

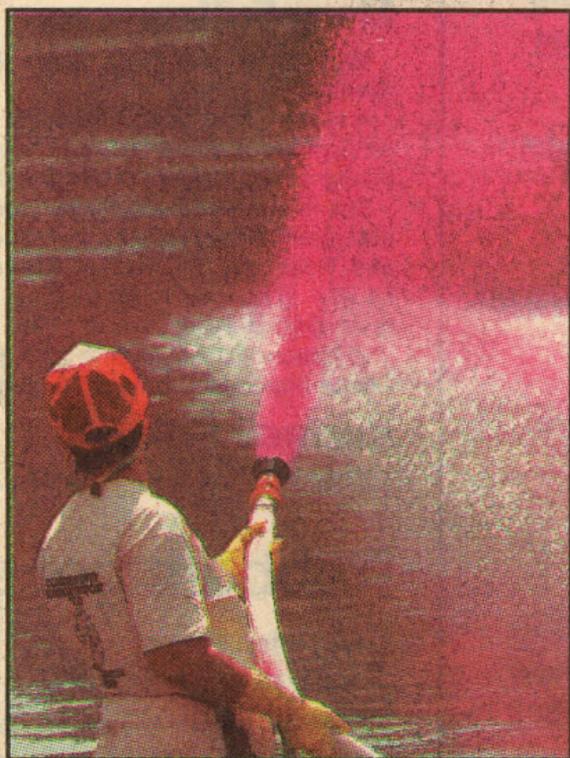
LIFE SUPPORT

Government and science join in an unprecedented and spectacular experiment that aims to rejuvenate, artificially, an environment starved for the Colorado River's natural cycle.

LEE'S FERRY, Ariz. — Julia Graf waded knee-deep into the water, grappling for a second with the heavy hose she was dragging. A generator coughed to life on the beach behind her, and from the nozzle she held shot a scarlet spray, which arced in the midday sun and settled onto the water's surface.

The Colorado River ran red once more.

A generation ago, Lee's Ferry in late March simmered in the deep, muddy river, already higher and faster in anticipation of spring runoff. Then, like a clogged artery



stops the flow of blood, Glen Canyon Dam stole the red from the Colorado, leaving clear, cold and more even-tempered water.

Graf, a U.S. Geological Survey hydrologist, wasn't trying to restore the Colorado's color as she injected it with 2,200 pounds of dye Wednesday. Rather, she and more than 150 other scientists were working to pump life back into the river, to return some of what the dam had taken away.

The dye would help researchers track an ambitious and unprecedented experiment — the controlled flood of the Grand Canyon by the Colorado River. Over seven days beginning last Tuesday, the river would be allowed to flex its long-dormant muscles, running at more than three times its normal flow in imitation of once-annual spring floods.

If it works — and early indicators were good — the deluge will restore eroded beaches, repair damaged wildlife habitats and refresh an environment starved for the river's natural cycle. The test also will teach scientists about how to better manage the dam and the canyon below it, and how to do artificially what nature intended.

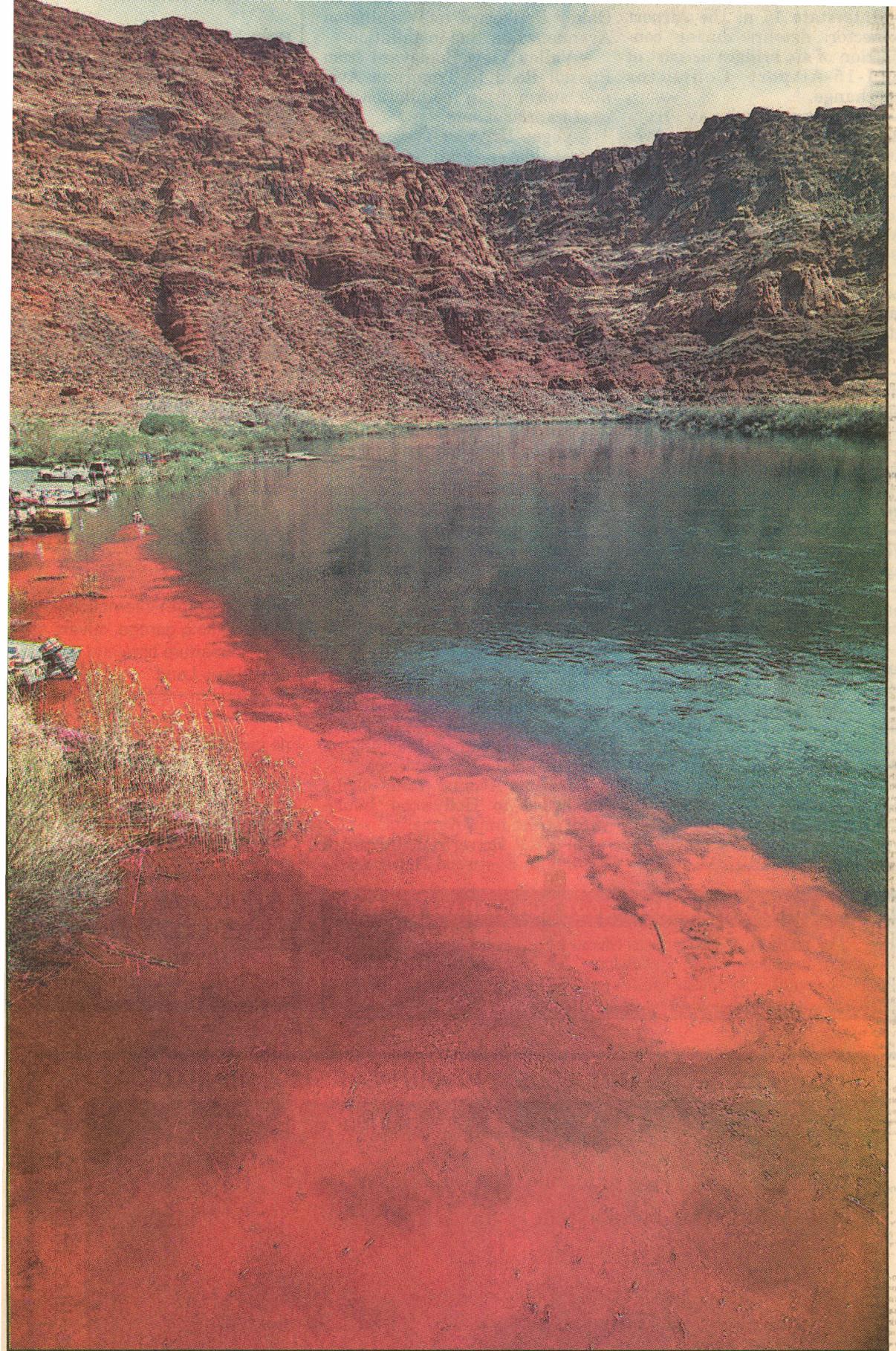
"It's unfortunate man has to intervene," said David Wegner, program manager for the Bureau of Reclamation Glen Canyon Environmental Studies and coordinator of the flood project. "But man has already intervened with the construction of the dam."

Glen Canyon Dam was finished in 1963, waylaying the Colorado River along the Utah-Arizona border about 100 miles up river of the Grand Canyon. The dam never was popular; its usefulness was debated long after concrete began to pour.

Edward Abbey, the author and naturalist, wrote, "No man-made structure in all of American history has been hated so much, by so many, for so long, with such good reason," and George Hayduke, the hero of Abbey's novel "The Monkey Wrench Gang," plotted to blow up the dam.

"Ten years later, this dam wouldn't have been built because there would have been better studies about the effects," said Sharon Galbreath, conservation chairwoman of the Sierra Club's Grand Canyon Chapter. "Even Barry Goldwater now says he regrets his vote to build the dam." Goldwater, an Arizona native, was a Republican senator when Congress approved construction of the dam.

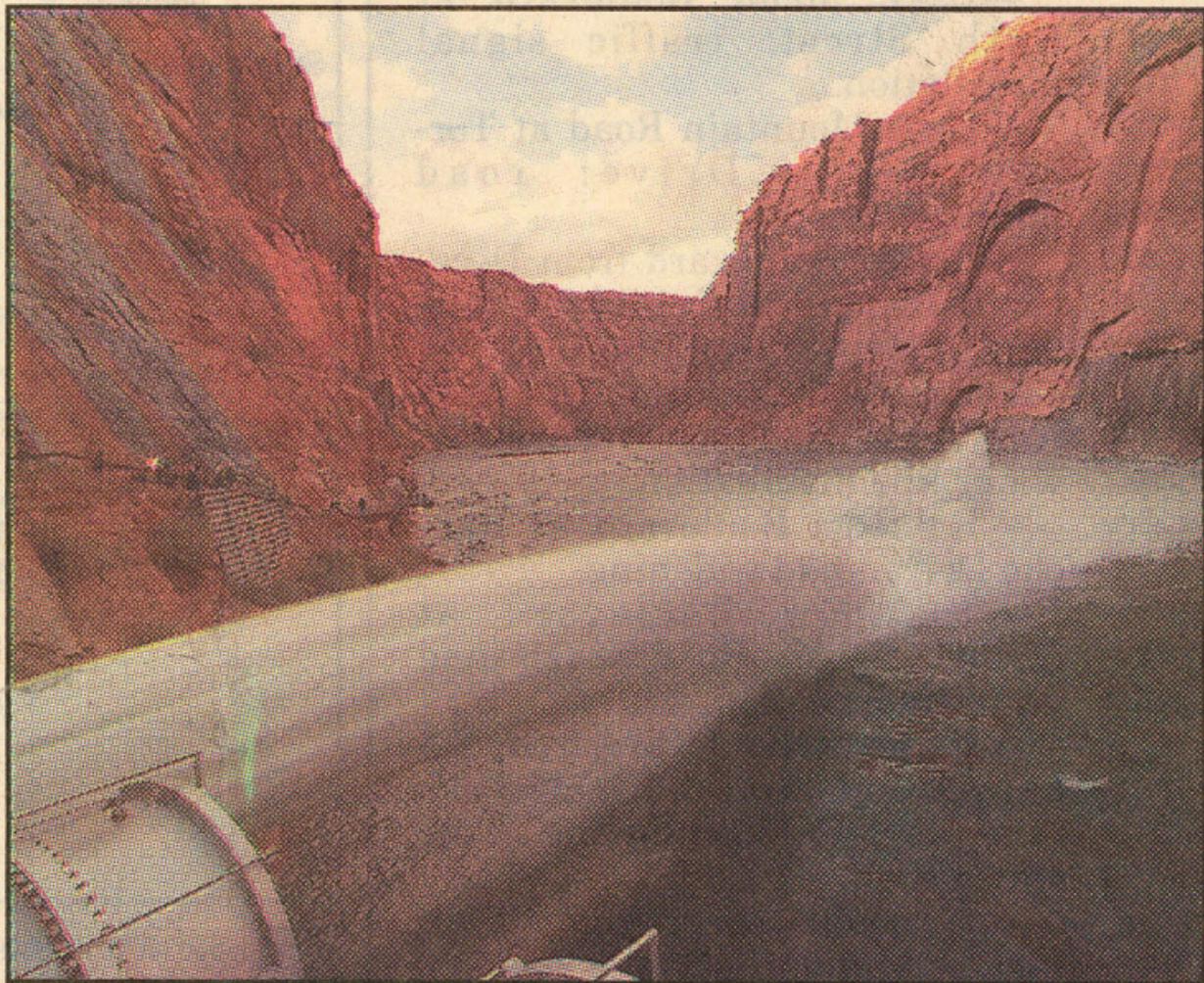
Interior Secretary Bruce Babbitt, also an Arizona na-



Jim Laurie/Review-Journal

Red dye begins to spread across the surface of the Colorado River near Lee's Ferry in Arizona. The 2,200 pounds of dye, a nontoxic, food

coloringlike substance, is used by scientists to track the river's velocity through the Grand Canyon and into Lake Mead.



One of four jet tubes at the base of Glen Canyon Dam near Page, Ariz., sends a torrent of water into the Colorado River as part of a controlled flood of the Grand Canyon.

Canyon

From 1B

tive and one-time governor of the state, defends the dam's role as a power provider, but he is candid about the mistakes he sees now in the dam's management.

"I was here when the dam was built, lived just up the road," Babbitt said last week. "There wasn't anyone here who asked what was going to happen to the Grand Canyon. No one saw the connection. We saw the landscape in bits and pieces.

"But when you think about the dam ... you have to think of the Grand Canyon 200 miles downstream, you have to think of the watershed upstream. What we're doing is coming to grips with the American landscape."

Before Glen Canyon Dam was erected, the Colorado River was unpredictable, untamable, even deadly. It ran low late in the summer and into the winter, then roared into spring with floods that would scour its bed, reshaping and rebuilding the banks and beaches with sand, sediment and life-giving nutrients.

After the dam, water flows were controlled, determined in large part by the generation of hydroelectric power. Seasons no longer mattered. The dam trapped most of the sediment that once sustained banks and beaches, leaving them to erode. Wildlife habitats disappeared.

For a while, researchers looked for answers everywhere but nature, eschewing floods as destructive. But time and study changed minds — one scientist last week said floods were to rivers as wildfires are to forests — and in the early 1980s, the Bureau of Reclamation began working on an idea that grew into the spectacular experiment now under way.

Beginning Tuesday, the flow of water from the dam was increased to 45,000 cubic feet per second, nearly three times the river's average volume. The flood waters will lift sediment, much of it near where the Pariah and Little Colorado rivers enter the Colorado, and deposit it down river along eroded beaches. The high water also will uncover backwater habitats for fish and birds and deliver nutrient-rich organic material.

"It will come as close to simulating nature as we can," said Duncan Patten, a professor emeritus at Arizona State University and senior scientist on the project. "It's not nearly as good as nature, but it's the best we can do."

More than 150 scientists are monitoring the flood, which ends Monday. Teams of researchers have been stationed along the nearly 300 miles of river from Glen Canyon Dam to Lake Mead, and many will stay throughout the summer to continue studying the flood's effects.

Some will look at wildlife, how endangered species such as humpback chub and razorback sucker fare, how the birds react, how non-native fish

weather the high water.

One team is focusing on the endangered Kanab ambersnail. One of the last remaining populations of the thumbnail-size creature survives at Vacey's Paradise about 30 miles into the Grand Canyon, and in a rare case of intervening with the natural cycle, scientists have moved the snails above the expected high water mark so they aren't wiped out.

Other studies will look at Lake Powell, expected to drop about a foot during the flood, and Lake Mead, which will rise about 3 feet.

Even with an army of scientists, the project has time and resources for only about 40 large-scale experiments. Hundreds of others were discussed and discarded, some because the flow of water, though three times the normal volume, is still a trickle compared with spring floods before the dam, which averaged more than 100,000 cubic feet per second and sometimes peaked at 300,000.

That's one of the complicated parts of the project: balancing the needs of power users and providers with the wishes of the scientists and the realities of what the canyon can survive.

The dam has changed the river irrevocably in most cases. Patten, for example, points to the tamarisk trees that line the river as it runs through lower Glen Canyon. The trees are non-native, brought in by settlers in the last century, and they suck water from other plants.

"The tamarisk was a mistake," Patten said. "I'd love to open up the dam and let it run at 100,000 (cubic feet per second) for a year and see if we can get rid of them. But at the same time, it's also a habitat for the southwest willow flycatcher, which is an endangered species."

At least as difficult as the science was bringing together various government agencies and private groups

needed to stage the flood. Wegner's group worked for years negotiating with power users and providers — who will pay a big part of the project's \$4.25 million cost — the National Park Service, Indian tribes, local and state governments and river and fishing guides who depend on the river for their livelihood.

That they agreed to cooperate, Bab-bitt said, is landmark in efforts to take care of the environment.

"Ten years ago, the Bureau of Reclamation didn't have any time for the National Park Service," he said. "That was the culture. Now it's changing. And it starts with the discussion of the science, bringing the agencies together with the scientists."

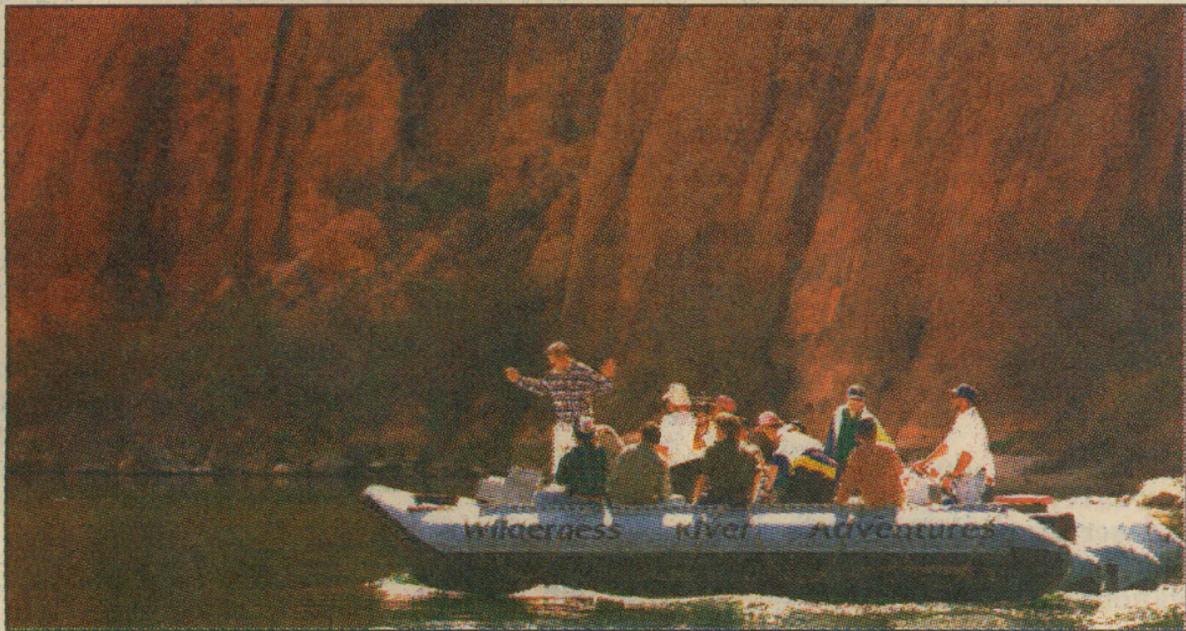
The flood, however useful, won't be a regular occurrence, Wegner said. Because the dam traps most of the sediment, the Colorado below the dam and the Grand Canyon won't be able to handle flooding even at last week's level for 10 years or more.

In the meantime, he said scientists can study what happened and apply what they learn to other dams and other river systems in this country and in others.

Pam Hyde, director of southwestern programs for the environmental group American Rivers, has been working on the Glen Canyon Dam project for six years. She watched last week as red dye was injected into a river that was starting to show more than just its old colors.

"The most important thing is we actually get an element of the natural process back," she said. "You can kind of think of the river as a living entity. If you take away a function that is part of a human body, you have a sick person. We had a sick river. Now we're getting it back on life support."

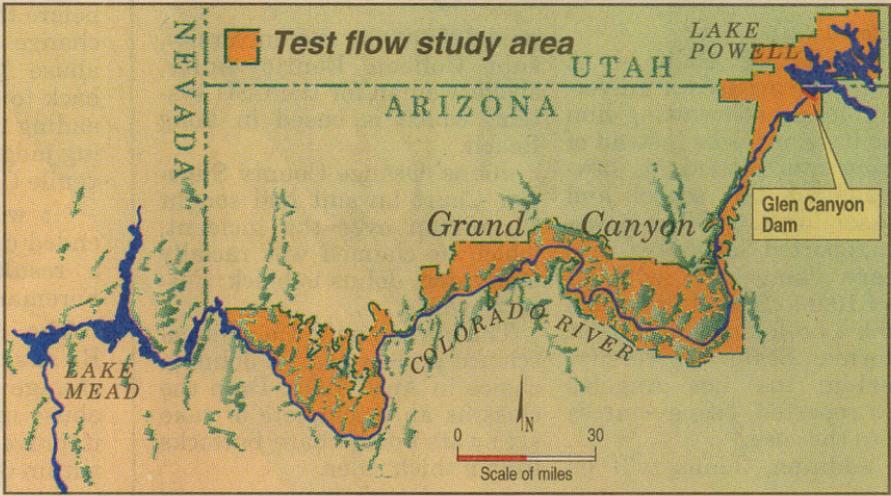
"This is what happened when the river ran naturally."



Jim Laurie/Review-Journal

Interior Secretary Bruce Babbitt, standing, answers questions from the media on a raft floating down the Colorado River in Glen Canyon. Babbitt toured the stretch of river between Glen Canyon Dam and Lee's Ferry the day before the Bureau of Reclamation began a controlled flood of the river through the Grand Canyon.

Ecological restoration



Controlled flooding of the Colorado River has been proposed as a way to manage resources in the Grand Canyon. With the construction of Glen Canyon Dam in 1963, natural flooding was disrupted, and as a result, scientists say the river as it runs through the canyon has been damaged. Banks are no longer restored, and changes in water temperature have hurt fish populations. By flooding the canyon over seven days, researchers hope to restore some banks and wildlife habitats.

