

# Pre-Analysis Plan: Wildfire Risk and Self-Protective Investment

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# 1 Introduction

Like other weather-related disasters, the occurrence of severe wildfires is growing throughout North America. This escalating risk can be mitigated through efforts by property owners to manage vegetation and other flammable material near homes. Despite the cost-effectiveness of these investments, take-up is low. There are several economic and psychological theories for why beneficial self-protective investments in wildfire readiness could have low take-up despite their likely cost-effectiveness: these could include lack of information, complexity and psychological frictions, credit/cash constraints, and spatial externalities across neighboring properties. We propose to conduct a pilot study to identify interventions to address these barriers. We will randomize households in areas with high wildfire risk to receive (1) information about existing resources to support defensible space (e.g., a home assessment from the local fire department) and (2) information about existing resources and a financial incentive. We will also have a pure control group that will not receive any outreach.

## 2 Research Strategy

### 2.1 Sampling

#### 2.1.1 Sampling Frame

The sampling frame is residential homes in Jackson County Oregon, District 3 (JCFD3) that are located in high wildfire risk areas. This amounts to 4,662 households, all of whom will be included in the study. Most will be placed into a control group.

#### 2.1.2 Assignment to Treatment

The experiment includes four treatment arms and a control group. Homes will be placed into treatment clusters of up to ten houses with neighbors on the same street. In total there are 648 clusters. Those clusters will be randomly placed in 27 blocks, and then each cluster will be block-randomized into one of the four treatment arms (each with  $1/24$  probability) or the control arm (with probability  $20/24$ ). This is in order ensure a fixed proportion of treatment and control clusters, and minimal variability in the number of homes in each arm.

Treatment 1 is a \$250 financial incentive for receiving an inspection and completing wildfire safety improvements on the property. Treatment 2 is a \$500 financial incentive for receiving an inspection and completing wildfire safety improvements on

the property. Treatment 3 is an information intervention focused on private benefits. Treatment 4 is an information intervention that emphasizes the benefits to neighbors from improving wildfire safety on one’s own property (we call this the ”moral suasion” treatment). All 4 treatments are delivered by mail and include information about free home inspections and other available services from JCFLD3.

For homes that take up the free home inspection, we plan to implement a follow-up ”neighbor nudge” treatment depending on the availability of partner resources from JCFLD3. Assuming that JCFLD3 has adequate staff resources to implement this additional treatment, the neighbor nudge will work as follows: For a subset of homes that take up the free home inspection, a random number generator will determine whether or not that adopter’s neighbors receive a neighbor nudge. The neighbor nudge is an additional information intervention informing the neighbors that a home in their area is utilizing JCFLD3 wildfire safety resources.

## **2.2 Fieldwork**

### **2.2.1 Instruments**

We will use the existing system that JCFLD3 has to record requests for home assessment or additional resource support to measure takeup in the sample. For homeowners who wish to obtain the subsidy (if eligible), we will also obtain (from JCFLD3) the results of their follow-up assessment.

For all homes (control and treatment arms), we will use information from an imagery-based remote assessment technology to identify the amount of vegetation near the home and the (modeled) risk of ignition. Imagery-based remote assessment is based on a third-party wildfire risk assessment product; our outcome of interest is improvement in this third-party wildfire risk assessment at endline relative to baseline.

### **2.2.2 Data Processing**

The JCFLD3 data and third-party imagery data will be transferred securely and stored on a secure server at the University of California, San Diego. These will be linked to publicly available tax lot data and merged together using home address to produce the final dataset. This dataset will be kept secure and used to run the empirical analysis.

## 3 Empirical Analysis

### 3.1 Variables

The main variables of interest are 1) a measure of takeup, which is defined as an indicator for whether a homeowner gets in touch with JCFLD3 during the study period to request assistance from the district, 2) measures of vegetation density near the home, obtained from the third-party wildfire risk assessment product, and 3) the modeled home wildfire risk from the same risk assessment product.

### 3.2 Balancing Checks

To check balance, we will first report means by treatment arm and standardized differences in means between the treatment arm and the control group.

We will also estimate home-level regressions of covariates on indicators for treatment, clustering by treatment cluster. With  $i$  indexing homes in the sample, this specification will be

$$X_i = \alpha + \beta_1 1[\text{Treatment 1}]_i + \beta_2 1[\text{Treatment 2}]_i + \\ \beta_3 1[\text{Treatment 3}]_i + \beta_4 1[\text{Treatment 4}]_i + \\ \beta_5 1[\text{Neighbor Nudge}]_i + \varepsilon_i$$

$X_i$  will include parcel acreage, the number of neighbors included in their treatment cluster, the improvement (structure) value of the parcel, the value of the parcel, parcel fire risk, and a social vulnerability index computed by the State of Oregon. We note here that these are the variables we plan to include at the time of this writing, but that we may elect to include additional covariates in our specifications and would include balance tests for them here as well.

The treatment indicators describe whether the household was included in the treatment arms described above.  $1[\text{Neighbor Nudge}]_i$  will indicate if the homeowner received a neighbor nudge letter as a result of their neighbor requesting services, which will be instrumented with randomization into the neighbor nudge group. We also note that our ability to implement the neighbor nudge treatment depends on capacity of our implementing partners as the experiment proceeds; if we are not able to implement the neighbor nudge, it will of course be omitted from the balance regression above.

### 3.3 Treatment Effects

We will estimate the effect of the treatment arm offers on measures of contact with the district and vegetation near the home using a similar specification to that used for the balance checks, but including control variables  $X_i$  as well.

$$y_i = \alpha + \beta_1 1[\text{Treatment 1}]_i + \beta_2 1[\text{Treatment 2}]_i + \beta_3 1[\text{Treatment 3}]_i + \beta_4 1[\text{Treatment 4}]_i + X_i + \varepsilon_i$$

If we are able to implement the additional neighbor nudge treatment, we will run this additional regression specification that measures the effect of this cross-cutting treatment.

$$y_i = \alpha + \beta_1 1[\text{Treatment 1}]_i + \beta_2 1[\text{Treatment 2}]_i + \beta_3 1[\text{Treatment 3}]_i + \beta_4 1[\text{Treatment 4}]_i + \beta_n 1[\text{Neighbor Nudge}]_i + X_i + \varepsilon_i$$

The outcomes  $y_i$  will include a measure of whether  $i$  contacted JCFD3, the imagery-measured degree of vegetation near the home, and the modeled home-level fire risk. Controls  $X_i$  are defined in the Balancing Checks section. We again note that  $X_i$  may include additional, not-yet-specified variables as appropriate, but that they would also be tested for balance.

### 3.4 Heterogeneous Effects

We intended to estimate separate effects by categories of fire risk (high or extreme) and categories of social vulnerability, as defined by the Social Vulnerability Index produced by the State of Oregon. We anticipate that homes at higher risk will be more likely to take up our offers. We expect that social vulnerability will play a role in takeup in our experiment, but we do not have a clear prior on which direction: while it seems likely that more vulnerable households will likely have a lower level of compliance with defensible space in general, whether they are more responsive to our treatment is not as obvious.

### 3.5 Standard Error Adjustments

Standard errors will be clustered by treatment cluster.

## 4 Research Team

Judson Boomhower is an assistant professor in the Department of Economics at the University of California San Diego and a Faculty Research Fellow at the National Bureau of Economic Research (NBER). His research focuses on environmental economics, energy markets, climate risk and adaptation, and the design of environmental and energy policy. Judson is a contributor to the U.S. National Climate Assessment, an invited researcher at the Abdul Latif Jameel Poverty Action Lab (J-PAL) and a faculty affiliate at the E2e initiative. He joined UC San Diego after a postdoctoral fellowship at the Stanford Institute for Economic Policy Research. He earned his PhD in Agricultural and Resource Economics at the University of California, Berkeley and BA and MS degrees from Stanford University. He is an Andrew Carnegie Fellow and a former Fulbright Scholar.

Patrick Baylis is an assistant professor and environmental economist at the Vancouver School of Economics at the University of British Columbia (UBC). He studies how people respond to environmental threats like climate change, air pollution, and wildfires. Recent work includes estimating the impact of temperature on tweets to understand preferences for climate change, assessing the implicit subsidy of federal wildfire suppression, projecting how climate change will alter peak electricity demand, and considering how consumers respond to defaults in electricity consumption. Many of these projects use large datasets, natural language processing, and spatial information. Before joining UBC, Patrick was a postdoctoral fellow at the Stanford Center on Food Security and the Environment, a graduate student in Agricultural and Resource Economics at UC-Berkeley, and a research assistant at the Energy Institute at Haas.

Bob Horton is the Deputy Director of the Western Fire Chiefs Association (WFCA), a regional association focused on intersecting technology and wildfire policy. He is also the Executive Director of the WFCA's Applied Sciences Center for Resilience Studies, and Council Chair on the Oregon Governor's Fire Service Policy Council. Previously, he served as Fire Chief of Jackson County Fire District 3 (appointed 2017) and before that was the Assistant Fire Chief for Las Vegas Fire & Rescue, where he started as a firefighter in 2000. Bob is a scholar-practitioner conducting applied research at the intersection of behavioral economics, public policy, and community risk management. His focus is on the use of evidence to evaluate program impact/effectiveness and to examine policy-relevant questions. Bob is a doctoral researcher-in-training in public policy at Old Dominion University and is a research affiliate with Oregon State University's Policy Analysis Laboratory. He has an MPA from the University of Oklahoma, an MPP from Oregon State University,

and an Executive Certificate in Public Policy from the Harvard Kennedy School.