LEARNING Networks notes FROM THE FIELD

Using Drones to Improve Our Understanding of Fire Behavior

Sycan Marsh Preserve ~ Oregon FLN

The emergence of affordable unmanned aerial systems (UAS) has created new opportunities to study fire behavior and ecosystem pattern-process relationships. At Sycan Marsh Preserve, the Big Coyote Fuels Reduction Project provided a project team from the U.S. Forest Service Fire Research Lab, University of Montana and The Nature Conservancy with an opportunity to expand upon existing efforts to quantify fire intensity, behavior and effects.

Field observations made using UAS in prescribed fire experiments allow researchers to quantify actual fire behavior, providing validation of numerical experiments and corroboration of modeling research. Deploying UAS in prescribed fire settings, rather than wildfire situations, simplifies operations somewhat; this enhances research efficacy, while exposing scientists and fire managers to the strengths and weaknesses associated with the use of UAS more broadly.

Fire behavior is important to a range of scientific inquires, including fire spread dynamics and fire behavior process-vegetation pattern relationships, as well as to assessments of fire and other disturbance interactions, fuel treatment design and effectiveness, and evaluation and validation of mathematical fire models. The ability to successfully collect precise field data requires extensive coordination to achieve desired experimental results while operating within the context of prescribed burn operations.

Remote sensing—from handheld or tripod-mounted devices, manned aircraft, satellites and, increasingly, UAS—is fundamental to the systematic measurement of fire behavior in the field. UAS are also proving useful for collecting vegetation data, resulting in opportunities for acquiring coincident fuels-fire behavior datasets with increasingly finer grains and larger spatial extents.

Results from seven study plots at the Sycan Marsh Preserve and Lubrecht Experimental Forest in Montana appear in the article "Deriving Fire Behavior Metrics from UAS Imagery" (*Fire* 2(2):36). Methods are discussed for collecting consistent time-series data for fire rate of spread and direction during complex fire behavior using UAS-borne near-infrared (NIR) and thermal IR cameras.

In addition, the paper provides techniques to determine appropriate analytical units to improve statistical analysis of fire-environment interactions.

Lloyd Queen, Matt Cunningham and Carl Seielstad from the University of Montana review data being collected by drones (UAS) during prescribed fire operations at Sycan Marsh Preserve, October 2018.
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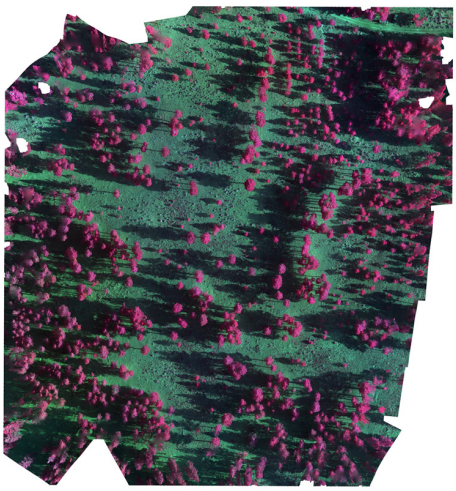

Image of Plot D on Brattain Ridge at Sycan Marsh Preserve, Oregon. Plots are 100 x 100 meters (2.47 acres), with the center plot being 10 x 10 meters. In examining the relationship between fire severity and structure we found mean canopy height to be a powerful explanatory variable.

Forest stand structural characteristics in this plot: 56 trees per acre; 30.4 percent openings; stand density index (SDI) 76; quadratic mean diameter (QMD) 12 in; basal area (BA) 48.1±8.3 ft^2/acre.

"UAS can give an unprecedented perspective for data collection in active fire environments at favorable spatial and temporal scales if the software, hardware, and fire operations conflicts are resolved or minimized."

Learn More

Moran, Christopher J., Carl A. Seielstad, Matthew R. Cunningham, Valentijn Hoff, Russell A. Parsons, Lloyd Queen, Katie Sauerbrey and Tim Wallace. "Deriving Fire Behavior Metrics from UAS Imagery." *Fire* 2 no. 2 (2019). https://www.mdpi.com/2571-6255/2/2/36

For more about the Big Coyote project at Sycan Marsh Preserve, contact:

Craig Bienz cbienz@tnc.org

The Fire Learning Network is part of *Promoting Ecosystem Resilience and Fire Adapted Communities Together*, a cooperative agreement between The Nature Conservancy, USDA Forest Service and agencies of the Department of the Interior. For more about PERFACT, contact Marek Smith at marek_smith@tnc.org.

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