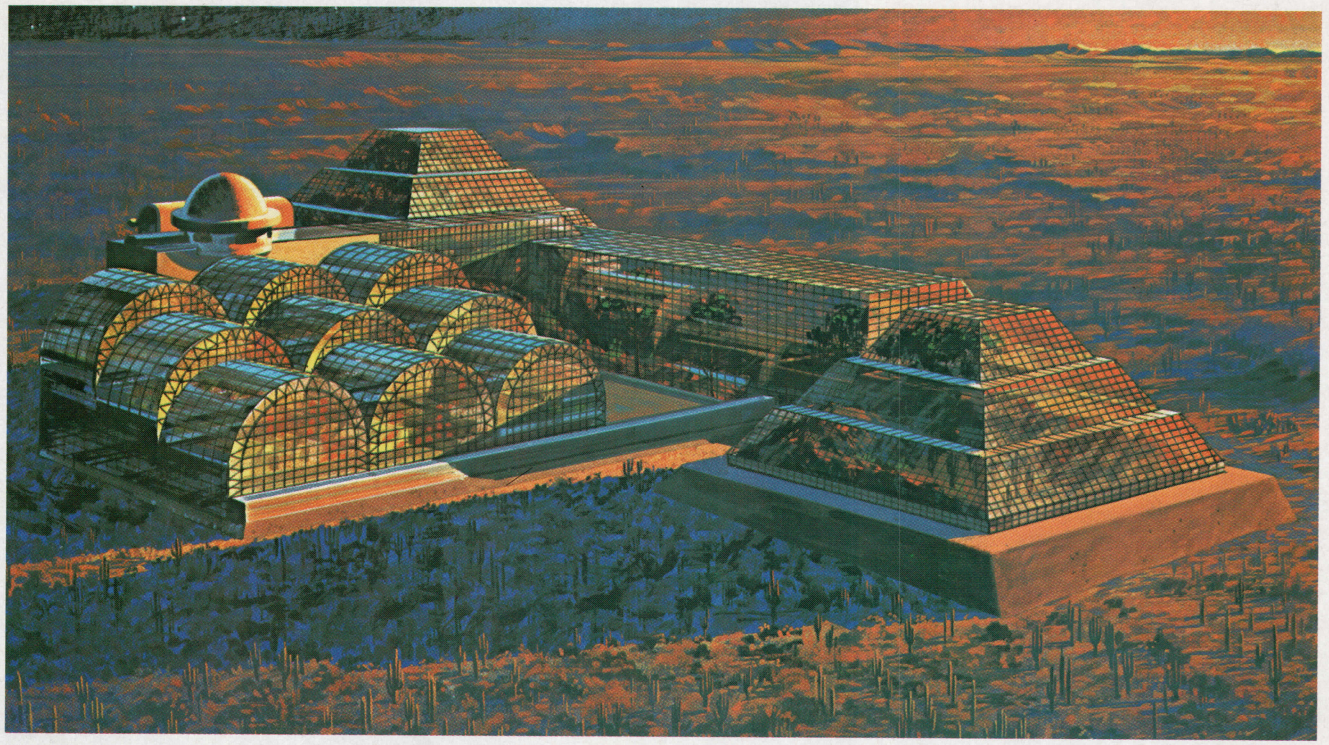


RICHARD GRIMES

BIOSPHERE II

by Cynthia Scanlon

In the Santa Catalina Mountains of Arizona, scientists are conducting a research project that may reveal better ways to manage earth's environment and extend it to other planets.

WHEN COMPLETED, it will be the ultimate environmental-research tool. It will engage the efforts of numerous scientific, research, and educational institutions. Five million cubic feet will be housed beneath steel and glass. It is . . . the earth.

Nestled in the Santa Catalina Mountains 30 miles from Tucson, a 90,300-square-foot structure is under construction at the SunSpace Ranch Conference Center near Oracle, Arizona. It is called Biosphere II (after planet earth, which is Biosphere I). When completed, it will contain seven earth biomes: an ocean, a savanna, a desert, a marsh, a rain forest, an agricultural zone, and a human habitat.

"It's one of the most exciting projects that's going on in this country at the moment," says Ghillean Prance, senior vice-president of science and director of the Institute of Economic Botany at the New York Botanical Garden.

If construction is on schedule, this world-in-microcosm will be "materially closed" by mid 1988. Nothing will go in or out except electronically transmitted information. Computer-operated louvers will cover the structure to control temperature and light. Biosphere II will be completely solar powered.

The company sponsoring the project, Space Biospheres Ventures (SBV), is as complex as the undertaking itself. SBV is an experimental conglomerate led by Decisions Team Ltd. and Decisions Investment Corp. Those organizations have engaged the expertise of the Institute of Ecotechnics, an

international agency based in London, which will oversee the research-and-development phase of the project. This financial, managerial, and scientific partnership intends to develop technology capable of eventually placing similar habitats on other planets. SBV also expects to gather information that will help solve environmental problems on earth. Carl Hodges, director of the Environmental Research Laboratory at the University of Arizona, explains:

"We've got acid problems, dirty-air problems, and we've got carbon dioxide increasing at an alarming rate. Right now we don't have a research tool where we can control the global parameters, like carbon dioxide and the quality of the atmosphere. I see the big payoff of Biosphere II as learning how to do a better job of stewardship of Biosphere I [the earth]."

The for-profit project is expected to cost $30 million over the next seven years. The money has been raised by a private venture-capital commitment, with a large percentage of the funds coming from Edward P. Bass, member of a prominent Texas oil family. Mr. Bass says:

"The . . . Biosphere II project grew out of a series of ecological, development-oriented venture projects with which I have been involved since 1972. . . . All of the projects are an investment in the long-term future, where lies the greatest unknown and the greatest risks but also the greatest opportunities."

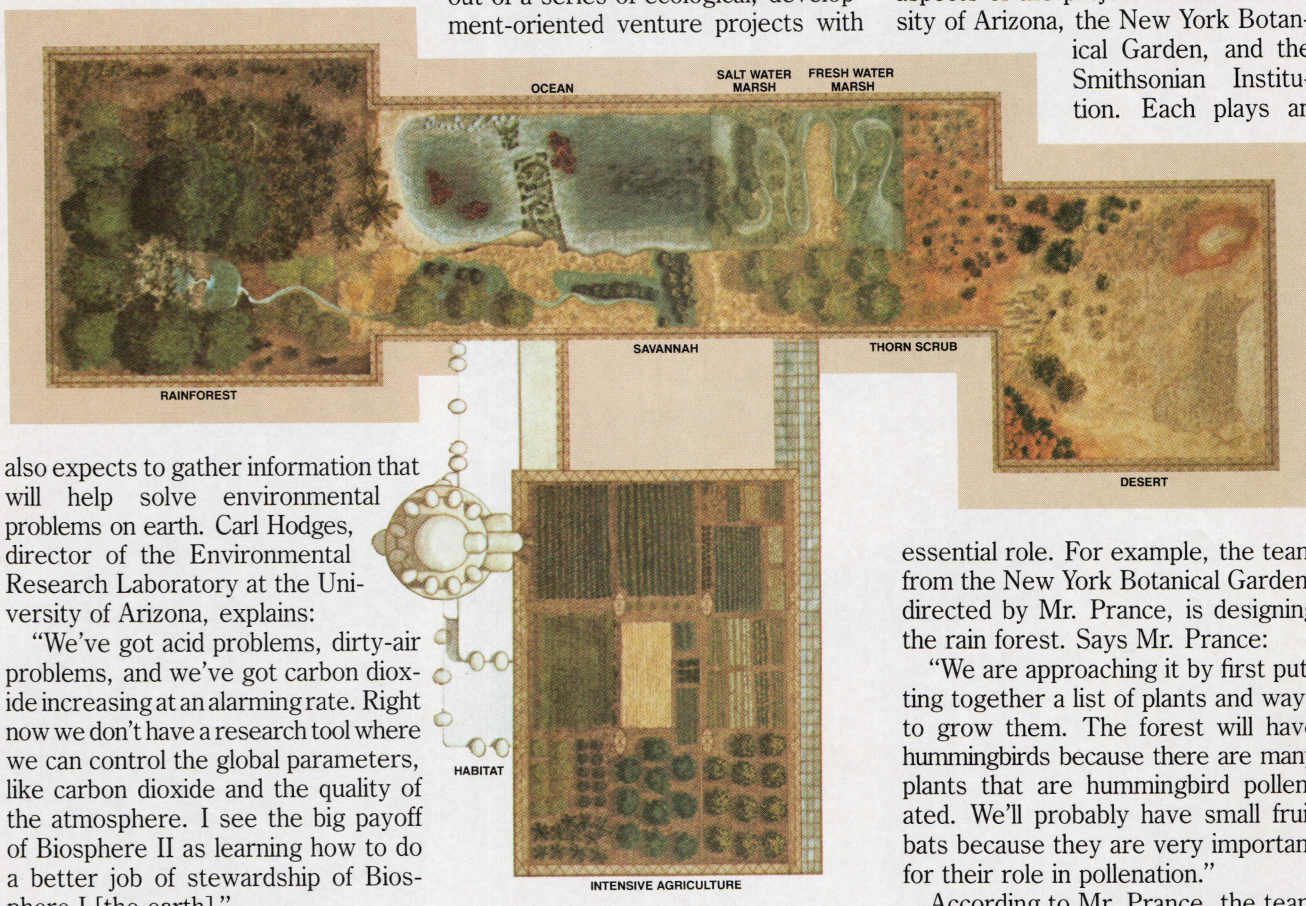
SBV officials are contracting various aspects of the project to the University of Arizona, the New York Botanical Garden, and the Smithsonian Institution. Each plays an essential role. For example, the team from the New York Botanical Garden, directed by Mr. Prance, is designing the rain forest. Says Mr. Prance:

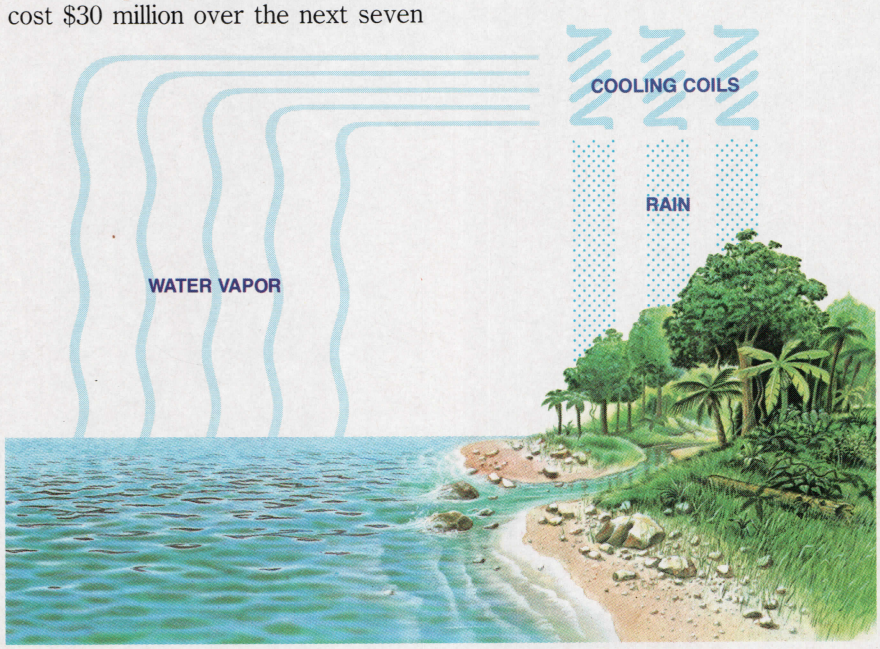
"We are approaching it by first putting together a list of plants and ways to grow them. The forest will have hummingbirds because there are many plants that are hummingbird pollenated. We'll probably have small fruit bats because they are very important for their role in pollenation."

According to Mr. Prance, the team expects to acquire information that not only will help prevent destruction of threatened rain forests but also will help reconstruct areas that are already decimated.

Scientists at the Marine Systems Laboratory (MSL), a part of the Smithsonian Institution, are responsible for building and maintaining most of the aquatic systems in Biosphere II. Walter Adey, head of MSL, will choose the

SPACE BIOSPHERES VENTURES





KEVIN BOUNDS

Above: **An architect's drawing reveals the seven earth biomes housed within Biosphere II, a 90,300-square-foot structure scheduled for completion in mid 1988.** ***Left:*** **Once the project is sealed, water will be recycled nature's way: Evaporation from the ocean will be carried by air currents to a rain forest, where a cooling coil will condense it into rain. Then streams will carry the water through fresh- and salt-water marshes back into the ocean.**

150 to 160 species of fish that will share the system with other life forms.

Mr. Hodges, of the University of Arizona, is design consultant for the entire project. His staff will oversee the 20,000-square-foot agricultural zone, which will include crops such as basil, sage, bananas, papayas, tomatoes, rhubarb, asparagus, and corn. The biome also will include goats, chickens, birds, reptiles, and insects.

SBV began construction in January, and officials hope to activate the system in mid 1988. On July 20, 1989, eight men and women, called "biospherians," will enter for a two-year closure period, during which they will monitor and manage the miniature world. Says Kathleen Dyhr, director of information services for SBV:

"We have 12 candidates, and they are in training. At this point, we have not identified any of them or gone into the whole management structure of the closure period. We'd like to formulate a comprehensive policy before we say anything about that."

The biospherians have been sequestered from journalists during their training, but Ms. Dyhr says their backgrounds include botany, ecology, electrical engineering, total-systems management, horticulture, animal husbandry, tool-and-die engineering, and scuba diving. She adds:

"This is not an experiment to isolate people. The biospherians are inside to operate the Biosphere II system. Since we know relatively little about the earth, the purpose of this is to generate information on biospheric systems and to set up a dialogue between Biosphere I and Biosphere II."

Biosphere II will include telephones, televisions, radios, video cameras, and computerized telecommunications equipment. Computers will monitor data and transmit from Biosphere II to SBV facilities.

Because Biosphere II will be sealed, virtually everything in the structure will be recycled. Water will evaporate from the ocean and be carried by air currents to the rain forest. With the help of a cooling coil at the top of the structure, the vapor will condense and fall back to the ground, where part of it will be collected for drinking water and part will run into a stream in the middle of the rain forest. The stream will flow over a waterfall, through the forest and the savanna, splash down to a freshwater marsh, then to a salt-water marsh, and return to the ocean. The ocean will be 35 feet deep and contain a coral reef kept alive by mechanically generated waves. Because water will recirculate throughout the biosphere, pesticides cannot be used, so SBV researchers are experimenting with natural deterrents such as marigolds and ladybugs.

A structure approximately one-million cubic feet in size will be attached to Biosphere II — a "lung" that will function like an overflow tank, expanding and contracting with the shifts in atmospheric volume and pressure. In addition, a laboratory for plant-tissue cultures, a 17,000-square-foot aquaculture greenhouse, and support buildings already are operational. Presently, various species of fish are being studied, and plants from throughout the world are being grown in various soils. Experiments with hydroponics — the cultivation of plants in liquids — also are being conducted.

The biospherians' habitat will include apartments, laboratories, office facilities, workshops, libraries, and an amphitheater. By the time the biospherians emerge in mid 1991, SBV officials hope to have begun selling newfound technology to research and educational institutions, space agencies, and municipalities.

For all the optimism of the SBV team, the obstacles to success are many. According to Mr. Prance, it will be difficult to enclose a living tropical rain forest. He explains:

"We don't know if it will function. It has never been done. The engineers are working on it, and they tell me they can provide the temperature, humidity, and light a rain forest needs. We also have various data which makes us believe this will be possible, but we don't know."

"People are dependent on plants and microbes, so if we go to space, we won't go alone. We will go with nature and with a biosphere."

The National Aeronautics and Space Administration regularly checks the progress of the SBV team, according to James Bredt, chief of biological-systems research for NASA. He says:

"We're trying to develop life-support systems for spacecraft that will regenerate food in addition to air and water. So NASA is interested in anybody that is researching on closed systems that include people."

The biospherians and their support team hope to revolutionize such research. Says Ms. Dyhr:

"Human beings evolved in the context of this biosphere, and we've evolved in the context of other creatures, plants, animals, and so forth. We are biological, and we are biospherical inhabitants. We cannot have a serious, long-term space program without a feasible, ecological, self-regenerating, and evolving system.

"People are dependent on plants and microbes, so if we go to space, we won't go alone. We will go hand in hand with nature and, more specifically, with a biosphere."