

Environmentalists have mounted a campaign to pull down a dam that drowned the scenic Hetch Hetchy Valley. Scientists say it would be a grand experiment in restoration

# Restoring Yosemite's Twin

*"It is a wonderfully exact counterpart of the Merced Yosemite, not only in its sublime rocks and waterfalls but in the gardens, groves and meadows of its flowery park-like floor."*

—John Muir

**JOHN MUIR SUFFERED HIS GREATEST** defeat in 1913, when President Woodrow Wilson signed a bill authorizing the building of a dam in the naturalist's beloved Yosemite National Park. Muir had fought the proposal for a decade, but he and his supporters proved no match for San Francisco's growing thirst. The 100-meter-tall O'Shaughnessy Dam provided the city with a reliable, gravity-fed supply of water so clean that it still needs no filtration. The environmental cost was steep, however: The dam flooded Hetch Hetchy Valley, famed for its striking granite cliffs and waterfalls that rivaled its twin, Yosemite Valley, for grandeur.

Ever since, environmentalists have dreamed of undoing what they see as one of the greatest environmental sacrileges of the past century. Tearing down the dam and restoring the valley would "inspire people to replicate that restoration across the state, throughout the country, and around the world," says Spreck Rosekrans, an analyst at Environmental Defense in Oakland, Cal-

ifornia. Scientists view it as an unprecedented chance to study the ecological benefits of dam removal. "It's a huge opportunity to advance restoration science," says David Hart, an environmental scientist at the University of Maine, Orono.

It would also be a mammoth undertaking. No dam this size has ever been removed—the tallest is 20 meters. "The scale is fundamentally different," says Emily Stanley of the University of Wisconsin, Madison, who has studied smaller dams. With more than 500,000 cubic meters of concrete to demolish and truck out, and 825 hectares of valley floor that will emerge from the receding water like a moonscape, advocates and skeptics agree that the idea is uncharted territory.

Combine those uncertainties with the huge economic cost and California's legendary water politics, and it's clearly an uphill battle. But advocates say the proposal is gathering steam, and it did get a boost this summer when a state analysis concluded that it was technically feasible. "It's such a grand idea, an extraordinary idea, that it merits further study," said state assemblywoman Lois Wolk, who called for the report at a hearing in Sacramento this month.



## Dam in the valley

This isn't the first time that someone has proposed restoring Hetch Hetchy. In 1987, an unlikely advocate emerged: Don Hodel, secretary of the interior during the Reagan Administration. During a visit to Yosemite National Park, he heard complaints about the crowding in Yosemite Valley and was flooded to learn that a similar valley, Hetch Hetchy, had been turned into a reservoir. He has been championing its restoration ever since. "The U.S. pushes countries to develop national parks around the world, and we've got a dam in a national park. It's absolutely ridiculous," says Hodel, who now runs an energy consulting firm in Colorado.

But Hodel's attempt in the 1980s didn't go far. "I spoke with [Diane] Feinstein"—then mayor of San Francisco—"and she went ballistic," says Hodel. According to Hodel, Feinstein persuaded Congress to put language in the Interior Appropriations bill that prohibited the agency from spending any money to further examine the idea. "We were totally stymied," Hodel says.

**The way back.** Historic photos could provide a guide to restoring the valley.

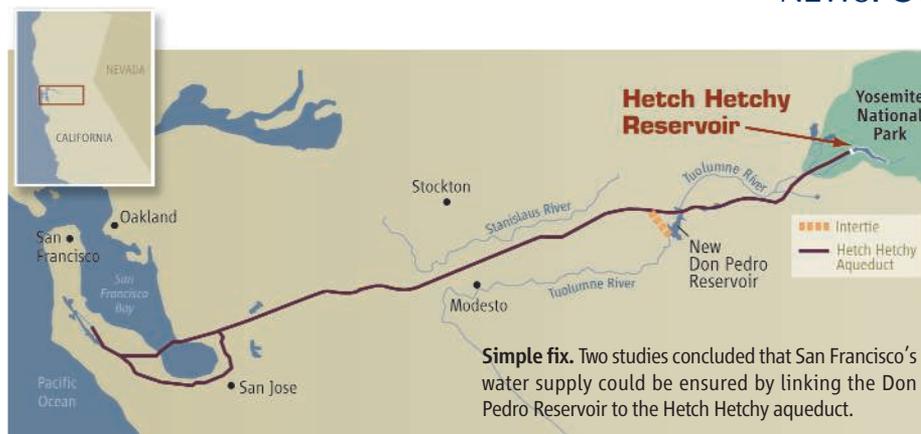
Feinstein maintained that Hetch Hetchy provides irreplaceable water storage for the city and keeps costs down. And the dam continues to generate 400 megawatts of green hydropower—now worth about \$50 million a year. The state is not keen to lose those benefits. “San Francisco and the Bay Area are very concerned about these proposals,” testified Michael Carlin, assistant general manager for water for the San Francisco Public Utilities Commission at the state hearing this month.

After Hodel’s initial attempts were squashed, the proposal dropped off the radar screen for about a decade. It began to resurface in 1999, when environmental activist Ron Good and others founded Restore Hetch Hetchy, a small advocacy group in Sonoma, California. Not long after, legendary environmentalist David Brower helped enlist the support of Environmental Defense, which has made the proposal a high priority.

The first feasibility issue was water storage: Could San Francisco get by without the dam? Environmental Defense’s Rosekrans tackled the question using a computer model, concluding in a 2004 report that “a few straightforward plumbing fixes” could solve the storage issue, he says. His solution was to connect the Hetch Hetchy aqueduct—which takes water to San Francisco—to Don Pedro Reservoir, 56 kilometers downriver from the Hetch Hetchy Dam (see map); this would provide storage for more than the annual flow of the river.

Jay Lund, a civil engineer at the University of California (UC), Davis, has independently hit on the same engineering fix. “It provides unusually reliable storage relative to demand,” Lund says. “There’s still a lot of reliability even if you get rid of Hetch Hetchy.” And that will remain true despite projected population growth and climate change, he and grad student Sarah Null show in a paper in the *Journal of the American Water Resources Association* published in April.

Although these findings are accepted by the scientific community, they “poke common wisdom in the eye,” says fluvial geomorphologist Jeffrey Mount of UC Davis, so politicians remain wary. Everyone does agree that the costs of this replumbing and dam removal would be huge. Estimates vary from \$1 billion over several years from Restore Hetch Hetchy to \$3 billion to \$10 billion from the state’s Department of Water Resources. That’s a bundle for a state that’s already spent nearly \$2 billion trying to fix its bay delta, for example.

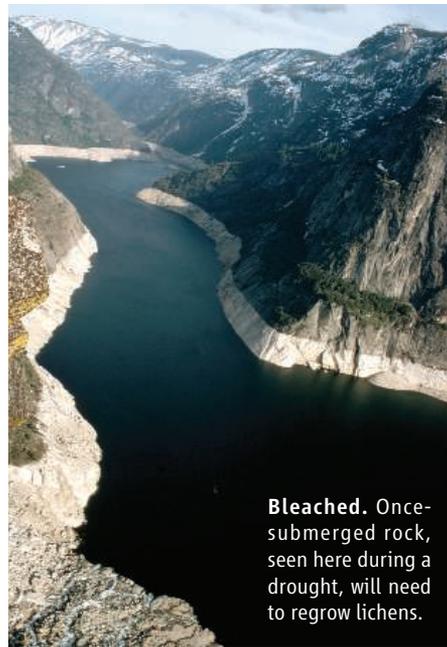


Hodel thinks up to \$1 billion could be saved by draining the water but leaving the dam in place; the concrete hulk would be a memorial to errant ways of the past. “People would find it fascinating to look at the dam, and they would say: ‘Can you believe they put a dam in this beautiful valley?’”

At any rate, advocates for restoring Hetch Hetchy say the state shouldn’t have to foot the entire bill, as the reclaimed valley would be national treasure. “All Americans have a stake in the outcome of the discussion,” Good says.

#### A blank slate

But transforming the existing reservoir into the beautiful valley Hodel and others envision will not be easy. The goal is to restore 825 hectares that are now underwater with an array of habitats—wetlands, grasslands, oak savanna, and pine forest—essentially from a blank slate, says restoration ecologist Mark Cederborg of Hanford Applied Restoration and Conservation in Sonoma,



**Bleached.** Once-submerged rock, seen here during a drought, will need to regrow lichens.

who consults for Restore Hetch Hetchy.

Figuring out exactly what to do will require some detective work. The reference, Yosemite Valley, has been heavily altered by invasive species, fire suppression, and other changes, so researchers will have to pore over historic photographs to help envision the predam landscape. Logistics will likely be difficult, too. The valley doesn’t have roads and is surrounded by designated wilderness area, so workers may not be able to use heavy mechanical equipment. Herbicides use could be ruled out as well, because the river water will still be headed for city faucets.

The best approach would be to slowly lower the reservoir and restore the emerging land in stages over a number of years, says Joy Zedler, a wetlands ecologist at the University of Wisconsin, Madison, who in 2004 created an adaptive restoration plan for the valley with her graduate students. Zedler maintains that such a phased approach would enable researchers to study how well restoration techniques were working and modify them before the next stage. “You’d be wiser before you exposed more of the bottom,” Zedler says. It would also spread out and lower costs, by improving techniques, and be easier on existing wildlife, she says.

This strategy, for instance, would reveal early on which invasive species are likely to be a problem—more than 140 thrive in Yosemite National Park—without letting them run wild over the whole valley. Invasives are a concern because the exposed terrain would be “like a vacant lot for plants to colonize,” says Hart. Unlike most other restoration projects, this one would have a failsafe mechanism to deal with runaway invasives, Zedler adds: raise the water level and drown them.

Restoring the lichens that once gave the rock its distinctive color will be especially daunting. Because the lichens died when they were submerged, the exposed rock will appear bleached—a 100-meter-tall “bathtub ring”—

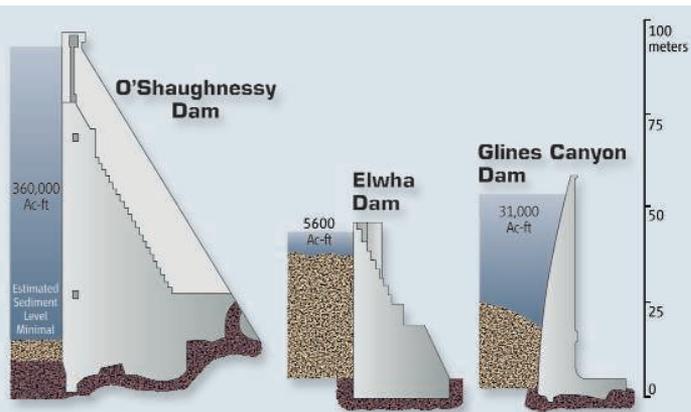
## Big Dams Ready for Teardown

As advocates push for the removal of O'Shaughnessy Dam in Yosemite National Park (see main text), they'll be closely watching a \$185 million restoration project in Olympic National Park in Washington state. There, two dams on the Elwha River are slated to be demolished starting in 2009. "If it works well, it will open the door to removing large dams like Hetch Hetchy," says Emily Stanley of the University of Wisconsin, Madison. "I see it as the test case for very large dam removal."

The Elwha once boasted an estimated 400,000 spawning sockeye salmon and other fishes. But the Elwha Dam and Glines Canyon Dam, which were built in 1913 and 1927, respectively, to provide hydropower for a mill in the town of Port Angeles, cut off 112 kilometers of spawning runs and degraded the quality of the remaining 8 kilometers.

It took decades of legal wrangling to get a green light for the dams' removal. In 2000, after the Elwha Klallam Tribe and various environmental groups prevailed, Congress appropriated \$29.5 million for the Department of the Interior to buy the dams. In an effort to restore the salmon runs, Congress has so far approved \$17 million of \$48 million for tearing down the dams and replanting the river valley. (The \$185 million price tag also includes \$75 million to provide a water-treatment facility, flood protection, and a sewer system for downstream communities.)

Removing the dams should take 3 years. A draft plan calls for draining the lake and blasting the Elwha Dam apart. The taller Glines Canyon Dam will be cut into 22-ton blocks and trucked away. Once the river runs free, it will wash away an estimated 40% of the 14 million cubic meters of sediment trapped behind the dams—far more than has ever been released from a dam before. "This would be an extreme case, but we don't anticipate any problems" for wildlife, says project manager and fisheries biologist Brian Winter of Olympic National Park. (Sediment likely won't be an issue at Hetch Hetchy; only a few centimeters are thought to have accumulated



**Cross section.** O'Shaughnessy Dam in Hetch Hetchy Valley holds more water and has more concrete than the two Elwha River dams, but it has trapped less sediment.

behind O'Shaughnessy, because the granite watershed erodes slowly.)

Scientists would like to study the effects of sediment release on the Elwha, but there are no funds for research in the restoration budget. "We're trying to document the baseline conditions," says Jerry Freilich, research coordinator for Olympic National Park. Local universities have received a \$1 million National Science Foundation grant to coordinate research efforts, but obtaining overall funding has been tough, Freilich says.

The sediment that remains in the valley will appear like natural river terraces, Winter says. Some 227 hectares of forest will be restored by planting native seeds and trees of various ages; the idea is to quickly create a diverse ecosystem in the hope of keeping invasive species from gaining a foothold.

Scientists say the salmon stand a good chance of recovery. Once the dams are removed, they will face few threats because most of the watershed is protected within Olympic National Park.

—E.S.

after the water is lowered. A 1988 Park Service report estimated that it would take 80 to 120 years for the lichens to grow back on their own. Zedler proposes experiments to speed the recovery by propagating native lichens and testing various agents to help them adhere when sprayed onto barren rock.

Even with such experiments, no one can say for sure how the ecosystem is likely to respond. "If people think it will be pristine, they may be surprised," Stanley says. "It may end up creating a novel ecosystem that we haven't seen before."

### Weighing priorities

The Hetch Hetchy experiment is not likely to happen anytime soon, even advocates concede. Only a few members of the state legislature are gingerly probing the issue, and opposition from Feinstein, who is now a U.S. senator, could hinder federal participation. "Politically right now, I don't see the stars aligned," says Mount.

The key reason: "The level of distrust among the various actors is very, very high," Dean Misczynski, director of the California Research Bureau, testified at the Sacramento hearing. The bureau has recom-

mended appointing a blue-ribbon panel, with advisory groups of stakeholders and technical experts, to lay out ways to keep all the current beneficiaries of the dam from feeling they are getting a raw deal.



**Aerial approach.** Working without roads, crews may have to plant seeds and control erosion via helicopters.

Hodel remains upbeat about the long view. "It is inevitable that the dam will be removed," he says, adding that the biggest opposition to the project now is economic, not technical. "It's only a matter of time and negotiations."

But others point out that there are more pressing ecological needs. The habitat in Yosemite National Park is less endangered than other places, like southern California, where nature is being boxed in by development. Margaret Palmer of the University of Maryland, College Park, questions the wisdom of investing huge sums in fixing a short stretch of river in a relatively unblemished watershed. "The priority needs to be cleaning up our damaged streams, many in urban and agricultural areas," she says.

Still, many acknowledge the validity of the central argument. "That land was set aside for the purpose of preserving it as wilderness," says civil engineer William Graf of the University of South Carolina, Columbia, who studies dam removal. "We have not carried through on the promise." Muir, who died a year after Wilson approved the dam, would heartily agree.

—ERIK STOKSTAD