The Battle for Planet Earth

Two OU biologists emerged from the tropical rain forests convinced that overpopulation and disregard for the ecosystems threaten human survival.

We are in the midst of a global war.

On one side of the conflict, people believe they are fighting for the very survival of the human race. On the other side, people insist that their livelihood and even their religious beliefs are being threatened by zealots who care more about spotted owls than human beings.

While conducting their research on biodiversity, two University of Oklahoma scientists have observed the rapid encroachment by land-hungry humans on the rain forests in the New World tropics. They line up squarely on the side of those who argue that, if drastic measures are not taken, the consequences of rapid population growth will affect the quality of human life on a global scale.

Laurie Vitt and Janalee Caldwell, both OU zoology professors and herpetology curators at the Oklahoma Museum of Natural History, take time from their busy teaching and research schedules to speak out on what they believe to be the greatest challenge ever faced by humankind.

At the time of the *Sooner Magazine* interview, the husband-wife research team had just returned from an expedition funded by the National Science Foundation to an Amazonian rain forest area in northern Brazil, where they spent two months studying and documenting the biodiversity of reptiles and amphibians. (Vitt's specialty is reptiles, Caldwell's amphibians.) This expedition was part of a long-term project to be conducted at nine sites encircling the Amazon River.

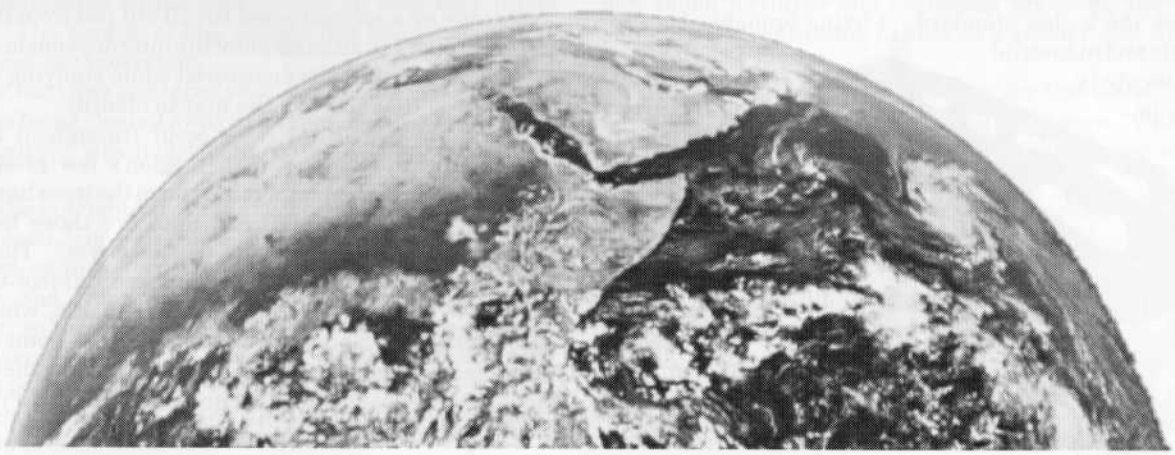
Both researchers are noted for their work in Brazil and Central America and have discovered numerous previously unidentified species—and they are witnessing firsthand the demise of many more.

In their shared office suite adjoining the museum, they discuss a well-documented biological principle known as "carrying capacity," which recognizes that a given environment has a limit as to how much life it can support.

"The carrying capacity for any environment is finite," Caldwell says, rummaging through a stack of books on her conference table to find a chart illustrating the demise of a deer species that exceeded the carrying capacity of its environment. "If a population grows beyond the carrying capacity, the population is reduced by disease and famine."

"If you leave an orange sitting out,

by Judith H. Wall
OU News Services



Biologists have sounded the alarm for years, but population keeps doubling.

pretty soon it is covered with mold," Vitt explains. "The mold flourishes until the resources of the orange are depleted, and then the mold dies. The world's population growth is like a fungus on the orange. When resources are depleted, our population will crash. The fungus might be able to move to another orange. Humans don't have another place to move to.

"We've seen this phenomenon in animal populations," he continues. "We're seeing it now in some human populations in Africa, where the carrying capacity has been exceeded.

"Biologists have been sounding the alarm about this for years," Vitt adds. "The population keeps doubling. It can't go on. Competition for resources will become more and more extreme. There'll be more wars. More famines. More disease. Environmental problems are a by-product of overpopulation and the associated industrial development."

In 1834, one billion people inhabited the earth, Caldwell says, turning to a population chart in another book. By 1934, the earth's population had doubled to two billion. The most recent billion people was added in 12 years. With a current population of 5.2 billion, the next billion is projected to be added in just 11 years. Every 24 hours enough people are added to the earth's population to fill a city the size of Newark or Akron.

While great strides have been made in food production, resource extraction, science and medicine, a vast majority of the 5.2 billion people inhabiting the planet do not—and never will—reap the benefits of these advances, Vitt and Caldwell point out. Only a handful of countries consume a majority of the resources.

Already many areas of the world are overpopulated to the extent that famine, disease, malnutrition and starvation are commonplace, as are other manifestations of overcrowding—war and rampant crime. The United States and other wealthy countries are being invaded by people who seek the higher standard of living brought about by economic and industrial development.

Ultimately, the debate under way in the United States about whether or not immigration should be limited will no longer matter, Vitt insists. "The United States won't be able to keep out illegal immigrants. One area of the world cannot exist in isolation."

The OU professors describe with great concern the encroachment of human beings on the wilderness as they have witnessed it in the Amazon Basin, Central America and southern Mexico.

"In every single place we've worked, the forests were being cut and burned," Caldwell says. "In two different areas, 2,000 miles apart, the forest was cut and burned, destroying our study areas, as we looked on."

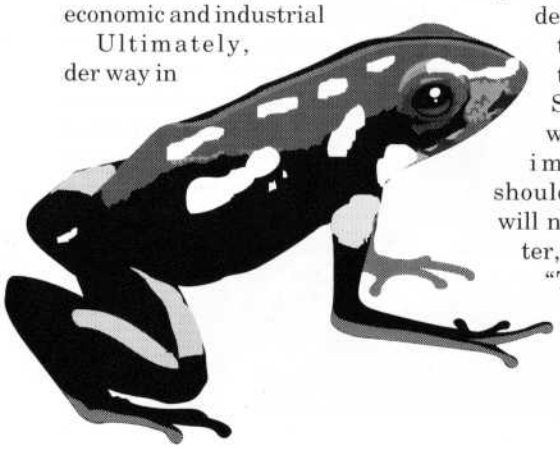
As biologists, Caldwell and Vitt lament the impact on individual species. But the overriding concern of all ecologists ultimately is not for individual species but for ecosystems. No one creature or plant exists in isolation of other organisms. The stability of the world's ecosystems is based on interdependence, the two professors emphasize.

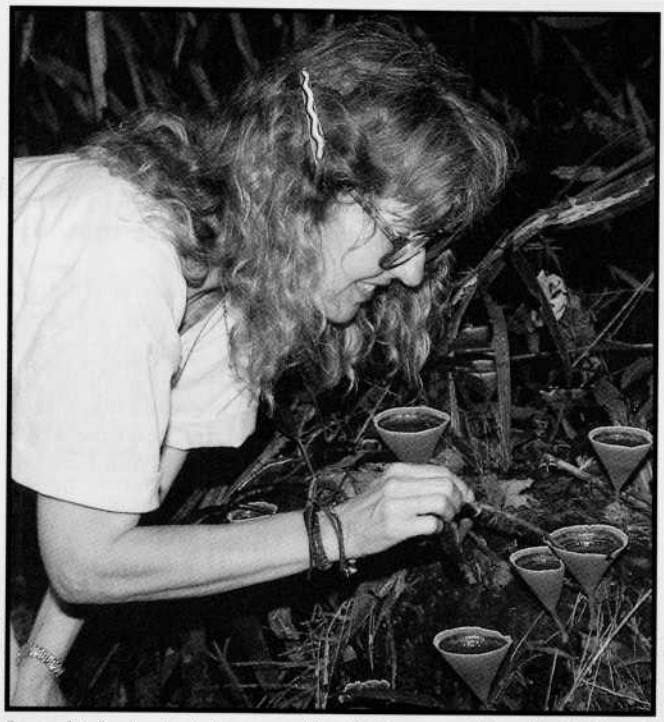
Laurie J. Vitt

In the complex ecosystem of the rain forest, the Brazil nut fruit capsule above plays host to frog and predaceous insect larvae, which compete in a "bigger eats smaller" race to develop and get out of the capsule as adults. The toad species, Bufo castaneoticus, *above, and the small dendrobatid frog, below, were unknown to science until discovered and named by OU's Janalee Caldwell.*

Picking up a coconut-sized Brazil nut pod from the table, Caldwell offers as an example of the interdependence among organisms one that she discovered while studying two species of frogs that she was the first to identify.

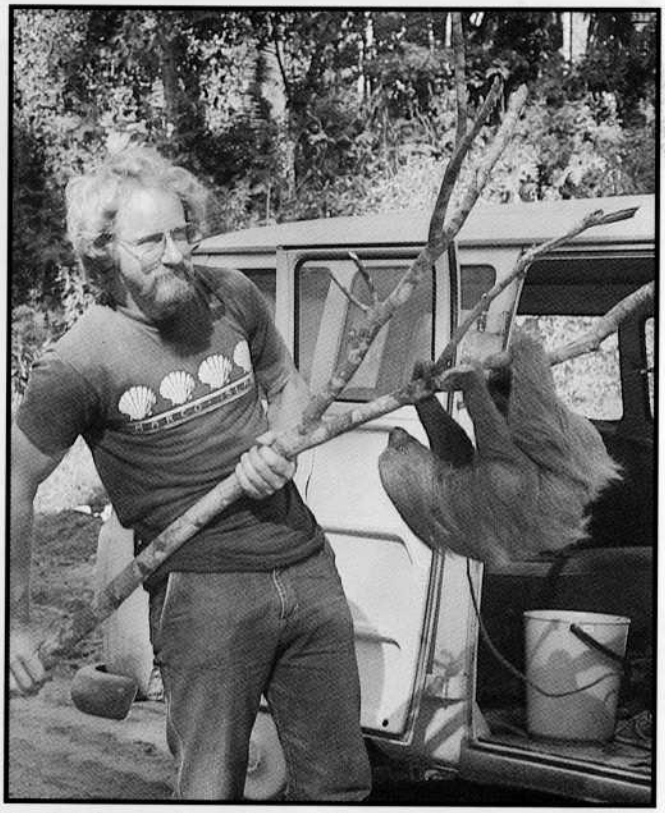
Stands of Brazil nut trees occur throughout the rain forests and provide one of the region's few products for export. Attempts to commercially farm the trees have failed, and the only source of Brazil nuts are those harvested directly from natural stands in the forest. The rather formidable nut pods that fall from these 120-foot-tall trees provide food for small rodents called agoutis, which chew through the tough husks and stash the seeds, some of which germinate into new seedlings. Without agoutis, the seed pod would not be opened, and the reseeding of Brazil nut trees would not take place.





Laurie J. Vitt

In a biological station north of Manaus, Brazil, Caldwell examines a cluster of rare cup-like fungi, the first of its kind she and Vitt had observed after years of working in the Amazon.



Janalee P. Caldwell

In studying reptiles and amphibians in the field, the OU biologists often encounter species such as a sloth Vitt confronted as it fled a burning forest in the state of Rodonia in western Brazil.

The open seed pods collect water, providing a protected breeding ground for the larvae of two species of frogs and two insects. Tadpoles eat the insect larvae—or the larvae eat frog eggs or tadpoles, depending on which grows larger first. These species depend on the Brazil nut husk to produce the next generation.

Bees feed on the Brazil nut tree blossoms and cross-pollinate the trees. And Caldwell says there are probably other interrelationships in this system not yet identified.

"The Brazil nut represents a microcosm of the complicated interdependence we see in nature," Caldwell explains. "Cutting Brazil nut trees to clear land for agriculture threatens not only the future of the tree but of numerous animal species."

The microcosm based on the Brazil nut tree is part of the larger ecosystem of the rain forest. Nature is composed of small microcosms within ecosystems, all delicately interrelated. The demise of one species has cascading effects throughout the ecosystem.

Brazil nut trees and other vegetation comprising the rain forest are being cleared away at a rapid pace to provide land for agriculture, which upsets the natural balance, Caldwell says.

"But the nutrients are in the vegetation of the rain forest, not in the soil," she continues. "The soil is actually very poor. After two or three years of agriculture, the soil will not produce, and crops will fail. The farmers can't afford fertilizer, so they cut down more trees."

The forest never comes back, she insists. All the nutrients are gone. The seed sources are gone.

"When it rains, the water runs off and takes whatever nutrients are left to the sea," Vitt injects.

As the land is clear-cut at a rapid rate and planted with crops, it goes from high species diversity to low species diversity, the two professors point out.

"If we eliminate natural growth and plant miles and miles of citrus trees or wheat or bananas, a monoculture replaces natural growth. Parasites and predators that thrive on that particular crop invade the area," Vitt says. "To counteract this, huge amounts of pesticides are used that contaminate water, adversely affect aquatic organisms, and ultimately cause health problems for human beings."

No easy alternative exists to using more and more pesticides as we attempt to feed more and more people, he adds.

Yet, no matter how many forests are cleared, no matter how much fertilizer and pesticides are used, the world's population is continuing to grow at a greater rate than food production.

"The per capita food production for the world is going down while population is increasing," Vitt says. "Our ability to produce food is improving, but it can't keep up with the population.

"It's hard to convince people in this country that there is a global emergency," Vitt continues. "We need to take drastic measures, to reduce the rate of resource depletion, to change the way we live, to limit population growth. But when people ignore the evidence that a problem exists, how can you possibly begin to tackle it?"

In the arena of global politics, the problem is even more complex, Vitt says.

"If America, the greatest consuming nation in the world,

Laurie J. Vitt

Laurie J. Vitt

The natural rain forest of the Amazon, top, is breathtaking, containing 140-foot trees and thousands of species as yet unknown to science. The burning forest, below, destroys the nutrient base of future forests while obliterating vegetation and wildlife, such as Caldwell's new-found dendrobatid frog.

tells a Third-World country that it needs—at the expense of its economic development—to stop cutting down the forest to stabilize the world's environment, the response is entirely predictable."

The two professors are not hopeful. They single out two problems—politics and religion—among the many other seemingly insurmountable ones standing in the way of realistic solutions.

Politicians, they contend, are elected for the short term and tend not to think past the next election. Politicians with real vision cannot be elected by voters who themselves don't appreciate the enormity of the problem.

And although millions of children starve to death every year, religious and ethnic groups generally are opposed to restricting population growth. The doctrines of the world's major religions were formulated at a time when the world population still numbered in the millions.

"Every group of people considers efforts to control population growth directed at them—that some form of ethnic genocide is being suggested," Vitt says.

"We make our own future," he adds. "Loggers will cut down the last tree on earth. We don't have the foresight to see—or we don't want to see—that we can't put a relatively few jobs in the short term before the future of the human race."

"There's a whole history of people changing jobs to adjust to realities," Caldwell adds. "We don't have the same set of jobs in this country that we had 25 or 100 years ago."

A Cal-Berekley colleague of the two OU professors has determined that, last year, the U.S. government spent three times more developing the space toilet than it spent fixing the environment. "And the space toilet doesn't even work!" Vitt says.

"Exploring space isn't going to solve the problems here on earth," he continues. "Twenty-five years from now, Mars will still be exactly as it is today. Earth, on the other hand, will be even less able to support human life than it is today—unless, of course, the crash has already occurred."