IBP: THE LAST LAP

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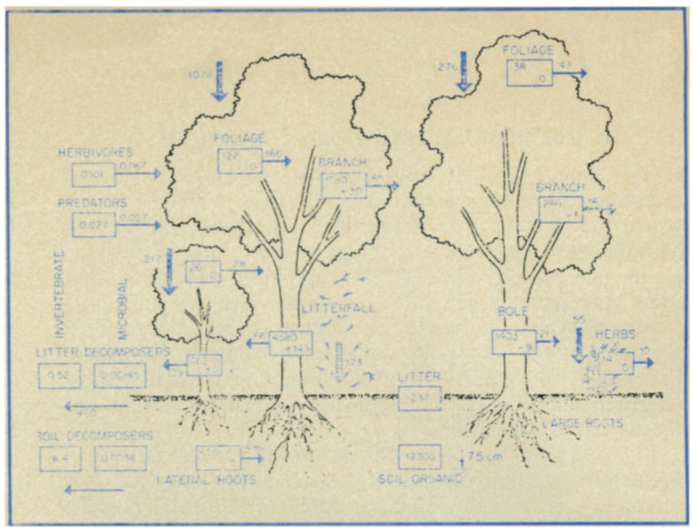


Eastern Deciduous Biome

Model of carbon use and transfer in deciduous forest.

by Joan Arehart-Treichel

A decade or so ago, the world's scientists had a vision: to understand how various components of nature make up forests, grasslands, deserts and tundras; to make computer models of these environments so the impact of changes on them could be predicted; to learn how people adapt to various enivronments.

So that the aim might be fulfilled, many scientists from various specialties —biology, ecology, mathematics, anthropology—and at various universities would cooperate in studies. Researchers in various countries would pool their results. The studies would be conducted under the auspices of the International Biological Program, to run from 1967 to 1972.

The IBP studies became a reality, with some 70 nations participating. A joint resolution introduced into Congress declared: "The International Biological Program . . . deals with one of the most crucial situations to face this or any other civilization—the immediate or near potential of mankind to damage, possibly beyond repair, the earth's ecological system on which all life depends."

But as Emilio Q. Daddario, former Connecticut Congressman and one of the Congressional backers of IBP recalls, "There were some financial problems because the budget was beginning to get tighter. IBP scientists never really did get the funding they wanted." Yet they did get funds, largely from the National Science Foundation.

Now that IBP scientists had Congressional backing, they encountered another obstacle: skepticism from many members of the scientific community. Some scientists were shocked that some of their colleagues might put aside a lifelong challenge of individual research to participate in a team research endeavor. Other scientists thought it presumptuous of IBP researchers to think that they might ever understand total forests, grasslands, deserts and tundras; or what's more, reduce these vastly complex environments to computer mathematics.

Yet that is precisely what IBP researchers did presume: to carry out the dictates of Leonardo da Vinci, who said: "No human study can be called science unless mathematical proof is possible."

The IBP, originally slated to end in 1972, got off to a late start in many areas. So it was extended to July 1974. Now that IBP is in its last lap, how close have American IBP researchers come to fulfilling their vision? Indications are that, in spite of limitations on funding, skepticism from the scientific community and even some doubts in IBP circles, the program is bringing home some strikingly valuable payoffs.

Forests, deserts, tundras and grasslands are now understood, not with the precision dreamed of, perhaps, but still far better than before. IBP scientists call these large environments "biomes," and their smaller components "ecosystems." They have made computer models of them. The models from various biomes are being compared. American results are being integrated with those from other countries.

"Our . . . research program began amidst some doubts in the professional community that the analysis of ecosystems was technically feasible," says David Reichle, an IBP scientist at the Oak Ridge National Laboratory. "We feel that we can now confidently lay these concerns to rest."

Some IBP findings are noteworthy. There is more dead than living organic material in forests, deserts, tundras and grasslands. This discovery surprised IBP investigators. Water is more of a variable than any other factor in all the biomes. Massive conversion of forests into farmlands has altered the chemistry of rivers. While identical ecosystems vary in function from one kind of biome to another, they seem to fulfill similar functions on the same kind of biome. Some 78 bird species can be found in the deserts of Arizona and Argentina, yet only three percent are common to both localities. Still, 70 percent of all bird species in both localities feed off insects. The other 30 percent feed off fruits and flowers. So birds in other deserts of the world probably feed mostly off insects as well.

Some IBP findings about ecosystems and biomes have practical implications. The disappearance of lichen from trees is an indication of air pollution. When fish are exposed to water polluted by a thermonuclear plant, they lose weight. If a forest is clear-cut rather than selectively cut by loggers, forest watersheds can change drastically. Their temperature increases. The amount of algae, nitrogen and phosphorus in them increases.

IBP models can predict many effects of drought, moisture, storms and DDT on biomes. The models should soon be able to predict effects of air pollution,

cloud seeding and erosion. "The Forest Service is committed to helping us in this [latter] important area," says Richard Waring, an IBP scientist at Oregon State University.

The models can give practical advice. They can tell loggers how much debris to leave in streams for fish habitats. They can give farmers alternatives to dropping the level of streams for irrigation when fish are spawning. (The Bureau of Reclamation is now using the model in Utah.) When herbivores graze, they apply various pressures to plants, especially in the desert. "The result can be marked shifts in vegetation composition," reports Frederic H. Wagner, an IBP researcher at Utah State University. The IBP models can offer ranchers advice on how to selectively graze herbivores in order to preserve grasses and shrubs.

"Some questions," Waring admits, "are too complex for the models. We cannot run them for a hundred years." Still, he says, the models provide "a general means of asking questions."

"Modeling techniques," says Wagner, "are new. We're excited about their potential."

IBP scientists working on human adaptation to various environments have complained that funds for their studies have been less generous than for the other biome programs. Still, they have come up with some valuable results. The remarkable influx of people from rural areas into cities is not just an American, but a worldwide phenomenon. Migrants throughout the world are also remarkably alike. They are young, healthy, optimistic and brimming with productive potential. These assets may be a contribution to cities, but they are definitely a drain on rural areas. Tribal leaders in Africa are losing the same people-power that farmers in southern Georgia are. One positive spinoff of urban migration is that once women get into cities, they get jobs and bear fewer children. The result is a drastic drop in the birth rate.

"The magnitude," declares Everett S. Lee, an IBP scientist at the University of Georgia, "is greater than the industrial revolution. It is really an urban revolution."

IBP studies show that people who continue to live in remote areas of the world and to follow primitive customs do not have heart disease, high blood pressure, high levels of cholesterol in their blood, dental disease, measles and other ills of modern life. If there is anything that sets these other-world people apart, it is their physical fitness. Some of the oldest persons in the world are found in their midst.

Some of these other-world peoples maintain a remarkable balance with their environment. Indians in the Andes of Peru have organized their lives so that they get the best mileage possible out of a low caloric intake, reports R. Brooke Thomas of Cornell University. The children start herding animals at six years of age because they require less energy for the job than adults do. A family can conserve 30 percent of their energy, or 100,000 calories a year, by having their children do the herding. During the summer, after crops are harvested, the people carry out weaving and other sedentary tasks to conserve their energy.

A high infant death rate holds down the size of the community and relieves pressure on limited food supplies. The children also grow more slowly than children elsewhere in the world, which results in a saving of 44,000 kilocalories a year per child.

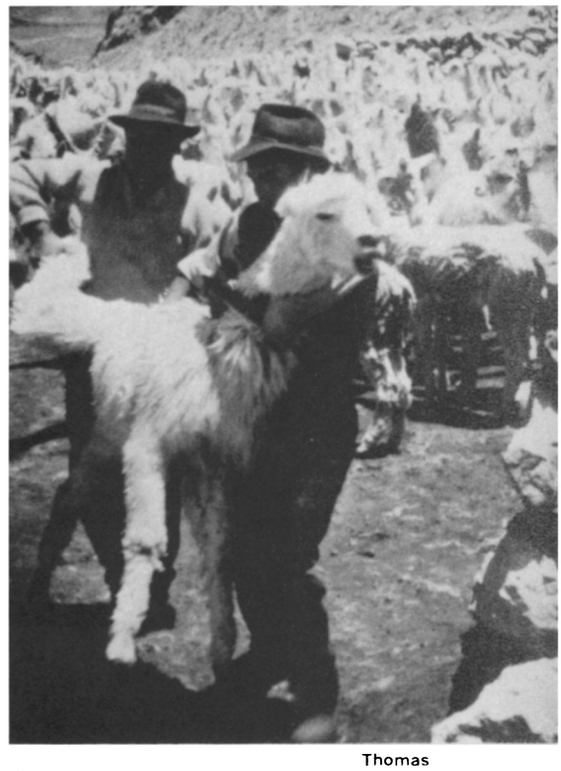
Like the biome studies, the human adaptability studies have practical advice to offer. For example, bringing outside food supplies or medical care to the Peruvian Indians could upset the Andean way of life as it has existed for centuries.

The IBP studies have spurred unprecedented team cooperation among scientists, especially among scientists from diverse specialties. Some IBP scientists view this cooperation as one of IBP's greatest achievements. The IBP studies have given women scientists exceptional opportunities. When Frieda Taub of the Coniferous Forest Biome Study in Seattle, was elected to a Standing Publications Committee for the U.S. IBP, no one asked, "What, a woman? And a pregnant woman at that!"

The next few months will see the final synthesis of all IBP results. "Integration of information," says John F. Reed, chairman of the U.S. National Committee for the IBP, "is an enormous task." The IBP researchers hope their results will be viewed favorably not only by the agencies that have funded them but by the scientific community at large. They hope they will have encouraged more scientists to look at the larger aspects of life without forever concentrating on small parts of the whole.

"We wonder," Lee challenges his fellow scientists, "whether once and a while you shouldn't put down your microscopes and look at things about you." □

For SCIENCE NEWS coverage of interim IBP results, see: "Grassland biome network: Results of first year (SN: 10/23/71, p. 282); "Body changes near the snow line" (SN: 3/4/72, p. 154); "When people migrate" (SN: 6/17/72, p. 395); "This is the forest primeval" (SN: 7/29/72, p. 78); "IBP: Predictive ecology biome by biome" (SN: 12/9/72, p. 373).

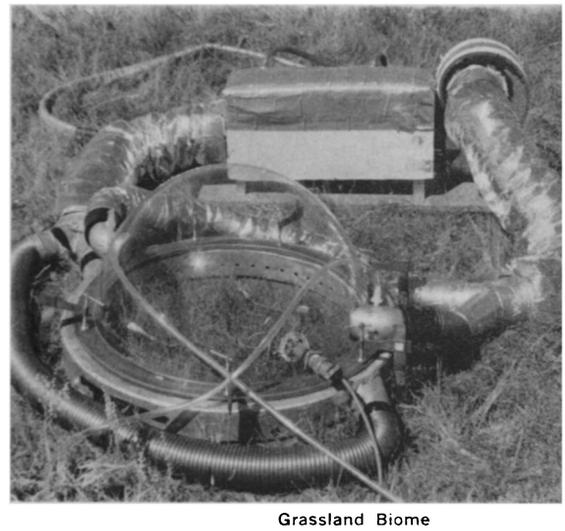


Thomas

Gearing activities to environment.

Grassland Biome

Monitoring buffalo's food intake.



Grassland Biome

Measuring grassland photosynthesis.