divining rod

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Funding up slightly for new projects

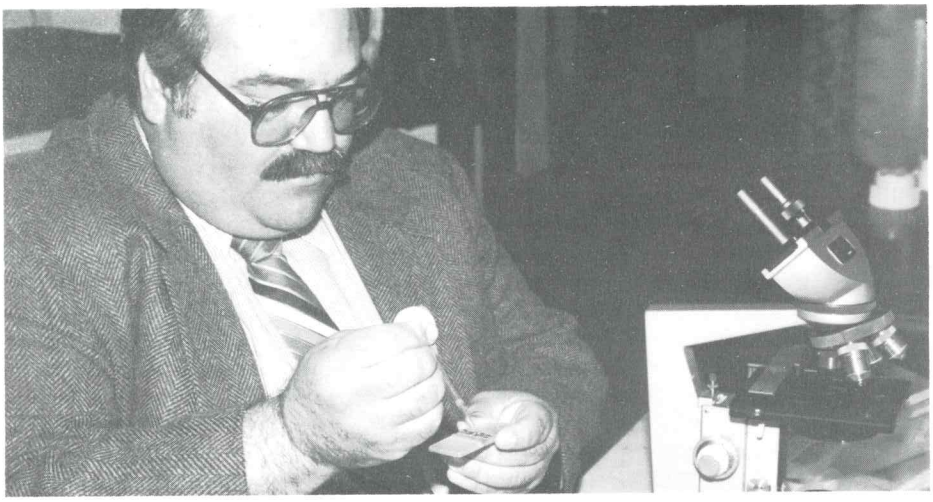
Funding for WRRI-sponsored projects was back up to the 1985 level after taking a slight dip in 1986. This $277,960 total will support 12 projects during the 1987-88 fiscal year, compared to last year's $262,686 funding total. Researchers submitted 30 proposals for funding compared to 21 proposals submitted last year. One interdisciplinary project, "Watershed Process Model Development," also received a $236,870 matching grant from the New Mexico Department of Game and Fish.

Federal Projects — USGS

- *Characterization of Deep Saline Aquifers in the Roswell Basin of New Mexico from Lithologic Analysis and Geophysical Well Logs.* John MacMillan and Gerardo Gross, geoscience, New Mexico Institute of Mining and Technology.
- *A Physiological Route to Increased Water-Use Efficiency in Alfalfa.* Vincent P. Gutschick and Gary L. Cunningham, biology, New Mexico State University.
- *The Pilot-Scale Cultivation of Commercially Valuable Marine Aquaculture Crops in New Mexico's Saline Ground Waters.* Barry Goldstein, Solar Energy Institute, New Mexico State University.
- *Development of Agronomically Valuable Plants with High Temperature, Drought and/or Saline Tolerances.* Glenn D. Kuehn, chemistry, New Mexico State University.

State Funded Projects

- *Treatment of Water Supplies Contaminated by Toxic Pollutants Using Tailored Smetities.* Fernando Cadena, civil engineering, New Mexico State University.



Microbiologist Barry Goldstein takes a sample from a beaker of algae in his NMSU laboratory. He recently was awarded funding to continue research using saline water to grow algae. See story inside.

- *Field Analysis of the Role of Three-Dimensional Moisture Flow in Ground Water Research and Evapotranspiration.* Daniel B. Stephens, geoscience, New Mexico Institute of Mining and Technology.
- *The Influence of Growth Conditions on Algal Lipid Production and Value from Algae Grown in Saline Ground Water.* R. Peter Herman, biology, New Mexico State University.
- *A Stable Isotope Investigation of Vapor Transport During Ground Water Recharge in New Mexico.* Fred M. Phillips and Andrew R. Campbell, geoscience, New Mexico Institute of Mining and Technology.
- *Improving Livestock Tolerance of Toxicants in Kochia Herbage, Toward Increased Usage of Kochia as a Water-Efficient Crop.* G.S. Smith and Herman E. Kiesling, animal and range sciences, New Mexico State University.
- *An Investigation into Water Use by and Salinity Effects upon Trickle Irrigated Grape Production in the Southern Basin and Range Province of New Mexico.* Peter J. Wierenga, crop and soil sciences, New Mexico State University.
- *Assessing the Sensitivity of High Altitude New Mexican Wilderness Lakes to Acidic Precipitation and Trace Metal Contamination.* Thomas R. Lynch and Carl J. Popp, biology and chemistry, New Mexico Institute of Mining and Technology and Gerald Z. Jacobi, biology, New Mexico Highlands University.
- *Hydrocarbons and Liquid Organic Hazardous Wastes in Ground Water.* John L. Wilson, geoscience, New Mexico Institute of Mining and Technology.

Developing an appetite for algae

How do you make a clam happy? Or satisfy a shrimp? Or please a picky oyster? Barry Goldstein will devote the next year to finding out. Goldstein, a microbiologist with the Solar Energy Institute will experiment with algae to see which species is the favored fare for clams, brine shrimp and oysters. He also will evaluate which growing techniques are best suited to commercial aquaculture production.

''We know clams and oysters can take a wide variety of temperatures and we know they like to eat algae. What we don't know is how they take to the strange salt water we're growing them in,'' he said.

The marine animals, including algae, will be grown at the Roswell Test Facility using the saline waters of the Pecos River Basin. The waters are from one tenth to one-third as salty as sea water.

Because algae are water creatures, the saline water can affect algae's growth, nutritional value and the way they taste. Oysters are particularly picky about the taste of algae, Goldstein said.

Goldstein is also testing three types of growing tanks to find the most productive method for growing algae under New Mexico conditions. The first is a greenhouse type with a shallow, concrete lined raceway. A paddle wheel mixes the raceway water.

Goldstein explained that many algae are by nature sedentary creatures and will settle to the bottom unless mixed. Mixing, he said, ensures that the nutrients and carbon dioxide reach the algae and that all the algae have an equal opportunity at light. ''It's just like cooking,'' he said, ''we have to keep everything well stirred.''

The city of Roswell also has built two shallow raceways and two large ponds for the project as commercial prototypes. The raceways are open air earthen channels lined with plastic. The deeper ponds will help determine if depth stabilizes the temperature extremes throughout the year. Both the earthen raceways and ponds will use an airlift propulsion system to mix the water, much like air bubbles are used to mix the oxygen in an aquarium.

Goldstein also will experiment with two harvesting techniques to determine the best management of the algae ponds. In one method the algae are harvested continuously during the daylight hours and in the second method algae are harvested in a batch once a day. He said each method has its benefits and drawbacks. ''Continuous harvesting demands more labor while batch harvesting requires a larger investment in equipment,'' he said.

Harvesting is an important consideration in algae production. Goldstein said under the best conditions algae will divide five times in one day. Under those circumstances a pound of algae could reproduce to 32 pounds in 24 hours.

He hopes to overcome some of the management obstacles through computerization. ''We are trying to build our knowledge into the computer and then let it do the work,'' he said. For example, he said once they learn what the best pH for the water should be, say 8.7, that number will be plugged into the computer. If the pH goes up to 9, then the computer will automatically add carbon dioxide to the water to bring the pH down to 8.7.

The computer will check the water every 10 minutes for pH, temperature, conductivity, turbidity, dissolved oxygen, and light penetration. Flow rates and fertilizer injections also will be automated.

This greenhouse raceway is one of five algae ponds at the Roswell Test Facility that will be used to test algae production methods.

Before coming to New Mexico in 1983, Goldstein was vice president of a commercial aquaculture facility in Hawaii that produced algae-fed oysters. He said the algae research at the Roswell Test Facility is the only active inland aquacultural production facility in the continental United States using saline ground water to grow marine organisms.

He began research on algae production his first year in New Mexico when the New Mexico Legislature awarded $500,000 to the Water Resources Research Institute for saline water research. About 40 percent of that money went to aquaculture research to test the suitability of using saline water for growing fish, shellfish and algae.

How will Goldstein know when he has succeeded in making his saltwater trio happy? ''We know that oyster production could be a commercial undertaking if we could get the oysters to reach market size in a year or less,'' he said. He also said algae production to feed the marine animals must reach 20 metric tons of dry weight a year.

''This area would be ideal for commercial aquaculture production,'' he said, ''because sunshine is constant, the land is inexpensive, and the saline water supply is abundant.''

Judge discounts pueblo claims

A federal judge has ruled in the 21-year-old *Aamodt* pueblo water rights case that four northern New Mexico pueblos can irrigate only 841.5 acres, not the 3,792 acres they had claimed.

The Nambe, San Ildefonso, Tesuque and Pojoaque pueblos argued they were entitled to the larger amount to fulfill the purpose of the reservation, which included an expanding right to water.

However, the non-Indian water users contended that the pueblos were entitled only to irrigate lands they had historically irrigated. In the April 28 decision, U.S. District Judge Edwin L. Mechem ruled in favor of the historic acreage amount, which is based upon acreage actually irrigated between 1846 and 1924.

The 1846-1924 period begins with the Treaty of Guadalupe Hildago in which the United States in taking the territory from Mexico agreed to continue to protect the Pueblo Indians by law. The 1924 Pueblo Lands Act, which was designed to recover some of the pueblo lands sold to non-Indians, essentially ended further expansion of the lands.

Mechem based his ruling on a 1931 study of pueblo and non-pueblo water use within the Rio Pojoaque stream system, which was in turn based upon a 1925 Indian Irrigation Service report.

The only question remaining under *Aamodt* is the actual amount of water allotted to each acre. The process of determining that amount will be under the authority of the State Engineer Office.

Al Utton, author of a recent study of Pueblo Indian water rights and University of New Mexico law professor, said that if the ruling stands, existing water rights will be protected.

The key question, he said, revolves around water rights for future expansion. ''The pueblos will have to acquire that water in the marketplace and the federal government probably will buy them those rights,'' he said.

The stakes for water rights in New Mexico are especially high, Utton said. ''It's like cutting a pie, if one person gets more than another person has to get less,'' he said.

University of New Mexico law professor Willis Ellis first served on the Program Development and Review Board in 1967.

Lawyer selected for board

Twenty years ago, University of New Mexico law professor Willis Ellis was named to serve on the institute's first Program Development and Review Board. Now he's back. ''I hardly remembered being on the first board, but when Bob Creel told me I would be reviewing proposals about chemistry, it all came back to me,'' he laughed.

Ellis teaches law courses on natural resources, community property, and oil and gas and is an author of Water Research. He replaces board member, Albert Utton, who is also a UNM law professor.

He is a graduate of Wabash College (Indiana) and holds a law degree from Indiana University at Bloomington. Ellis first taught water law at the University of Denver even though he said as a midwesterner he didn't know much about water law then.

In his teaching, Ellis believes it is his responsibility to encourage a close student/teacher relationship. He said that role is important because law school is not just a continuation of an undergraduate education. ''Law school is entirely new to each student. We have an ethical obligation to prepare our students to represent clients without committing malpractice,'' he said.

He said his approach to research is like that of most lawyers--solitary. ''I like to sit down by myself, figure it out and then write it,'' he said.

El Paso's water demands disputed

Since the El Paso hearings began in November 1986, the city's water demands and economic outlook have been dissected and disputed by both sides.

As New Mexico presents its side of the case, its expert witnesses are trying to show that El Paso's projected water demands are not as great as El Paso's experts contend.

El Paso's water demand is one of the six criteria New Mexico State Engineer Steve Reynolds will use to determine whether El Paso will be permitted to drill 21 wells in the Hueco Bolson in New Mexico and export that water to El Paso.

Milton Holloway, an economist testifying for New Mexico, projected that El Paso will grow to between 833,000 and 860,000 people by 2030.

During cross examination, El Paso attorney Pete Schenkkan tried to show that Holloway's population projections were based on outdated net migration figures. Schenkkan said El Paso's expert recalculated Holloway's projections using a later estimate for net migration and came up with a projected population of about 1.2 million by 2030.

Holloway, chief executive officer of Southwest Econometrics in Austin, Texas, faulted El Paso's projection technique for not taking into account El Paso's unique economic character. "Population growth and migration are principally explained by employment," he said.

Ben Phillips, an attorney for El Paso, poses a question during cross examination at the water hearing. Phillips is from Santa Fe.

In the case of a border city like El Paso, employment in neighboring Juarez, Mexico, also must be considered.

Holloway said every 100 maquiladora jobs in Juarez results in a related 92 jobs in El Paso. The maquiladora, or twin-plant industry, involves companies that manufacture goods in the United States and then ship them to Mexico where they can be assembled cheaply.

El Paso also tried to discount the maquiladora projections, contending that Holloway was not qualified to make such projections.

Key testimony for New Mexico also was presented by John Boland, an engineer at Johns Hopkins University. Boland designed the water demand forecasting model the U.S. Army Corps of Engineers uses for municipal water planning.

The model relies on as many as 284 factors in making long range water demand forecasts. For example, his model took into account El Paso's population fluctuation, military influence, southwestern climate and the value of the peso.

The model predicts that El Paso will need 158,300 acre-feet of water a year by 2030. El Paso experts have said the city will need 263,000 acre-feet by then.

Other witnesses for New Mexico are expected to present testimony on New Mexico's water supply and the demands placed on that supply. The hearing is expected to continue into August.

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