**Monitoring Fire and Drought Risk using a Real-time Fuel Moisture System**

Changes in climate will increase wildfire danger and vegetative drought stress across the globe. To be prepared, we need accurate data on live fuel moisture (moisture content within living vegetation). This simple metric is critical for risk management, providing information on how likely and vigorously a fire will spread and identifying areas of low ecosystem resilience where drought-stressed vegetation is more susceptible to additional stressors such as insects and disease. The challenge: fuel moisture has high spatial and temporal heterogeneity, and it is critical to know the fuel type (e.g., grass, scrub, forest, urban) to understand fuel moisture implications.

While scientists have been using remote sensing to evaluate fuel characteristics since the 1980s, rapid improvements in satellite technology combined with increased data cadence provide new opportunities. Many past studies have lacked appropriately scaled calibration and validation data that can quantify moisture across a vertical profile from the upper canopy to the surface fuels. This is partially due to remotely sensed fuel moisture historically being done in isolation without up-to-date spatial characterisation of the fuel type. Without fuel type, fuel moisture is limited in its value: for example, grassland fuel moisture will translate differently to fire behaviour and drought pressure compared to forest fuel moisture.

Remote sensing can evaluate live fuel moisture through satellite and satellite-derived metrics. A real-time fuel moisture system will improve risk management, reducing catastrophic impacts from wildfires and drought. As a stand-alone, real-time fuel moisture provides a critical tool for identifying drought anomalies. Linking real-time live fuel moisture directly to fire behaviour models exponentially increases their value by improving model predictions and risk management. At the simplest level, as vegetation dries out, it burns better. While this is an important indicator for fire behaviour, many fire behaviour models, including NZ models, only consider surface fuel (litter, sticks, twigs, soil) moisture as model input. Surface fuel moisture misses how the fire moves through mixed live and dead vegetation.

Our solution is to use remote sensing to couple real-time fuel moisture with fuel type. We are working towards achieving this through a multi-phase process collaborative project between Scion, NASA Ames Research Center, Australian National University, The US Forest Service and Fire and Emergency NZ. We will present our progress in Phase 1 of - the publication of a roadmap that will identify the developmental pathway of a real-time fuel moisture system. The roadmap is an up-to-date synthesis of what satellite imagery (e.g. Landsat, Sentinel) and remote sensing metrics (e.g. NDVI, NDWI) have been used for evaluating fuel moisture and fuel type in other regions of the world (e.g. Europe, Western North America, Australia). This systematic study provides an understanding of the current state of knowledge and identifies an actionable plan that lays out a strategy to develop a real-time fuel moisture system (Phase 2) and then to couple the system with fire behaviour models (Phase 3).