Wildfire Management

This problem is derived from Benjamin’s Research Assistantship work with Prof. Jacquillat and we will meet with him to discuss it in-depth.

# Problem Description

Wildfire management presents a complex challenge due to the unpredictable nature of fire spread and varying effectiveness of suppression efforts. The key issue is the optimal allocation of fire crews to different incidents, ensuring timely and effective response while minimizing resource waste and maximizing safety. Current allocation methods often rely on experience and local heuristic approaches, which may not efficiently utilize available data and predictive models.

# Data Sources

This project will leverage three datasets that we have processed, with data being collected from <https://www.wildfire.gov/application/sit209> for year 2015 to 2018 included as well as synthetic data for estimating the cost of deployment of a fire crew unit (proportional to the distance).

# Methods

First, we will generate treatment data and build the necessary counterfactuals. If a fire has some characteristics and that we apply a treatment, what is the “next-day cost”?

Then we aim to come up with a simple problem formulation for a one day problem. So far we have written the outline of the problem in natural language.

**Decision variables**

Number of fire crew units allocated to fire incident i from base j

**Parameters**

Estimated cost if fire incident i is treated with x fire crew units (function of current cost and x)

Total number of fire crew units available at base j

Cost of deploying x fire units from base j to incident i

**Objective**

Minimize the total expected cost of wildfire management: fire damage cost + fire crew allocation cost

**Constraints**

1. Allocation constraint: number of allocated fire crew units does not exceed the number available at each base
2. Non-negativity and integrality of decision variable

Finally, we would like to run this experiment over several days.