MAT482 Presentation Notes

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STRAIGHT UP FACTS

- In Canada, during bad forest fire years, it has been estimated that the carbon released by forest fires approaches the amount released by auto vehicles in Canada. In addition, the amount of Mercury released in these bad years is similar to the amount released by industry in North America
- Large fires, those that are greater than 200 ha account for only 3% of the fires that occur but account for 97% of the area burned.
- Fires are expensive. Canadian forest fire management agencies spend approximately 500 million dollars a year on direct fire suppression.

BACKGROUND

During intense crown fires (when the fire leaves the ground and burns the entire tree), the upward force caused by the fire plume causes mechanical failure of small cylinder shaped pieces of burning wood (show picture). The fire plume can loft these firebrands very high (up to km's) and then they are deposited down-wind. Upon landing, given sufficient mass and proper fuel conditions, these firebrands can ignite new fires possibly many kilometers downwind from their original source.

This is a mechanism by which fires are able to cross what we will call fuel-discontinuities - ie rivers, lakes, roads, etc. The main fire modelling system in Canada employed by the Canadian forest service does not account for spotting beyond 20 meters.

MODELLING QUESTION

- Under high to extreme fire weather conditions, can we create a fire spread model that accounts for firebrand spotting.

Auxiliary Questions

- What is the probability that a fire will breach a fuel break?
- What is the cost of creating a fuel discontinuity large enough to decrease the expected value of the area burned below a certain threshold?

THE MODEL

The model we created consist of three parts:

1. The elliptic fire growth model from the Fire Behaviour Prediction system. This is a deterministic physical model.

2. A firebrand model spotting model based on work by myself and Professor Martell. As found this is a physical model that we turned into a physical model with random forcing.

3. A probability of ignition model. THis is a statistical model that comes from performing a logistic regression a data set. This model represents the probability that a flaming match will be able to cause sustained flaming and hence ignition in a fuel bed. We adapted this model to account for firebrand mass upon landing.