**Extraction of Active Fire Fronts from Airborne Time-Sequence Imaging of the Arch Rock Fire in Southeast Ohio**

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**BACKGROUND**

Prescribed fire has been suggested as a site preparation method in order to sustain oak regeneration in eastern mixed-oak forests. One of the most important fire parameters is rate of spread, which can be estimated once direction of fire propagation is known. The active fire fronts, then, become central features because they can be used to estimate how fast the fire moves and predict where the fire is likely to be in the future. See examples of prescribed fire in Figure 1.

**METHODOLOGY**

**Step 1: Image Enhancement**

- **Figure 4**: Gradient magnitude images: rapid radiance changes (contrast)

**Step 2: Bi-Spectral Edge Detection**

- **Figure 5**: High gradient magnitude pixels: digital number 255 (in white)

**Step 3: Fire-Pixel Extraction**

- **Figure 8**: A Boolean And logical operator was applied to Fig. 5 and 7. Pixels having the same value 255 in both images were coded 1 and all other possible combinations 0.

**SPATIAL ANALYSIS**

**Fire Propagation: Direction & Distance**

Direction of fire propagation was estimated based on the assumption that a fire front is elliptical in shape; therefore, quadratic fitting was performed for some of the active fire fronts in order to estimate straight lines pointing towards unburned areas.

- **Figure 10**: Thermal data resulting from the image composite corresponding to t = 4:30 pm was overlapped with elevation; lighter areas indicate high elevation (210-230 m).

**APPLICATIONS**

- Forecasting future fire dynamics
- Fuel consumption assessments
- Model predictions for tree injury and mortality
- Smoke transport simulations
- Time series analysis to predict for unknown locations and time
- Trend surface analysis & Cost weighted surface analysis
- Fire animation