3D Fuels Project

- Susan Prichard, project lead
- Adam Watts, federal PI
- Andrew Hudak, co-I
- Louise Loudermilk, co-I
- Russ Parsons, co-I
- Eric Rowell, co-I
- Nick Skowronske, co-I
- Grad students: Gina Cova, Jonathan Batchelor, Michelle Bester
Hierarchically scaled imagery

Coarse scale – ALS canopy & modeled surface fuels (1-5 m³)

Individual Tree Detection
(Mohan et al. 2017)

Meso scale – canopy and understory fuels (10 cm³ to 1m³)

High-Resolution TLS, Photogrammetry
(Rowell et al. 2020)

Fine scale – TLS and close range photogrammetry (< 1 m³)

High-Resolution TLS
(Hudak et al. 2020)
Objectives

Evaluate sampling methods for 3D fuel characterization required for computational fluid dynamics (CFD) models of fire behavior and smoke production

• Develop building blocks for next-generation fuels mapping of SE pine and western pine/grasslands

• Advance our understanding and application of 3D fuel characterization
Fire-Adapted Pine Forests

Southern pine (FL)

Western pine (MT)
SE flatwoods (completed)

- Osceola NF, FL
- Tate’s Hell A, FL
- Tate’s Hell B, FL
- Aucilla, FL

SE loblolly/sweetgum forests (2 completed, 1-2 planned)

- Hitchiti, GA
- TTRS, FL
- Hitchiti, GA
- TBD

- 1 year
- 2 year
- 3 year
- > 4 year
Additional 3D Fuels Sites (completed)

Blackwater, FL  
Pebble Hill, FL  
Fort Stewart, GA
Western ponderosa pine forests (completed)

- Sycan, OR
- LANL, NM
- Methow, WA
- Lubrecht, MT

Western grasslands (completed)

- Sycan, OR
- LANL, NM
- Tenalquot, WA
- Glacial, WA
Example Field Site – Sycan Marsh, OR
Scaled Imagery

**Synoptic (200 x 200 m)**
- Terrestrial lidar scanning (TLS)
- UAS SfM photogrammetry

**Plot (5 x 5 m)**
- TLS
- UAS SfM photogrammetry

**Destructive voxel plot (< 1 m)**
- Close-range photogrammetry
5 x 5 m Scan Plots
Destructive Sampling (voxel plots)
Close-Range Photogrammetry
Close-Range Photogrammetry Models

\[ R^2 = 0.72, \ p < 2.2\times10^{-16}, \text{ RSE: 25.84} \]

\[ R^2 = 0.72, \ p < 2.2\times10^{-16}, \text{ RSE: 25.75} \]
Terrestrial Lidar Scanning Models

Shrub Fuels
Plant-area density

R² = 0.42

Litter Fuels
Porosity

Slide credit – Eric Rowell
Inputs to CFD models

**FUELS CRAFT**

- **SIM**
  - 3D animation and simulation
  - User interface
  - Concept model
  - Inputs

- **Field**
  - Overview
  - FieldLearn3D

**3D FUELS**

**FIRE MODELING**

- **Rapid**
  - Coupled Atmosphere & Spread
  - QUICFire, Levelset

- **Slow**
  - Coupled Atmosphere & Full Physics
  - FIRETEC, WFDS
Planned Integration with FastFuels
Open Science Framework – Integrated 3D datasets

https://osf.io/7mgnx/
Project Website

https://depts.washington.edu/tera/3dfuels/