National Aeronautics and Space Administration

FY23 Strategic Initiatives Research and Technology Development (SRTD)

Wildfire: A Cross-cutting, Extreme Earth System Science Phenomena and Decision-support Target

Principal Investigator: Felix Seidel Caprez (329)**; Co-Investigators:** Brian Drouin (320), John Reager (329), Charles Miller (329), David Schimel (329), Olga Kalashnikova (329), Yunling Lou (334), Karen An (334), Ryan Briggs (382)

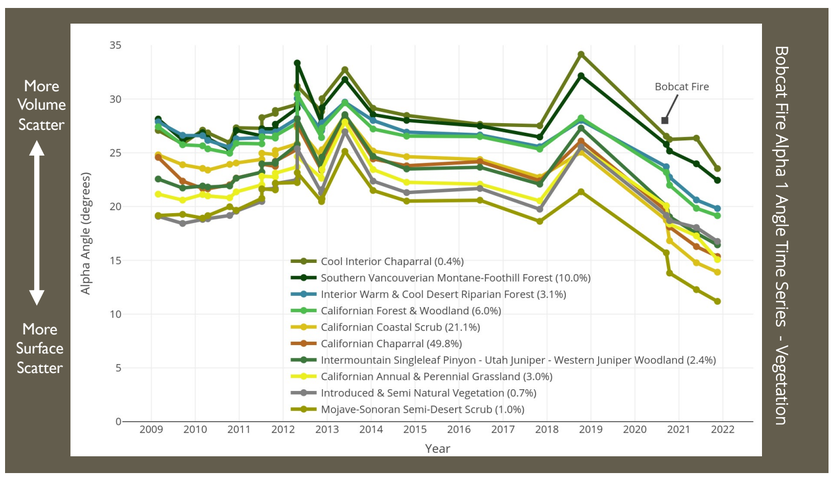
Strategic Focus Area: Wildfire: A Cross-cutting Science& Decision-support Target | **Strategic Initiative Leader:** Brian J Drouin

Objectives:

- Establish JPL's role in addressing wildfires by enhancing wildfire science and technology expertise with partners.
- Improve UAVSAR technology for wildfire risk assessment, focusing on PolSAR-based fuel structure and moisture retrievals.
- Prepare for the 2027 Earth Science Decadal Survey by building consensus within JPL and with partners.
- Develop a wildfire engagement strategy.
- Foster coordination with NASA, academic institutions, and stakeholders.

Background:

- Rising wildfires demand urgent attention, falling within Earth system science, climate change, and societal concerns.
- Align with JPL's mission to strategically address this challenge.



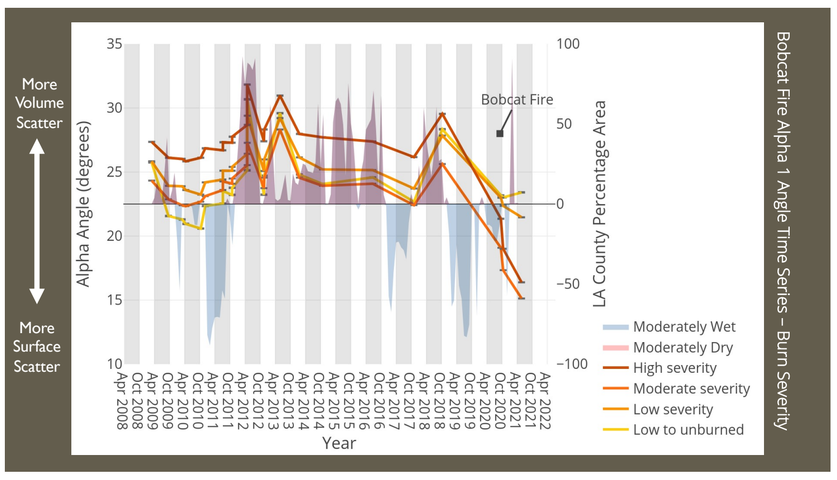
Vegetation Time Series: Eigenvector 1 (Alpha Angle 1, higher values indicating more vegetation) data collected from 23 UAVSAR flights conducted within the southern Bobcat Fire perimeter. The data distinguishes various vegetation species based on in-situ and optical imagery. It highlights the **influence of the Bobcat Fire on vegetation**, with a noticeable decrease in alpha angle values following the fire, especially in areas of high and moderate severity.

Approach and Results:

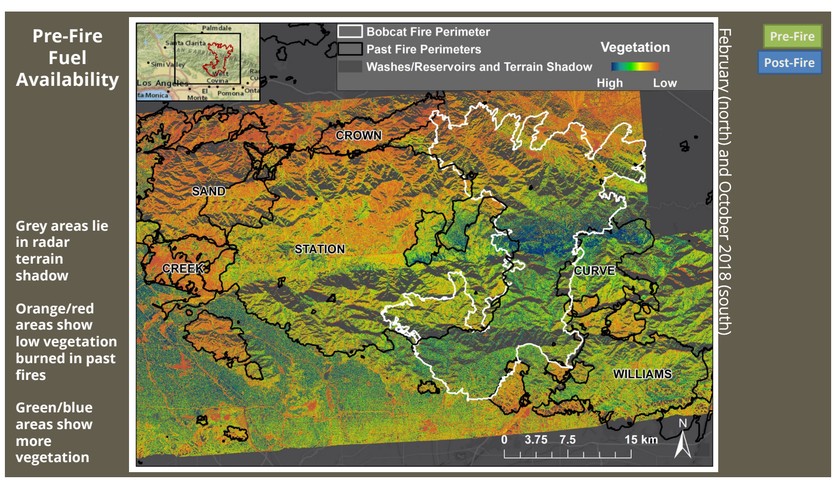
- Pilot algorithm for fuel structure moisture retrievals developed.
- Findings presented at IGARSS and submitted for peer-review publication.
- Building consensus for active participation in the 2027 Earth Science Decadal Survey.
- Comprehensive strategy for long-term wildfire engagement developed through SWOT analysis.
- Identified JPL's strengths, weaknesses, opportunities, and threats in wildfire research.
- Active coordination with NASA, academic partners, and stakeholders ensures alignment with broader wildfire mitigation efforts.

Significance/Benefits to JPL and NASA:

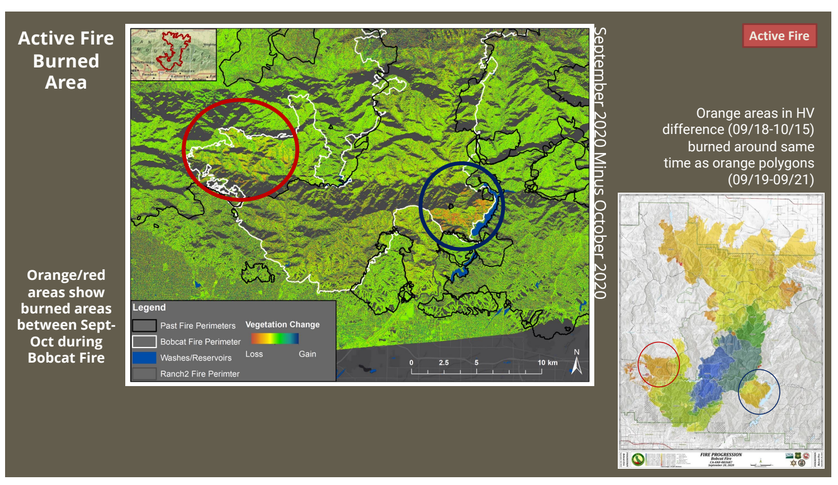
- UAVSAR improves wildfire risk assessment accuracy with critical fuel data.
- Influence the 2027 Decadal Survey, reinforcing JPL's role in Earth system science and societal impact.
- JPL is a vital NASA partner advancing Earth system science where it counts.



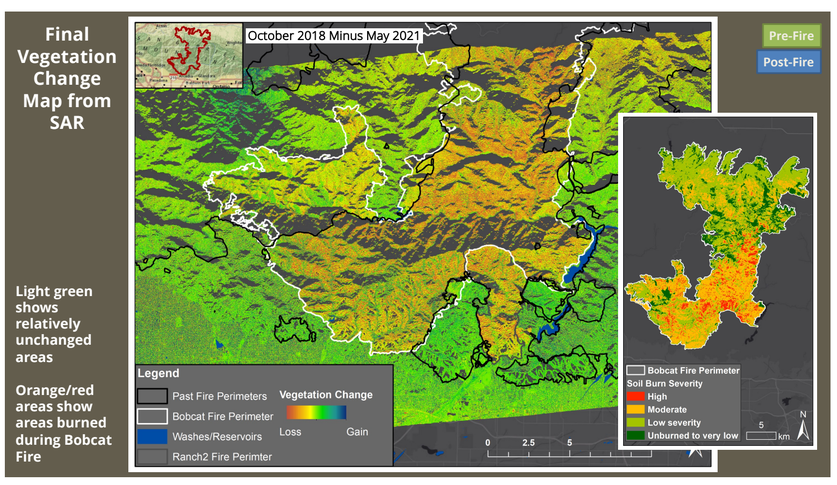
Fuel Structure Analysis: UAVSAR data within the Bobcat Fire perimeter, categorized by burn severity classes and overlaid with U.S. Drought Monitor shading. Decreased alpha angles post-fire indicate vegetation impact, particularly in high and moderate severity zones. The figure also reveals temporal volume scattering dynamics and post-fire recovery in low severity areas, providing **insights into ecological changes** following the Bobcat Fire.



UAVSAR polarization HV data from February 2020 (North) and October 2020 (South), with red indicating lower vegetation structure and blue indicating higher vegetation structure. **Demonstrating the utility of airborne SAR measurements for forest management**.



UAVSAR polarization HV difference images for September 2020 minus October 2020, with red indicating **vegetation loss caused by the late September 2020 Bobcat fire** (reduction in volume scattering). The remote sensing data aligns with Forest Service in-situ observations in the Angeles National Forest, highlighting the **effectiveness of airborne SAR measurements in detecting vegetation structure changes for decision-making during active wildfires**.



Long-Term Vegetation Change Assessment: UAVSAR polarization HV difference images comparing October 2018 to May 2021, with red signifying vegetation loss (reduction in volume scattering). The remote sensing findings align closely with in-situ data collected by the Angeles National Forest's Forest Service, showcasing the **effectiveness of airborne SAR measurements in delivering information on vegetation structure changes to decision-maker**s, eliminating the need for extensive field surveys.

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Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

www.nasa.gov

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Publications:

[A] Karen An, Cathleen E. Jones, and Yunling Lou, “Developing a detection and monitoring framework for wildfire regimes with L-Band Polarimetric SAR”. ESS Open Archive (April 04, 2023). https://doi.org/10.22541/essoar.168056839.98485943/v1

[B] Karen An, Yunling Lou, Cathleen E. Jones, “DEVELOPMENT OF AN L-BAND SAR FUEL MOISTURE PRODUCT FOR PRESCRIBED BURN MONITORING,” Presented at IGARSS23 in Pasadena, July 2023 in the Session: TH2.R15. https://2023.ieeeigarss.org/view_paper.php?PaperNum=2203

PI/Task Mgr. Contact Information:

818-354-7604 Felix.Seidel@jpl.nasa.gov