

Human terrarium, Biosphere 2, looking good at 20

April 26 2011, By ALLEN G. BREED , AP National Writer

(AP) -- Jane Poynter and seven compatriots agreed to spend two years sealed inside a 3-acre terrarium in the Sonoran Desert. Their mission back in the 1990s: To see whether humans might someday be able to create self-sustaining colonies in outer space.

Two decades later, the only creatures inhabiting [Biosphere 2](#) are [cockroaches](#), nematodes, snails, crazy ants and assorted fish. Scientists are still using the 7.2-million-square-foot facility, only now the focus is figuring out how we'll survive on our own warming planet.

Next month, workers will begin a new chapter for "B2" - building the first of three enclosed soil slopes in what was once the "intensive agricultural biome," the space where Poynter and the other original "biospherians" grew the rice, sorghum, peanuts, bananas, papayas, sweet potatoes and lablab beans that supplied 90 percent of their nutritional needs.

The new "Land Evolution Observatory" - a 10-year, \$5 million project - will help scientists learn how vegetation, topography and other factors affect rainwater's journey through a watershed and into our drinking supplies.

"What makes me really happy is that it really does capture a lot of what we were trying to do in the early years of Biosphere 2," says Poynter, who founded an aerospace company with husband and fellow biospherian Taber MacCallum. "I mean, they're doing some world-class

science. They really have the vision of the place. They understand what it was intended for in many ways."

And researchers say Biosphere 2 may be even more relevant today than when those first people passed through the airlocks on Sept. 26, 1991.

Located about 30 miles northeast of Tucson in the foothills of the Santa Catalina Mountains, B2 rises out of the high-desert landscape like a giant glass-and-steel ziggurat.

In a story previewing that first mission in 1991, the New York Times described Biosphere 2 - Earth is "Biosphere 1" - as a "combination [greenhouse](#) and futuristic shopping mall." But with its network of interconnected domed chambers and observatory-topped tower, anchored by the 91-foot-high pyramid and its 6,500 double-laminated windows, the complex resembles nothing so much as one of those plastic Habitrails you kept your hamsters and gerbils in as a kid.

Which is apt, since Poynter and the other biospherians - four men and four women - were very much human Guinea pigs.

Co-founded by counterculture ecologist John Polk Allen and Edward Perry Bass, the billionaire Texas environmentalist who put up the initial \$30 million bankroll, Biosphere 2 was described variously as an example of "vision and courage" and, as Ecology magazine put it, "New Age drivel masquerading as science."

The facility at SunSpace Ranch contained five distinct ecosystems, or "biomes": A mangrove wetland, tropical rain forest, savanna grassland, coastal fog desert, and a 600,000-gallon "ocean" with its own wave-lapped sand beach and living coral reef. All told, nearly 4,000 species of animals and plants lived there.

Passing through the first submarine door into the ocean biome, eyeglasses and camera lenses immediately fog up. In the rain forest, mist wafts from the walls. Tiny snails, crawling out onto paths, sometimes get crunched underfoot. Vines snake along support trusses, and a thick canopy of tropical foliage nearly blocks out the sun in places.

The building itself - with its network of 52 tanks that collected up to 5,000 gallons of water from the air each day and "rained" it back into the various biomes, and two massive domed "lungs" that kept the airtight building from exploding or imploding as outside temperatures fluctuated from below freezing to more than 120 degrees - was an engineering marvel.

But it wasn't long before the biospherians began experiencing serious problems.

First, just a couple of weeks into the mission, Poynter - manager of field agricultural crops - sliced off the tip of her left middle finger in a rice hulling machine. When inside attempts at reattachment failed, Poynter reluctantly left the B2 briefly for surgery - but still lost the fingertip.

Project officials had boasted that B2 was more airtight than the space shuttle. But by December, tests showed significant leakage, and outside air had to be pumped in.

Over time, oxygen levels inside B2 had dropped to dangerous levels, while carbon dioxide spiked. Poynter and the others were experiencing lethargy, shortness of breath, sleep apnea and "mood swings."

"The chemistry of the atmosphere was all whacked out," says Joaquin Ruiz, dean of UA's College of Science. "Tonight Show" host Jay Leno, who made B2 a running gag, had an explanation.

"Any kid'll tell you you can't keep eight scientists in a giant mayonnaise jar unless you put holes in the top of the thing."

There were explosions in the cockroach and ant populations. The coral reef died. And then there were revelations that a carbon dioxide scrubber had been installed - belying the notion that the plants would keep the air pure - and that the facility had been stocked with outside food.

Biosphere 2 had a 100-year business model - 50, two-year missions. But after one more group of eight finished its two-year tour in 1994, the live-in phase at B2 was over.

Columbia University became B2's "managing university partner" in 1996 and began manipulating carbon dioxide levels in the now "flow-through" system to study global warming. Columbia left in 2003, and nothing much went on there until June 2007, when Arizona became the "managing university partner."

In a way, B2 itself has been recycled. Everywhere you look, there are experiments going on.

In one current project, researchers from a German company have draped green and white blankets bristling with solar panels over a series of old mine "tailings - the elongated debris piles that surround B2 and snake through the Southwest. Such arrays already allow B2 to go "off the grid" if necessary, and the hope is they may someday dot the landscape, serving the dual purpose of preventing erosion and producing clean, renewable energy.

All water inside B2 was once recirculated and reused. These days, the facility works on a one-path system, says Matt Adamson, senior education and outreach coordinator.

"Because we'll often introduce an isotope into the water for research purposes, and so we don't want to recycle and then reread that data over again."

They're even studying B2 itself, which, aside from the odd cracked window pane or spot of surface rust, looks pretty good for its age.

"Biosphere was completely over-engineered," using first-rate materials, says Ruiz.

Adamson says researchers are in the middle of a survey of all plant life inside Biosphere 2, which will then be compared against the original planting charts. They've already found one species of palm-like cycad - *Zamia fischeri* - that is now endangered in the outside world.

"Some people imagine a scenario where Biosphere might almost be an ark of plants," Adamson says as he passes a prehistoric-looking tree that stretches almost to the glass ceiling. "As they potentially become endangered in the real world, we'll have viable, healthy specimens in here."

But of all the experiments going on there, "LEO" is the star.

Each of the small watersheds - measuring about 18 meters wide by 30 meters long - will contain tons of "naive soil" (previously unexposed to the elements) mined near Flagstaff and ground to scientists' specifications, says B2 director Travis Huxman. Researchers will be able to alter the conditions inside each chamber and control the conditions to which each slope is exposed.

"Our understanding of how ecosystems are coupled to the atmosphere, how they're driven by climate, I mean, these are all issues that we absolutely have to deal with - right now," says Huxman, a professor of

ecology and evolutionary biology at Arizona. "Biosphere 2's just become more and more relevant to that science through time. We don't have the capability to do this anywhere else."

And, as it has been from the beginning, B2 is a major tourist attraction.

About 100,000 visitors a year make the journey out to Oracle. Many, like Web designer Lisa Gray of Newport, Ore., were unaware that the biospherian era had ended.

"I thought that the people were still living here, and that the experiment was still ongoing," says Gray, who toured the facility one recent day with her wife, Kelly Everfree, and their 6-year-old son, Orion.

As the 20th anniversary of that first closed mission approaches, university officials are trying to keep things in perspective.

"We need to be careful that people do understand that what's going on there now is really serious research," says Ruiz. "In the end, simply put, when they sealed themselves in there, it was an experiment that failed."

Poynter, chairwoman and president of Tucson-based Paragon Space Development Corp., bristles at such talk.

"I just am so SICK of that sort of snarky way that a lot of people talk about the Biosphere in its early years," says Poynter, who still visits B2 often and sometimes leads tours. "The fact is that we built this unbelievable place that no one had ever done before. ... We were a very forward-thinking, very unusual group of people - pulled off an unbelievable feat. But, somehow, the unbelievable feat gets lost in the rest of the story."

If the outcome had been preordained, she points out, it wouldn't have

been an experiment. If something doesn't work, you learn from it.

So what did she learn from her experience inside the bubble?

"Humans are NOT built to be enclosed," she says with a guffaw. "It is NOT a regenerative process."

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