

Profile of the USGS Columbia Environmental Research Center

By MARCIA KELLY NELSON

Editor's Note: This is the third profile to appear in Park Science of a science and technology center operated by the USGS Biological Resources Division (see also 18(1):13-14 and 15(3):12-13). The nationwide network of 16 centers (a 17th is soon to be added) was described in 15(2):24-26 of this publication and is detailed on-line at http://biology.usgs.gov/pub_aff/centers.html. Park managers with research and technical assistance needs related to environmental contamination and its effects on habitat will find useful expertise and research activities described below.

Clean water resources and habitat quality are essential for the health of all living organisms, a fundamental concept in the mission of the Columbia Environmental Research Center (CERC). The center provides scientific information and data for the U.S. Geological Survey and its clients, including the National Park Service, needed to address national and international environmental contaminant issues and to assess effects of habitat alterations on aquatic and terrestrial ecosystems. The center has a unique capability for conducting both focused and large-scale multidisciplinary research that includes, but is not limited to, large-river floodplains, coastal habitats, wetlands, and lakes. Emphasis is on projects that integrate scientific disciplines to address complex environmental issues on large geographical scales. Scientists at CERC form partnerships with national, state and local agencies, nongovernmental organizations, and universities to enhance scientific information needed for management of the nation's resources.

CERC is one of 16 science centers in the U.S. Geological Survey's Biological Resources Division. Historically, the center was established in 1959 at the Denver Wildlife Research Center of the U.S. Fish and Wildlife Service and was called the Fish Pesticide Research Laboratory (FPRL). In 1966, the University of Missouri deeded 33 acres to the Fish and Wildlife Service and the FPRL moved to its present location. The partnership initiated between the uni-

Figure 1. Known as a semipermeable membrane device or SPMD, this sampling tool was invented at the Columbia Environmental Research Center and is deployed to collect in situ contaminants. The device is a "virtual fish," mimicking the parts of animals that cause contaminants to bioconcentrate. It is a long, flat, plastic tube that contains oil that allows contaminants to pass through, like membranes of animal cells. The oil is similar to a highly purified fish fat in which most contaminants readily dissolve and become concentrated, as if in the fat of a fish.



versity and the laboratory in 1966 remains strong today through a number of cooperative research programs. The center was incorporated into the U.S. Geological Survey Biological Resources Division in 1996. The name of the laboratory was changed to CERC in 1998. In addition to the main facility in Columbia, Missouri, CERC administers seven field research stations located across the nation.

Center organization

About 150 federal and contract employees, with an extensive range of scientific and technical expertise, staff CERC. Research areas and services cover broad aspects of environmental toxicology and chemistry, ecology, ecogeography, large-river ecology, and information and technology transfer. The center's science program is organized into seven branches: Toxicology, Ecology, Ecogeography, Environmental Chemistry, Biochemistry and Physiology, Field Station Research, and Information Transfer.

Environmental toxicology, is the functional responsibility of the Toxicology Branch. The branch scientists develop, apply, and validate methods for assessing the effects of contaminants and other environmental stressors on aquatic organisms. Research focuses on bioaccumulation and toxicity of contaminants from water, sedi-

ment, and food; the physical, chemical, and biological factors affecting these processes; and relationships between laboratory responses and characteristics of contaminated aquatic ecosystems. Disciplines include invertebrate and vertebrate toxicology, limnology and benthic ecology, and culture of aquatic organisms.

Research of the Ecology Branch focuses on understanding the effects of habitat alteration caused by environmental contamination, physical destruction, eutrophication, exotic species, and climate change on aquatic systems. The ecological investigations are integrated with other biological, chemical, and physical science programs at CERC to provide a comprehensive understanding of habitat alteration on aquatic populations and communities. The Ecology Branch has laboratory, field, and mobile facilities to conduct ecological assessments under controlled and natural environments. The branch is extensively involved in cooperative research with other federal, state, and private institutions to meet the research needs of client agencies, to develop standardized methods and guidelines, and to

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contribute to the basic scientific knowledge concerning human impacts to natural systems.

The Ecogeography Branch investigates the spatial and quantitative relationships among the biotic and abiotic components of the environment. The branch has expertise in landscape analysis, landscape ecology, fisheries biology, geographic information systems (GIS) analysis, collection of geographic positioning systems (GPS) and bathymetric data, hydraulic modeling, statistical consultation, geomorphology and surficial processes, environmental monitoring and risk assessment. Ecogeography scientists are responsible for providing information and technical support for the development and use of digital databases for natural resource planning and management, and for conducting research at an ecosystem scale. The USGS River Studies Station (RSS), located at the center, is included in the research program of the Ecogeography Branch. The station's mission is to increase the understanding of how management and restoration activities function on large-river systems through a comprehensive and integrated science approach. River studies research emphasizes how management changes in the physical and chemical condition of rivers affect habitat and ecological conditions. Areas of expertise RSS include expertise in fisheries biology, aquatic and terrestrial ecology, hydrology, hydraulics, floodplain configuration and evolution, remote sensing, and GIS.

The Environmental Chemistry Branch is critical to the integrated approach of chemical discovery and biological cause and effect (figure 1, page 33), the basis of environmental contaminant research in the USGS. Environmental chemistry research encompasses all areas relating to environmental pollution, including analytical methods development, fate of environmental contaminants, development of techniques for defining bioavailability, bioconcentration potential, and determining toxicological significance of exposure to contaminant residues. The branch conducts aquatic, terrestrial, and atmospheric ecosystem research and collaborative projects with other CERC scientists as an integral part of the center's anticipatory research approach. The branch provides environmental science information to the public, other Department of the Interior agencies, and the sci-

entific community through presentations and scientific publications. The branch's scientists are nationally and internationally known for their research and are often consulted by other researchers in environmental science.

The Biochemistry and Physiology Branch conducts basic and applied research at the cellular, organ, and organismal levels in fish and wildlife. Emphasis is on the sublethal effects of chemicals that lead to behavioral, developmental, and population changes that may ultimately influence ecosystem health. Scientists in the branch identify biochemical and physiological indicators of individual toxicant stressors in addition to overall physiological effects and toxicity of complex chemical mixtures. Research focus includes reproductive, developmental, and neurotoxic effects of stressors. The branch develops and uses analytical techniques such as microscale assay, cell bioassay, and immunoassay, to quantify exposure and estimate toxicity in both lab and field studies. In addition, branch scientists study the mechanism(s) of action of contaminants to develop and validate sublethal indicators of chemical stress.

The Field Station Research Branch specializes in ecological and toxicological research that is relevant to natural resource issues in the Texas/Gulf Coast, intermountain West, and Great Lakes/Great Plains regions of the United States. Research stations are located in Corpus Christi, College Station, and Padre Island, Texas; Jackson, Wyoming; Yankton, South Dakota; and International Falls, Minnesota. Scientific expertise at the research stations includes marine ecotoxicology; sediment toxicology; waterfowl and avian ecology; wildlife ecology; ecotoxicology of mammals, reptiles, and amphibians; sea turtle ecology; assessment of acid or metals effects in native western fishes; natural resource damage assessments; agricultural irrigation drainwater assessment; and aquatic community evaluations of endangered, native, and invasive fish species. Capabilities include both laboratory and on-site field assessments. Research activities are conducted in collaboration with a wide variety of federal, state, university, international, and nongovernmental cooperators.

The Information Technology Branch is dedicated to providing traditional and contemporary data distribution and management systems to retrieve the most current scientific information. An emphasis is

placed on the discovery, access, and full use of information sources available through the Internet and World Wide Web. The center plays an active role in developing the National Biological Information Infrastructure, a network of distributed databases and information sources for biological information. The branch organizes the analyzed and reported data collected in research investigations and ensures rapid dissemination of research metadata into national databases. Emphasis is placed on training and keeping research staff abreast of rapid changes in computer technology, coupled with increasing emphasis on interdisciplinary science, information exchange, and multimedia presentations, particularly over the World Wide Web. The center's homepage can be viewed at <http://www.cerc.usgs.gov/>.

Field stations located at national parks

Two CERC field research stations are closely allied with national park research needs, and are located at NPS facilities. Sea turtle ecologist, Donna Shaver-Miller, conducts sea turtle research along the Texas coast at Padre Island National Seashore (see story on page 16, this issue), and fisheries biologist, Larry Kallemeyn, conducts fisheries research on native and exotic fishes in lakes of Isle Royale National Park, Michigan, and Voyageurs National Park, Minnesota.

Obtaining assistance

The Columbia Environmental Research Center offers technical assistance in all of its areas of expertise. If you have an environmental problem you would like to discuss or need any information related to our research efforts, we want to hear from you. If you have a national park research project in which CERC can offer some expertise, do not hesitate to contact us. For more information on contacts or on the areas of expertise at CERC, consult table 1 or visit the center's website. **P**

Marcia Kelly Nelson is the Outreach Coordinator for the Columbia Environmental Research Center. In addition to handling many aspects of external affairs for CERC, which includes intergovernmental affairs, she promotes science education and awareness of the center's role and activities. She can be reached at CERC, USGS Biological Resources Division; 4200 New Haven Rd.; Columbia, MO 65201; 573-876-1875; marcia_nelson@usgs.gov; <http://www.cerc.usgs.gov/>.

Table 1.
USGS Columbia Environmental Research Center contacts

Branch	Research Areas or Services	Ongoing/Recent NPS-Related Projects
Center Director Wilbur "Bill" Mauck 573-876-1900 bill_mauck@usgs.gov	Research and development planning and coordination.	
Toxicology Christopher G. Ingersoll, Branch Chief 573-876-1819 chris_ingersoll@usgs.gov	Assessing biological effects of contaminants and other environmental stressors on aquatic organisms.	
Ecology Edward E. Little, Branch Chief 573-876-1817 edward_little@usgs.gov	Understanding effects of habitat alteration caused by environmental contamination, physical destruction, eutrophication, exotic species, and climate change on aquatic systems.	Evaluation of ultraviolet radiation as a factor in amphibian decline in montane habitats in Glacier, Rocky Mountain, Sequoia, and Olympic National Parks (Ed Little).
Ecogeography Pamela S. Haverland, Branch Chief 573-876-1841 pamela_haverland@usgs.gov	Investigations of spatial and quantitative relationships among the biotic and abiotic components of the environment.	Evaluating the links between tributary land use and aquatic habitat quality on the Buffalo, Jacks Fork, and Current Rivers within park boundaries in the Buffalo National River and Ozark National Scenic Riverways (Robb Jacobson).
Environmental Chemistry Jim D. Petty, Branch Chief 573-876-1824 jim_petty@usgs.gov	Encompasses all areas relating to environmental pollution, including contaminant fate, development of analytical methods, techniques for defining bioavailability, bioconcentration potential, and determination of toxicological significance of exposure to contaminants.	
Biochemistry and Physiology Donald E. Tillitt, Branch Chief 573-876-1886 donald_tillitt@usgs.gov	Conducts research on the sublethal effects of chemicals that lead to behavioral, developmental, and population level effects that ultimately influence ecosystem health.	
Field Station Research Laverne Cleveland, Branch Chief 573-876-1874 laverne_cleveland@usgs.gov	Specializes in ecological toxicological research relevant to natural resource issues in the Texas/Gulf Coast, Intermountain West, and Great Lakes/Great Plains regions of the United States.	Sea turtle ecology/recovery at Padre Island NS (Donna Shaver-Miller); aquatic community evaluations of endangered, native, and invasive species at Isle Royale and Voyageurs NPs (Larry Kallemeyn); effects of geothermal additions on the biology and distribution of trout in the Firehole River of Yellowstone NP (Dan Woodward); water quality investigations in Garnet Canyon and lower Cascade Canyon, and winter movements and habitat use of Snake River cutthroat trout in Grand Teton NP (Dan Woodward), contaminant investigations in the food chain of peregrine falcons in Big Bend NP and other areas of the Chihuahuan Desert (Miguel Mora).
Information Technology Ted R. Schwartz, Branch Chief 573-876-1832 ted_schwartz@usgs.gov	Information management, library, technical editing, and computer support and applications.	