Partners in the Sky

Tanana Chiefs Conference collaborates on aerial remote sensing

TCC + sUAS = an exciting pair of research projects for Alaska NSF EPSCoR.

Researchers with the Tanana Chiefs Conference, the regional non-profit organization representing 42 Alaska Native tribes scattered across the Interior, are collaborating with the EPSCoR Boreal Fires team on two projects studying wildfire-related impacts using small unmanned aircraft systems (sUAS) or drones. One study is examining vegetation regrowth in village firebreaks, and the other is looking at how fires along rivers could influence salmon habitat and growth rates.

"They've got a better handle on what's important to their communities than we do," Boreal Fires researcher Todd Brinkman said of TCC. "I want us to co-produce research that helps TCC advocate for the interests of their communities and helps them make smart, timely, and adaptive decisions with regards to wildfire and to resilience to wildfire."

Photo by Fabian Keirn/TCC

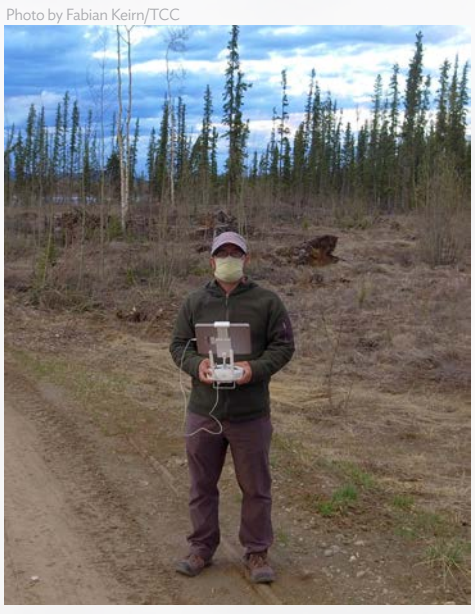

Photo by Debra Lynne/TCC

Left: Tanana Chiefs Conference Forester Fabian Keirn gathers sUAS footage of a firebreak in the village of Tanacross, May 12, 2020. Right: Tanana Chiefs Conference Natural Cultural Resources Specialist Debra Lynne gathers sUAS footage of the Chena River outside Fairbanks in summer 2020.

Firebreaks

In May 2020, TCC Forester Fabian Keirn traveled to the communities of Dot Lake, Tanacross and Tetlin, all of which had had preventative firebreaks put in at various times over the last 20 years. They are all "shaded fuelbreaks," in which crews had thinned stretches of woods rather than clear-cutting them. "That way when a fire is coming towards the community, the hope is that the fire will hit the break and move the fire out of the crowns of the trees and drop it down until there could be some direct suppression efforts," explained Keirn.

Keirn's job was to gather remotely sensed photos of the firebreaks using sUAS, working at dusk or dawn to minimize shadows - which can create artifacts in the imagery that interfere with analysis. He ground-truthed the data by measuring the size and number of trees, as well as the percent cover of grasses, at a set of small circular plots of the firebreaks stationed roughly 200 feet apart. He then shipped the data to UAF, where Brinkman, fellow Boreal Fires researcher Santosh Panda and undergrad Irina Sweedler have been studying the imagery to see how successfully it can be used to correctly classify vegetation types.

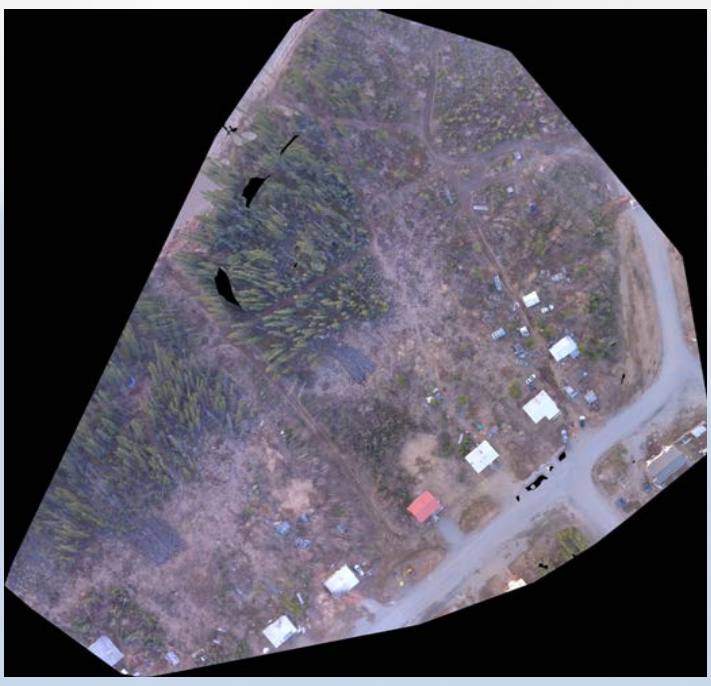

Image courtesy Fabian Keirn/TCC and Todd Brinkman/Alaska EPSCoR

Top: An orthomosaic of 2020 sUAS imagery of the village of Tanacross, including a firebreak running through the center of the photo. Bottom: Orthomosaic (left) and Normalized Difference Water Index (right) maps of a Chena River study site at mile 37.7 Chena Hot Springs Road. The legend shows the NDWI value for each pixel in the NDWI index map.

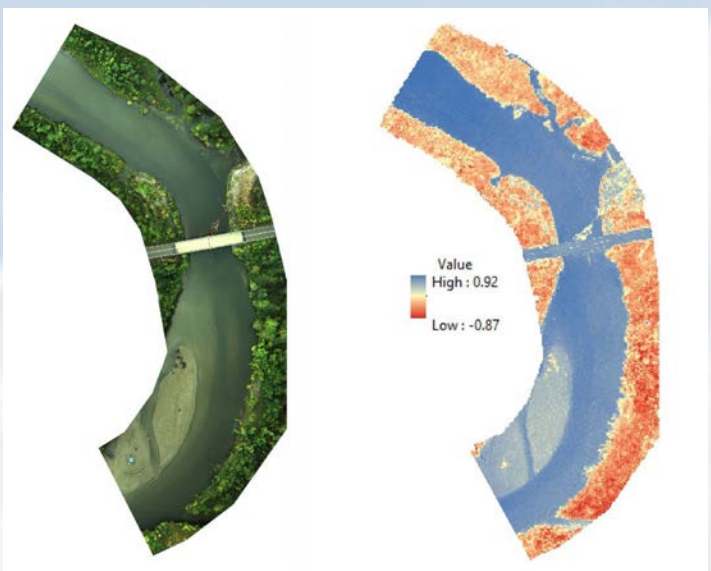

Image courtesy Brian McKenna/TCC

Keirn said the data could enable researchers to examine whether firebreaks have grown back to the point where they may no longer serve their purpose, and also to look at how effective these types of fuel breaks are in the first place. "I don't think too many people have done too many studies on these shaded fuelbreaks," he noted. "Whether or not that (strategy) is working hasn't really been followed up on."

Brinkman said the project is also a proof-of-concept of the sUAS technique, which could provide organizations with a rapid, simple tool for the currently time-consuming process of evaluating firebreaks. He said the UAF researchers are concluding their evaluation of the technique and they've been generally pleased with the results, and that the next step is to share their findings with TCC and decide whether to further pursue the study.

"I'd love to put together some sort of training workshop for rural communities where they can assess their fuelbreaks themselves," Brinkman noted. "This is something that they could probably do from start to finish without us. It would be great."

Turbulence

Remotely sensed sUAS imagery collected by TCC also plays a major role in a Boreal Fires project to study the impacts of forest fires on juvenile Chinook salmon in the Upper Chena River outside of Fairbanks. A research team led by UAF research scientist Erik Schoen spent summer 2020 taking measurements of fish, aquatic invertebrates, and water quality in the Chena River and tributaries to see whether portions of the river upstream and downstream of recent fire sites exhibit different characteristics that could impact juvenile salmon growth rates. Schoen said fires could affect salmon in a number of ways: for example, they can result in warmer water temperatures, which may increase growth rates; they may increase the amount of fine-scale debris in the river, which salmon mistake for insects and waste energy by chasing; conversely, vegetation like fireweed that appear after fires may produce more insects for fish to eat. "We're not sure how all these different interacting facts play out, whether it's a net positive or a net negative for juvenile salmon," Schoen said. "We're studying the river at a couple different scales here trying to understand how."

Another significant way that fires may impact juvenile salmon is by flushing more sediment into the water and thus increasing river turbidity, which may inhibit feeding and growth. To study turbidity, TCC Natural Cultural Resources Specialist Debra Lynne used a sUAS equipped with a multispectral sensor to gather both visual and multispectral imagery of the stretches of the Chena River where sampling was taking place. The multispectral imagery was then sent to TCC Fisheries Biologist Brian McKenna, who has been post-processing the data sets and combining spectral bands from the imagery to create maps displaying the Normalized Difference Water Index (NDWI) - an optical measure that prior studies have used to estimate turbidity. Much like the firebreak project, McKenna's next task is to compare the imagery to measurements taken directly from the river to see how well NDWI can be used to track turbidity.

"We're going to be comparing and analyzing the relationship between the in-river turbidity measurements and the NDWI values from the index maps," he explained. "We're trying to build a relationship between those two."

Also like the firebreak project, McKenna and Schoen said a major goal of the research is to test the effectiveness of the sUAS as a rapid deployment tool, especially in remote environments. "If there's a new forest fire on a salmon stream, you might be able to deploy a drone and collect some rapid assessment imagery and have some idea of whether that fire is going to be beneficial or harmful or maybe neutral to juvenile Chinook production," Schoen said.

Photo by Seth Adams/Seth Adams Photography

UAF researcher Michelle Quillin examines a juvenile Chinook salmon sampled from the Chena River, August 21, 2020.

All the researchers pointed to the mutually beneficial aspects of the TCC partnership. In the case of the firebreaks, TCC was able to use EPSCoR image processing equipment and expertise, while TCC's involvement facilitated access to villages during the early days of the COVID pandemic. And the salmon study will enable both UAF and TCC researchers to gain knowledge about potential impacts to a singificant natural resource.

"Chinook salmon are an important source of food for the residents of the TCC region within the Yukon and Kuskokwim rivers, and also provide an important cultural role in fish camps," noted McKenna. "We were excited about the projects because we want to better understand how climate change is impacting wild food resources, so we can better manage these resources."