Water Quality: Arizona is Taking Research to the People

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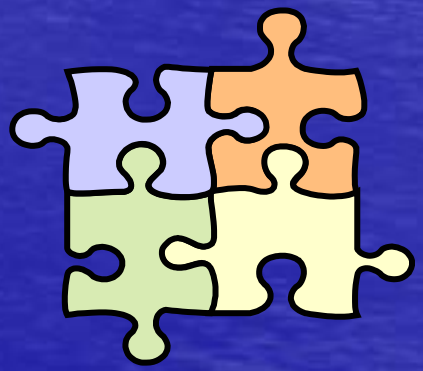
Purpose of this Presentation

- Focus on water quality projects used to connect science to the community.
- Highlight innovative activities in Arizona, the region, and the nation.
- Provide example of one water quality issue that is becoming integrated across the nation.

Let's Define a Couple of Terms

- Human Dimensions
  - Peoples' perceptions and behaviors regarding water quality
- Integration
  - Use research, education, and extension in a multidisciplinary environment to begin to address issues and solve problems



Extension/Outreach - Ideally

- Grassroots request for information/data to solve particular problem
- Extraction of information/data
- Analysis of resulting information/data
- Audience-appropriate means of sharing information/data

Extension/Outreach - Pragmatically

- Investigator wants to know something about his/her world
- Investigator invests time and effort into obtaining funding to answer "the" question
- Extraction and analysis of data
- Investigator may or may not have allotted time or other resources to adequately "share" the extracted and analyzed data before moving on to the next quest
- Information either doesn't get to the needed audience in a timely manner or doesn't get disseminated at all

Connecting Water Quality Issues with Research and Outreach

- Arizona
  - Animal Waste Management
  - Fertilizer Management
  - Arsenic
  - Onsite Wastewater Treatment

Animal Manure Management

- *Application of Animal Manure/Compost in an Irrigated Oat/Corn Rotation,* E. Martin
- *Application of Animal Manure/Compost in an Irrigated Alfalfa Production System*, E. Martin and K.A. Tanksley
- Used to educate Confined Animal Feeding Operators (CAFO) by way of web site, *Agricultural Waste Management Field Handbook* (joint author effort with ACE, ADA, NRCS)

Animal Waste Management

The University of Arizona

Fertilizer Management

- Work done by Thomas A. Doerge, Soils Specialist; Robert L. Roth, Superintendent of Maricopa Ag Center; Bryant R. Gardner, former Research Scientist Yuma Ag Center
- Used to educate Confined Animal Feeding Operators (CAFO) by way of web site, *Agricultural Waste Management Field Handbook* (joint author effort with ACE, ADA, NRCS)
- Used also to educate crop farmers best management techniques for environmental and economic benefits

Animal Waste Management
The University of Arizona

Arsenic

- *Arsenic in Arizona: Economic costs and hydrogeologic feasibility of non-treatment methods*
  - Steve Stewart and James Hogan
  - Integrating knowledge of concentrations of arsenic in geologic formations, information on the location of small water providers, and costs of non-treatment options that may be feasible for each water provider
  - **Target audience**: small water providers
  - **Methods & Innovation**: a tool to aid in decision-making

Onsite Wastewater Treatment

- *Effectiveness of Seepage Pits to Treat Septic-Tank Effluent*, K. Farrell-Poe, J. Walworth, and J. Field
  - Investigated the effectiveness of deep soil treatment and dispersal
  - **Target Audience**: State and county regulators
  - **Methods & Innovations**: attempted to answer "question," perhaps will lead to change in regulations

Onsite Wastewater Treatment

- *Student Design Competition for Decentralized Wastewater Treatment*, K. Farrell-Poe and M. Gross
  - Developed methodology to deliver national student design competition to reinforce undergraduate curriculum and provide real world application of principles
  - **Target audience**: undergraduate instructors, undergraduate students
  - **Methods & Innovations**: national student design competition with all data available on web site, prizes, national professional organization partnership

University Sources

- **WRRC Section 104B:** http://www.ag.arizona.edu/AZWATER/research/104bgrant.html
- **TRIF:** http://www.uawater.arizona.edu/programs/index.html
- SAHRA: http://www.sahra.arizona.edu/research/index.html
- WQC: http://wqc.arizona.edu/research.htm

University Sources

- **WRRC Section 104B** : about 20 projects funded in water quality area since 2000; primarily research
  - Perchlorate
  - Nitrate
  - Arsenic
  - Salt accumulation
  - Estrogenic activity in sludges and biosolids
  - Impact of drought
  - Irrigation and water conservation
- Excellent write-up on projects on WRRC web site

University Sources

- **TRIF**: over 14 projects that have research and identified end use
  - Estrogen activity in reclaimed water and stormwater (audience: managers who regulate water reuse practices)
  - Evaluation of paleo data to determine hydrologic variability (audience: agency planners, land managers, politicians, public interest groups, general public)
  - Improved turf irrigation management (audience: county and city governments, water suppliers, landscape managers)
  - Water and pesticide safety (audience: general public)
  - Occurrence and control of emerging waterborne pathogens (audience: local and state health departments, ADEQ, local water utilities, manufacturers of point-of-use devices)

University Sources

- **SAHRA**: about 39 projects that are integrated and multidisciplinary
  - Basin-scale water balances
    - Plot- to hillslope-scale processes
    - Landscape- to basin-scale water balances
    - Linkages between scales
    - Behavioral components, institutional analysis, and policy criteria
    - Stakeholder involvement
    - Relevant technology and equipment
  - River systems
    - Riparian water balance
    - Nutrient and solute sources and cycling
    - Ecosystem dynamics and value
    - Nonmarket value and links to ecosystem dynamics
    - Stakeholder involvement
    - Integration into decision support
    - Relevant technology and equipment

University Sources

- **WQC**: about 14 research projects that address water quality or quantity issues in urban, industrial, municipal sectors
  - Potable Water Management
  - Water Security
  - Waste Reuse
  - Fate and Remediation of Commercial/Industrial Contamination
  - Mining

Regional

- Rangeland
- Arsenic
- Nitrate Hazard Index
- Dog Exercise Area and Water Quality
- Water Quality Survey

Rangeland

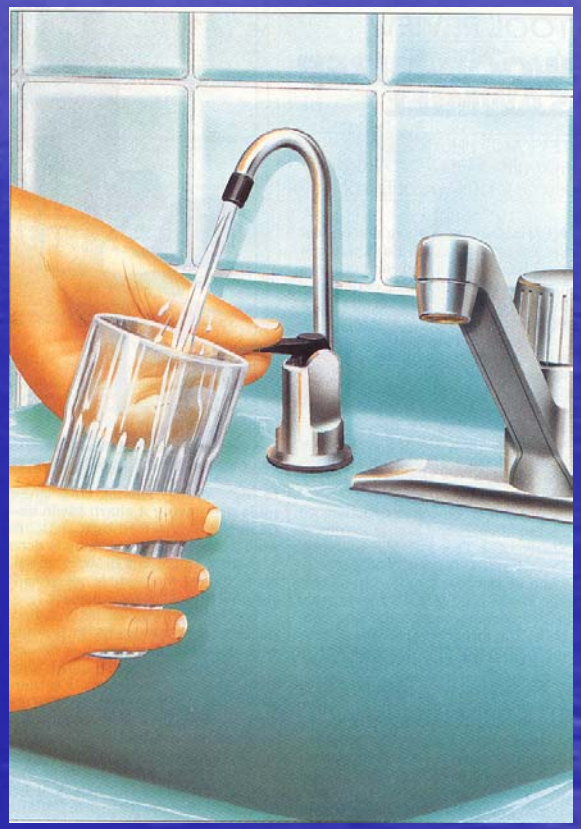
- *Development of a Spatial Decision Support System for Rangeland Watershed Management*, P. Guertin
  - Evaluate BMP's, develop Spatial Decision Support System
  - **Target audience**: land managers
  - **Methods & Innovations**: GIS technology, Internet

Rangeland

- *Water Quality on California Rangeland Watersheds*, Dahlgren, R. A.; Tate, K. W.; Atwill, E. R.; Allen-Diaz, B.; Singer, M. J.
  - 8 research watersheds to study the watershed-scale effects of fire and grazing intensity on water quality, hydrology, nutrient cycling and plant community dynamics on California's oak woodland ecosystems
  - **Target audience**: land management, regulatory, and conservation group
  - **Methods & Innovations**: watersheds as demonstration for university classroom

Arsenic

- *Arsenic in Churchill County, Nevada Domestic Water Supplies*
  - M. Walker, UN-Reno
  - Three-year effort to focus on research and public education about occurrence of arsenic in drinking water supplies from private, domestic wells
  - **Target audience**: private well owners, municipal officials
  - **Methods & Innovations**: county level characterization of actual exposure, fact sheets, dedicated help line, survey of affected county residents



Nitrate Hazard Index

- *Nitrate Groundwater Pollution Hazard Index*, L. Wu, and J. Letey, and C. French
  - With overlay of soil, crop, and irrigation information, an overall potential hazard number is assigned and management practices are suggested where necessary
  - **Target audience**: farmers, NRCS personnel
  - **Methods & Innovations**: soil surveys, GIS, index, web-based system

Dog Exercise Area and Water Quality

- M. Walker, UN-Reno
- 5 public water suppliers in Lake Tahoe needed to show control of potential sources of microbial contamination
- **Target audience**: land-use managers, public water suppliers, EPA
- **Methods & Innovations**: research into dog exercise areas, fact sheet

SOUTHWEST STATES & PACIFIC ISLANDS
Regional Water Program

Regional Water Quality Survey

- 37-question survey of awareness, attitudes, and actions toward water quality in Southwest States and Pacific Islands
- Completed by 1766 residents in four states, 303 residents in Islands
- SAS analysis; sampling error +/- 5%
- **Target audience**: general public, state and federal agencies, extension water quality programs
- **Methods & Innovations**: survey, fact sheet, poster presentations, program planning

National

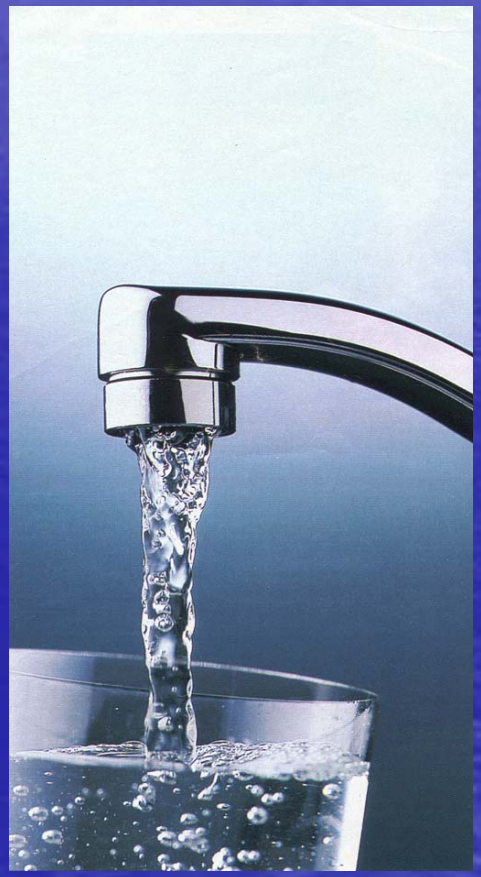
- *Educating Real Estate Professionals,* Washington Cooperative Extension
- *Ultraviolet Light Disinfection of Drinking Water: An Alternative to Chlorination,* Florida A&M University

Educating Real Estate Professionals

- The program is series of seven stand-alone courses that provide participants with CEUs toward biennial professional license certification.
- **Target audience**: real estate professionals, developers
- **Methods & Innovations**: self-supporting program, provides CEUs, follow-up evaluations

Ultraviolet Light Disinfection of Drinking Water: An Alternative to Chlorination

- CSREES Researchers have found that UV light disinfection is an effective treatment to inactivate waterborne pathogens in point-of-use drinking water systems
- **Target audience**: general public
- **Methods & Innovations**: Work is being undertaken to develop and apply low-cost UV disinfection technology to drinking water supplies in Tanzania and South Africa



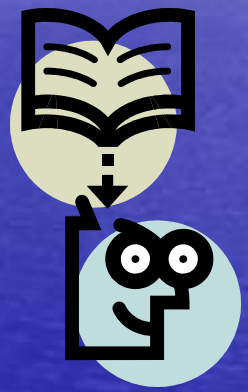
Integrated, Multidisciplinary WQ Program: Onsite Wastewater Example

- Curriculum development
- Research
- Extension/Outreach

- National efforts
- Regional efforts
- Statewide efforts

Onsite WWT Education

- Curriculum Development
  - Nationally developed, reviewed, and pilot tested
  - PowerPoint presentations, instructors' guides
  - **University**
    - 18 modules
    - Senior-level engineering and environmental science
    - Also includes example problems and exams
  - **Practitioner**
    - Improve field practitioners' abilities to effectively utilize onsite and decentralized technologies and improve the State of Practice (SOP)
    - 4 modules
  - **Draft Onsite Wastewater Glossary**
    - This draft glossary was developed in an attempt to standardize the language used in the Academic and Practitioner Curriculum projects.
  - **Student Design Competition**



OWWT Education: Research

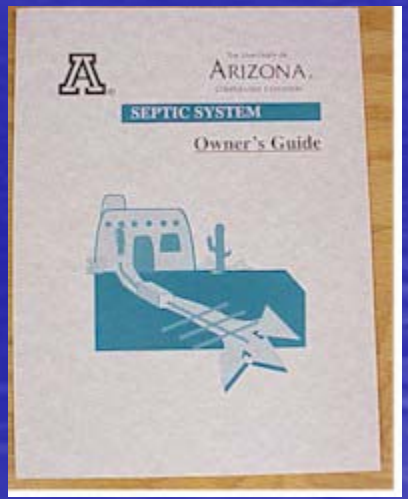
- Drip dispersal – Texas A&M
- Seepage pit effectiveness – Univ of AZ
- Oxygen transfer in soils – Univ of WI
- Occurrence and fate of emerging organic chemicals in onsite wastewater systems – CO School of Mines
- Long term performance of septic systems designed for effluent storage using soil morphology – Univ of AR
- Wastewater planning handbook: Mapping onsite treatment needs, pollution risks and management options using GIS – Univ of Rhode Island

Practitioner Training

- Workshops
  - O&M for Service Providers
    - Standard checklists are developed for each component in the treatment trains of a range of system configurations.
- Certification training
  - Inspection Training and Certification
- Continuing education workshops
- Training centers
  - 20 Centers in 14 states
- Web sites

Homeowner Training

- Workshops
- Training centers
  - Northern Arizona University
  - UA @ Maricopa Agricultural Center
- Web sites
  - Ag.arizona.edu/waterquality/onsite
- Fact sheets, homeowner guides



Summary

- CALS and their partners are taking research to the community through state, regional, and national efforts.
- Innovative activities include undergraduate curriculum development, GIS/GPS decision models, web-assisted indices and support tools, certification and continuing education training for professionals, interactive CD/DVD informational programs.
- Integration of research, education, and extension in multidisciplinary groups are the KEY to funding and success.