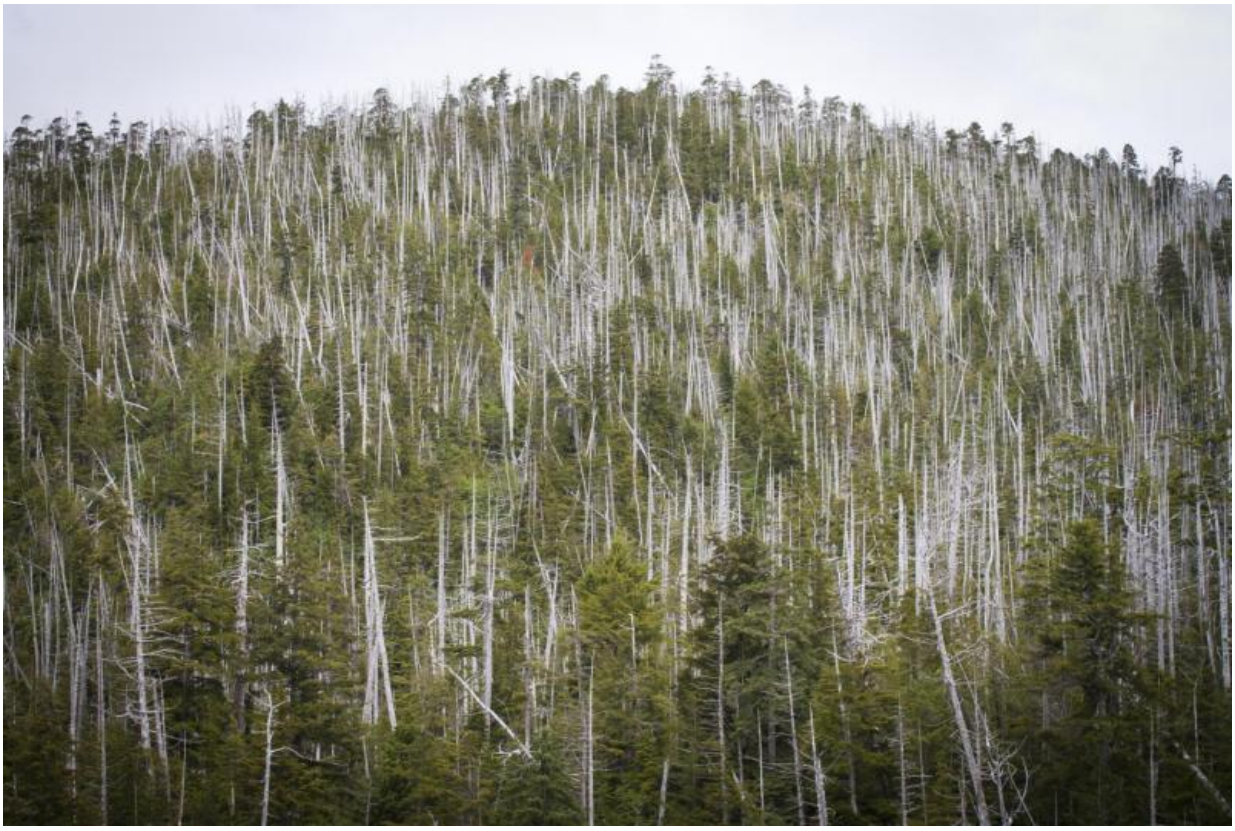
Climate change requires new conservation models

October 15 2015



Yellow-cedar decline south of the study area, near the current latitudinal limit where the climate-induced tree mortality occurs. Credit: Courtesy of Lauren Oakes.

A threatened tree species in Alaska could serve as a model for

integrating ecological and social research methods in efforts to safeguard species that are vulnerable to climate change effects and human activity.

In a new Stanford-led study, published online this week in the journal *Biological Conservation*, scientists assessed the health of yellow cedar, a culturally and commercially valuable tree that is experiencing climate change-induced dieback and that is found throughout coastal Alaska.

In an era when climate change touches every part of the globe, the traditional conservation approach of setting aside lands to protect biodiversity is no longer sufficient to protect species, said the study's first author Lauren Oakes, a research associate at Stanford University.

"A lot of that kind of conservation planning was intended to preserve historic conditions, which, for example, might be defined by the population of a species 50 years ago or specific ecological characteristics when a park was established," said Oakes, who is a recent PhD graduate of the Emmett Interdisciplinary Program in Environment and Resources (E-IPER) at Stanford's School of Earth, Energy and Environmental Sciences.

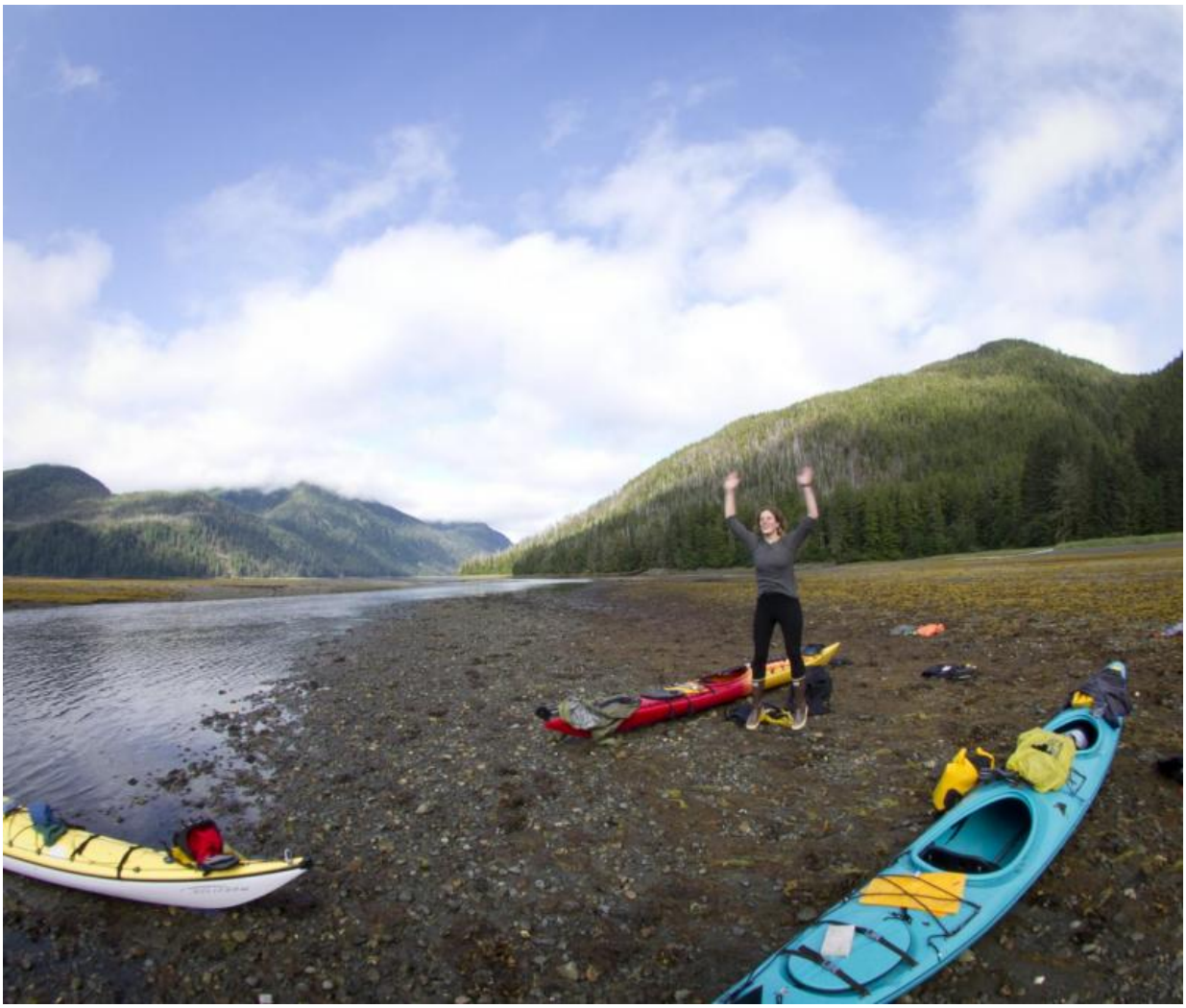
But as the effects of climate change become increasingly apparent around the world, resource managers are beginning to recognize that "adaptive management" strategies are needed that account for how climate change is affecting species now and in the future.

Similarly, because climate change effects will vary across regions, new management interventions must consider not only local laws, policies and regulations, but also local peoples' knowledge about climate change impacts and their perceptions about new management strategies. For yellow cedar, new strategies could include assisting migration of the species to places where it may be more likely to survive or increasing protections of the tree from direct uses, such as harvesting.

Gathering these perspectives requires an interdisciplinary social-ecological approach, said study leader Eric Lambin, the George and Setsuko Ishiyama Provostial Professor at Stanford and Senior Fellow at the Woods Institute for the Environment.

"The impact of climate change on ecosystems is not just a biophysical issue. Various actors depend on these ecosystems and on the services they provide for their livelihoods," said Lambin, who is professor in the School of Earth, Energy and Environmental Sciences.

"Moreover, as the geographic distribution of species is shifting due to climate change, new areas that are currently under human use will need to be managed for biodiversity conservation. Any feasible management solution needs to integrate the ecological and social dimensions of this challenge."



Lead author Lauren Oakes, taking a moment to celebrate completion of the measurements at a site. The research team accessed remote forests by kayak and foot on the outercoast of southeast Alaska. Credit: Lauren Oakes.

Gauging yellow cedar health

The scientists used aerial surveys to map the distribution of yellow-cedar in Alaska's Glacier Bay National Park and Preserve (GLBA) and collected data about the trees' health and environmental conditions from

18 randomly selected plots inside the park and just south of the park on designated wilderness lands.

"Some of the plots were really challenging to access," Oakes said. "We would get dropped off by boat for 10 to 15 days at a time, travel by kayak on the outer coast, and hike each day through thick forests to reach the sites. We'd wake up at 6am and it wouldn't be until 11am that we reached the sites and actually start the day's work of measuring trees."

The field surveys revealed that yellow-cedars inside of GLBA were relatively healthy and unstressed compared to trees outside the park, to the south. Results also showed reduced crowns and browned foliage in yellow-cedar trees at sites outside the park, indicating early signs of the dieback progressing towards the park.

Additionally, modeling by study coauthors Paul Hennon, David D'Amore, and Dustin Wittwer at the USDA Forest Service suggests the dieback is expected to emerge inside GLBA in the future. As the region warms, reductions in snow cover, which helps insulate the tree's shallow roots, leaves the roots vulnerable to sudden springtime cold events.

Merging disciplines

In addition to collecting data about the trees themselves with a team of research assistants, Oakes also conducted interviews with 45 local residents and land managers to understand their perceptions about climate change-induced yellow cedar dieback; whether or not they thought humans should intervene to protect the species in GLBA; and what forms those interventions should take.

One unexpected and interesting pattern that emerged from the interviews is that those participants who perceived protected areas as "separate"

from nature commonly expressed strong opposition to intervention inside protected areas, like GLBA. In contrast, those who thought of humans as being "a part of" protected areas viewed intervention more favorably.

Hourly soil and air temperature data were collected to compare thermal regimes in forests inside Glacier Bay National Park and Preserve with forests just further south in the West Chichagof-Yakobi Wilderness. OR Hourly soil and air temperature data were collected in protected areas as part of the interdisciplinary study in order to explore current climate-related risk to yellow-cedar. Credit: Lauren Oakes.

"Native Alaskans told me stories of going to yellow-cedar trees to walk with their ancestors," Oakes said. "There were other interview

participants who said they'd go to a yellow-cedar tree every day just to be in the presence of one."

These people tended to support new kinds of interventions, because they believed humans were inherently part of the system and they derived many intangible values, like spiritual or recreational values, from the trees. In contrast, those who perceived protected areas as "natural" and separate from humans were more likely to oppose new interventions in the protected areas.

Lambin said he was not surprised to see this pattern for individuals because people's choices are informed by their values. "It was less expected for land managers who occupy an official role," he added. "We often think about an organization and its missions, but forget that day-to-day decisions are made by people who carry their own value systems and perceptions of risks."

The insights provided by combining ecological and social techniques could inform decisions about when, where, and how to adapt conservation practices in a changing climate, said study coauthor Nicole Ardoin, an assistant professor at Stanford's Graduate School of Education and a center fellow at the Woods Institute.

"Some initial steps in southeast Alaska might include improving tree monitoring in protected areas and increasing collaboration among the agencies that oversee managed and protected lands, as well as working with local community members to better understand how they value these species," Ardoin said.

The team believes their interdisciplinary approach is applicable to other climate-sensitive ecosystems and species, ranging from redwood forests in California to wild herbivore species in African savannas, and especially those that are currently surrounded by human activities.

"In a human-dominated planet, such studies will have to become the norm," Lambin said. "Humans are part of these land systems that are rapidly transforming."

Provided by Stanford University