# Biomass Burning Ignites Concern

Burning practices around the world pollute the atmosphere far more than scientists had assumed, leaving once-pristine tropical regions bathed in high levels of harmful ozone and acid precipitation, researchers reported last week in Williamsburg, Va., at the first international conference to address the issue of biomass burning.

Scientists once viewed air pollution as a problem primarily of smokestacks and tailpipes, but a growing body of evidence shows that intentionally lit fires over the globe also contribute significantly to pollution levels and could play a major role in changing Earth's climate. "[Fires related to] agricultural practices and land-use conversion have a very large impact on the overall chemistry of the atmosphere. That is something that has come as a surprise," says Paul J. Crutzen, an atmospheric chemist from the Max Planck Institute for Chemistry in Mainz, West Germany.

Fires cover about 2 to 5 percent of the Earth's land areas each year, and scientists at the conference estimate that humans light more than 95 percent of them, says Joel Levine of the NASA Langley Research Center in Hampton, Va., who organized the meeting. The fires burn primarily in tall-grass savannas, in tropical rain forests and on farms around the world.

Concern over the effects of biomass burning has grown since the late 1970s, when Crutzen first alerted scientists to the widespread emission of gaseous pollutants from fires. In the last few years, researchers have carried out studies in Africa, South America, the United States and elsewhere to measure how biomass burning affects the local and global environment.

Among the results reported at the meeting:

• Levels of ozone in the troposphere (lower atmosphere) over certain regions of tropical Africa are approaching values shown to be toxic to plants, says Meinrat Andreae of the Max Planck Institute. Tropospheric ozone, which irritates the eyes and lungs as well as harms vegetation, forms when sunlight energizes chemical reactions between nitric oxide, hydrocarbons and carbon monoxide — three kinds of chemicals emitted during combustion. It also adds to the greenhouse effect.

In field experiments in the Congo, researchers from Germany, France and the Congo measured monthly average ozone levels as high as 40 parts per billion at ground level and 100 parts per billion in air during the dry season, when fires are worst.

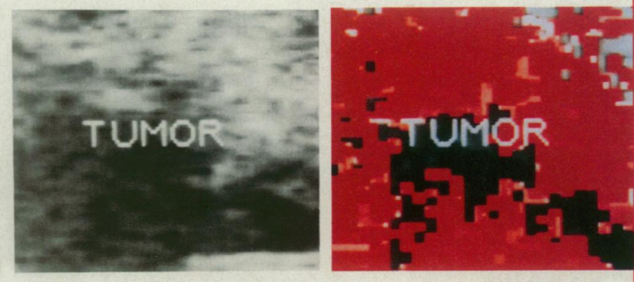
The ground measurements verify satellite data collected over the past few years, which suggest that levels of tropospheric ozone over a wide region of the tropics are much higher than researchers believed. Without confirmation from ground-based studies, many scientists questioned the high values measured by satellite.

The satellite data indicate that ozone over broad regions of unindustrialized West Africa reaches levels comparable to those over the heavily industrialized eastern United States, says Jack Fishman of NASA Langley. Satellite measurements also show high ozone levels over Indonesia and South America, particularly Brazil. Moreover, Fishman reports, aircraft and satellite data collected last year suggest that ozone from fires in Africa travels clear across the Atlantic and can be measured in easternmost Brazil.

• Measurements taken over the last several years in the Ivory Coast and Congo reveal unexpectedly high acidity in the rainwater. "Our data show that acidity fluxes in regions of the tropics are of the same order of magnitude certainly as those we get in the eastern United States," says Andreae. Other researchers have found high acidity levels in rain falling over the Amazon.

Much of the acidity comes from gases emitted by fires, says Levine. Combustion

## Vibration imaging: Sounding out tumors




Parker, Lerner

*Left: Conventional ultrasound image of a human malignant prostate tumor shows a faint impression of a possible tumor that would warrant a biopsy to determine whether it is malignant. Right: The same tumor imaged with doppler vibration reveals distinct differences between the stiff malignancy and the surrounding healthy tissues. The tumor appears dark, while the softer, healthy tissues show up in red.*

Two researchers are tooting their own horn to detect cancerous tumors. The new technique, called doppler vibration imaging, is the first to use a horn's low-frequency sound waves to create vibrations that distinguish between hard and soft tissues, they say. Malignant tumors are more rigid and vibrate less rapidly than surrounding healthy tissues, offering a potentially useful diagnostic clue.

Tumors embedded in soft tissues such as the prostate, breast, liver and spleen often escape early detection because they can't be seen or felt, says Kevin J. Parker, who developed the imaging technique with Robert M. Lerner. The two University of Rochester scientists describe their work in the April ULTRASOUND IN MEDICINE AND BIOLOGY.

Like conventional ultrasound, doppler vibration uses sound waves to image targeted tissues in the body. Ultrasound, however, bombards tissues with inaudible sound waves at more than 20,000 hertz, and the echoes returning from tumors and healthy tissues can be identical, leaving the tumor undetected, Lerner says. Doppler vibration instead uses a speaker-like horn to generate whisper-soft sound waves at 200 hertz. A doppler device detects the resulting tissue motion, and a video screen displays a color "map" of the contrasting vibrational patterns.

Using the new method in rabbit livers and in human prostate and breast samples, the Rochester researchers say they have detected cancerous tumors that conventional ultrasound missed. They plan to conduct clinical trials and compare the method's sensitivity to that of other imaging systems in about a year. Lerner says the technique, if successful, would be much more affordable and more widely available than the magnetic resonance imaging sometimes used to detect prostate tumors or the CT scans often used to detect tumors in the liver and spleen.

"I'm convinced the principle [of the technique] works," says Daniel Rachlin of Stanford University, who has used doppler vibration imaging with synthetic tumor models. But the real test, he says, will come when researchers compare it with other imaging methods.

*— C. Decker*