

## **Biosphere 2, Version 3.0**

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## Biosphere 2, Version 3.0

Remember Biosphere 2? That controversial experiment in space living and would-be research center in the Sonoran Desert near Oracle, Arizona? That place so many people thought was defunct? Well, Biosphere 2 is back.

The University of Arizona assumed management of research at Biosphere 2 on 1 July 2007 and is breathing new life into the place. University scientists have already begun biological research there, and university officials hope to make it a center for scientists, as well as for the public.

The 3.14-acre (1.27-hectare) Biosphere 2 was built in the 1980s to see if people could live in a self-contained enclosure, mimicking conditions space colonists would most likely face. The experiment, which began in 1991 and was interrupted in 1993, ended in 1994 when managers and participants were removed from the facility. Columbia University took over Biosphere 2 in 1996; undertook a three-year, \$3 million retrofit; and launched research on the effects of global warming and increased carbon dioxide levels on plants and other organisms. But a change in university leadership and program direction, in addition to budget problems, led Columbia to pull out of Biosphere 2 in 2003.

Since then, the facility has sat largely empty, aside from a maintenance staff and tourists (about 60,000 visitors annually). Then, in 2005, Ed Bass, the Texas oil billionaire who built and funded Biosphere 2, asked the University of Arizona to take over. "We were asked whether we would be interested in the Biosphere," recalls Joaquin Ruiz, dean of Arizona's College of Sciences. "I said, 'Absolutely, yes.'" The university will lease the Biosphere from the Edward Bass companies for \$100 a year. A thousand acres (404.7 hectares) of land adjacent to the facility were sold in June 2007 to CDO Ranching, which plans to develop the property.

"Many of us have dreamt of this," says Pierre Meystre, a University of Arizona physics professor and director of the B2 Institute, which conducts interdisciplinary programs to tackle scientific "Grand Challenges." Meystre cites the ability to conduct research, sponsor scientific meetings, and train students in a closed facility that is just a 45-minute drive from the university's main campus in Tucson. Taking over Biosphere 2 was "a natural thing for us to do," he says.

Work has already begun there on a study of the effects of global warming on pinyon pines (*Pinus edulis*), which dominate many semiarid regions in the Southwest. The trees have been dying throughout the West, says David Breshears, a University of Arizona professor of natural resources, because of the decade-long drought and high temperatures in the region. More than 90 percent of pinyon pines at a site near Los Alamos, New Mexico, died between 1999 and 2000 alone.

Breshears and his research team transplanted 50 pinyon pines from Los Alamos to the controlled environment of Biosphere 2. There, the researchers will manipulate water and temperature to see how the trees respond. Many computer models predict a hotter, drier climate in the desert Southwest under global warming. "We want to know what it takes to kill pinyon pines," Breshears says.

A second experiment, expected to begin this fall, will look at how shrubs affect water flow and water balance on a desert hillside. The study will examine how water flow in the soil changes under global warming, as the plants both take up water and provide shade, thus reducing evaporation. "We want to know how plants modify their environment," says Travis Huxman, a University of Arizona associate professor of ecology and evolutionary biology and director of both Biosphere 2 and B2 Earthscience, the research arm of Biosphere 2 operations.

Beyond research, university officials hope to make Biosphere 2 a center where scientists and others can discuss major scientific questions, Meystre says, citing Biosphere's 28 three- to five-bedroom houses, the conference and meeting rooms, the office and research facilities, and the expansive setting in the foothills of Arizona's Santa Catalina Mountains. "This is a perfect place to examine grand problems," he adds. Possibilities include alternative energy sources, global warming, biodiversity, and the origin of life.

The University of Arizona also plans to make Biosphere 2 a key interface between working scientists and the public. "We want visitors to see how science works," says Lisa Graumlich, director of the university's School of Natural Resources. "We hope people will come and learn how ecological knowledge is gathered and tested. We feel [the Biosphere] can be a place where scientists can communicate what they do to the public."

Finally, the university hopes that Biosphere 2 can be a place where students learn about the environment through programs aimed at elementary through high school science teachers. Many of those teachers are at rural, isolated schools, Meystre says, where resources are scarce. "We want to support the teachers and improve science education," he adds.

"This is a really extraordinary facility," Meystre says. "We can do almost anything here—science, art, public outreach, maybe even concerts under the stars."

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