Earth Science

Small swirls spin hurricane's top winds

Flying extremely low over areas damaged by Hurricane Andrew, a meteorologist has discovered evidence of a previously unknown whirlwind pattern that develops during hurricanes and creates the most dangerous conditions during those storms. T. Theodore Fujita of the University of Chicago reports that these small vortices produced winds of up to 200 miles per hour that cut a narrow path of severe destruction during Hurricane Andrew.

Fujita, who has spent decades studying tornadoes, identified the new phenomenon by examining high-resolution photographs he snapped while flying only 400 feet above areas damaged by the storm in August 1992. In the past, he says, most meteorologists have attributed the worst hurricane damage to strong gusts. But the damage patterns in the photographs did not follow the straight parallel lines that gusts would produce, Fujita says. Instead, the worst damage patterns exhibit a curved trace, evidently produced by swirling vortices carried along by the hurricane's normal winds, he says.

Fujita proposes that the eye wall of the hurricane—the region of strongest winds surrounding the calm "eye"—spawns small, swirling eddies that measure only 500 feet in diameter. If these eddies drift into the eye, they are harmless. But if they pass under the fast-growing clouds outside the eye, the cloud convection pulls air upward, stretching the vortex skyward and causing it to tighten. Like spinning skaters who pull their arms inward, the tightening vortex swirls faster, reaching speeds of up to 80 miles per hour during Hurricane Andrew. Because these spinning features were carried along by the 120-mile-per-hour winds of the hurricane, they produced combined winds of 200 miles per hour, Fujita says.

The discovery of these so-called spin-up vortices has implications for building critical structures, such as nuclear power plants, in hurricane-prone regions, Fujita says. But it would be impossible to construct most buildings to withstand such high winds, which strike only limited regions during a hurricane. Instead, says Fujita, the discovery of spin-up vortices adds more incentive for residents to evacuate when officials call for such action.

Seeing the parkland through the haze

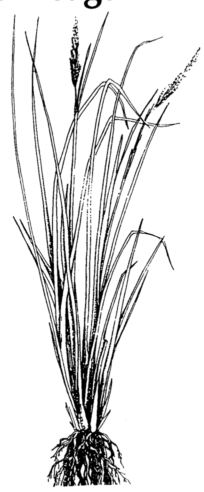
Parks and wilderness areas in the United States may look clean, but widespread air pollution across the country drastically diminishes visibility in even some of the most remote parklands, according to "Protecting Visibility in National Parks and Wilderness Areas," a National Research Council report. Current efforts aimed at improving visibility, however, will not solve the problem and in some cases are "doomed to failure," say the researchers who drafted the report. In the western United States, people can see only half to two-thirds of the 230-kilometer range that would be possible without pollution. In the east, average visibility is only one-fifth the natural range of 150 kilometers. The vista-diminishing pollution comes from coal-burning power plants, diesel- and gasoline-fueled vehicles, residential and forest fires, and even livestock farms. Sources spread out over hundreds of kilometers contribute to the pollution, which also harms human health.

Congress in 1977 set a goal of reducing haze in large national parks and wilderness areas, but the Environmental Protection Agency, the Agriculture Department, and the Interior Department have been slow to carry out their responsibilities for reaching that goal, the report says. In particular, it faults current efforts to improve visibility by targeting just individual polluters, a tactic the National Park Service used in a recent case involving a coal-burning power plant near Grand Canyon National Park. The report calls instead for strategies that consider the various sources in a region that contribute to haze.

Environment

Miracle grass as erosion-control hedge

The National Research Council (NRC) has given the nod to the use of a grass native to India as a way of controlling erosion in tropical countries.



National Research Council

Vetiver

Worldwide, 20 billion tons of soil disappear each year—the equivalent of about 6 million hectares of arable land. But a tall, stiff grass called vetiver, which grows into a dense hedge when planted in lines along the contours of slopes, can slow runoff and prevent soil from washing off slopes, according to "Vetiver Grass," an NRC report released in late January.

For almost a decade, a few agricultural experts have touted vetiver's value as an inexpensive panacea for erosion. The NRC panel examined the risks and benefits of introducing it in tropical countries.

For centuries, vetiver's roots have provided an oil used to scent perfumes and soaps. It is grown in 70 countries, but few use it for erosion control, the NRC panel reports.

In many ways, it seems like an ideal plant. Its stiff stems and leaves and deep roots enable it to function as a virtual dam even when dormant, and it survives for decades. Thus far, it has not spread or become a pest, as have other plants — such as kudzu — introduced to stop erosion.

However, the report cautions that only domesticated vetiver from South India — which produces no seeds and spreads by vegetative propagation — should be used, not the wild type from North India. The two types can be difficult to distinguish.

Vetiver typically grows wild in hot, humid climates, but it also survives in desert-like conditions and in poor soils.

Although it remains unclear whether vetiver hedges might significantly hamper the growth of adjacent crops, the hedges seem to have had no negative effect in cotton fields.

The NRC report also suggested that researchers evaluate whether this grass will prove useful as foliage along footpaths, railroads, and road cuts. The report surveys other plants that show promise for erosion control, including a perennial grass from Africa called the weeping lovegrass.

Drywall dust does well in dirt

As an undergraduate student working part-time in a building supply store, Mark E. Burger became dismayed by the amount of waste drywall piling up because landfills will no longer accept this material. But when he looked into the composition of these gypsum panels, he decided that he might be able to put them to work fortifying soils.

So, as a graduate student at the State University of New York College of Environmental Science and Forestry in Syracuse, he and soil scientist Edwin White ground up some virgin drywall and applied it to test plots. They grew corn on untreated soil and soils with limestone, ground drywall, or excessive drywall. They discovered that the drywall did enhance the nutrient content of the soil and helped increase the amount of corn produced. However, adding extra drywall to dispose of more of this waste could lead to leaching of potassium, says Burger.

Many gardeners buy gypsum additives to compensate for high clay or salt content. But using pulverized drywall offers the added advantage of not contributing to landfills, White says.

Only "regular" drywall from construction sites should be used, say the researchers, because used drywall tends to have paint or other contaminants, as do fire-resistant or moisture-resistant drywall materials.