**STA160 Project Plan**

*Glendale Fire Risk Interactive Visualization*

*Team Number: 3*

**1. Team Members**

* **Ruhi Aggarwal** (*Data Science, 4th year*)
* **Alexander Davis**\* (*Statistics, 4th year*)
* **Alyssa Chau** (*Statistics/Managerial Economics, 3rd year*)
* **YiChun Chen** *(Data Science, 4th year)*
* **Zhichu Zheng** (*Statistics, 4th year*)

\*team leader.

#### **2. Motivation & Problem Statement**

* **Problem:** Communities in the Wildland-Urban Interface (WUI), like Glendale, CA, face a growing threat from wildfires. City planners, emergency services, and residents need accessible tools to understand which areas and structures are most vulnerable. Our project addresses the need for a clear, data-driven visualization of fire risk.
* **Importance:** This work has practical relevance for municipal planning, resource allocation for fire mitigation, and public awareness. It provides a tangible way to communicate complex spatial risk to a non-expert audience. Additionally, given the recent widespread wildfires in Southern California, Glendale is especially at risk due to its position in a valley.
* **Intended Use:** The interactive dashboard is intended for use by city officials, the Glendale Fire Department, and community members to explore and understand fire risk patterns across the city.

#### **3. Data Sources**

* **Datasets:**
  1. **Building Footprints:** LA County GIS Data Portal (includes height attributes).
  2. **Digital Elevation Model (DEM):** USGS National Map (10-meter resolution).
  3. **Vegetation / Fuel:** CalFire Fire and Resource Assessment Program (FRAP).
  4. **Fire Hazard Severity Zones (FHSZ):** Pre-calculated risk zones from CalFire.
  5. **Glendale City Boundary:** LA County GIS Data Portal.
* **Access:** All datasets are publicly available and downloadable from government-hosted open data portals.
* **Preprocessing:** All raw data layers will be clipped to the Glendale city boundary in QGIS. Data will be reprojected to a consistent Coordinate Reference System (CRS). Raster layers will be reclassified into a standardized risk scale (e.g., 1-5).
* **Ethics/Privacy:** The project uses public, anonymized data focused on structures and environmental factors. No personally identifiable information (PII) is required or will be used, posing minimal privacy risks.

#### **4. Methods & Tools**

* **Methods:** We will employ a weighted risk overlay analysis. In QGIS, we will derive slope and aspect layers from the DEM. We will then reclassify the slope, vegetation (fuel), and aspect layers into numerical risk scores. Weights for slope, vegetation, and aspect layers will be determined based on prior research from CalFire and related fire risk studies. We will perform a sensitivity analysis by varying weights to observe how building-level risk classifications change. These scores will be combined using a weighted formula in the Raster Calculator to produce a final, unified "Fire Risk Score" map. This score will then be spatially joined to the building footprint data.
* **Tooling:**
  + **GIS Analysis & 3D Export:** QGIS with the *qgis2threejs* plugin.
  + **Web Dashboard:** Plotly Dash (Python).
  + **Version Control:** Git / GitHub.
* **Computing:** Standard team member laptops are sufficient for the scope of this analysis.
* **Reproducibility:** The risk analysis workflow will be documented, and the QGIS project file will be saved. The Dash application code will be stored in a GitHub repository. All code and data workflows will be maintained in a public GitHub repository with clear folder structure. Each member will work on feature branches and use pull requests for integration.

#### **5. Expected Outcomes**

* **Deliverables:**
  1. An interactive 2D Plotly Dash web dashboard showing buildings colored by their calculated fire risk score, with filters for risk level.
  2. An embedded 3D visualization (exported from QGIS) showing the terrain, extruded buildings, and the fire risk map draped over the landscape.
  3. A final project report detailing the methodology, data sources, and results.
  4. A presentation summarizing the project for the final review.
* **Evaluation of Success:** Success will be evaluated based on the functional completion and successful integration of the deliverables. The primary metric is the creation of a working, intuitive dashboard that clearly communicates the results of our risk analysis. We will not be evaluating predictive accuracy, but rather the effective visualization of our data-driven model. We will also compare the resulting risk map to CalFire’s official Fire Hazard Severity Zones to check for consistency and identify discrepancies.

#### **6. Risks & Mitigations**

* **Risk 1 (Data Quality):** Building footprint data may be incomplete or lack height attributes, hindering the 3D visualization.
  + **Mitigation:** If height data is unusable, we will extrude all buildings to a uniform, representative height for the 3D model. We will prioritize finding the best available data in Week 1.
* **Risk 2 (Technical Feasibility):** Potential issues embedding the *qgis2threejs* export into the Plotly Dash *Iframe*.
  + **Mitigation:** The PM/Integrator will create a proof-of-concept prototype in Week 3 to validate this workflow early, allowing time to pivot if necessary.
* **Risk 3 (Scope Creep):** The team may be tempted to add complex features like predictive modeling or real-time data.
  + **Mitigation:** We will adhere strictly to the defined "risk analysis" scope. The Project Manager will ensure the team remains focused on the core deliverables outlined in this plan.

#### **7. Timeline & Milestones**

| Week / Date | Goal / Deliverable | Responsible |
| --- | --- | --- |
| **Week 3**  (Oct 13-19) | Finalize project plan. | Alexander |
| **Week 4** (Oct 20-26) | Acquire, clean, and clip all necessary GIS data. | All |
| **Week 5** (Oct 27-Nov 2) | Perform GIS analysis: derive slope/aspect, reclassify all risk layers. | Zhichu, YiChun |
| **Week 6** (Nov 3-9) | Develop and finalize the weighted risk overlay model. Generate final "Fire Risk Score" raster. | Ruhi, YiChun |
| **Week 7** (Nov 10-16) | **Milestone:** Finalize GeoJSON (buildings with risk scores) for Dash development. Begin Dash 2D map & chart development. Begin 3D scene creation in QGIS. | All |
| **Week 8** (Nov 17-23) | Complete 2D dashboard functionality. Complete and export the 3D web scene. | Alexander, Zhichu |
| **Week 9** (Nov 24-30) | **Milestone:** Integrate the 3D scene into the Dash app. Finalize UI/UX, write documentation, and begin final report/presentation. | All |
| **Week 10** (Dec 1-7) | Final testing, bug fixes, and project submission. Rehearse presentation. | All |

#### **8. Division of Work**

| Work | Skills | Owner(s) |
| --- | --- | --- |
| **Data Collection & Cleaning** | GIS, Data Sourcing | Zhichu, YiChun |
| **GIS Analysis (Slope, Aspect)** | QGIS, Raster Analysis | Zhichu, Alyssa |
| **Risk Model Definition** | Statistics, GIS | Ruhi |
| **3D Scene Creation & Export** | QGIS, *qgis2threejs* | Alexander, YiChun |
| **Dashboard Development (2D)** | Python, Plotly Dash, HTML | Alexander |
| **Integration & Project Mgmt** | Python, HTML, Organization | Alyssa, Ruhi |
| **Final Report & Presentation** | Writing, Presentation | All |

#### **9. Constraints & Policies (Course-Specific)**

**Collaboration:**Our team will collaborate primarily through GitHub and Discord. All members will contribute to the shared GitHub repository using feature branches and pull requests to ensure version control and transparency. Weekly check-in meetings will be held to review progress against the project timeline and assign upcoming tasks. The project manager will oversee task distribution and integration milestones to maintain alignment and ensure deadlines are met.

**AI Usage:**We will use generative AI tools for purposes such as debugging code, generating documentation templates, and improving clarity in report writing.

**Attribution:**All data sources (e.g., CalFire FRAP, LA County GIS Data Portal, USGS DEM) and software tools (QGIS, Plotly Dash) will be properly cited in the final report and README documentation.