

## Nations to ban ozone-harming compounds

Fifty-nine countries took an unprecedented environmental step last week by consenting to stop producing chemicals that destroy the Earth's protective ozone layer. The agreement requires the United States and other developed nations to set up a fund of at least \$160 million to help poorer countries in their shift toward less damaging chemicals.

The new measures significantly strengthen a 1987 treaty that required a 50 percent cut in production of only certain chlorine-containing chemicals — a reduction that would not successfully protect the ozone in Earth's stratosphere. The original agreement, called the Montreal Protocol, was weakened further when China and India declined to ratify it, saying the treaty did not provide sufficient assistance to developing countries in the form of money or technology.

With the establishment of the new fund, representatives of India and China said they would urge their nations to ratify the protocol as soon as possible. If both countries join, the fund will increase to provide developing nations with a total of \$240 million over the next three years, with the United States contributing \$60 million. Until two weeks ago, the Bush administration had opposed contributing to this type of assistance fund.

Settling the questions of technology transfer and establishing the fund proved the most difficult steps in reaching the agreement, says Richard J. Smith of the State Department, who represented the United States at preconference negotiations in London. Last week's discussions were much more complex than those leading to the Montreal Protocol, he adds.

The new agreement requires participating nations to end production of chlorofluorocarbons (CFCs) and halons by the end of the century, whereas the 1987 protocol called for a 50 percent cut in CFC production and a freeze on halon production by 2000. Today, CFCs have widespread industrial uses in refrigeration, air conditioning and the production of foam and insulation. They also serve as solvents for cleaning electronic equipment and, in some countries, as propellants in aerosol cans. Halons are used in fire extinguishers.

Chlorine from such chemicals thins the stratospheric ozone layer, which filters out harmful ultraviolet radiation. CFCs and halons also contribute to global warming.

The revisions also regulate other important chlorine-containing solvents not mentioned in the 1987 protocol. Participating nations have agreed to lower production of methyl chloroform by 70 percent by the year 2000 and to end its production by the year 2005. They will also reduce carbon tetrachloride production by 85 percent by 1995 and stop pro-

ducing it by the end of the century.

The agreement includes a nonbinding provision to phase out hydrochlorofluorocarbons (HCFCs) by 2040, and if feasible by 2020. HCFCs destroy ozone, although to a lesser extent than CFCs, and many companies have been developing these compounds as replacements for CFCs.

Thirteen nations pushed for a CFC phaseout before the year 2000. Although they failed to work that into the treaty, they committed themselves to a complete phaseout by 1997 at the latest.

## Florida 'circles' may be ancient fisheries

A mysterious, prehistoric network of circular canals and earthen mounds dotting the landscape of southern Florida's interior may represent North America's earliest known fisheries, says archaeologist Robert S. Carr, who described his ongoing investigation of the sophisticated Indian construction projects to *SCIENCE NEWS* last week.

Some of the nearly 40 "earthwork" sites — most discovered by Carr since 1974 — date to as early as 450 B.C. Others originated at about the time the Spanish explorers reached Florida in the 16th century. The carefully engineered structures indicate that prehistoric hunter-gatherers inhabiting inland regions of southern Florida developed socially stratified societies based on fish harvesting, asserts Carr, who directs the non-profit Archeological and Historical Conservancy in Miami.

An agricultural way of life is usually considered essential for the nurturing of social classes, but Indians in southern Florida and the Pacific Northwest — another region where marine resources abound — broke that rule, he says. Anthropologists have long noted that Indians along Florida's southern coast developed stratified societies with powerful chiefs and shamans although these tribes fished and hunted rather than planting crops. Inland inhabitants probably had a social elite that coordinated construction of fish harvesting sites, Carr maintains.

Other investigators have speculated that Florida's earthworks either served some type of ceremonial purpose or provided drainage ditches for maize fields. But early Spanish accounts contain no mention of agricultural activity in southern Florida. Moreover, researchers have not identified maize pollen at any of the circular canals.

"Carr's new interpretation is a viable alternative theory," says archaeologist John Griffin, retired chief of the National Park Service's Southeast Archaeological Center in Macon, Ga. Indians living along

Environmental groups and several nations view the revised protocol as a model for future negotiations addressing the more complex problem of global climate change. Many countries argue that the industrialized world is largely responsible for ozone loss and the threat of global warming, and therefore must help the developing world wean itself from polluting technology, notes S. Jacob Scherr of the Natural Resources Defense Council in Washington, D.C. Negotiators from the United States, however, inserted language into the new agreement stipulating that the ozone treaty does not set a precedent for solving other environmental problems. — R. Monastersky

southern Florida's coast were avid fish consumers, Griffin notes, so the construction of numerous inland fisheries "makes sense given the overall regional pattern."

Using aerial photographs, Carr discovered a unique earthwork complex early this year. A rectangular earthen "plaza," 400 feet wide and 200 feet long, dominates the site. Pottery from several large sand mounds near the plaza dates to sometime between A.D. 1200 and A.D. 1600, Carr says.

The earthwork sites more commonly feature circular ditches, some up to 1,450 feet in diameter and 6 feet deep, located in the savannas and floodplains adjacent to Lake Okeechobee and various creeks and rivers. Lake Okeechobee is located in mid-southern Florida. The man-made circles contain strategically placed gaps where drainage canals extend outward, Carr says. At one site, aerial photographs of a large circle show the traces of two pronged channels draining from a nearby river. Another site features a circle with two prongs allowing for the diversion of water from a creek.

The Indians could easily have blocked the channels to trap fish that swam into the ditches, Carr contends. However, evidence confirming his theory — such as fish bones embedded in the bottom of a ditch — has not been found.

The circular structures may also have functioned as ceremonial sites, he says. All the circles investigated so far surround earthen mounds, which may have been human burial mounds.

Most of the ditches are near sites of ancient settlements, he adds. They bear some resemblance to 1,700-year-old circular canals in southern Ohio, which scientists attribute to the Hopewell Indian culture, but Carr says the "Hopewellian circles" clearly were used to drain cornfields.

He plans to further investigate the curious earthworks this fall, focusing on a site containing two large canals just west of Lake Okeechobee. — B. Bower