P3.27 Fusion of Multi-platform EO Data for Mapping of Fire Progression and Post-fire Vegetation Recovery

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Introduction

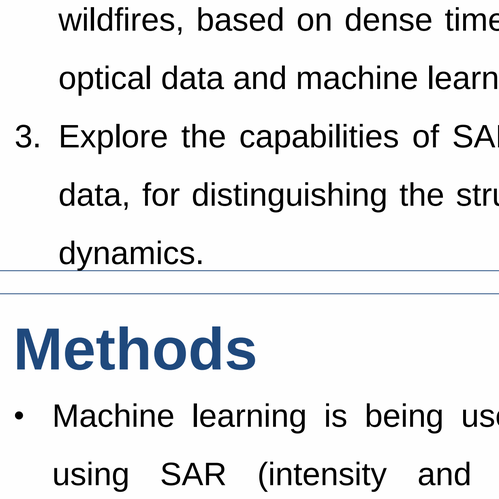
- The 2019/20 bushfires occurred at an unprecedented scale and severity.
- This research is addressing key methodological gaps and limitations in existing systems for monitoring the impact of fire on vegetation.
- The key innovation is the development of robust methods for the integration of imaging radar into current and emerging systems for monitoring the impact of fire on vegetation.
- Radar is cloud and smoke penetrating and provides complementary information on vegetation structure and biomass.
- The project will support land and fire managers to make more informed decisions, by developing more accurate and timely measures of burnt area extent and tools for monitoring post-fire recovery.

Aims

1. Develop remote sensing methods that will be integrated into an operational framework for monitoring the impact of fire on vegetation.
2. Improve rapid fire extent and progression mapping, particularly for large wildfires, based on dense time-series of synthetic aperture radar (SAR), optical data and machine learning.
3. Explore the capabilities of SAR and LiDAR data, integrated with optical data, for distinguishing the structural characteristics of post-fire recovery dynamics.

Methods

- Machine learning is being used for rapid fire extent mapping, trained using SAR (intensity and interferometric coherence) and optical (reflectance and indices) metrics, and compared to available line scan imagery.
- Time-series profiles, intensity differences and indices are being extracted from dense time-series of Sentinel-1 (C-band) and ALOS-2 PALSAR-2 (L-band) to assist in recovery monitoring.
- Field and laser scanner measurements are being used to interpret SAR data and decouple the recovery response in different vegetation strata.



NSW Study sites in Blue Mountains, Pilliga, Kaputar and Clouds Creek

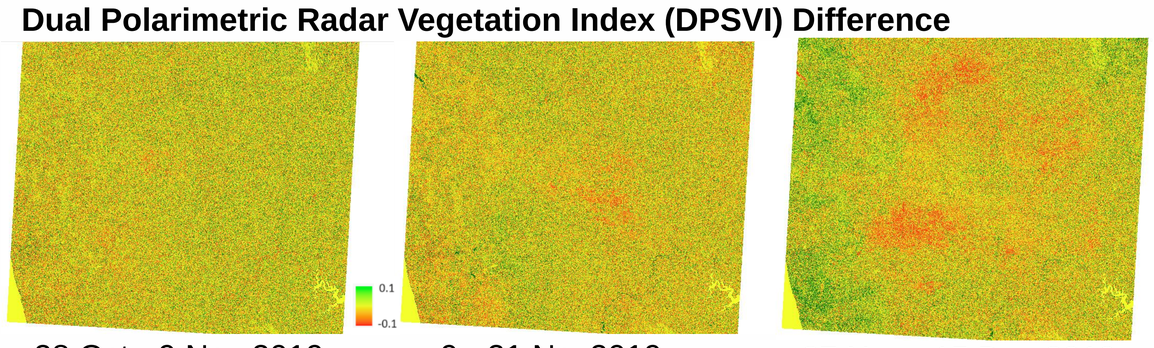
The results show:

- fire progression and post-fire vegetation regrowth are noticeable from the radar intensity, radar derived vegetation indices and InSAR coherence analyses;
- Work comparing the SAR, LiDAR and optical remote sensing data are currently in progress;
- the project is expected to complete in June 2024.

Results: Fire progression mapping

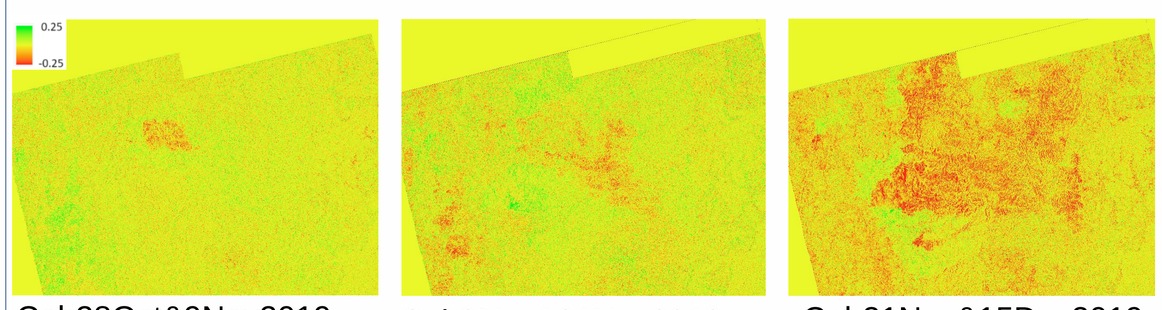
Example: Blue Mountains
- using radar derived vegetation indices and identifying the change (delta) between successive acquisitions.
- using radar interferometric coherence and identifying the change (delta).

Dual Polarimetric Radar Vegetation Index (DPSVI) Difference



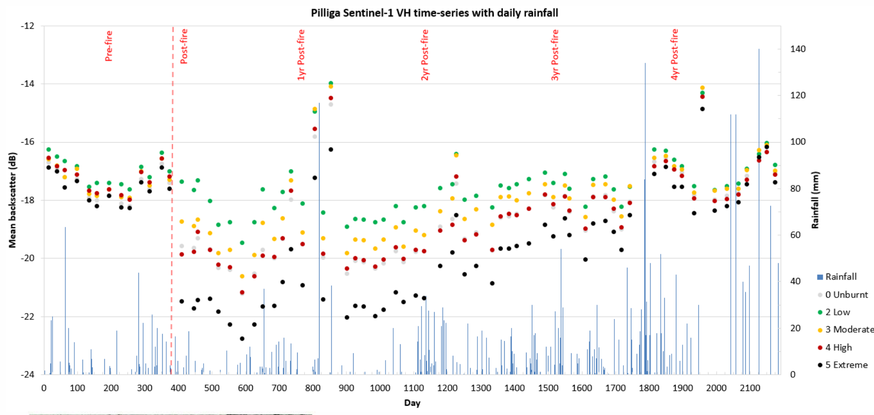
28 Oct - 9 Nov 2019 | 9 - 21 Nov2019 | 27 Nov - 15 Dec 2019

InSAR Coherence Difference: S1 VV

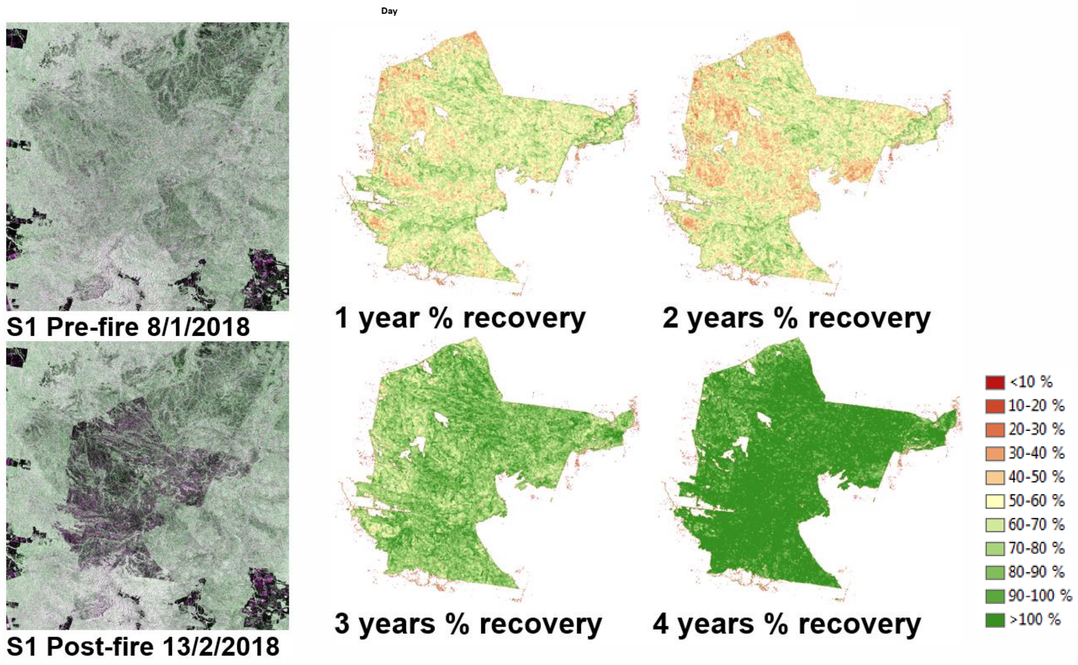


Coh28Oct&9Nov2019 - Coh9Nov&21Nov2019 | Coh9Nov&21Nov2019 - Coh21Nov&15Dec2019 | Coh21Nov&15Dec2019 - Coh15Dec&27Dec2019

Results: Post-fire recovery monitoring



Mean monthly Sentinel-1 VH g0 backscatter time-series for samples of unburnt and severity classes and daily rainfall data



Pilliga forest: Object-based % VH recovery from pre-fire baseline

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