STORY BY MOSHAY SIMPSON, STAFF WRITER • PHOTOS BY CHARLES NEUMAN, STAFF PHOTOGRAPHER

Monika Braun took a close-up look at the Santa Margarita River near a crossing at the Santa Margarita Ecological Reserve. She is the wife of Hans-Werner Braun, a San Diego Supercomputer principal investigator and one of the primary liaisons with the Santa Margarita reserve.

Techno-ecology

UCSD supercomputer lets scientists study life at SDSU's Santa Margarita Ecological Reserve from afar

In the wilderness of the Santa Margarita Ecological Reserve, technology is working hand in hand with Mother Nature to study and preserve the environment.

San Diego State University, which operates the 4,334-acre preserve straddling the Riverside and San Diego county line, has teamed with the San Diego Supercomputer Center at the University of California San Diego to incorporate real-time sensor technology and outdoor field research to create an unusual outdoor laboratory.

Instead of Burrows burrowers and microscopes, this natural lab is equipped with state-of-the-art bells and whistles that allow researchers — from anywhere in the world — to monitor life as it happens.

Still and motion cameras are scattered over the reserve. Motion sensors attached to cameras capture the preserve's wildlife on the move.

Water-quality sensors have been installed along the bed of the Santa Margarita River and its tributaries. Other sensors, about 20 in all, monitor such things as wind speed, temperature, humidity, rainfall and moisture content of plants.

All of the sensors, some of which cost more than $30,000, are connected to the Internet through a wireless network. This allows students and other researchers to monitor their experiments in the field with the click of a mouse, the stroke of a personal digital assistant or the punch of a cell phone. Researchers are capable of cross-referencing data from other tests to see if and how they may affect their own studies.

Studying from a distance

Swiss botanist Rolf Baumberger, a biology researcher at the University of Zurich, for example, is using the Santa Margarita preserve to study the role of hummingbirds, bees and moths in the pollination of the bush monkey flower. Until recently, he would have had to come to the preserve for even the most mundane observations.

Now, with sensors set up at his project site, photos of the flowers are taken hourly, and Baumberger can examine high-resolution images on his computer without changing time zones.

John Helly is in the early stages of using the reserve's sensor network to develop a statewide plan for observing watersheds remotely. At his disposal are a water-quality sensor, flow monitor, and

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Hans-Werner Braun of the San Diego Supercomputer Center pointed out locations of the High Performance Wireless Research and Education Network on a map projection at the North Field Station on the Santa Margarita Ecological Reserve.

Ramona unites in airport protest

Plan seen as threat to way of life in town

By Brian E. Clark
STAFF WRITER

RAMONA — Five years ago, when the county floated a plan to expand the local airstrip by 1,900 feet, Carol Angus helped start an opposition group called Save Ramona.

The ensuing controversy pitted neighbor against neighbor because some saw the proposal as a way to bring jobs to the community, while others viewed it as a threat to Ramona's grasslands.

After endangered kangaroo rats were found near the site, an industrial park was dropped from the plan and the runway expansion was trimmed to 900 feet, enough to allow bigger firefighting planes to use the strip. A new tower will be built in 2003.

Now, however, a proposal that would put an international airport in this bucolic valley has united residents who often are on opposite sides of growth issues.

In this case, both sides see this airport plan as a threat to their way of life that must be stamped out immediately.

"I don't know anyone who is even remotely in favor of it," Angus said.

That's putting it mildly, many others say.

Dutch van Dierendonck, chairman of the town's planning group, said an international airport would mean the end of Ramona. "You could just kiss this place goodbye," said van Dierendonck, who moved to Ramona in the early 1970s and teaches equestrian skills.

Many Ramonans weren't worried when their community was included on a consultant's list of 321 possible airport sites last year.

But when the list was pared down to 21 two months ago, alarm spread like a fire through dry brush. Groups were formed, meetings held, politicians contacted. Residents say they want to make sure Ramona is off the short list of five sites when it is unveiled in September.

"Everyone up here thinks the idea of putting a huge airport up here stinks and they still can't quite believe it is even being considered," said Angus, a 13-year resident of Ramona who owns a Native paving company and is a member of the planning group.

No one is talking about how this project would attract business.

Scott Taylor, president of the Chamber of Commerce, said his group will formally oppose the airport plan.

"This would truly destroy our quality of life here," he said. "The

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"This is just the tip of the iceberg of terrestrial observation systems."

SEDRA SHAPIRO, executive director of SDSU's field stations

Pablo Bryant, of SDSU's Santa Margarita Ecological Reserve, checked one of the reserve's telecommunications sites that has cameras aimed at points of interest in a section of the Santa Margarita River gorge. The cameras monitor the area for many types of research, and the information is transmitted via wireless antennas to the university lab's network. *Charlie Neuman / Union-Tribune photos*

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Technology helps studies yield more knowledge, SDSU official says

still and video cameras lining the Santa Margarita River.

Researchers studying the flow of water in a river typically use a flow meter, a metal rod with a propeller at the end. The propeller is placed in the river at various points, and the user listens through headphones for clicks.

Helly, a senior scientist at the Supercomputer Center, is trying to use camera images to gauge water flow by calculating the water's height at the bank. He will compare data from remote and conventional observation methods to determine effectiveness.

Developing a more effective monitoring system, Helly said, could be a cost-effective way to track Southern California's infrequent and intense rains. His goal is to remotely follow where water comes from and where it goes in the region.

"The benefits could be substantial," he said.

Real-time data

San Diego State University established the Santa Margarita reserve in 1962, and nature studies have been going on there for many years. Some 50 projects are in the works, including ant and bat surveys, studies of bird migrations and research into the effects of air pollution on soil and plant growth.

But only since November could data from projects be centrally collected and viewed remotely.

"The studies were always there," said Sedra Shapiro, executive director of SDSU's field stations. "The knowledge has increased because of the technology."

Before the innovations, researchers' field experiments were subjected to potential vandalism and malfunction, which may not have been detected until they revisited the project site. Real-time technology gives them such information immediately.

With instant access to centralized environmental data, SDSU is creating an environmental observatory that will allow comprehensive research on all aspects of wildlife. Most important, the project will allow for intense study of how urban growth affects the great outdoors.

"You can get data. You can send data. You can collect data," said Pablo Bryant, the field stations' research technology manager. "It's all wireless. It's all ubiquitous."

Students benefit from the project because data are easily accessible. "Researchers and students don't have to track down, contact and try to finagle information from a professor," Bryant said.

In addition, students are able to see data and images that aren't dated and stale. "It's not a canned classroom session," Bryant said, "but a real-world experience."

Synergy of going wireless

None of it would be possible without the High Performance Wireless Research and Education Network, known as HPWREN, co-headed by Hans-Werner Braun and Frank Vernon, San Diego Supercomputer principal investigators and the primary liaisons with the Santa Margarita reserve.

HPWREN is a prototype high-performance wide-area wireless network funded by the National Science Foundation. The $2.3 million, three-year project is providing the reserve the wireless connectivity that allows for network analysis research and high-speed (45 megabits per second) Internet access to field researchers in disciplines from geophysics to astronomy and ecology.

"It has a synergistic type of benefit," Helly of the Supercomputer Center said.

The network has also been used around the county to test the Coronado Bridge's structural integrity and to provide wireless Internet access on some local Indian reservations.

"We're not building a communications network for the sake of building a communications network," Braun said. "Unless it has value to someone, it's a gimmick."

Another National Science Foundation-funded effort is Real-Time Observatories, Applications and Data Management Network, or ROADNet, headed by John Orcutt of the Scripps Institution of Oceanography. This component assists in the archiving and organizing of the information collected at the reserve.

The network also will support further instrumentation of the environment and the testing of new ways to conduct remote data collection. Shapiro, Vernon and Braun are also involved with this aspect, along with scientists at the Supercomputer Center and SDSU.

More than science

The techno-ecological collaboration on display at the reserve is of obvious benefit to researchers, educators, farmers and students. But it may prove to have even more advantages for protecting public health and safety, particularly in an age of terrorism.

Sensors in the preserve now track water quality in the Santa Margarita River for researchers. But if anyone ever tried to tamper with the river, a primary water source for Marines at Camp Pendleton, the technology is in place to detect it.

Other sensors detect radioactivity, and seismic instruments relay information about the movement of earthquake faults. Moisture detectors monitor foliage to assess fire risk. Weather towers measure temperature, wind speed and rainfall.

"This is just the tip of the iceberg of terrestrial observation systems," Shapiro said.

The Santa Margarita Ecological Reserve may not be the first or only of its kind to merge technological wizardry with the study of nature, but it could become a template of what the National Science Foundation is considering creating on a national level.

The foundation is trying to get congressional funding for its National Ecological Observatory Network. If created, it would establish a continent-wide consortium of outdoor observatories to create a virtual lab linked via the Internet for the purpose of allowing scientists to form a "predictive understanding of the environment."

"The foundation of our society rests on our natural resources," said Joann Roskoski, executive officer of the biological sciences directorate at the foundation.

The foundation recently awarded Santa Margarita $187,000 to help expand its wireless technology and to add more water and air sensors to the project area.

Soon the reserve's Web site, http://www.sci.sdsu.edu/BES/, will undergo a major overhaul. By year's end, the public is expected to have access to a lot of the data and to the still and motion images that researchers use.

"These technologies augment the creativity of the human mind," Shapiro said.

Mark VanScoy worked on a computer in the "data shack" in a remote part of the Santa Margarita Ecological Reserve. A nearby meteorological tower is hard-wired to the shack's computers. Antennas there send data via other antennas on hilltops to the university lab's network.

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