The effect of topography on fuel moisture

J. Best, A. Tepley

1Ecoinformatics Summer Institute, Clarkson University
2Department of Geography, Oregon State University

Ecoinformatics Summer Institute Final Presentation
Introduction
- Why are fires important?
- What about fuel moisture?

Methods
- Collection
- Measurement

Results

Discussion

Acknowledgements
Why are fires important?

- Large scale disturbance
- Community composition
  - Resets successional pathway
- Management issues
  - Conflicts with people
  - Timber harvesting
What about fuel moisture?

Fuel Moisture = \( \frac{\text{Wet mass} - \text{Dry Mass}}{\text{Dry Mass}} \)

- Local intensity
- Local rate of spread
Collection Methods

- Transects in WS01
  - Extensive met. data
- Collected for 24 hr.
  - $\frac{1}{8}$ in.: Hourly
  - $\frac{5}{8}$ in.: Every 6 hr.
Measurement Methods

Each sample:
- Massed wet
- Dried 36 hr. at 60°C
- Massed dry
The effect of topography on fuel moisture

J. Best,
A. Tepley

Introduction

Fires
Moisture

Methods
Collection
Measurement

Results

Discussion

Fuel moisture change over time

Site 2: Lower, N facing
Site 5: Valley bottom
Site 8: Upper, S facing
Statistical Model

Moisture ~ SlopePosn + Aspect + Slope + AT1 + AT2

Coefficients:

|                      | Coefficient | Pr(>|t|)    |
|----------------------|-------------|------------|
| (Intercept)          | 0.1581867   | < 2e-16 ***|
| SlopePosn            | -0.0214542  | 1.19e-08 ***|
| Aspect               | -0.0025753  | 0.000888 ***|
| Slope                | -0.0289303  | 0.033211 *  |
| AT1                  | 0.0146129   | 9.37e-13 ***|
| AT2                  | -0.0165226  | 5.82e-15 ***|

---

Signif. codes:  0 ‘***’  0.001 ‘**’  0.01 ‘*’  0.05

Multiple R-Squared:  0.7863, Adjusted R-squared: 0.7746
p-value:  < 2.2e-16
The effect of topography on fuel moisture

J. Best, A. Tepley

Introduction

Fires
Moisture

Methods
Collection
Measurement

Results

Discussion

Statistical Model

\[ (\text{Intercept}) \; 0.1581867 \; < \; 2e^{-16} \; *** \]

A flat area at 0°C results in 16% moisture.

\[ \text{SlopePosn} \; -0.0214542 \; 1.19e^{-08} \; *** \]
Upper slopes are drier.

\[ \text{Aspect} \; -0.0025753 \; 0.000888 \; *** \]
Increasing aspect bearing decreases moisture.

\[ \text{Slope} \; -0.0289303 \; 0.033211 \; * \]
Steeper areas are drier.

\[ \text{AT1} \; 0.0146129 \; 9.37e^{-13} \; *** \]
Warmer 15 min. temperature increases moisture.

\[ \text{AT2} \; -0.0165226 \; 5.82e^{-15} \; *** \]
Warmer 30 min. temperature decreases moisture.
The effect of topography on fuel moisture

J. Best, A. Tepley

Introduction

Fires
Moisture

Methods
Collection
Measurement

Results

Discussion

Statistical Model

(Intercept) 0.1581867 < 2e-16 ***
A flat area at 0°C results in 16% moisture.

SlopePosn -0.0214542 1.19e-08 ***
Upper slopes are drier.

Aspect -0.0025753 0.000888 ***
Increasing aspect bearing decreases moisture.

Slope -0.0289303 0.033211 *
Steeper areas are drier.

AT1 0.0146129 9.37e-13 ***
Warmer 15 min. temperature increases moisture.

AT2 -0.0165226 5.82e-15 ***
Warmer 30 min. temperature decreases moisture.
The effect of topography on fuel moisture

J. Best, A. Tepley

Introduction

Fires
Moisture

Methods
Collection
Measurement

Results
Discussion

Statistical Model

(Intercept)  0.1581867  < 2e-16  ***
A flat area at 0°C results in 16% moisture.

SlopePosn  -0.0214542  1.19e-08  ***
Upper slopes are drier.

Aspect  -0.0025753  0.000888  ***
Increasing aspect bearing decreases moisture.

Slope  -0.0289303  0.033211  *
Steeper areas are drier.

AT1  0.0146129  9.37e-13  ***
Warmer 15 min. temperature increases moisture.

AT2  -0.0165226  5.82e-15  ***
Warmer 30 min. temperature decreases moisture.
The effect of topography on fuel moisture

J. Best, A. Tepley

Introduction

Fires
Moisture

Methods
Collection
Measurement

Results

Discussion

Statistical Model

(Intercept)  0.1581867  <  2e-16  ***
A flat area at 0°C results in 16% moisture.

SlopePosn  -0.0214542  1.19e-08  ***
Upper slopes are drier.

Aspect  -0.0025753  0.000888  ***
Increasing aspect bearing decreases moisture.

Slope  -0.0289303  0.033211  *
Steeper areas are drier.

AT1  0.0146129  9.37e-13  ***
Warmer 15 min. temperature increases moisture.

AT2  -0.0165226  5.82e-15  ***
Warmer 30 min. temperature decreases moisture.
Statistical Model

- (Intercept) 0.1581867 < 2e-16 ***
  A flat area at 0°C results in 16% moisture.

- SlopePosn -0.0214542 1.19e-08 ***
  Upper slopes are drier.

- Aspect -0.0025753 0.000888 ***
  Increasing aspect bearing decreases moisture.

- Slope -0.0289303 0.033211 *
  Steeper areas are drier.

- AT1 0.0146129 9.37e-13 ***
  Warmer 15 min. temperature increases moisture.

- AT2 -0.0165226 5.82e-15 ***
  Warmer 30 min. temperature decreases moisture.
Statistical Model

- (Intercept) 0.1581867 < 2e-16 ***
  A flat area at 0°C results in 16% moisture.
- SlopePosn -0.0214542 1.19e-08 ***
  Upper slopes are drier.
- Aspect -0.0025753 0.000888 ***
  Increasing aspect bearing decreases moisture.
- Slope -0.0289303 0.033211 *
  Steeper areas are drier.
- AT1 0.0146129 9.37e-13 ***
  Warmer 15 min. temperature increases moisture.
- AT2 -0.0165226 5.82e-15 ***
  Warmer 30 min. temperature decreases moisture.
Discussion

- **Driest:**
  - Southern exposure
  - High on the hillslope
  - Easiest ignition, fastest spread
  - Lightning strikes ridges

- **Wettest:**
  - Northern exposure
  - Valley bottom
  - Natural firebreak
Discussion

Issues:
- Only half the sites
  - Missing topographic data
  - Missing met. data
- Some topographic data suspect (Site 7)
- Representing aspect

Future work:
- Other watersheds
  - Veg. cover
  - Aspect
I would like to thank:

- My field crew: Max, Keala, Chris, Ari, Leanne, Ransom, Zack, Nina and Jenna
- Barb Bond’s Airshed Group
  - Adam Kennedy
- Alan Tepley
- Kari O’Connell
- Desiree Tullos
- All the EISI participants for a great summer