

**MICHIGAN STATE**  

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**UNIVERSITY**

# Beta Presentation

## Wildfire Risks Forecasting Tool

The Capstone Experience

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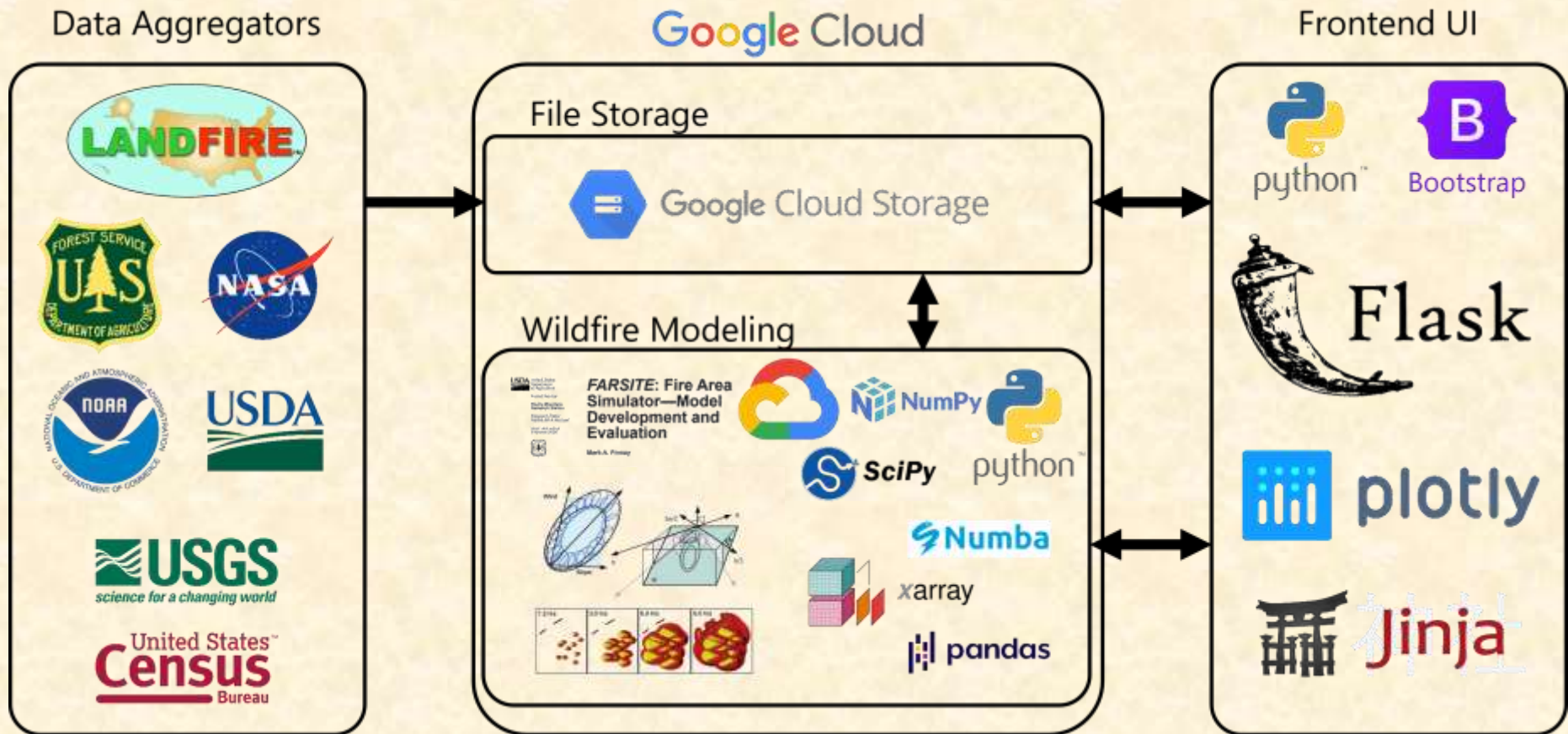
*From Students...  
...to Professionals*

# Project Overview

- Wildfires in San Francisco's Bay Area threaten lives, property and the environment
- Public understanding of wildfire risk lags wildfire & climate science
- We have created an intuitive web app to simulate wildfires and predict their impacts
  - Accessible from any internet-connected computer, phone, or tablet
  - Modern, minimalist, intuitive



# System Architecture



# Inputs > Wildfire Risk Visualization

Home About Contact Problem Solution Resources

Home

How might wildfires affect your local community? How can you protect your family, home, and neighbors? You've got questions. We've got answers. Visualize wildfire risk and simulate the impacts of a hypothetical wildfire below.

Risk

1.0  
0.8  
0.6  
0.4  
0.2  
0.0

Risk: 0.451 (604619102145) proximity of igniter  
Latitude: 37.19053  
Longitude: -122.8382

Inputs

Impacts

Step 1: Understand the Risks

Visualize the various risk factors at play when wildfire strikes.

Wildfire Risk  
Population  
Historical Wildfires  
Housing

Step 2: Select an Ignition Point

Click on the map or type below to select an ignition point.

Latitude: 37.37 °N  
Longitude: 122.00 °E

Step 3: Set a Baseline

Specify baseline weather conditions for the wildfire simulation from a particular day, or as the climatological average conditions in a particular month.

Historical Date: mm/dd/yyyy  
Climatological Date: mm

Step 4: Adjust for Climate Change

Under climate change, higher temperatures, lower humidity, and higher winds are expected in the Bay Area. Adjust the weather conditions below away from their baseline to see how wildfire spread will be affected.

Temperature: 0 °C  
Humidity: 0 %  
Wind Speed: 0 m/s  
Wind Direction

Step 5: Simulate a Wildfire

Click "Run" to visualize the footprint of a simulated wildfire and its effects.

Run





# Inputs > Historical Wildfires Visualization

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Home

How might wildfire affect your local community? How can you protect your family, home, and neighbors? You've got questions. We've got answers. Visualize wildfire risk and simulate the impacts of a hypothetical wildfire below.

Historical Fire  
Name: GULF LIGHTNING COMPLEX  
Year: 2020  
Ignited: 2020-06-30  
Contained: 2020-06-24  
Area: 9800,4906379

Inputs | Impacts

**Step 1: Understand the Risks**  
Visualize the various risk factors at play when wildfire strikes.

Year Wildfire Risk  
Year Population  
Year Historical Wildfires  
Year Housing

**Step 2: Select an Ignition Point**  
Click on the map or type below to select an ignition point.

Latitude: 37.82 °N  
Longitude: -122.47 °W

**Step 3: Set a Baseline**  
Specify baseline weather conditions for the wildfire simulation from a particular day, or as the climatological average conditions in a particular month.

Historical Data: mm/dd/yyyy  
Climatological Data: mm

**Step 4: Adjust for Climate Change**  
Under climate change, higher temperatures, lower humidity, and higher winds are expected in the Bay Area. Adjust the weather conditions below away from their baseline to see how wildfire spread will be affected.

Year Temperature: 0 °C  
Year Humidity: 0 %  
Year Wind Speed: 0 m/s  
Year Wind Direction

**Step 5: Simulate a Wildfire**  
Click "Run" to visualize the footprint of a simulated wildfire and its effects.

Run



# Inputs > Population Density Visualization

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Home

How might wildfire affect your local community? How can you protect your family, home, and neighbors? You've got questions. We've got answers. Visualize wildfire risk and simulate the impacts of a hypothetical wildfire below.

Population Density Visualization

Population: 3491.502115044057 people per km<sup>2</sup>  
Latitude: 37.76198  
Longitude: -122.4428

**Inputs** | **Impacts**

**Step 1: Understand the Risks**  
Visualize the various risk factors at play when wildfire strikes.

Wildfire Risk  Historical Wildfires  
 Population  Housing

**Step 2: Select an Ignition Point**  
Click on the map or type below to select an ignition point.

Latitude:  °N  
Longitude:  °E

**Step 3: Set a Baseline**  
Specify baseline weather conditions for the wildfire simulation from a particular day, or as the climatological average conditions in a particular month.

Historical Data    
 Climatological Data

**Step 4: Adjust for Climate Change**  
Under climate change, higher temperatures, lower humidity, and higher winds are expected in the Bay Area. Adjust the weather conditions below away from their baseline to see how wildfire spread will be affected.

Temperature  0 °C  
 Humidity  0 %  
 Wind Speed  0 m/s  
 Wind Direction

**Step 5: Simulate a Wildfire**  
Click "Run" to visualize the footprint of a simulated wildfire and its effects.



# Inputs > Housing Density Visualization

Home about Contact Problem Solver Resources

Home

How might wildfire affect your local community? How can you protect your family, home, and neighbors? You've got questions. We've got answers. Visualize wildfire risk and simulate the impacts of a hypothetical wildfire below.

Housing: 1231 43942110238 housing units per acre  
Latitude: 37.34261  
Longitude: -122.5181

Inputs Impacts

**Step 1: Understand the Risks**  
Visualize the various risk factors at play when wildfire strikes.

Wildfire Risk  
Population

Historical Wildfires  
Housing

**Step 2: Select an Ignition Point**  
Click on the map or type below to select an ignition point.

Latitude:  'N  
Longitude:  'E

**Step 3: Set a Baseline**  
Specify baseline weather conditions for the wildfire simulation from a particular day, or as the climatological average conditions in a particular month.

Historical Data    
Climatological Data

**Step 4: Adjust for Climate Change**  
Under climate change, higher temperatures, lower humidity, and higher winds are expected in the Bay Area. Adjust the weather conditions below away from their baseline to see how wildfire spread will be affected.

Temperature  0 °C  
Humidity  0 %  
Wind Speed  0 m/s  
Wind Direction

**Step 5: Simulate a Wildfire**  
Click "Run" to visualize the footprint of a simulated wildfire and its effects.





# Inputs > Temperature Visualization

The screenshot displays a web-based interface for a wildfire risk simulation tool. The main area features a map of the San Francisco Bay Area with a color-coded overlay representing temperature. A vertical color scale on the right side of the map ranges from 17 (dark purple) to 34 (yellow), with intermediate markers at 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, and 33. A tooltip on the map shows coordinates: Latitude: 37.78317, Longitude: -122.534.

The right-hand control panel is titled "Inputs" and "Impacts" and contains five steps:

- Step 1: Understand the Risks:** Includes checkboxes for "Wildfire Risk" (checked), "Population" (checked), "Historical Wildfires" (checked), and "Housing" (checked).
- Step 2: Select an Ignition Point:** Includes input fields for "Latitude" (37.78317) and "Longitude" (-122.534).
- Step 3: Set a Baseline:** Includes radio buttons for "Historical Data" (selected) and "Climatological Data". The "Historical Data" field is set to "04/01/2022".
- Step 4: Adjust for Climate Change:** Includes sliders for "Temperature" (set to 0 °C), "Humidity" (set to 0 %), and "Wind Speed" (set to 0 m/s). There is also a "Wind Direction" control.
- Step 5: Simulate a Wildfire:** Includes a "Run" button.





# Inputs > Humidity Visualization

Home About Contact Problem Solution Resources Search

## Home

How might wildfire affect your local community? How can you protect your family, home, and neighbors? You've got questions. We've got answers. Visualize wildfire risk and simulate the impacts of a hypothetical wildfire below.

**Humidity: 11.899482000000002%**  
**Latitude: 37.76907°**  
**Longitude: -122.4757°**

**Inputs** **Impacts**

**Step 1: Understand the Risks**  
Visualize the various risk factors at play when wildfire strikes.

<input type="checkbox"/> Wildfire Risk	<input type="checkbox"/> Historical Wildfires
<input type="checkbox"/> Population	<input type="checkbox"/> Housing

**Step 2: Select an Ignition Point**  
Click on the map or type below to select an ignition point.

Latitude  °N  
Longitude  °E

**Step 3: Set a Baseline**  
Specify baseline weather conditions for the wildfire simulation from a particular day, or as the climatological average conditions in a particular month.

Historical Date

Climatological Date

**Step 4: Adjust for Climate Change**  
Under climate change, higher temperatures, lower humidity, and higher winds are expected in the Bay Area. Adjust the weather conditions below away from their baseline to see how wildfire spread will be affected.

<input type="checkbox"/>	Temperature	<input type="range"/>	0 °C
<input checked="" type="checkbox"/>	Humidity	<input type="range"/>	0 %
<input type="checkbox"/>	Wind Speed	<input type="range"/>	0 m/s
<input type="checkbox"/>	Wind Direction	<input type="range"/>	0 °

**Step 5: Simulate a Wildfire**  
Click "Run" to visualize the footprint of a simulated wildfire and its effects.



# Inputs > Wind Speed Visualization

The screenshot shows a web application interface for wildfire risk simulation. The page is titled "Home" and includes a navigation menu (Home, About, Contact, Problem, Solution, Resources) and a search bar. Below the header, there is a descriptive paragraph: "How might wildfire effect your local community? How can you protect your family, home, and neighbors? You've got questions. We've got answers. Visualize wildfire risk and simulate the impacts of a hypothetical wildfire below."

The main content area is divided into two sections: a map and a control panel. The map on the left shows a geographic area with a color-coded risk overlay. A yellow box on the map displays the coordinates of the selected ignition point: "Latitude: 37.774999, Longitude: -122.49142222222222". To the right of the map is a vertical color scale legend ranging from 0 (dark purple) to 100 (yellow).

The control panel on the right is titled "Inputs" and "Impacts" and contains five steps for configuring the simulation:

- Step 1: Understand the Risks**  
Visualize the various risk factors at play when wildfire strikes.  
Controls:  Wildfire Risk,  Historical Wildfires,  Population,  Housing
- Step 2: Select an Ignition Point**  
Click on the map or type below to select an ignition point.  
Latitude:  °N  
Longitude:  °E
- Step 3: Set a Baseline**  
Specify baseline weather conditions for the wildfire simulation from a particular day, or as the climatological average conditions in a particular month.  
Historical Data:    
Climatological Data:
- Step 4: Adjust for Climate Change**  
Under climate change, higher temperatures, lower humidity, and higher winds are expected in the Bay Area. Adjust the weather conditions below away from their baseline to see how wildfire spread will be affected.  
Temperature:  °C  
Humidity:  %  
Wind Speed:  m/s  
Wind Direction:  °
- Step 5: Simulate a Wildfire**  
Click "Run" to visualize the footprint of a simulated wildfire and its effects.



# Inputs > Ignition Point Selection

The screenshot shows a web application interface for wildfire risk simulation. The page is titled "Home" and includes a navigation menu (Home, About, Contact, Problem, Solution, Resources) and a search bar. Below the header, there is a descriptive paragraph: "How might wildfire affect your local community? How can you protect your family, home, and neighbors? You've got questions. We've got answers. Visualize wildfire risk and simulate the impacts of a hypothetical wildfire below."

The main content area is divided into two sections: "inputs" and "impacts".

**Step 1: Understand the Risks**  
Visualize the various risk factors at play when wildfire strikes.  
Wildfire Risk:  **High** | Historical Wildfire:  **High**  
Population:  **High** | Housing:  **High**

**Step 2: Select an Ignition Point**  
Click on the map or type below to select an ignition point.  
Latitude:  °N  
Longitude:  °E

**Step 3: Set a Baseline**  
Specify baseline weather conditions for the wildfire simulation from a particular day, or as the climatological average conditions in a particular month.  
Historical Date:    
Climatological Data:

**Step 4: Adjust for Climate Change**  
Under climate change, higher temperatures, lower humidity, and higher winds are expected in the Bay Area. Adjust the weather conditions below away from their baseline to see how wildfire spread will be affected.  
Temperature:  0 °C  
Humidity:  0 %  
Wind Speed:  0 m/s  
Wind Direction:

**Step 5: Simulate a Wildfire**  
Click "Run" to visualize the footprint of a simulated wildfire and its effects.

The left side of the interface features a map of the San Francisco Bay Area. A color-coded heatmap is overlaid on the map, showing wildfire risk levels. A yellow box on the map indicates the selected ignition point with the following coordinates: "Ignition Point: Latitude: 37.21445 Longitude: -121.87663". A vertical color scale legend is positioned to the right of the map, ranging from 0.0 (dark purple) to 0.9 (yellow).





# Inputs > Loading Facts & Prevention

**Simulation Loading**

Thank you for your patience as we simulate a hypothetical wildfire and compute its impact. We're running a state-of-the-art model known as **FARSITE**, developed by top scientists at the U.S. Forest Service, which may take up to 30 seconds. Please don't refresh this page.

While you wait, did you know? Wildfires like dry conditions, drought conditions, dry undergrowth and the presence of combustible and flammable materials contribute to wildfire hazard.

Reduce your own risk to fire by maintaining five feet of non-combustible "defensible space" around your home; keep a five-foot diameter space of gravel, brick, or concrete in the area adjacent to your home.

Wildfire facts courtesy of the [Insurance Information Institute](#).

**Close**

**Home**  
How might wildfire affect your local community? How can you protect your family, home, and neighborhood?

**Inputs** **Impacts**

**Step 1: Understand the Risks**  
Define the various risk factors at play when wildfires strike.

Wildfire Risk  **High** **Historical Wildfires**  
Population  **High** **Housing**

**Step 2: Select an Ignition Point:**  
Click on the map or type below to select an ignition point.

Latitude   
Longitude

**Step 3: Set a Baseline**  
Specify baseline weather conditions for the wildfire simulation: from a particular day, or as the climatological average conditions in a particular month.

Historical Data  **Load**  
Climatological Data  **Load**

**Step 4: Adjust for Climate Change**  
Under climate change, higher temperatures, lower humidity, and higher winds are expected in the Bay Area. Adjust the weather conditions below away from their baseline to see how wildfire spread will be affected.

Temperature   
Humidity   
Wind Speed   
Wind Direction

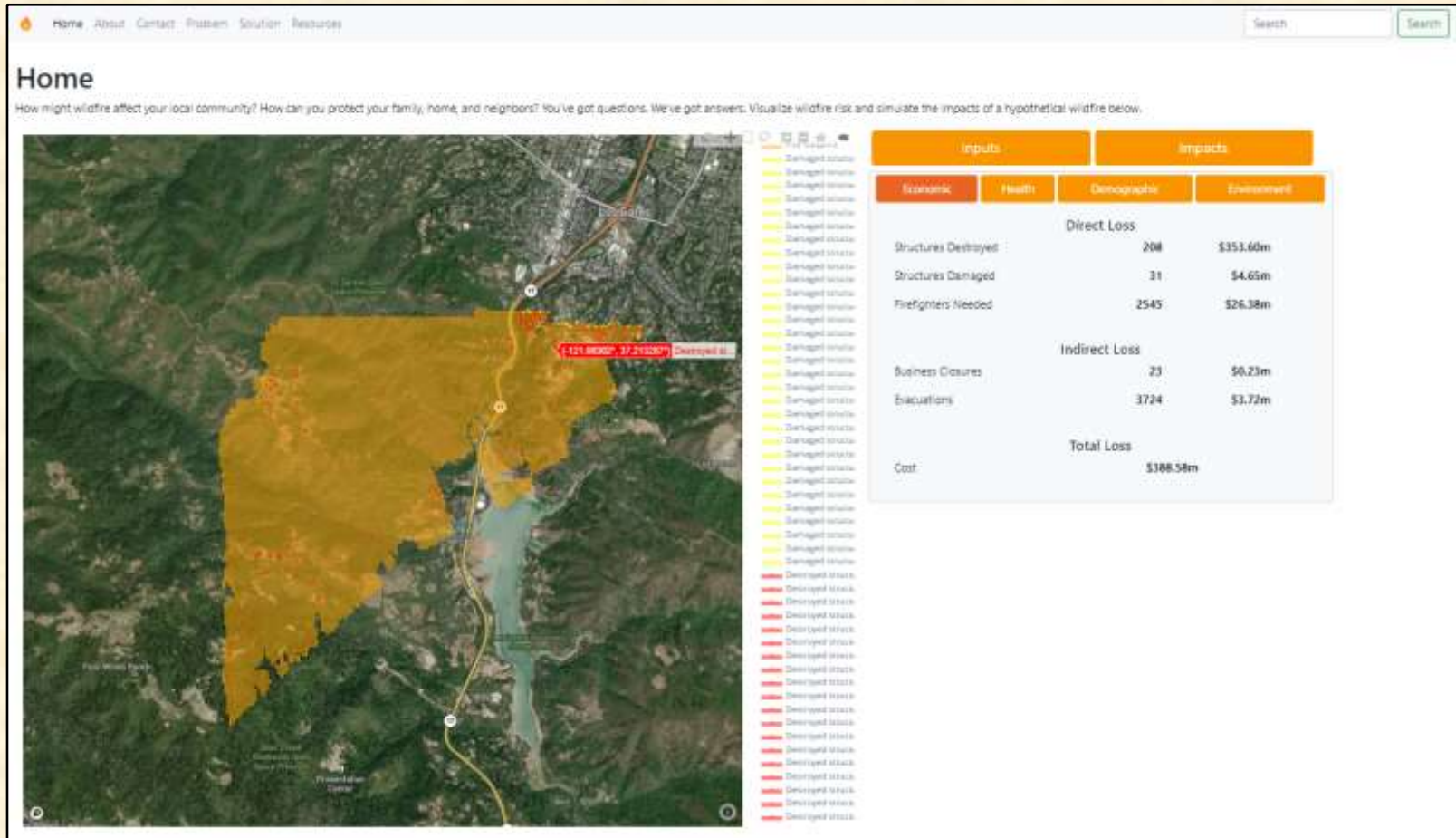
**Step 5: Simulate a Wildfire**  
Click "Run" to visualize the footprint of a simulated wildfire and its effects.

**Run**

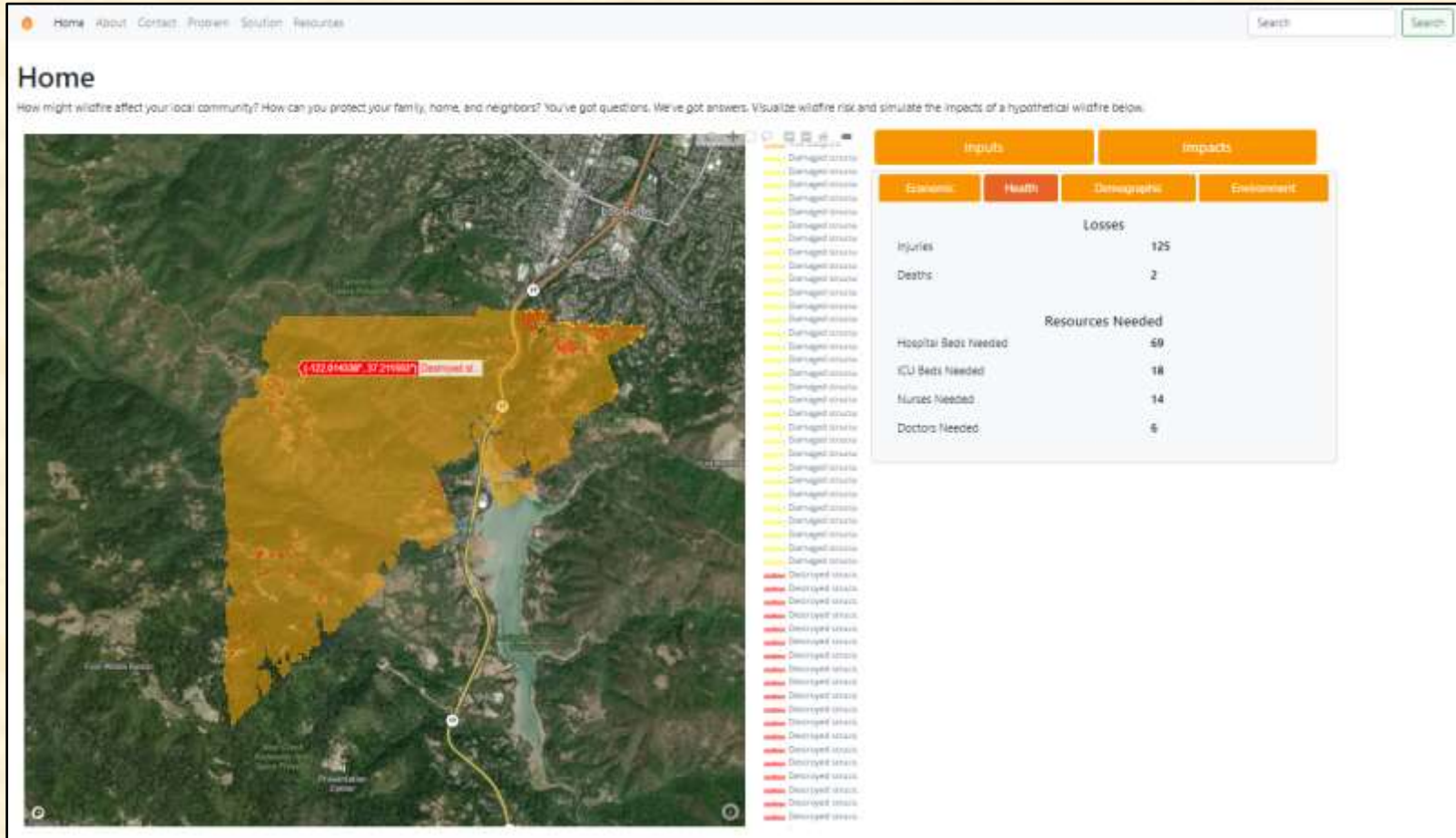




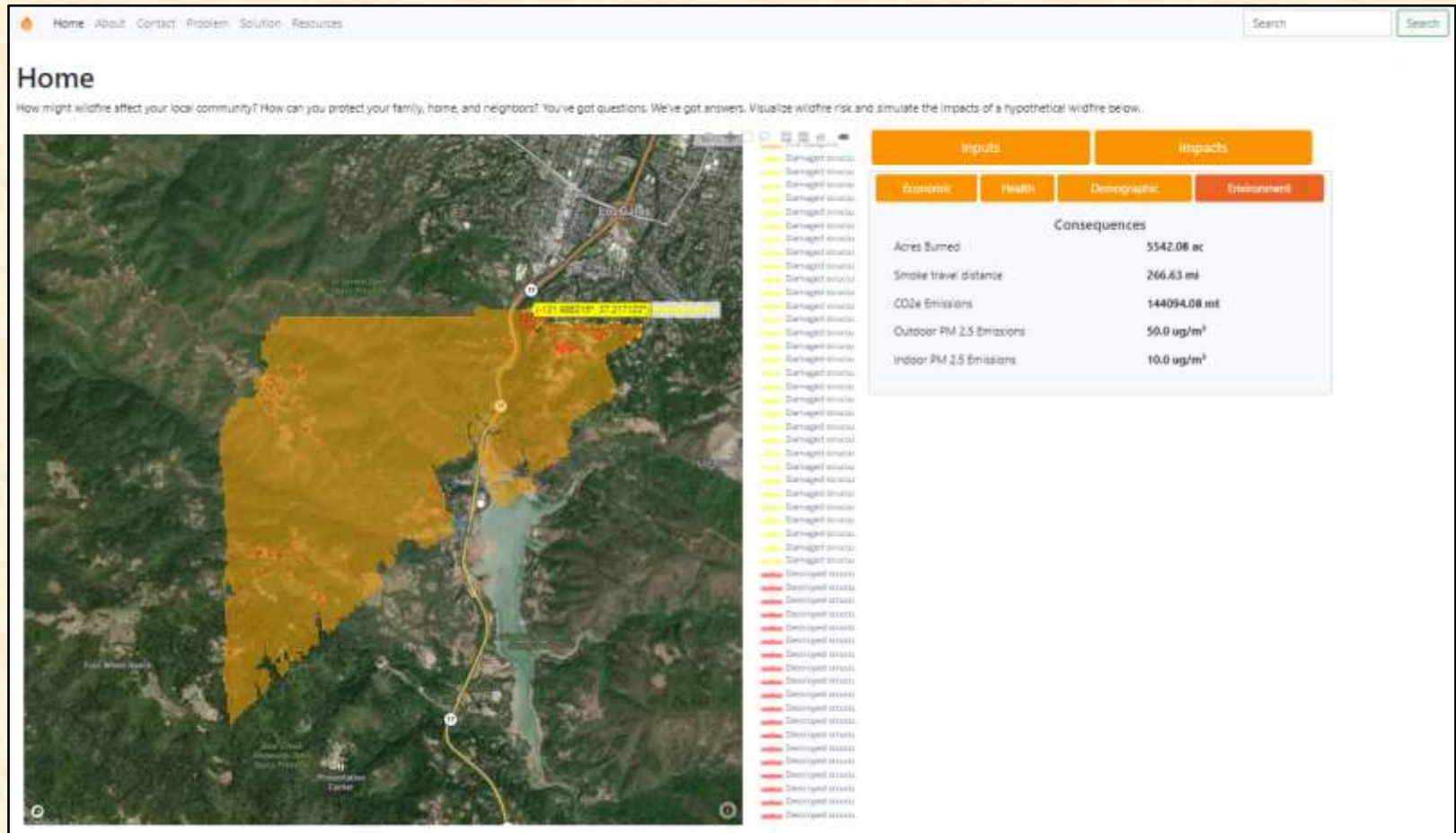
# Impacts > Economic



# Impacts > Health



# Impacts > Environment





# What's left to do?

- Features
  - Full historical weather and climate normals integration
- Stretch Goals
  - Integrating spot fire in the simulator
  - Expand demographic calculations with census data
  - Time-stepping burn playback
- Other Tasks
  - About, Contact, Problem, Solution, Resources pages
  - Expand unit testing and CI/CD pipeline
  - Continued UI improvements





# Questions?

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