evaluated alternatives for noxious weed control in the area and provided GIS/GPS coordinated database for location and tracking of noxious weed populations.

ECO-08 ***Tanner Tap Transmission Line Noxious Weed Survey (Bonneville Power Administration), WA.*** 1999. Reference: Kathy Stephenson kwstephenson@bpa.gov. Performed field surveys and prepared report documenting occurrences of invasive weed species along a 5-mile power transmission corridor between Snoqualmie and North Bend. The final report proposed a methodology for noxious weed control in the area.

ECO-09 ***Kangley-Echo Lake and Raver-Echo Lake Transmission Line Noxious Weed Survey (Bonneville Power Administration), WA.*** 2000. Reference: Gene Lynard (503) 230-3790. Performed field surveys and prepared report documenting occurrences of invasive weed species along a 9-mile power transmission corridor between Snoqualmie and North Bend. The final report proposed a methodology for noxious weed control in the area.

ECO-10 ***Skykomish River Avulsion Barrier Environmental Permitting (northwest hydraulic consultants), WA.*** 2002-2003. Reference: John Sayre (360) 588-1917. **Skykomish River Training Structure Environmental Permitting—Northwest Chinook Recovery, WA.** Project manager for all environmental permitting (SEPA, shoreline substantial development, hydraulic projects approval, and clearing & grading permit) for an engineered logjam to be constructed along the Skykomish River near Monroe. This work required close coordination with personnel representing the U.S. Army Corps of Engineers, Washington Department of Ecology, Washington Department of Fish and Wildlife, and Snohomish County Planning Department.

ECO-11 ***Maury Island Glacier Northwest Gravel Mine Environmental Impact Statement (King County), WA.*** Prepared the terrestrial vegetation resources section of an EIS for a proposed 235-acre gravel mine that would be located on Puget Sound. Analysis focused on

biology of Pacific madrone and options for phased implementation of proposed action in order to mitigate impacts on existing vegetation.

ECO-12 ***Wenatchee River Channel Migration Zone Study, Phase 1 (Chelan County Public Works Department), WA.*** 2001-2003. Reference: Mike Caputa [REDACTED]. Supervised fieldwork, mapping and reporting for all portions of the project dealing with vegetation and site restoration. Jones & Stokes assisted Chelan County in describing changes in fluvial morphology and riparian conditions in the lower 26 miles of the Wenatchee River from Leavenworth to Wenatchee, Washington. Aerial photographs from the 1930's to 1998 were used to map changes in fluvial morphology and riparian vegetation. Additionally, we identified potential salmonid habitat restoration opportunities in the existing river system. Data collected included changes in river meanders, floodplains, channel migration zones, extent of riparian vegetation; identifying disconnected channels or historic oxbows; and hydrologic modifications that have occurred on the river (e.g., dikes, revetment, roads, bridges, grade control structures). Reconnaissance level field surveys were conducted to verify interpretations of current aerial photography. The data was entered in an ARC/INFO GIS database. GIS layers were created for the different time periods for historic and current channel locations, floodplains, and riparian vegetation. The GIS analysis was conducted to predict future channel migration zones and to calculate the loss of floodplains and riparian vegetation. The analysis helped to explain the dynamic processes that have resulted in current river and salmonid habitat conditions. Based on the results of the study, field sites will be identified where data will be collected in the next project phase to refine salmonid habitat restoration planning.

Wetlands and Water Quality

WET-01 ***Water Quality Module Training (Washington Department of Natural Resources), Olympia, Washington.*** 1997 to 1999. Reference: [REDACTED]. Taught these courses from when the water quality module was adopted by the Forest Practices Board until mothballing of the program.

WET-02 ***Enumclaw Millpond Habitat Enhancement (Weyerhaeuser Company), Enumclaw, WA.*** 199[REDACTED]. Reference: [REDACTED]. Conducted site photography and rephotography, monitoring of riparian and wetlands restoration plantings, and report preparation.

WET-03 ***Wetland Mitigation (15 Lake Bellevue LLC), Bellevue, WA.*** 1998-1999. Reference: [REDACTED]. Acquired necessary permits, located mitigation site and prepared mitigation report for project involving apartment building construction on peat wetlands adjoining Lake Bellevue. Project replaced invasive with native vegetation on a 4-acre parcel of peatland owned by Bellevue Parks. As of Spring 2003 the project is performing as designed.

WET-04 ***Second Supply Project (Tacoma Public Utilities), Tacoma, WA.*** 199[REDACTED]. Reference: Ken Brunner (206) [REDACTED]. Conducted literature review and interviews assessing the feasibility of establishing tree and herb vegetation to enhance fish and wildlife habitat within the seasonally inundated portion of the Howard Hanson Reservoir.

WET-05 ***Wood Waste Landfill Facility Project (Weyerhaeuser Company), Longview, WA.*** 199[REDACTED]. Reference: [REDACTED]. Conducted site photography and rephotography. Assisted in monitoring of restoration plantings and report preparation.

WET-06 ***Various Small-Scale Wetland Delineations and Assessments, WA and ID.*** 1993-1999. Reference: Fred Huston (425) [REDACTED]. Conducted field delineations and assisted in report preparations. Most clients have been developers or utilities in the Puget Sound area.

WET-07 **Portland to Seattle Fiber Optic Line (Williams Communications), Lacey, WA.** 1999. Reference: [REDACTED]. Performed field assessments including wetland delineation, stream habitat assessment and wildlife habitat description.

WET-08 **Pacific Highway South HOV Lanes (City of Kent Engineering Department), WA.** 199 [REDACTED]. Reference: [REDACTED]. Prepared JARPA and conceptual mitigation plan addressing wetland fill and related potential impacts from extensive repairs and lane additions along a 3-mile length of highway in Kent and Des Moines.

WET-09 **Seattle Processing & Distribution Center (U.S. Postal Service), WA.** 199 [REDACTED]. Reference: [REDACTED]. Prepared JARPA application addressing in-water work on a minor stream and maintenance work in the Duwamish River that might be needed during renovation of the main processing center for Seattle-region mail.

WET-10 **Crystal Mountain Road Maintenance Plan.** 1999-2000. Reference: [REDACTED]. Developed road monitoring and maintenance plan for use on all private roads at the Crystal Mountain resort.

WET-11 **Crystal Mountain Watershed Monitoring Plan.** 1999-2000. Reference: [REDACTED]. Developed watershed monitoring plan to provide implementation, verification and trend monitoring for implementation of a master development plan for the Crystal Mountain ski area.

Critical Areas Ordinances

Washington towns and counties regulated under the Growth Management Act are required to revise their Critical Areas Ordinances every 10 years. The ordinances are required to consider Best Available Science (BAS).

CAO-01 **Best Available Science Review (City of Lynnwood), WA.** 2004-2005. Reference: Jared Bond (425) 670-6637. Jones & Stokes reviewed the City of Lynnwood proposed critical areas ordinance vis-a-vis BAS and prepared a memorandum advising the City on appropriate further revisions to the ordinance that would enhance its compliance with BAS and further protect environmentally sensitive areas. This work enabled the City to meet their Critical areas management obligations in a timely and effective manner. Dr. Earle was project manager for this work, and prepared the BAS memorandum.

CAO-02 **Critical Areas Ordinance (City of Mount Vernon), WA.** 2003-2005. Reference: Jana Hanson (360) [REDACTED]. Dr. Earle co-authored a memorandum describing BAS as applicable to the City of Mount Vernon, and assisted in preparing the revised ordinance incorporating BAS principles. He attended numerous City Council and stakeholder meetings where the BAS requirements of the Growth Management Act, and their application to Mount Vernon, were explained and debated in depth. This work enabled the City to meet their Critical areas management obligations in a timely and effective manner.

CAO-03 **Critical Areas Ordinance (City of Marysville), WA.** 2003-2005. Reference: Gloria Hirashima (360) 651-5100. Dr. Earle co-authored a memorandum reviewing and extending a BAS analysis prepared by the City of Marysville, as well as a second “strategic review” memorandum and numerous brief memoranda addressing smaller issues of concern to the City. He attended numerous Planning Commission, City Council and stakeholder meetings where the BAS requirements of the Growth

Management Act, and their application to Mount Vernon, were explained and debated in depth, and he also met with the Washington Department of Ecology, securing their approval of the proposed ordinance, which was fully adopted by the City in April, 2005.

CAO-04 ***Critical Areas Ordinance Review (Upper Columbia Salmon Recovery Board), WA.*** 2005. Reference: ????. Dr. Earle authored a memorandum reviewing the existing critical areas ordinances for Chelan County, Douglas County and Okanogan County, identifying elements of the ordinances providing programmatic protection for salmonids and their habitat, and suggesting possible amendments to the ordinances that could significantly increase those protections.

CAO-05 ***Riparian Area Protection Memorandum (Douglas County), WA.*** 2005. Reference: Chuck Jones (509) 884-7173. Dr. Earle authored a memorandum reviewing the existing riparian areas protection provisions of the Douglas County critical areas ordinance, identifying elements of the ordinance not consistent with BAS provisions of the Growth Management Act, and identifying ways to achieve consistency. He also attended a County Council/public meeting reviewing and discussing the memorandum.

Dendrochronology

DEN-01 ***Reconstruction of Streamflow in the Sacramento River Basin, 1600-1980 (California Water Resources Control Board), CA.*** 1984-1986. Reference: Harold Fritts [REDACTED]. Used existing tree-ring data and data on historical streamflow variation in the America, Yuba, Feather, and Sacramento Rivers to create a statistical model describing long-term variation in basin streamflow and to predict likelihood of droughts of various intensities. Discovered significant latitudinal anomalies in long-term climate variation between northern and southern California. Research published in peer-reviewed journal. This work involved application of multivariate statistics, including multiple linear regression and ARMA modeling on several computer systems using statistical software to analyze and produce reconstructions of streamflow from temperature, precipitation, and tree ring-width data.

DEN-02 ***Subalpine Fire Recovery in the Pacific Northwest (National Park Service), Olympic, Mt. Rainier and North Cascades National Parks, WA.*** 1986. Reference: Jim Agee (206) [REDACTED]. Collected vegetation and tree age data at sites that experienced subalpine fire during the period 1550-1986 within the Subalpine Fir Zone at each National Park in Washington. Data used to analyze rates and patterns of forest recovery following fire. Research published as NPS-University of Washington internal report.

DEN-03 ***Effects of Climate Change on Ribbon Forest Development (U.S. Forest Service), Rocky Mountain Experiment Station Medicine Bow National Forest, WY.*** 1989-1992. Reference: Will Moir [REDACTED]. Collected vegetation and tree age data at sites currently occupied by subalpine tree clumps and ribbon forests. Collected tree-ring data to permit long reconstruction of climate change and collected historical data on climate variation and domestic grazing. Used these data to reconstruct long-term forest development. Research published as University of Washington Ph.D. dissertation.

DEN-04 ***Bearing Tree Age Determination (Washington Department of Natural Resources), WA.*** 199[REDACTED]. Reference: [REDACTED]. Sampled three long-dead bearing trees and used dendrochronological methods to determine when they were scribed by a surveyor. Results were used in resolution of a boundary dispute.

DEN-05 ***Bearing Tree Age Determination (Cairncross & Hempelmann/Plum Creek Timber Co.), Enumclaw, WA.*** 2001-2002. Reference: Tom Richardson (206) 254-4455. Sampled a long-dead bearing tree and used dendrochronological methods to determine when it was established, its size at the time of the survey, and when it died. Results were used in resolution of a boundary dispute between the Plum Creek Timber Co. and a landowner in the Enumclaw, Washington area.

Geoscientific Research and Assessment

GEO-01 ***Hanford Project (Washington Public Interest Research Group), Seattle, WA.*** 1983-1984. Reference: Jerry Pollett [REDACTED]. Provided technical review of hydrogeologic aspects of a proposal to store high-level nuclear waste at the Hanford Reservation in Washington. Coordinated all Hanford-related activities at WashPIRG, including media relations, volunteer management, lobbying, giving testimony at state House and Senate Committee meetings, writing newsletter articles and other informational material, negotiating with U.S. Department of Energy and Westinghouse Hanford representatives, and coordinating with WashPIRG staff on legal issues.

GEO-02 ***Well Geologist (Exlog-Smith Geothermal Company), Cobb, CA.*** 1981-1983. Reference: Dwight [REDACTED]. Performed data logging, equipment maintenance, and other technical duties at geothermal drilling sites in California and Nevada.

CERTIFICATION

Washington Department of Natural Resources. Watershed Analysis Analyst: channel, hydrology, riparian function, public works/water supply, water quality and monitoring modules.
Instructor for water quality module. Last activity on these certifications: 1999.

PADI Advanced Open Water diver.

HONORS AND AWARDS

- 1988-1989 Fulbright Cooperative Research Fellowship (\$13,500) for research conducted in China.

- 1987-1988 Grant awarded by EPA Forest Response Program to assess acid rain impacts in the Puget Lowland. Co-wrote grant (\$125,000) with Dr. Linda Brubaker, University of Washington, Seattle.

- 1985-1986 Grant by the California Department of Water Resources, U.S. Bureau of Reclamation, and Western Weather Corporation to produce a tree-ring-based reconstruction of Sacramento River streamflow since 1600. Co-wrote grant (\$23,000) with Dr. H. C. Fritts, University of Arizona, Tucson.