in that layer. But because the thickness of the layer has not increased during that time, the hole's depth hasn't, either. And its breadth—the width of the hole—has increased only slightly since the mid-1990s. "That's positive news," says atmospheric physicist and assessment chapter co-author Paul Newman of NASA's Goddard Space Flight Center in Greenbelt, Maryland. With ozone-destroying halocarbons expected to be on the decline, Newman says, "by 2010, we could see 5 to 6 years when the hole looks consistently smaller than during the past 5 years."

Encouraging news is coming from the Arctic, as well. That scary string of low-ozone years in the mid-1990s (researchers never rated them "holes") ended with 1997. Four of the 5 years since have seen minimal springtime ozone losses. The Arctic, it turns out, was not plunging into a full-blown, Antarctic-like ozone hole. New modeling reported in the assessment suggests that it might never do so. An early model study had suggested that the greenhouse gases that cool the stratosphere would encourage PSC formation and cause a massive ozone loss (*Science*, 10 April 1998, p. 202). "It's really looking like the more detailed models don't give that [low-ozone] result," says atmospheric chemist Susan Solomon of the National Oceanic and Atmospheric Administration in Boulder, Colorado.

Outside the polar regions, ozone has fared better than feared too. In the 1990s, rather than worsening over the northern midlatitudes, ozone depletion all but ground to a halt. Researchers aren't sure what caused the slowdown. Plateauing halocarbons certainly played a major role, but some researchers have suggested that changes in atmospheric circulation have been a key factor as well (*Science*, 22 June 2001, p. 2241). If natural variations, global warming, or even ozone depletion itself increased the amount of air moving into midlatitudes from the ozone-rich tropics, for example, midlatitude ozone would be bolstered.

There is increased evidence that atmospheric dynamics has in fact contributed to the leveling off of midlatitude ozone depletion, says dynamical meteorologist and chapter co-author William Randel of the National Center for Atmospheric Research in Boulder: "Some fraction of ozone changes—probably less than 50%—may be associated with changes in the dynamics of the stratosphere." No one can say what proportion of dynamically induced ozone change might be natural and how much is human induced.

A certain amount of optimism runs through the assessment, but so does a note of caution. The effect of climate change remains uncertain, not just on the Arctic but the whole stratosphere. The assessment also notes that although damaging ultraviolet radiation has increased on the order of 10% in some regions, ozone depletion has not been the only cause. Difficult-to-predict changes in cloud cover and pollutant hazes have altered and will continue to alter the amount of ultraviolet reaching the ground, it says. And then there's the human element. Further reductions in the production of ozone-destroying halocarbons are required in the next few years under the Montreal Protocol, especially by developing countries. Without continued reductions, the assessment concludes, ozone recovery could be delayed decades or even indefinitely. **–RICHARD A. KERR**

CREDITS (TOP TO BOTTOM): ELAINE THOMPSON/AP; THIERRY CENNEN/CGIAR

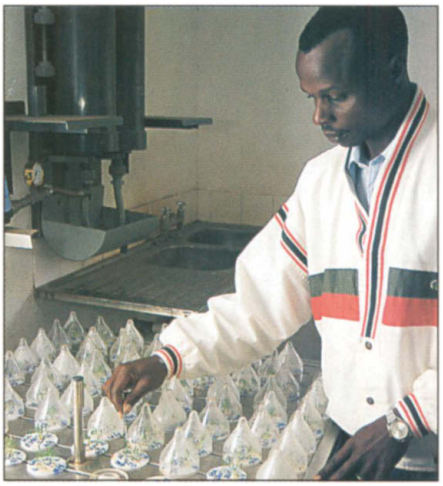
PLANT SCIENCES

Rescue Planned for Seed Banks

Plant germ plasm is a political hot potato. The issue of access to—and payments for—samples stored in gene banks was a sticking point for a treaty signed last fall by 116 nations (*Science*, 26 October 2001, p. 772). Now it could haunt a new proposal, announced last week, aimed at preserving a deteriorating global network of gene banks.

On 29 August, a new organization called the Global Conservation Trust used the United Nations (U.N.) World Summit on Sustainable Development in Johannesburg, South Africa, to announce a drive to raise a $260 million endowment to rejuvenate these seed banks. A report also released at the summit shows that shrinking budgets and smaller staffs are hindering repositories' ability to keep seeds available to breeders for improving strains or fighting diseases.

Crop gene banks around the world hold perhaps 2 million varieties of plants. Some of these, such as wheat, can be stored for years as seed. Others must be maintained in tissue culture. But even seeds need occasional replanting to ensure a viable supply, a laborious



Undernourished. Many gene banks lack resources to care for rare crop varieties.

ScienceScope

Anthropologists Win on Kennewick A federal judge has ruled that the U.S. government must allow scientists to study the bones of Kennewick Man, an ancient skeleton unearthed on the banks of the Columbia River near Kennewick, Washington. The 30 August decision marks a clear victory for a team of eight anthropologists who have fought to gain access to the 9300-year-old skeleton, arguing that it could offer new clues to how people first arrived in America. But the ruling might not end the 6-year legal tussle, as the Justice Department can still appeal the decision.

Kennewick Man, known as "the ancient One" to Native Americans, was discovered in 1996. The 380 bones and bone fragments compose one of the most nearly complete sets of ancient remains ever found in North America. Government researchers completed an initial analysis of the skeleton in 1998. But it was placed out of scientific bounds 2 years ago, when then–Secretary of the Interior Bruce Babbitt ruled that a 1990 law called the Native American Graves Protection and Repatriation Act required the skeleton to be given to the five modern Native American tribes that claimed him as an ancestor and sought to have him reburied (*Science*, 29 September 2000, p. 2257).

In his 73-page ruling, U.S. Magistrate John Jelderks of Portland, Oregon, called Babbitt's decision "arbitrary and capricious." After reviewing some 22,000 pages of documents, Jelderks ruled that there was insufficient evidence to link the skeleton to any modern tribe. "Allowing study is fully consistent with applicable statutes and regulations, which are clearly intended to make archaeological information available to the public through scientific research," Jelderks wrote. Plaintiff attorney Alan Schneider calls the decision a "landmark" because it sets an important precedent that should give researchers access to future discoveries of ancient remains.

"We are delighted with the decision," says Robson Bonnichsen, who heads the Center for the Study of the First Americans at Texas A&M University in College Station and was a plaintiff in the case. He says researchers hope to carry out a wide variety of tests on the skeleton, including skull measurements and possibly DNA tests, to pinpoint the origin of the bones. The ruling gives the researchers 45 days to submit a study proposal to the Department of the Interior and another 45 days for the government to respond.

and costly process called regeneration. A 1996 survey of 151 countries by the U.N. Food and Agriculture Organization (FAO) found that many facilities were rapidly deteriorating and had a large backlog of samples needing regeneration. A follow-up survey in 2000, analyzed by Chris Higgins and colleagues at Imperial College London, U.K., concludes that "the situation has gotten worse," says Geoffrey Hawtin, director of the International Plant Genetic Resources Institute in Rome, Italy.

For Enrique Suárez, director of the National University of Agricultural Technology's main gene bank, in Castelar, Argentina, that means insufficient staff to regenerate samples. And the recent devaluation of the peso has left him too poor to buy specialized sample bags to refrigerate some 30,000 samples awaiting curation. "The work at the gene bank is stopped," he says. "It's very frustrating." Plant samples are stacking up in two-thirds of the countries surveyed, and the budgets of a quarter of gene banks have been trimmed.

The Global Conservation Trust teams FAO with the Consultative Group on International Agricultural Research, which runs 11 major gene banks. At the summit, the Swiss government ponied up $10 million, but trust officials say they need 10 times that figure before they will solicit proposals.

Uncertainty about the governance of the trust could spell trouble, warns Pat Mooney of the ETC Group in Winnepeg, Canada, which defends the rights of farmers in developing countries. Some governments might misconstrue the endowment as a way for industrialized countries to gain control over germ plasm resources, he cautions. "What worries me a lot is that it will open a wide vista for agribusinesses to serve their own purposes," says Melaku Worede, an agricultural consultant based in Addis Ababa, Ethiopia. But the trust's Ruth Raymond says that developing countries will have a voice in the trust's governance structure, and that several countries are interested in contributing. **–ERIK STOKSTAD**

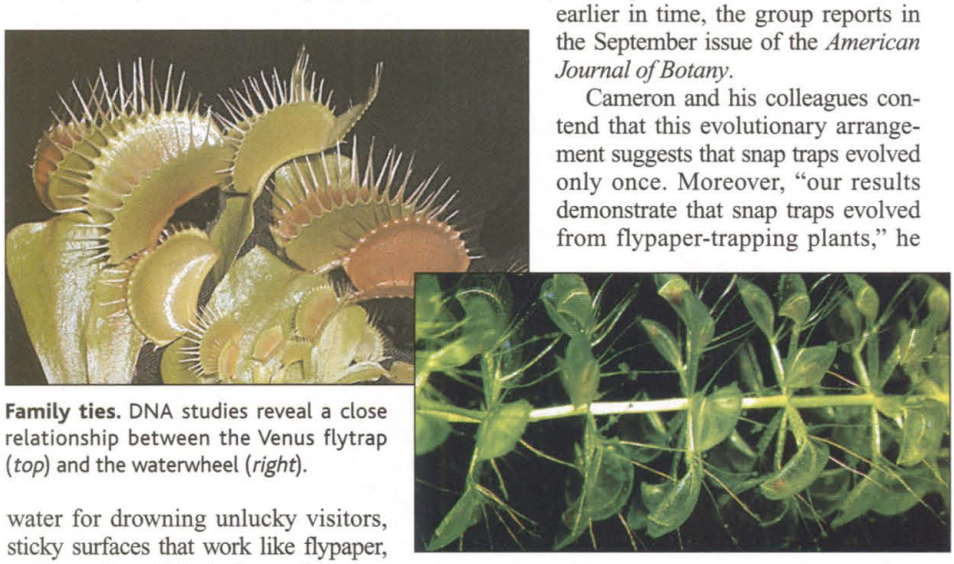
PLANT EVOLUTION

Elaborate Carnivorous Plants Prove to Be Kin

The Venus flytrap has a muddled family history. Charles Darwin thought this elegant bug eater from the southern United States had close ties to a European aquatic weed called the waterwheel. A century later, researchers decided that the waterwheel's closest kin was not the Venus flytrap but the terrestrial sundew, which also dines on insects. Now a DNA analysis of these botanical carnivores suggests that Darwin's hunch was right after all.

In many ways, this revised family history makes sense, comments Mark Chase, a plant systematist at the Kew Royal Botanical Gardens in Surrey, U.K.—even though he once suggested otherwise. Of all the plants that feast on animals, waterwheels and Venus flytraps "have taken carnivory to the extreme," he notes: Each has leaves reshaped into traps that snap shut. Now that their close relationship is "nailed down, it sets the stage for people to ask more intelligent questions about how these mechanisms evolved," Chase points out.

Carnivorous plants have come up with a variety of ways to snare their prey: pools of water for drowning unlucky visitors, sticky surfaces that work like flypaper, or "snap traps" that clamp down on morsels in milliseconds. Sundews are flypaper predators; waterwheels and Venus flytraps depend on snap traps. All use their prey not as a food source but to provide minerals.



Family ties. DNA studies reveal a close relationship between the Venus flytrap (*top*) and the waterwheel (*right*).

Evolutionary biologists have long speculated about how these features evolved. In the late 1800s, Darwin picked up on similarities in the stamens and pistils—a flower's reproductive parts—of waterwheels and the Venus flytrap and suggested that these two plants were closest kin. However, in the early 1990s, Chase and his colleagues threw a fly in the ointment, so to speak, when they compared the DNA of about a dozen carnivorous plants and took a closer look at their morphology. They had no DNA from waterwheels and so relied solely on morphology (*Science*, 11 September 1992, p. 1491).

The 20th century study led researchers to conclude that they should lump the sundew in with the waterwheel and push the Venus flytrap out of the tight-knit group. This family tree had evolutionary implications, says Richard Jobson, a plant systematist at Cornell University in Ithaca, New York. Snap traps might have evolved twice, once in the waterwheel and once in the Venus flytrap. Alternatively, the alignment could mean that a snap-trapping ancestor gave rise to sundews, in which case the less elaborate flypaper traps represented simple, modified snap traps.

Now a 21st century DNA analysis tells a different evolutionary story. Jobson, Kenneth Wurdack, a plant systematist at the Laboratories of Analytical Biology of the Smithsonian Institution in Suitland, Maryland, and Kenneth Cameron of the New York Botanical Garden have compared four genes instead of the one studied in the 1990s. They conclude that even though the Venus flytrap is terrestrial and the waterwheel aquatic, the world's only two snap-trapping plants are nonetheless siblings. The sundew is no closer than a cousin, sharing a common ancestor much earlier in time, the group reports in the September issue of the *American Journal of Botany*.

Cameron and his colleagues contend that this evolutionary arrangement suggests that snap traps evolved only once. Moreover, "our results demonstrate that snap traps evolved from flypaper-trapping plants," he says. They also think that among snap-trappers, the Venus flytrap came first.

Chase thinks the snap-trap story might be more complicated than it now looks. The two species "don't live in the same parts of the world," he explains, and although fossils show that the waterwheel was once common throughout Eurasia, the Venus flytrap is known to grow only in North and South Carolina. That leaves open the question of where the snap-trap plants got started and how they spread. **–ELIZABETH PENNISI**

INFLAMMATORY ARTHRITIS

How Immune System Gangs Up on Joints

Mast cells are best known for releasing the dastardly allergy compound histamine, which induces sniffles and swollen eyes. Now rheumatologists have found the troublemaker cells embroiled in another dysfunctional immune system activity: inflammatory arthritis. On page 1689, David Lee of Harvard Medical School in Boston and colleagues report that mast cells in mice act as a bridge linking arthritis's self-attacking antibodies and the inflammation that swells joints.

It took time to accumulate evidence on the suspects. "There are 20 years of literature documenting mast cells in human inflammatory

CREDITS: (TOP TO BOTTOM) K. CAMERON/THE NEW YORK BOTANICAL GARDEN; BARRY RICE/WWW.SARRACENIA.COM