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**Seeing Trends, Coalition Works to Help a River Adapt**

**By**[**LESLIE KAUFMAN**](http://topics.nytimes.com/top/reference/timestopics/people/k/leslie_kaufman/index.html?inline=nyt-per)



NISQUALLY NATIONAL WILDLIFE REFUGE, Wash. — For 10,000 years the Nisqually Indians have relied on chinook salmon for their very existence, but soon those roles are expected to reverse.

Based on current warming trends, climate scientists anticipate that in the next 100 years the Nisqually River will become shallower and much warmer. Annual snowpack will decline on average by half. The glacier that feeds the river, already shrunken considerably, will continue to recede.

Play the scene forward and picture a natural system run amok as retreating ice loosens rock that will clog the river, worsening flooding in winter, and a decline in snow and ice drastically diminishes the summer runoff that helps keep the river under a salmon-friendly 60 degrees.

To prepare for these and other potentially devastating changes, an unusual coalition of tribal government leaders, private partners and federal and local agencies is working to help the watershed and its inhabitants adapt. The coalition is reserving land farther in from wetlands so that when the sea rises, the marsh will have room to move as well; it is promoting hundreds of rain gardens to absorb artificially warmed runoff from paved spaces and keep it away from the river; and it is installing logjams intended to cause the river to hollow out its own bottom and create cooler pools for fish.

Jeanette Dorner, the director of the salmon recovery program for the [Nisqually Tribe Natural Resources Department](http://www.nisqually-nsn.gov/content/natural-resources), grew up wading along a creek that feeds the river, hunting freshwater mussels. Even though protecting the rivershed requires herculean feats of coordination among various authorities and has cost roughly $35 million in the past decade, she said, “It is urgent we do not just walk away.”

Many scientists and policy analysts believe the best course of action is to do what conservationists have long tried to do: return ecosystems to their strongest natural health and then stay out of the way. This approach is known as resiliency.

But as humans come to be adversely affected by the stepped-up ecological change, they also increasingly look to help Mother Nature out in more active ways.

In North Carolina, the United States Fish and Wildlife Service has teamed up with the Nature Conservancy to buy parcels just behind Alligator River National Wildlife Refuge to allow the swamp to roll inland as the sea rises from glacial melt and to help black bears and red foxes migrate to inland refuges. In Montana the [Wildlife Conservation Society](http://www.wcs.org/) is working with land trusts and others to secure corridors just outside Glacier National Park for wide-ranging cold-sensitive species like wolverines.

Such projects are on the rise, in part, because an executive order in 2009 by President Obama led to a mandate that federal agencies integrate adaptation to [climate change](http://topics.nytimes.com/top/news/science/topics/globalwarming/index.html?inline=nyt-classifier) into all of their planning. But they often remain, like Nisqually, complex collaborations spurred more by imminent local ecological catastrophes.

**Warm-Water Fish**

The Nisqually begins as a fast chute off Mount Rainier, rushes through shattered rock carved from the glacier above and then plunges through thick forests for 78 miles until it broadens into a rich estuary connecting with Puget Sound.

It remains a relatively healthy watershed because in 1989 — long before “global” and “warming” were inextricably linked — the Washington State Legislature, in the face of local protests and a court battle over Indian fishing rights, created the [Nisqually River Council](http://nisquallyriver.org/), the first watershed-wide protection council west of the Mississippi.

The council provided a framework for parties along the river to discuss their needs and goals. Financing came through many sources: lawsuits brought to protect native endangered species like the chinook and the spotted owl, state and federal grants, the Park Service in Mount Rainier, the Fish and Wildlife Service and the Nisqually Tribe, which has prospered since casino gambling on Indian lands was legalized.

For its first 20 years the council concentrated on undoing manmade damage, with efforts like persuading the operator of the [hydroelectric](http://topics.nytimes.com/top/reference/timestopics/subjects/h/hydroelectric_power/index.html?inline=nyt-classifier) dam on the river to add salmon gates. Last year, as the council was updating its management plan, it began looking at the river “through the lens of climate change,” said David Troutt, its chairman. Suddenly restoration was not going to be enough.

Amy K. Snover, a director of the Climate Impacts Group at the University of Washington, said computer modeling showed that as early as 2020 there would be “significant” increases in rain in the Nisqually Basin in November and December. Sixty years beyond that there would 50 percent less snowpack at the end of winter, according to the average-climate projection. Warmer air and less snowmelt would mean a much warmer river and depleted soil moisture in summer, which would stress forest vegetation.

Ducks Unlimited, a conservation group founded by hunters, predicts that the entire low-lying wetlands at the river’s mouth, a prime fish nursery, will be inundated by the sea in the next 50 years, meaning that the species the council was working to save would be imperiled again.

Christopher S. Ellings, a salmon research biologist with the Nisqually Indian Tribe, said any of the changes — on its own — could significantly alter the local food web. He identified the chinook, a keystone species that is a mainstay food for many predators, as a prime example.

“A warmer river would favor fishes that don’t have a long freshwater rearing,” he said.

Meaning, not the chinook, which spend their early lives at the edge of the salt water, bulking up to travel the sound.

**Eatonville Evolves**

There are shuttered businesses in Eatonville, Wash., along North Mashel Avenue, lingering signs of the timber industry’s decline. But there are also signs of new life as the town transitions to an ecofriendly bedroom community. Eatonville is important because it sits between the Nisqually’s main tributaries, the Ohop and the Mashel, and had been contributing to their warming.

Water that falls on Eatonville’s roads and parking lots is directed through storm drains into Ohop Creek. By contrast, water falling on unpaved spaces seeps into the ground, raising the moisture level in the soil and eventually feeding into the Mashel River, a shallower tributary that is in greater danger of overheating.

While Eatonville looks into redesigning its drainage system, the council has teamed the town up with [Stewardship Partners](http://www.stewardshippartners.org/), a nonprofit group that is promoting rain gardens specially designed for the end of driveways and other paved spaces to intercept runoff and sink it into the ground.

Stewardship has financed nearly two dozen demonstration gardens, including one in the yard of the town’s mayor, Ray Harper. The group hopes to spawn 12,000 gardens across the Puget Sound area, including 700 across the Nisqually, which would treat about 9.3 million gallons per year, said David Burger, Stewardship’s executive director.

Eatonville also agreed to accept a new kind of river breakwater promoted by the council. Boxes made of logs, roughly 20 by 20 feet, are placed deep into the sides of the riverbed. Angled into the water, each box acts as a natural logjam might, catching debris and causing the river to swirl in on itself and dig deep, cool pools inviting to chinook.

Mr. Harper said the town signed on to the council’s approach after the council and its partners paid nearly a million dollars for property to place the logjams.

With that money, he said, “We are going to be able to put a hiking trail system along the river, which is also a draw.”

**The Watershed Ahead**

The most crucial component to resiliency may be the most difficult — and expensive: preserving what are expected to be the crucial ecosystems of the future.

For 100 years, an earthen manmade dike kept the tidal saltwater away from the marshlands near the river to create agricultural lands. Then in 2009, the refuge, working with Ducks Unlimited and others, took it down, and the area reconnected with the saltwater in the largest estuary restoration project in the Pacific Northwest. The project was controversial, in part, because many park regulars had gotten used to the altered landscape.

The park superintendent, Jean Takekawa, kept the plan on course because wetlands and tidal flats, where fresh and salt water commingle, have been largely eliminated along Puget Sound despite being critical breeding areas for fish and wildlife.

At the same time, Ms. Takekawa was also working with partners to double the park’s acreage away from the sound. The land she won federal authority to preserve — and eventually buy if owners are willing — is mostly farmland. If seas keep rising, however, it has the potential to be wetlands in the next century.

“The restoration project was an important step for the near term, but the refuge expansion creates potential for the long-term future,” Ms. Takekawa said.

The council’s efforts on behalf of the river and its chinook fishery are being monitored, but effects take a long time to show up.

Elders along the river remember when it used to run black with chinook, from late summer into fall. It has not been that way for decades, Ms. Dorner, of the Nisqually Natural Resources Department, said. The species was listed as endangered in 1999.

Each year some 30,000 adult fish course back into the river, but these days, only 10 percent, at best, are born in the wild. The rest are raised in hatcheries. The council’s success will be measured, Ms. Dorner said, by how many return completely on their own and can survive the heat to bear their own young.

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