Karl Wood *was named director of the New Mexico WRRI in June 2000. He joined the NMSU faculty in 1979. Prior to his tenure at the WRRI, Karl was assistant department head and range coordinator for NMSU's Department of Animal and Range Sciences. Much of his research over the years has been related to water resources and for 20 years, he was a member of the Range Improvement Task Force. Karl completed a B.S. in forestry and range management and an M.S. in range science with field emphasis on soils and range improvements, both from the University of Nevada/Reno. In 1978, Karl received a Ph.D. in range science with field emphasis on watershed management from Texas A&M. Karl has nearly 150 journal articles, research bulletins, special reports and conference proceedings publications to his credit, mainly in the areas of range hydrology, range vegetation and soil assessment, and rangeland management, including reclamation of disturbed lands, range improvement techniques, grazing systems and management of rare and endangered species.*

WHY DO WE NEED RESEARCH FOR REGIONAL AND STATE WATER PLANNING IN NEW MEXICO?

M. Karl Wood
New Mexico Water Resources Research Institute
New Mexico State University
PO Box 30001, MSC 3167
Las Cruces, NM 88003-8001

Regional and state water plans need extensive information, which is not always available. Additional research and information gathering is required because of spatial and temporal variability that is found in a state of immense physiographic and cultural diversity. How do we get the best information for regional and state water plans? Information is acquired from literature reviews, public input, expert witnesses, and new research.

There are basically four reasons to do research. The first reason is curiosity, and this leads to basic research, which may not have any apparent applications. An example is the exploration of Mars, which currently probably does not affect many human lives on Earth, but the results are fascinating to many. The other three reasons to conduct research lead to applied research. These include research for making management decisions, research to aid in enforcing regulations, and research for effective planning.

Regional and state water plans require extensive information. Where should we find this information? As an example, suppose someone makes a simple statement like: "We irrigate with a full ditch for 3 hours." Someone may ask, "How do you know that is adequate but not wasteful?" An appropriate answer is to cite some "way of knowing" such as (1) an appeal

to tradition such as, "That is the way we have always done it," or (2) an appeal to authority such as "If you don't believe me, you can ask the Ditch Master," or (3) an appeal to faith or religious authority such as "The good book says…," or (4) an appeal to deductive or inductive logic such as "We always get a good crop," or (5) an appeal to experience such as "I saw this same thing in Alaska," or (6) an appeal to science. Each of these six ways of knowing truth has its strengths and weaknesses. However, an appeal to science should be the strongest if scientific investigation is adequate to meet objectives.

After initial formulation, regional and state water plans will always need updating. Initial formulations and updates need new information that may necessitate new research. The most credible research involves the "Scientific Method." The scientific method is a means by which researchers are able to make conclusive statements about their studies with a minimum of bias. The interpretation of data can be laden with bias. As any skilled debater knows, just about any opinion can be justified and presented as fact. In order to minimize the influence of personal stakes and biased opinions, a standard method of testing a hypothesis is expected to be used by all members of the scientific community. Data selectively collected are often cheap, collected rapidly, can give results to meet political goals, have maximum opportunity for bias, and often appeal to government land management agencies and litigants in law suits. Data collected by the scientific method are usually more expensive, time consuming, give the least bias, may help avoid law suits, and represent the information with the most integrity.

Bias can be minimized by (1) randomization of samples, (2) replication of the study, (3) obtaining an adequate sample size, and (4) using peer reviews. As an example, suppose a client has a problem. The client provides a grant or hires a researcher. The researcher is sometimes called a consultant and has a couple of options. In Option A, the researcher designs a research project, conducts the research, and gives the results and interpretations to the client. Private consultants often chose this option. Their research often only appears in final reports to the client and maybe the client's regulatory agency. In Option B, the researcher designs a research project, solicits peer review of the objectives and methods, conducts the research, solicits peer reviews of the data interpretation, and gives results and interpretations to the client. Researchers in academia often chose this option. Their research often appears in final reports to the client and in refereed scientific journals. Many researchers have fears and may choose Option A because they may see peer reviewers as potential competitors and convince their client of their own competence so that peer review or assistance is not needed. The client may see the peer review process as time consuming and costly.

What do clients do with the results? Clients and/or their lawyers take the researcher or consultant to regulators, a management agency, or court. The researcher is expected to support the client. The client and their lawyers may (1) accept and present all of the findings, (2) present part of the findings, or (3) sit on or hide findings. If the researcher supports (2) or (3), then the researcher is now a "hired gun." If the regulator, management agencies, and courts are public institutions, then the study is probably public information and the peer review process can prevent options (2) and (3). The client needs to be educated about the peer review process and the importance of presenting all findings. This is seldom done. Also regulators, management agencies, and courts need to be educated about the peer review process and the importance of presenting all findings. This is also seldom done. These groups often are not satisfied that all findings are presented. These groups may not be competent enough to understand the objectives, so they ask for satisfaction of related or unrelated objectives. Great distrust often results. The risk to the client of accepting all findings means more time and money.

What are judges and juries most likely to accept? Peer reviewed or non-peer reviewed research? Judges and juries are most likely to accept either and anything. Therefore, it is best to avoid courts and litigation. The best opportunities to avoid courts and litigation are with the best possible science. Insisting on going to court is often an indicator of not enough scientific evidence to achieve a political agenda any other way. Two recent examples of where scientific knowledge was used to help settle disputes are the Klamath Falls endangered fish situation and the safe arsenic levels controversy. Scientific scrutiny showed that the management and regulatory agency was wrong in the first situation, and probably right in the second.

Sound science is the bridge between problem and solution. Regional and state water plans without credible scientific knowledge are scary.