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Bridging the Gap: Where Indigenous Knowledge and Western Science Come Together to Shape Environmental Stewardship

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BRIDGING THE GAP: WHERE INDIGENOUS KNOWLEDGE AND WESTERN
SCIENCE COME TOGETHER TO SHAPE ENVIRONMENTAL STEWARDSHIP

By

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Bridging the Gap: Where Indigenous knowledge and Western science come together to shape environmental stewardship

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In the era of climate change, humans are grappling with how to ensure that natural resources exist into the future. For millennia, Indigenous people have actively managed the environment, drawing upon deep connections to the land passed down through generations. The Western worldview, on the other hand, sees humans as separate from nature — an attitude that has led to many of the environmental crises we see today.

This portfolio examines places and programs where Western science and Indigenous knowledge (IK) or traditional ecological knowledge (TEK) come together to shape environmental stewardship. Western science and IK/TEK are inherently different ways of knowing. Rather than intersecting, they run parallel and complement one another, offering new insight. The following stories provide a window into what can happen when connections between these two knowledge systems occur.

The first story is an audio piece that focuses on the Fort Belknap Grassland Restoration Project, which is a first-of-its-kind partnership between the Fort Belknap Indian Community and the Bureau of Land Management. The program trains Native youth to be field technicians in the field of ecological restoration and shares Aaniiih and Nakoda knowledge to connect youth with their tribal culture.

The second story profiles Keith Parker, Yurok tribal member and senior fisheries biologist for the Yurok Tribe. Parker's graduate research identified two subspecies of Pacific lamprey by drawing from both TEK and Western science. His findings are helping scientists, including Parker, steward Pacific lamprey into the future, which will support tribal food sovereignty and ecological health in the Klamath River basin.

The final story profiles Morgan Zedalis, Heritage Program manager for the Payette National Forest in central Idaho. Zedalis and her team, who are responsible for sharing and protecting cultural resources on public lands, are building a long-term partnership with the Nez Perce Tribe to preserve cultural sites within the forest. By working with tribes to document the cultural value of different sites, the Heritage Program is moving away from a strictly Western view of archaeology and embracing a more holistic approach to resource management that honors and incorporates TEK.

Empowering Native youth through grassland restoration | The Fort Belknap Grassland Restoration Project is training Aaniiih and Nakoda youth to be field technicians

(Anchor)

Native grasses, like those in the Great Plains ecosystem, are more resilient to drought and their seeds can be used to restore areas of degraded prairie. Bowman Leigh reports on how the Fort Belknap Indian Community is training its young people to monitor and restore these lands into the future.

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(Nat sound-crunching grasses, fade in)

(Chase-The Boy – Our ancestors walked all over this. They were here, you know, and for me, it's like church out here. I think that this program will honestly, like, make that cool again. :10)

(Nat sound-crunching grasses, fade out)

(Leigh)

Young female tribal members sat in a circle among the grasses at the Fort Belknap Indian Reservation on a hot, dry morning in early August.

(Nat sound-nervous laughter, fade in/out)

(Leigh)

The young women giggled nervously, not sure what to expect. Today was their first day in the field as Community Fellows in the Fort Belknap Grassland Restoration Project — a ten-year program funded by the Bureau of Land Management.

(Leigh)

The program is a partnership between the BLM and the Fort Belknap Indian Community that trains Native youth to be field technicians, teaching them how to collect data and gather seeds that can be used to restore prairie grasslands. It's led by indigenous ecologist, Cristina Eisenberg, who begins the field day by asking each of the Fellows a question.

(Eisenberg – What are you hoping to get out of being here? :03)

(Leigh)

The Fellows, many of whom are considered at-risk, take turns sharing a response. Sakura Main, who is twenty-two, says that she didn't expect to have an interest in this work.

(Main – When I first got here, I didn't, like, really expect to get anything, but now that I've been here and got to experience, like, what you actually do here, it kind of sparked an interest that I didn't know I had. Like, I didn't think I would be interested in, like, finding out, like, grasses that

grow here and stuff like that, and especially having, like, the traditional part tied into it, that's pretty interesting. :25)

(Leigh)

Native grasses, like those that grow on the Fort Belknap reservation, are uniquely adapted to the Great Plains ecosystem and increase its resilience to drought and climate change. Eisenberg and her team, with help from the Community Fellows, have gathered twenty-three pounds of seed this summer, ninety-six percent of which came from tribal land. The seeds will be stored and saved for use by the Aaniiih and Nakoda tribes, who can choose to sell this seed to the BLM for future restoration projects on public lands.

(Velman – There have been a lot of different land uses happen on tribal and BLM land in the last hundred years. :05)

(Nat sound-Wendy Velman talking)

(Leigh)

This is head BLM botanist for Montana and the Dakotas, Wendy Velman, who oversees the project.

(Velman – The cool part about working with the reservation is that as the elders share stories with the youth, they can get a much better understanding of very long-term historic uses on their landscapes. They get to delve into that historic knowledge that is not available on other parts of land from, you know, from white science perspective. :18)

(Leigh)

Eisenberg explains that the Grassland Restoration Project, in this sense, is not just about collecting data or building a scientific skill set among young tribal members.

(Eisenberg – When they're in the field, all they do is smile. They love what they're doing and it's very, deeply meaningful to them. This is not science for the sake of science at all, you know. That's, like, the least important part of this. It's really about healing. :15)

(Leigh)

The program aims to heal the land through grassland restoration, but also works to heal the community through empowering Native youth. The program blends hands-on Western science training with traditional ecological knowledge, exposing young people to sacred stories and places that provide a connection to their tribal culture. Program coordinator and cultural liaison, Dan Werk, says this link is crucial.

(Werk – It's powerful for them to hear those things, you know. You know, just trying to set the tone for 'em and let 'em know that there's things out here that you can grab a hold of and that are going to help you live a more fulfilling life. We're really a unique people, you know, and letting 'em know how unique they are. :15)

(Leigh)

Eisenberg says that part of the generational trauma experienced by Native peoples includes being displaced from their ancestral land.

(Eisenberg – Most of the public land that we have — well, all of it, you know — was once tribal land. And so how are we going to fix this? And a key part of that is by empowering these communities. :10)

(Leigh)

Haile Chase-The Boy worked as a Community Fellow last summer, the first year of the program, and returned this season as a field technician. She now works alongside Eisenberg to train new Fellows — a job that gives her the chance to teach, and then watch as other participants begin to feel empowered just like she did.

(Chase-The Boy – I’m learning from the ground up, on what I want to do. Looking at these, you know, these techs and these Fellows, um, you can just see that spark, when they realize, like, “Hey, like, I could be good at this, this could be good for me, something that I wanna do. :18)

(Leigh)

Chase-The Boy sees herself eventually leading the program and hopes to pursue a degree in botany or environmental law.

(Chase-The Boy – I didn’t think this was cool when I first started. And now I’m just, like, so into it. :04)

(Leigh)

Both the grasses and the community, she adds, are survivors.

(Chase The-Boy – These native grasses were supposed to be gone, but we’re still here. These grasses are still here. And so that’s how I find it empowering. :08)

(Leigh)

The Fort Belknap Grassland Restoration Project is poised to train and employ even more young tribal members in future years, hoping to inspire the next generation of environmental and cultural stewards.

(Chase-The Boy – Well, you know how I said, like, this is like church to me? Like, all of our techs feel the same way. This is where we feel grounded. And honestly, I hope everybody finds that in their life ‘cause it’s just, it’s such an amazing feeling and this program really does that for me and, you know, my co-workers. :18)

(Leigh)

For KBGA News, I’m Bowman Leigh.

Where the lamprey lead | How Indigenous science is shaping the future of fisheries management

By Bowman Leigh

On an unseasonably warm winter day, Keith Parker drives across the Klamath River in an aluminum jetboat.

The jets hum as Parker approaches a long sandbar at the river mouth, where the Klamath River — and the Yurok Indian Reservation — meet the Pacific Ocean on what is now known as the northern California coastline.

Parker, a Yurok tribal member and senior fisheries biologist for the Yurok Tribe, pushes an anchor into the sand and then walks toward a narrow channel. His salt-and-pepper hair is pulled into a small ponytail at the base of his neck. He holds a backpack in one hand, and in the other carries a long metal hook with a wooden handle, a traditional Yurok tool for catching Pacific lamprey.

Just above the river mouth, Parker rounds the corner and stops. The faces of over fifty sea lions have turned to look at him. Most lay on the sand near a bottleneck in the river, ready to feed on passing fish, while others, startled by Parker, splash into the channel below.

“They’re looking for lamprey,” Parker says, as he adjusts his route to give the sea lions more space. “This time of year, it’s what sustains them just like it sustained our people.”

Pacific lamprey are an ancient fish species that has existed for 450 million years. Like salmon, lamprey migrate from freshwater to the ocean and back again, bringing valuable marine nutrients to river ecosystems. The eel-looking fish are known for their toothed, disc-shaped mouth, which they use to attach to hosts in the ocean before returning to the river to spawn and die. The Yurok people, along with other fishing tribes in the Pacific Northwest, have relied on lamprey’s fatty meat as a part of their traditional diet for generations.

Parker walks to the ocean side of the sandbar and stands quietly beside a churning mix of river and seawater. Large breakers crash in the distance and the smooth, dark bodies of sea lions surface and dive, barking every so often in his direction. Looking down, he scans the shallows for movement.

“See how they’re working that edge?” Parker says, motioning toward the sea lions swimming in front of him. “What I’ll do a lot of times is just let them herd [the lamprey] over to the edge for me.”

Parker conducted his graduate work in this very spot almost six years ago — the same place where Yurok men before him have hunted lamprey for millennia. Parker harvested more than 200 lamprey in one year using his handmade “eel” hook and then analyzed the biological and genetic data from each sample. What he discovered next, Parker says, he never could have predicted. The project revealed two genetically distinct subspecies of Pacific lamprey: one that

matures in the ocean, and another that matures in the river. Parker's study found that ocean-maturing lamprey return to the river during a shorter window — February to early March — and can spawn within three to six weeks, while river-maturing lamprey run upriver for months and can take up to year to lay their eggs.

His research was [published in Molecular Ecology](#) in 2019 and became one of the first to blend traditional ecological knowledge (TEK) and Western science in a peer-reviewed academic journal. Parker's study even named the two new subspecies using words from the Yurok language in honor of lamprey's importance to Pacific Northwest tribes.

Parker continues to use both TEK — which expert Fikret Berkes defines as “knowledge, practice, and belief” passed down through generations — and Western science to inform his approach to stewarding the Klamath River. But navigating these two different worldviews, he says, is not easy.

Before leaving the beach, Parker looks back at the hunting sea lions. One key difference between traditional and Western ecological knowledge, he says, comes down to how people see themselves: as either a part of, or separate from, nature.

“This idea that we're managers and we manage the river and we manage land — that's not true,” Parker said. “The Creator didn't put us here to manage all of this. The Creator put us here to interact with it, to live on it, to thrive with it, to coexist. All of these creatures have equal importance to [us] in our belief system.”

—

Parker grew up on the Yurok reservation, where his grandfather taught him how to fish. His family would seasonally harvest Pacific lamprey, Chinook salmon and other fish species throughout the year and then smoke them using alder and Pacific madrone — hardwoods that grow in the coastal forests along the lower Klamath River.

When Parker was 12, his father got a job in Santa Rosa 280 miles south of the reservation and their family moved. But he returned every summer to fish and visit relatives.

Parker began a career as a federal agent for the Naval Criminal Investigative Service, and later worked as the CEO of the Yurok Economic Development Corporation. But in 2002, after the largest-ever recorded fish kill occurred on the Klamath, something changed.

“I was angry,” Parker said. “I had a lot of anger.”

In a [2004 report](#), the Yurok Tribal Fisheries Program estimated that 34,000 adult salmon, mostly Chinook, died primarily due to low flows coming from the Iron Gate Dam more than 140 miles upstream of the Yurok reservation. Parker still remembers the smell of the river blanketed with rotting fish. Elders from the Yurok Culture Committee said in the report that they had never seen “such a mass destruction of [their] salmon resource.” The fish kill, the report said, had a profound impact on the Yurok people “both economically and spiritually.”

Other events on the Klamath, like toxic blue-green algae blooms every summer, added to Parker's distress. And then, in the summer of 2011, a [female Pacific gray whale and her calf became trapped](#) in the lower river, unable to return to the ocean due to low flows. The calf escaped a month later, but the 45-foot mother whale remained. Yurok tribal members and marine scientists tried various tactics to coax her back out to sea, including playing killer whale sounds upriver, but she died after 53 days. The Yurok Tribe buried the whale in a private ceremony on the riverbank near where she beached. And before she died, Parker would visit her. He remembers the whale brushing against his boat, rolling her eyes up to look at him.

"It was a culmination of things, you know, fish kills, whales dying. Our people are being poisoned by one of the worst natural toxins you can have," Parker said, referring to the microcystin produced by blue-green algae blooms, which the [U.S. Environmental Protection Agency](#) lists as a liver toxin and potential human carcinogen.

"I knew that if I didn't go back to school and do what I always wanted to do, which was to be a fisheries or marine biologist... and try to affect change and restore our fish runs that are so culturally important to our people, I would never do it," he said.

Parker enrolled in the fisheries biology program at Cal Poly Humboldt and commuted from the reservation for the next seven years. He earned a bachelor's and master's degree back-to-back. Along the way, he received funding from the National Science Foundation and [Robert and Patricia Switzer Foundation](#) in support of his research.

Andrew Kinziger, Parker's graduate advisor and chair of the fisheries biology department, says that Parker's intimate knowledge of the Klamath River gave him a unique set of scientific tools.

"It's a deep-seated thing for him because he grew up on the river as a kid, catching lamprey and salmon as part of subsistence, and so he's lived that. Because of that upbringing, he brought a full skillset with him to do field work that he'd been doing his whole life," Kinziger said.

Kinziger adds that Parker not only knew how to catch lamprey, but also understood how to navigate the complicated tides and strong currents at the mouth of the Klamath River, which can be dangerous for those unfamiliar with the area. Parker's expertise enabled him to collect samples that Kinziger says would be hard for most people to do.

They landed on Pacific lamprey as the focus for Parker's graduate work because of its underappreciated status within the fishery and cultural value to the Yurok Tribe. Parker also hoped that his findings would inform future lamprey conservation efforts and support tribal food sovereignty.

Kinziger, who is non-Native, says that he learned just as much from Parker through working on this project.

"We all benefitted. I got to know more about Keith and his culture and working with Indigenous scientists, and Keith got to work with me and learn about genetics," he said.

Cal Poly Humboldt sees only a few Indigenous students per year come through their fisheries program, but Kinziger hopes that having graduates like Parker will increase that number.

After 45 minutes of searching for lamprey at the river mouth, Parker decides to head back to the boat empty-handed. The sea lions, not ready to give up yet, continue to fish.

“See, herein lies the big problem,” Parker said. “We’re not catching any.”

Pacific lamprey are on the verge of disappearing on the entire west coast, Parker says. A [2009 report containing TEK from Yurok and Karuk tribal members](#) indicates that Pacific lamprey numbers in the Klamath River have dropped 98% from historic levels. Human impacts on rivers, especially dams, have led this ancient species to decline rapidly in less than 100 years.

These sea lions would normally be gorging on them — Parker says they can eat up to 16 per hour — but as lamprey populations decline, the entire ecosystem feels the effects. Pacific lamprey not only bring critical marine nutrients to river systems, but also provide a buffer to native species like salmon. Predators would much rather eat a scaleless, slippery, slow-swimming lamprey with three times the fat content than a strong, scaly Chinook that’s hard to catch.

“These things all have to be restored together because they’re all interconnected,” Parker said.

But because there is no commercial market for lamprey, they are far less valued than salmon and rarely prioritized when it comes to scientific research, Parker says. Indigenous scientists, on the other hand, who recognize Pacific lamprey’s immense ecological and cultural value, have been leading the effort to study and restore this keystone species.

The [Columbia River Inter-Tribal Fish Commission \(CRITFC\)](#) is one organization that has been working to bring Pacific lamprey back.

The treaty tribes of the Columbia River Basin — the Nez Perce, Umatilla, Warm Springs, and Yakama Nation — formed CRITFC in 1977 with the goal of restoring native fish species and “ensuring a unified voice in the overall management of the fishery resource.” For over 10 years, CRITFC’s member tribes have carried out a coordinated effort to restore Pacific lamprey throughout the basin, including relocating lamprey to upstream tributaries, improving fish passage, and conducting artificial propagation where wild lamprey offspring are raised in a lab and then reintroduced. More than a decade of work led by tribal scientists is beginning to yield positive results, with lamprey numbers slowly rising in areas where they had previously disappeared. Members of the Yakama Nation, for example, recently had the chance to conduct a limited lamprey harvest in the Yakima River for the first time in 50 years.

CRITFC also operates the [Hagerman Genetics Laboratory](#) in partnership with the University of Idaho and the U.S. Department of Agriculture. CRITFC founded the Hagerman Lab in 1999 in

response to member tribes' call to use genetics to inform fisheries management, and for Parker, this facility enabled him to unlock new answers hidden in the genes of Pacific lamprey.

When Parker harvested lamprey for his graduate work, he gathered information about each fish, including sex, weight, length, and the date they were caught. He also measured egg mass in females, which is an indicator of maturity. But in doing so, Parker noticed something strange: female lamprey that looked identical on the outside had a starkly different number of eggs on the inside; some ready to spawn and others not close at all. Still, these pieces of biological information, also known as phenotypes, did not reveal a complete picture.

“All the other stuff is great, having all that phenotype information,” Parker said. “But for someone like me as a molecular biologist, the genotype-phenotype correlation — that is where it's really informative. I mean, that is powerful.”

This genotype-phenotype connection is what Parker uncovered when he ran his samples through the Hagerman Lab. Parker found that the females full of eggs were genetically distinct from the less mature females, indicating two different subspecies.

With so little known about Pacific lamprey in the scientific community, Parker's study helped to fill in part of the mystery.

Jon Hess, fisheries geneticist at CRITFC and a co-author of Parker's 2019 paper, says that Parker's on-the-ground familiarity with lamprey enabled him to know what to measure, which is key.

“That data gets combined with this powerful genetic tool and then suddenly you make these discoveries that Keith was able to make,” Hess said.

Parker's findings prompted CRITFC to analyze Pacific lamprey in the Columbia Basin to see if they could find the same connection between gene type and maturity level. As it turned out, Hess said, their findings were consistent.

“I don't think it would have been on our radar unless Keith came along and was like, ‘There's something different about these fish,’” Hess said. “It was a very cool collaboration.”

Hess used this insight to publish a [2020 study](#) that shows where these two subspecies, ocean-maturing and river-maturing, are likely to travel once they reenter freshwater. Ocean-maturing lamprey seem to stay close to the coast, while river-maturing lamprey move farther up interior basins to spawn. Curiously, the Klamath River — known to support more species of lamprey than anywhere else — contains a mix of both types, which is a question Hess says scientists have yet to answer.

Genetics are opening new levels of understanding about Pacific lamprey, but tribal scientists say that TEK is critical to seeing the full picture.

“The Western science and what we have, certainly there’s amazing technology and things we could use,” said Ralph Lampman, biologist for Yakama Nation Fisheries. “But historical info is something that we don’t have a lot of.”

Lampman leads the Yakama Nation’s Pacific Lamprey Project and interviews tribal elders as part of his work. His goal is to preserve Indigenous knowledge and get a more accurate sense of historic versus current lamprey populations. Lampman says that elders’ accounts of past lamprey numbers and preferred harvest locations inform where his team will relocate adult lamprey. He also thinks that two common terms used by elders — “day eels” and “night eels” — may refer to the two subspecies Parker later identified.

“This knowledge, this cultural knowledge, is something that could disappear and never come back,” Lampman said. “We need to make sure we don’t lose [it].”

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Back in the boat, Parker makes one more stop before returning to his office. He turns upriver and speeds away from the sandbar, heading for a tributary called Blue Creek.

The clear water stream is known to be a prolific spawning ground. Because of this, Parker says, the Yurok Tribe does not allow tribal members to fish within 500 feet of the mouth. He slows the boat and anchors it on the rocky riverbank, then walks quietly up the creek.

Parker stops after about a quarter mile and sits on the edge of a large pool, where the creek deepens and forms an eddy. A bald eagle floats silently overhead as Parker describes how Yurok tribal members would follow Blue Creek on their way to a sacred prayer site.

He opens a mason jar of smoked lamprey and grabs a small piece, pulling the skin off one side before popping the dark pink flesh into his mouth.

He explains that lamprey do not return to their home streams like salmon do. Instead, lamprey latch on to other animals when they reach the ocean and may travel hundreds of miles from their river of origin. When it’s time for them to spawn, scientists believe lamprey return to whatever freshwater is nearby where they can smell pheromones from lamprey larva. Parker refers to it as the “suitable river strategy” and says this explains why lamprey are so genetically diverse: they’re constantly mixing with fish in other rivers.

“A tree with no branches, in genetics, doesn’t make it very long,” Parker said, adding that lamprey’s genetic diversity has enabled it to be nimbler. “I firmly believe that the reason [lamprey] are still here with us is because of their ability to quickly adapt from generation to generation.”

As early as 2023, the four dams on the Klamath River — including the Iron Gate — are likely to be removed. If approved by the Federal Energy Regulatory Commission, the project would become the largest dam removal in United States history and allow the Klamath, and its fish, to run free again.

After witnessing the dams' negative impact on the river for years, Parker says he can't wait for the barriers to come down. Dam removal will restore access to critical spawning habitat and give him the opportunity to monitor how fish respond.

Parker wants to build a genetics lab near the mouth where he and his team could analyze samples in real time. That way, Parker says, when rare fish enter the river, he can alert the tribe to protect individual species. He also plans to collect a bank of genetic information to compare fish pre- and post-dam removal.

Parker says it's all part of his work to bridge the gaps in understanding between TEK and Western ecological knowledge.

"There's no one group of people that's going to fix all these ecological problems that we have," he said. "It's going to take a diversity of different approaches and different paradigms 'cause there's always multiple solutions to a problem. We know that as scientists. There's never just one solution."

Scars that tell a story | A partnership with the Nez Perce Tribe is changing cultural resource management in the Payette National Forest

By Bowman Leigh

On a sunny summer day in 2018, four women walk beneath a canopy of Ponderosa pines along Cold Springs Creek in central Idaho.

The group is led by Morgan Zedalis, archaeologist for the U.S. Forest Service, and includes one of her co-workers and two young women from the Nez Perce Tribe. The tribal members have traveled to the Payette National Forest for a two-night camping trip as part of a new summer internship. They have come to see where their ancestors were and to witness what they left behind on the landscape.

The grove of pines appears no different from the rest of the forest at first glance. The Ponderosas' thick bark has a characteristic amber hue and tufts of long, green pine needles extend from the branches overhead. But on closer inspection, some of the trunks bear something special: oblong scars.

The Nez Perce, or Nimípuu as the tribe calls themselves, have moved across what is now the Payette National Forest for at least 16,000 years. The scars are living artifacts, evidence of Indigenous people who cut into the trunks of pine trees to harvest cambium, which is a thin layer of sweet-tasting inner bark.

Nez Perce elders say that cambium served as a food source in winter and spring when other food was scarce. Tribal members would cut into the outer bark and pry it from the tree, then scrape off juicy strips of cambium to eat. Nothing from the peels went to waste, but was collected for tools, medicine, or prayer. Tribal members peeled only a portion of the trunk and spaced out each grove so that the trees could heal.

Ashley Hendren, one of the two interns in 2018, grew up hearing stories about cambium peel trees from her mother and grandfather on the Nez Perce reservation, but had never seen one in person until her trip to the forest.

“I would try to use that knowledge and go out and look for these trees with my sisters, but I didn't know what I was looking for. Working with Morgan [Zedalis], I was able to put a picture to a description,” Hendren said.

Zedalis manages the Payette National Forest Heritage Program, the Forest Service department responsible for protecting and sharing cultural resources on public lands. And in the summer of 2017, she began talking with Nakia Williamson, director of the Nez Perce Tribe's Cultural Resource Program, about creating a new opportunity for young people.

Williamson had just developed a 12-week internship for tribal students, and he and Zedalis decided to add an element where interns could work directly with the Forest Service. The partnership would allow students to participate in projects on their ancestral lands and see what a

career in archaeology might look like. And it would offer Zedalis a chance to grow her relationship with the tribe and integrate traditional ecological knowledge (TEK) into land management.

The goal of the 2018 internship was for the two young tribal members to visit cultural sites on the forest, and then interview Nez Perce elders to inform new interpretive signage at the tree grove.

Hendren says that Zedalis' openness and cultural sensitivity during the project made her feel like an ally.

"It's really nice just having somebody who's not a tribal member listen to you and sympathize with the loss of land, or looking at how important these trees are and wanting to protect them just as much as your own tribe does," Hendren said.

The cambium peel tree project, while small in scale, speaks to a broader partnership being built between the Heritage Program and the Nez Perce Tribe. By documenting the cultural value of different sites, Zedalis and her team are moving away from a strictly Western view of archaeology and embracing a holistic approach to resource management that honors and incorporates TEK.

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Zedalis lives just outside the Payette National Forest boundary in the resort town of McCall, Idaho. Less than half a mile from her house stands a tall Ponderosa pine on the edge of Payette Lake.

The tree is one of a handful that shade Rotary Park, which is a small green space on the lakeshore with two picnic tables, a public bathroom, and a parking lot. The park transforms into a popular swimming location in the summer, but stays fairly quiet during the off-season.

Zedalis begins most mornings with a walk to the tree, which has a cambium peel scar on one side. Most park visitors, Zedalis says, don't even notice the scar, much less understand what it means.

"It's just incredible that it's still there regardless of all the development that's occurred," she said. "It's this beautiful story sitting right there that no one knows about."

Zedalis grew up in a working-class family with five siblings in the town of White Bird, then moved an hour and a half south to McCall when she was in seventh grade. She attended the University of Hawaii as an undergraduate, earning a bachelor's degree in anthropology, and then crossed the Atlantic to study for a master's in environmental anthropology at the University of Kent.

Zedalis' master's research brought her back to Idaho in 2009 to pursue a thesis on wolf reintroduction, which is when she began to build relationships among the Nez Perce Tribe. She

sat in living rooms and listened to stories over cups of coffee and chocolate chip cookies, with stakeholders ranging from cattle ranchers to tribal members. Zedalis says that hearing these perspectives gave her a deeper appreciation for different relationships to the land.

“I think that’s the challenge,” she said. “Oftentimes we’re not telling the human part of the story.”

After completing her master’s degree, Zedalis moved back to McCall and interned for the Forest Service while working toward a Ph.D. in environmental philosophy from the University of Idaho. She was hired as a full-time archaeologist for the Payette National Forest in 2014 and has remained there ever since.

Now, as manager of the forest’s Heritage Program, Zedalis says that her work continues to build on these earlier conversations, particularly those with the Nez Perce Tribe.

“What I learned in my master’s and Ph.D. research was that integrating TEK helps provide some perspectives that we may not have heard before or thought about and it might change some nuances to our management,” Zedalis said.

She has continued to look for opportunities to share information and partner with tribes on cultural resource projects, often for the first time in Heritage Program history. Zedalis says that working with the Nez Perce to create interpretive signage for the cambium peel tree grove was a natural fit, especially because past documentation of these sites did not include tribal perspectives.

“The way that [cambium peel trees] were documented archaeologically in the record... took a much more traditional approach, just looking at the archaeological and historical value of those places. And it struck me that there hadn’t been any interviews with tribal members about those trees and the practices related to them,” she said.

Through documenting the cultural value of these sites, Zedalis and her team have been able to list cambium peel tree groves as eligible for the National Registry of Historic Places, which the Forest Service is required by law to manage and protect. Zedalis has also worked to preserve senses of solitude, soundscapes, and viewsheds at different sites to foster tribes’ spiritual experiences.

Yet despite her intention to deepen relationships and share a more accurate picture of historic land use, Zedalis acknowledges that working within a federal agency has its limitations.

“I’m not necessarily in this institution for what it is now, but for what I think it can be in the future,” she said.

Zedalis hopes that growing relationships with tribal members can offset some of the legal and structural challenges she faces within the agency when trying to incorporate Indigenous knowledge.

Reflecting on what shaped her approach to this work, Zedalis recalls one moment during her undergraduate education that turned her off from traditional archaeology. She was tasked with sifting through a collection of artifacts from the 1980s that were stored in an old, rusty shipping container on campus. It was only after she started sorting that Zedalis realized the artifacts were human remains. She still gets chills thinking about it.

“I understand the importance of data collection for the value of science,” Zedalis said. “But I guess I have always felt that we can’t answer those questions and compromise the relationships that we have with people... They need to be a part of the process.”

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When it comes to legal protections for cultural resources on public lands, tribes have limited power compared to federal agencies.

The National Historic Preservation Act dictates how historic preservation is carried out, and section 106 of the NHPA states that agencies must consult with tribes if a proposed action could potentially affect historic or culturally significant properties.

But legal experts say that the NHPA also gives federal agencies “considerable discretion in how rigorously [the act] is applied to the protection of sacred places and cultural resources.” A [2021 report](#) on tribal co-management explains that section 106 requires agencies to consult, but doesn’t mandate any kind of cultural preservation.

Monte Mills, professor and co-director of the Margery Hunter Brown Indian Law Clinic at the University of Montana, co-authored the report and says that tribal consultation is often treated like checking a box.

“Rather than the agency having regular dialogue and understanding what the tribe may be concerned about, they’re just like ‘Oh, we have this [oil and gas] lease. Who do we need to talk to?’” Mills said.

According to the report, the NHPA creates an opportunity for tribes to participate in federal decision-making, ideally to minimize harm to sacred places, but rarely protects tribal interests when disputes arise. The law’s design can also place a heavy administrative burden on tribes, especially those with significant ancestral territories like the Nez Perce. With so many proposed actions occurring on public lands, tribal historic preservation offices can become overwhelmed with stacks of consultation requests. This puts tribes in a reactive state, Mills says, by forcing them to prioritize projects that could be most impactful to cultural sites.

On top of these challenges, the NHPA doesn’t require federal agencies to compensate tribes for participating in the consultation process.

“It puts the responsibility on us,” said Nakia Williamson, director of the Nez Perce Tribe Cultural Resource Program. “It’s like saying, ‘go do this [tree] thinning, but you find the resources to do it.’”

Williamson says that one of the larger issues in dealing with agencies is that they use resources in a Western way that views them as separate from people. Much of Williamson's job entails trying to explain his tribe's relationship with the land to other resource managers, but he says putting this connection into words is difficult.

"What we understand has to be lived or experienced," Williamson said. "How do you explain it?"

Williamson is used to receiving letters informing him of proposed government actions and requesting tribal consultation. Even when conversations occur, he says, talking doesn't necessarily lead to action. But working with Zedalis has been a different, more positive experience.

"The way she does her work is a lot more conducive to exchanging information," Williamson said, adding that Zedalis' earnestness and ability to listen has built a trust between them.

"She wants to do more than just write us a letter," he said.

After their 2018 camping trip in the Payette National Forest, the two interns returned to the Nez Perce reservation to interview tribal elders about cambium peel trees.

They learned how the trees were peeled, what tools were used, and how the cambium was stored. They also documented words in the Nez Perce language related to this practice. The information was compiled and shared with the Heritage Program, which then produced draft text for a future interpretive sign at the tree grove. Zedalis sent the draft to Williamson for review and plans to work with a Nez Perce artist on graphics.

Hendren says that the signage will help educate others on the tribe's historic presence in the forest.

"Having these interpretive signs lets other people know that we were a large tribe and we expanded far beyond the small reservation boundary," Hendren said. From a legal perspective, she adds, having signage shows that tribal members used this landscape for millennia and supports their continued right to hunt, fish, and conduct spiritual practices in these areas.

But as of 2022, a range of factors have stalled the interpretive signage from going up, including the COVID-19 pandemic and bark beetle damage to the tree grove. Still, Zedalis says she is confident that the signs will ultimately be installed.

Outside of the forest, Zedalis is working with the City of McCall's Historic Preservation Commission to add interpretive signage near the cambium peel at Rotary Park. Funding from the Idaho Humanities Council will help pay for the signs and supported bringing Williamson to McCall in 2021 to speak about the cambium peel on the edge of the lake.

“The commission [has] done a good job telling the stories of settlers and homesteaders and miners, but I saw this big void of sharing Indigenous history,” Zedalis said.

When she thinks about the future of the Payette National Forest, Zedalis says that she hopes to eventually work herself out of a job.

“I don’t see a lot of tribal members involved in federal cultural resource management and that’s, to me, a missed opportunity,” she said.

“It’s a goal of mine to work with tribal youth and to encourage folks to get credentials in the field of archaeology... so that they’re in the role of managing their own cultural resources.”