

HISTORY

The U.S. Water Conservation Laboratory is part of the Agricultural Research Service (ARS), the major research arm of the U. S. Department of Agriculture. The primary mission of ARS is to help meet the nation's food and fiber needs. ARS works closely with the State Experiment Stations, State Departments of Agriculture, other government agencies, public organizations, farmers, ranchers, and industry. The organizational structure of ARS is designed to insure active research programs and to provide maximum responsiveness to the needs and problems of the public.

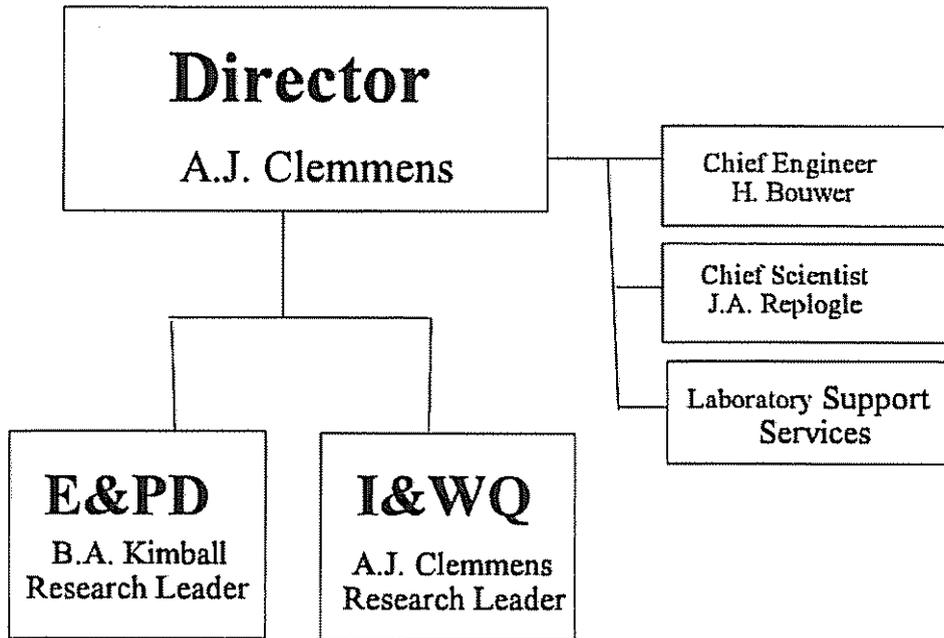
The U. S. Water Conservation Laboratory was established in central Arizona in 1959 to develop methods to conserve surface and groundwater used for agriculture. Research focuses on more efficient use of water and reduction of water losses in the soil-plant-atmosphere continuum. More recently, research has expanded to include studies in water quality, new crops with low water requirements, and effects of increased carbon dioxide on crop production, water use, and climate. The research is national in scope with international impact and deals with both present and potential problems. Although research results are documented primarily in technical literature, the staff works directly with State and Federal agencies.

In addition, the staff works closely with industry and individuals to facilitate technology transfer. New concepts and prototype equipment are tested cooperatively under actual conditions. The Laboratory does both theoretical and applied research at field sites and in laboratories. Facilities are well equipped for these purposes. Specialized electronic and mechanical prototype equipment is made in-house. Basic equipment to support the research programs includes electronic instrument calibration apparatus, data acquisition and processing computers, controlled environmental rooms, sophisticated water flow calibration, control and measuring devices, and a spectral imaging analyzer system. Specialized laboratory analytical instruments consist of a mass spectrometer, gas and high performance liquid chromatographs, automated titrator, solution analyzer, infrared gas analyzer, electrophoretic equipment, and cytological microscope.

The research teams are composed of engineers and scientists trained in various disciplines. The disciplines represented are civil, agricultural, and hydraulic engineering; soil and biological sciences; physics; chemistry; and plant physiology and genetics. Support staff consists of agricultural, biological, and physical science technicians, an electronics engineer, a computer systems manager, a program analyst and a machinist. Administrative support includes secretaries, clerks, and maintenance personnel.

The total Laboratory research effort operates under two research groups that work closely in a multi-disciplinary, cooperative manner: the Irrigation and Water Quality (I&WQ) and the Environmental and Plant Dynamics (E&PD) Research Units.

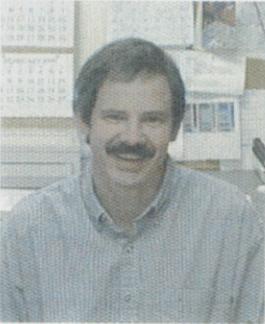
Laboratory Organization



Mission

The mission of the U. S. Water Conservation Laboratory (USWCL) is to conserve water and protect water quality in systems involving soil, aquifers, plants, and the atmosphere. Research thrusts involve developing more efficient irrigation systems, improving the management of irrigation systems, developing better methods for scheduling irrigations, developing the use of remote sensing techniques and technology, protecting groundwater from agricultural chemicals, commercializing new industrial crops, and predicting the effect of future increases of atmospheric CO₂ on climate and on yields and water requirements of agricultural crops.

LABORATORY MANAGEMENT



ALBERT J. CLEMMENS, B.S., M.S., Ph.D., P.E., Laboratory Director, Research Leader for Irrigation and Water Quality, and Supervisory Research Hydraulic Engineer

Surface irrigation system modeling, design, evaluation, and operations; flow measurement in irrigation canals; irrigation water delivery system structures, operations management, and automation.



HERMAN BOUWER, B.S., M.S., Ph.D., P.E., Chief Engineer and Research Hydraulic Engineer

Water reuse; artificial recharge of groundwater; soil-aquifer treatment of sewage effluent for underground storage and water reuse; effect of groundwater pumping on stream-flow; surface and groundwater relations.



JOHN A. REPLOGLE, B.S., M.S., Ph.D., P.E., Chief Scientist and Research Hydraulic Engineer

Flow measurement in open channels and pipelines for irrigation; irrigation water delivery system structures, operations, and management.



BRUCE A. KIMBALL, B.S., M.S., Ph.D., Research Leader for Environmental and Plant Dynamics and Supervisory Soil Scientist

Effects of increasing atmospheric CO₂ and changing climate variables on crop growth and water use; free-air CO₂ enrichment (FACE) and CO₂ open-top chambers and greenhouses; micrometeorology and energy balance; plant growth modeling.

LABORATORY SUPPORT SERVICES

ELECTRONICS ENGINEERING LABORATORY

D.E. Pettit, Electronics Engineer

The electronics engineering laboratory is staffed by an electronics engineer whose duties include design, development, evaluation, and calibration of electronic prototypes in support of U.S. Water Conservation Laboratory research projects. Other responsibilities include repairing and modifying electronic equipment and advising staff scientists and engineers in the selection, purchase, and upgrade of electronic equipment. Following are examples of work performed in 2000:

- Continued designing software for the Generation II probes measuring water advanced recession date and times.
- Designed a low power fiber optics amplifier and source/detector board using surface mount technologies to interface to the GEN II probe. Designed, constructed and experimented with a fiber optic transducer for water detection.
- Generated new fiber optics control and Generation II probe software.
- Designed schematic capture parts and printed circuit board footprints for the appropriate ORCAD libraries being used in the fiber optics board.
- Experimented with mold making and plastics/potting compounds that are translucent and reflective to design and construct an optic transducer jell block used with fiber optic light pipes.
- Constructed 10 new fiber optic sensing Generation II probes for field evaluation.
- Repaired cream separator and Nuclear Magnetic Resonance (NMR) equipment.
- Updated LPKF circuit board mill machine and the following software packages: (1) ORCAD Printed Circuit Board, (2) Circuit CAM, and (3) Board Master. These three software packages interconnect and were backed-up to a CD ROM disk.

LIBRARY AND PUBLICATIONS

Lisa DeGraw, Publications Clerk

Library and publications functions, performed by one publications clerk, include maintenance of records and files for publications authored by the Laboratory Research Staff, including publications co-authored with outside researchers, as well as holdings of professional journals and other incoming media. Support includes searches for requested publications and materials for the Staff. Library holdings include approximately 2600 volumes in various scientific fields related to agriculture. Holdings of some professional journals extend back to 1959.

The U.S. Water Conservation Laboratory List of Publications, containing over 2000 entries, is maintained on PROCITE, an automated bibliographic program. The automated system provides for sorting and printing selected lists of Laboratory publications and is now accessible on LAN by the Research Staff and on the USWCL home page (www.uswcl.ars.ag.gov) by the public. Publications lists and most of the publications listed therein are available on request.

COMPUTER FACILITY
T.A. Mills, Computer Specialist

The computer facility is staffed by one full-time Computer Specialist and one full-time Computer Assistant. Support is provided to all Laboratory and Location Administration Office computer equipment and applications. Network support is also provided to Western Cotton Research Center, and network access for a Phoenix ARS, APHIS location.

The facility is responsible for designing, recommending, purchasing, installing, configuring, upgrading, and maintaining the Phoenix Location's Local and Wide Area Networks (LAN, WAN), computers, and peripherals. The Laboratory LAN consist of multiple segments of 10 Base-T, 100 Base-T hubs and switches. The LAN is segmented using a high speed switches. Segments are made up of fiber optics, CAT 5 and standard Ethernet. This configuration currently provides over 200 ports to six Laboratory buildings. Internet service is provided by Arizona State University (ASU) via a Point-to-Point T-1 line. Our Laboratory also provides Internet access to the Western Cotton Research Center and APHIS by an additional T-1 line through our router. The facility maintains a Class C block of Internet addresses for our Laboratory operating under the domain uswcl.ars.ag.gov, and a block of 128 addresses for the Western Cotton Research Center and APHIS operating under the domain wcr.ars.usda.gov. The Laboratory LAN is comprised of several servers operating under Windows NT 4.0. End users operate mainly under Windows 95, 98, 2000, and Windows NT 4.0 with a few OS/2 workstations. Services such as print, file, remote access, and backup are provided by the Laboratory LAN. Other services such as DNS and E-Mail are provided to both the Laboratory and Western Cotton Research Center. The Laboratory maintains its own Web Server, which can be accessed at www.uswcl.ars.ag.gov.

The Laboratory is currently in the process of adding two additional fiber optic gigabit segments.

MACHINE SHOP
C.L. Lewis, Machinist

The machine shop, staffed by one machinist, provides facilities to fabricate, assemble, modify, and replace experimental equipment in support of U.S. Water Conservation Laboratory research projects. The following are examples of work orders completed in 2000:

- Resin Impregnation Chamber: This tool required machining and welding to withstand vacuum and 125 psi pressure. Some of the machining had to be within +/- .002". Chamber 10" + 32" and 18" long.
- Machined three different dimensions in Fo-St female connector. Two dimensions within ± .002. Machine Fo-St male fiber optic connector two dimensions also ± ,002. Thirty of each. All for GEN II probe.
- Cut teflon/nylon washers to .440 length (8 each) ± .0015 for Five-channel IR amplifier board.

USWCL OUTREACH ACTIVITIES

During 2000, the USWCL staff participated in numerous activities to inform the public about ARS and USWCL research, to solicit input to help guide the USWCL research program, to foster cooperative research, and to promote careers in science. A summary of activities follows:

“Experiments for the Classroom.” The USWCL web site contains experiments suitable for high school science classes.

“Water & Science Ag-Ventures,” Feb. 16 & 18. USWCL, in cooperation with the University of Arizona Maricopa Agricultural Center and the Natural Resource Education Center of NRCS, provided a hands-on science and agricultural program for junior high school students. The event was held at the Maricopa Agricultural Center and included hands-on exhibits based on USWCL research programs, an actual hands-on irrigation event, a tour of the aquaculture ponds, and an informational presentation on careers in science.

Arizona Regional Science Bowl, Glendale Community College, Arizona, February 19. Gail Dahlquist, Dave Dierig, Floyd Adamsen, and Kathy Johnson served as moderators for the science bowl. Mike Wiggett and Terry Coffelt served as rule judges. The science bowl is an annual science knowledge competition among Arizona high school students.

Arizona Ag Day Exhibit, March 15. Ed Barnes, Brian Wahlin, Dave Dierig, Gail Dahlquist, and Shirley Rish provided a USWCL exhibit at the annual Arizona Ag Day celebration in downtown Phoenix. Attendance at the event was estimated at 6,000, and many USWCL and ARS materials were distributed.

Minority Hiring. A woman, Norma Duran, was hired as a permanent, full-time microbiologist.

Seminar on USDA-ARS Research Organization. On September 6, Bruce Kimball gave a seminar, “How Research is Organized in USDA-ARS,” to the National Institute of Agro-Environmental Research, Tsukuba, Ibaraki, Japan.

Seminar on FACE Studies. On September 26, Paul Pinter presented a seminar, “Consequences of Rising Atmospheric CO₂ for Agriculture: A Decade of FACE Studies,” at the Institute for the Study of Planet Earth, University of Arizona, Tucson.

Association for Persons with Disabilities in Agriculture (APDA) 2000 “Super Supervisor” Award. On October 25, Michael Wiggett, Phoenix Location Administrative Officer, was presented this award by the President of APDA in Washington, DC, for his sensitivity to and support of location employees with disabilities.

Disabilities Month Observance. On October 26, as part of Disabilities Month, the EEO Committee hosted an all employee potluck/program at which the special guest speaker was Kim Peek. Kim, who is autistic, is the real life character portrayed by the actor Dustin Hoffman in the movie “Rainman.” Kim was born with brain damage and neuromotor dysfunctioning. He and his father spoke about respecting rather than ridiculing differences.

ARS Irrigation and Drainage Exhibit at the International Irrigation Show, November 12-14. Shirley Rish coordinated an exhibit on irrigation and drainage (I&D) research at the annual Irrigation Association International Show in Phoenix, Arizona. The exhibit featured a hands-on display of the "Directory of ARS I&D Researchers and Research" on the ARS web site. Registered attendance was over 7000, and the ARS exhibit was well attended. The Irrigation Association provided complimentary exhibit space, and the exhibit was otherwise supported by Dale Bucks, National Program Leader for Water Quality and Water Management. The exhibit booth was staffed by members of the National Program Staff and I&D researchers from ARS locations at Phoenix, Arizona; Ft. Collins, Colorado; Florence, South Carolina; and Baton Rouge, Louisiana.

Visitors to USWCL. During 2000, USWCL had over 187 visitors, including 1 from Canada, 12 from India, 35 from Mexico, 4 from Senegal, 3 from Uzbekistan, 1 from The Netherlands, and 2 from Saint Vincent and The Grenadines.

Training and Learning Opportunities for Minority Students. USWCL continued to provide training and learning experiences for part-time minority student employees from Arizona State University.

SAFETY

T. Steele

The Laboratory Safety Committee enjoys well-deserved respect from the employees. The committee takes its duties seriously and has worked diligently to insure compliance with all EPA and OSHA regulations and radiological safety protocols. Employees are encouraged to report all safety concerns, even those that might seem trivial.

The Safety Committee membership was revised this past year to provide better reaction to issues brought before the committee. The committee has also undertaken a major project, gathering information for inclusion into a data base that the Phoenix Fire Department uses in a new emergency response program. The program provides the fire department with information about site layout, building construction and composition, hazard location, and other information that enables better effectiveness in the event of an emergency such as a fire.

It is a time-consuming commitment, and requires judicious management of time and work priorities. Serving on the safety committee, however, is gratifying in terms of its record of accomplishments.

The location staff thanks the committee for their good work on our behalf.

STUDENTS AT USWCL

J. Askins

The USWCL has enjoyed a mutually beneficial relationship with students from nearby Arizona State University over the years. Students come under work-study agreements and student federal appointments. They perform a variety of tasks, from collecting samples to solving computer problems; from numbering vials to writing protocols; from weighing soil to processing and analyzing non-soil data. Students who work in the clerical/administrative area have worked in personnel and safety areas as well as doing general clerical work such as filing and copying. Operation of ARS automated systems, publication clerk duties, and literature searches are also performed.

The students benefit from the income and experience, and we benefit from their enthusiasm, up-to-date expertise, and energy. Some have stayed on after graduation, even earning Ph.Ds. under ARS assistance programs.