A RIVER RETURNS

THE REWILDING OF THE ELWHA.

BY KATHARINE LOGAN

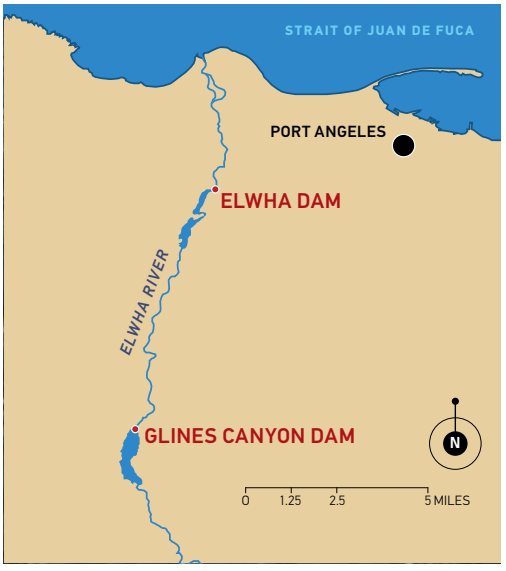
From across the Strait of Juan de Fuca, the mountains of Washington's Olympic Peninsula are always changing. They loom huge and sharp and white, or float in a band of blue haze. Some days they disappear altogether. On an April afternoon, under nearly every kind of cloud scudding across the sky, I drove off the Port Angeles ferry and up and around the nearest mountain to a lookout on Hurricane Ridge. There, at more than 5,000 feet, one of those clouds was snowing thick and fast, obscuring in its white hush the pleated mountain ridges I had come to see. If not for the snow, I like to think I might have glimpsed—but maybe it's not possible—about 45 miles south and a little west, the country where the cascades of six glaciers form the headwaters of the Elwha River.

Robert Elofson, who is now the river restoration director for the Lower Elwha Klallam Tribe in Port Angeles, traveled to the headwaters country in the early 1970s. "Gorgeous!" he remembers thinking. "Except—there's no salmon." The absence of salmon at the source of the Elwha and throughout 90 percent of the river habitat was due to two high dams that blocked their route upstream. The salmon have begun gradually to move up again, and the river is reasserting itself at its estuary since the last of the dams was demolished in September 2014, freeing the Elwha River and generating massive ecological change on a scale people seldom see.

ABOVE
The former Lake Mills reservoir's revegetation.

JOSHUA CHENOWETH

LEFT
The Elwha Dam demolition.



The Elwha River once supported stocks of all the anadromous salmonid species native to the Pacific Northwest. An estimated 400,000 fish teemed upriver annually to spawn, including large-bodied spring chinook weighing as much as a hundred pounds. In the lower river, salmon sometimes thronged so thick the Klallam fishers didn't have to catch them; they just had to startle the fish, and some would ride aground. Salmon provided food for hundreds of kinds of animals in the river's ecosystem, and for the forest itself, as salmon-borne nutrients nourished trees miles from the river's edge.

In the early 20th century, that changed. In 1911 and 1927, private companies constructed two hydroelectric dams across the river, five and 13 miles from the river's mouth, which is about five miles west of Port Angeles. The first dam was 108 feet high, and the second one was 210 feet high. Together the dams flooded nearly 800 acres of the river valley, including the site of the tribe's creation story, and barred the salmon from more than 90 percent of their spawning habitat.

"Nobody knew about the plan to put a dam there until it happened," says Elofson. "We had no say. But we knew it was bad."

The annual salmon populations were trapped in the lower five miles of a river starved of sediment, nutrients, woody debris, and even water itself. Fish numbers plummeted from nearly 400,000 to less than 3,000, with stocks of some species falling almost to zero. Downstream, the complex ecosystem of the estuary eroded to bare cobbles. For the tribe this ecological devastation destroyed the livelihood that had sustained the Klallam people for thousands of years and lay at the heart of their culture.

In the decades that followed, tribal elders continued to voice objections to the dams, and when relicensing requirements brought the dams under scrutiny in the latter third of the century, the tribe intervened. The first blow to the dams came when part of the foundation at the lower dam gave way. Second, the dams had conspicuously failed to provide required fish passage, and with 83 percent of the river basin lying within the Olympic National Park, an increasing number of environmentalists joined the cause. The third strike was the diminishing economic utility of the dams' electricity output: With the Olympic Peninsula connected to the power grid, the dams provided very little of the power the region used.

In 1992, Congress passed the Elwha River Ecosystem and Fisheries Restoration Act, enabling the largest dam removal project in history. Almost a decade passed in political skirmishing, locally and in Washington, D.C., before a senator who was blocking funding for the project was voted out of office. In September 2011, demolition began. By September 2014, both dams were down, and, for the first time in more than 100 years, the Elwha River ran free.

The dams' removal marked the end of a struggle but by no means the end of the story. The Elwha restoration is the second-largest ecosystem restoration project in the history of the national park system after the Florida Everglades, and it's unlike anything attempted before.

"This is an enormous chance to study a complete restoration process," Elofson says.

Different parts of the river's ecosystem are changing at different rates. The inorganic components that

ERDMAN VIDEO SYSTEMS IN COLLABORATION WITH THE NATIONAL PARK SERVICE, LEFT (SERIES); KATARINA KATSMA, ASLA, MAPS

ABOVE
The former Lake Aldwell reservoir.

BELOW
The Glines Dam demolition.

BOTTOM RIGHT
The dam stub, now a lookout point.

define the landscape's form have changed faster than the rest, and are expected to settle down faster, too, says Jonathan Warrick, a research geologist with the U.S. Geological Survey. "The river has been very efficient in moving sediment," he says, "and we're seeing new, emergent landscapes throughout the system—in the reservoirs, throughout the river corridor below, and into the coast."

Upstream from the dam sites, those 800 formerly inundated acres have resurfaced but are nothing like what they were before. A century's worth of sediment, more than 21 million cubic meters, had backed up behind the dams. When the dams were removed, and the river cut through the former lake beds to find its new channel, it carried 13 million cubic meters of sediment down to the estuary in a series of chocolate milk torrents, leaving the remainder of the sediment perched in terraces 20 to 60 feet above the riverbed.

That gave the revegetation team a lot to think about.

"There aren't any analogues to these conditions," says Joshua Chenoweth, a restoration botanist with the National Park Service, based in Port Angeles. "There are no primary successional landscapes out there with five feet of silt like we have on the valley walls. And there are no sand and gravel terraces instantly perched above a riverbed."

So the revegetation team's strategy was simply to plant out some 400,000 plants of 80 early successional native species, without any assumptions as to what would thrive, running the program over seven years to give the site time to teach them.

Chenoweth calls the results of the revegetation effort so far "a tale of two surfaces," and, from a windy outlook on a stub of the upper dam, it's easy to see why. The forest edge defines the old lake level like a vast bathtub ring. Within that, the valley walls are a clear success. A 92 percent survival rate for plantings, helped by plentiful wind-borne reseeding from the adjacent forest, has greened the silted slopes with alder, willow, cottonwood, and little Douglas firs.

"It actually turned out to be a really good site," Chenoweth says. So much so that the revegetation of the valley walls will complete a year ahead of schedule.

The instant, perched terraces are another story. High above the water

JOSHUA CHENOWETH, TOP LEFT AND RIGHT; ERDMAN VIDEO SYSTEMS IN COLLABORATION WITH THE NATIONAL PARK SERVICE, BOTTOM LEFT (SERIES); NATIONAL PARK SERVICE, BOTTOM RIGHT

level, far from the forest edge, with no soil to speak of, only lupines are really thriving. Great big Seussian tufts of them are springing up, fixing their own nitrogen, setting flowers, and scattering seed. Among the lupines, a few cottonwoods, ocean spray, and snowberries are holding on, but the terraces are still 80 percent bare ground.

They may be slow going, but Chenoweth is confident that in time the terraces will establish themselves as a viable ecosystem. They'll be different: "We've always thought that this would potentially lead to novel ecosystems," he says. "As long as they're native, as long as they're forest, from a veg perspective, that's fine."

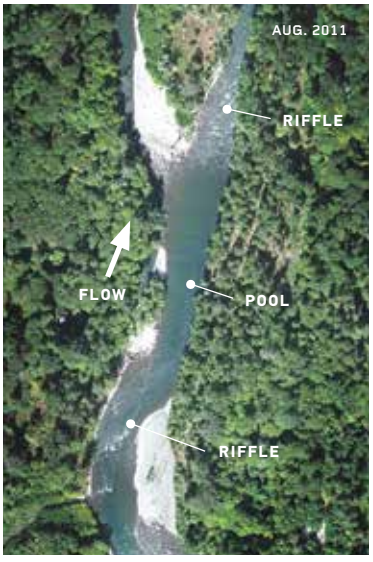
From a fish perspective, the outlook is less certain, although numbers are creeping up since the dams came down. Over the course of the 20th century, river management practices of burning and clearing logjams and bulldozing the river channel compounded the dams' impact on water, sediment, and wood starvation. The tribe's fisheries habitat manager, Mike McHenry, says those practices grossly simplified the channel of the lower Elwha.

To help restore fish habitat, the tribe has been carrying out remediation downstream from the dams. I followed McHenry a couple of miles along a track that runs on top of a dike and then across the floodplain, until we came to a sandy clearing. "This was a construction site," McHenry said. I asked what it was for. "You'll see." And we walked the last few yards to the river's edge.

More used to the ocean, I find the fast-flowing water fascinates me and makes me a bit uneasy at the same time. I stood back from the edge and looked around. Positioned at intervals on both sides of the river was a series of giant wooden artifacts: intriguing, strangely beautiful, not-quite-natural structures. They are engineered logjams, McHenry said, and they are making a significant difference to salmon habitat in the lower river.

The idea for engineered logjams on the Elwha came from a study on another river that showed the biggest, most stable old trees were actually growing on buried older logjams. "So there was this aha moment of realizing that we need the wood to grow the forests that are going to replenish the river over time," McHenry said.

BELOW
More than 50 engineered logjams downstream of the former dam sites are contributing to the restoration of the lower river.



LEFT
Before demolition, an artificially simplified channel; after demolition, braiding of the river as it re-engages its floodplain.

ANDY RITCHIE, NATIONAL PARK SERVICE. TOP: TIM ABBE/NATURAL SYSTEMS DESIGN. BOTTOM

"We started asking what we could do to replace the lost wood. And we came up with these engineering solutions to re-create logjams."

The tribe has been building logjams since 2000, when the dam removals were still uncertain. There are now more than 50 logjams along a three-mile reach of the lower river, making this one of the largest efforts of its type in the world. We can expect to see more of them in the Pacific Northwest, McHenry says, as a movement toward rewilding landscapes gathers momentum.

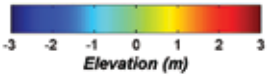
Besides providing hard points in the floodplain to nurse a new cycle of tree growth, the engineered logjams are supporting the river's recovery in the short term. By jiggering the water's straight run, the logjams are spreading the river out, reconnecting it to its floodplain. Overflow and ancillary channels have already begun to braid the river through gravel bars, creating complex new habitat.

At a finer scale, the river swirling against each logjam creates scour pools, which provide essential places for fish to hide, for adult fish to hold, and for juvenile fish to rear. "Put a mask and snorkel on at low flow," says McHenry, "and dip into one of these things, and you'll just see clouds of salmon."

A bend or two beyond the last of the logjams, the river flows into the Strait of Juan de Fuca. Of the 21 million cubic meters of material once backed up behind the dams, the river has transported about 60 percent of it to the river's mouth, building a massive new coastal estuary out into the sea,

ABOVE
The transformation of the estuary: Top left is before demolition.

BELOW
Maps show the geomorphic evolution of the Elwha delta as the river transported 13 million cubic meters of sediment to the river mouth.



and creating new underwater landscapes on the sea floor kilometers from the mouth.

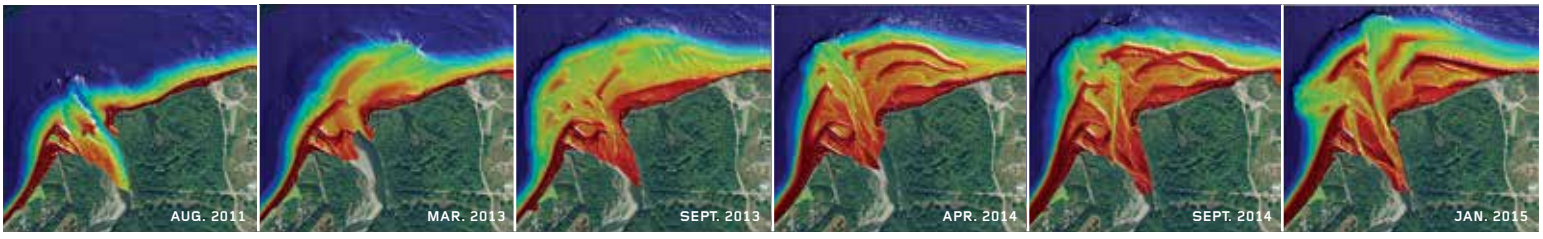
"We really are at the beginning," Warrick says. "We've just given birth to this new system, and we're watching it evolve in front of our eyes."

On the final morning of my visit, I stepped over the crest of a dune onto the new beach. The estuary seems to stretch for miles, and there's not a bare cobble in sight. It's impossible to imagine all this was created in a geological instant. The new sand is strewn with woody debris, some of it ocean bleached, but most of it dark from the river, a rotted pinecone among the smaller stuff offering extra proof. Waves from the strait eddy about the edges of sandbars, which have created wide new mudflats behind. I spotted two semipalmated plovers with the mudflats to themselves. On the other side of the river, a flock of gulls lifted into the air. Otherwise, this magnificent new land lay quiet, ready for life to return. ●

KATHARINE LOGAN IS A BRITISH COLUMBIA-BASED WRITER WITH A FOCUS ON DESIGN FOR SUSTAINABILITY. SHE HOLDS A PROFESSIONAL DEGREE IN ARCHITECTURE.

Project Credits

ELWHA RIVER RESTORATION **CLIENT** NATIONAL PARK SERVICE. **KEY PARTNERS** LOWER ELWHA KLALLAM TRIBE, THE CITY OF PORT ANGELES, CLALLAM COUNTY, BUREAU OF RECLAMATION, U.S. FISH AND WILDLIFE SERVICE, NATIONAL MARINE FISHERIES SERVICE, U.S. ARMY CORPS OF ENGINEERS. DEMOLITION **CLIENT** OLYMPIC NATIONAL PARK, PORT ANGELES, WASHINGTON. **ENGINEERING** U.S. DEPARTMENT OF THE INTERIOR | BUREAU OF RECLAMATION. **GENERAL CONTRACTOR** BARNARD CONSTRUCTION, BOZEMAN, MONTANA. REVEGETATION **CLIENTS** (FORMER LAKE MILLS) OLYMPIC NATIONAL PARK, PORT ANGELES, WASHINGTON; (FORMER LAKE ALDWELL) LOWER ELWHA KLALLAM TRIBE, PORT ANGELES, WASHINGTON. **PARTNERS** WASHINGTON CONSERVATION CORPS, OLYMPIA, WASHINGTON; STUDENT CONSERVATION ASSOCIATION, SEATTLE; WASHINGTON'S NATIONAL PARK FUND, SEATTLE. **RESTORATION BOTANISTS** OLYMPIC NATIONAL PARK, PORT ANGELES, WASHINGTON. **PLANT NURSERY** MATT ALBRIGHT NATIVE PLANT NURSERY, AGNEW, WASHINGTON. ENGINEERED LOGJAMS **CLIENT** LOWER ELWHA KLALLAM TRIBE, PORT ANGELES, WASHINGTON. **ENGINEERING** NATURAL SYSTEMS DESIGNS, SEATTLE. **CONSTRUCTION** LOWER ELWHA KLALLAM TRIBE RESTORATION CREW, PORT ANGELES, WASHINGTON. **MAJOR FUNDING** NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, SALMON RECOVERY FUNDING BOARD, PACIFIC COAST SALMON RECOVERY FUND.



JONATHAN FELIS, USGS, TOP LEFT; IAN MILLER, WASHINGTON SEA GRANT, BOTTOM LEFT; NEAL AND LINDA CHISM, LIGHTHAWK, TOP RIGHT; USGS, BOTTOM