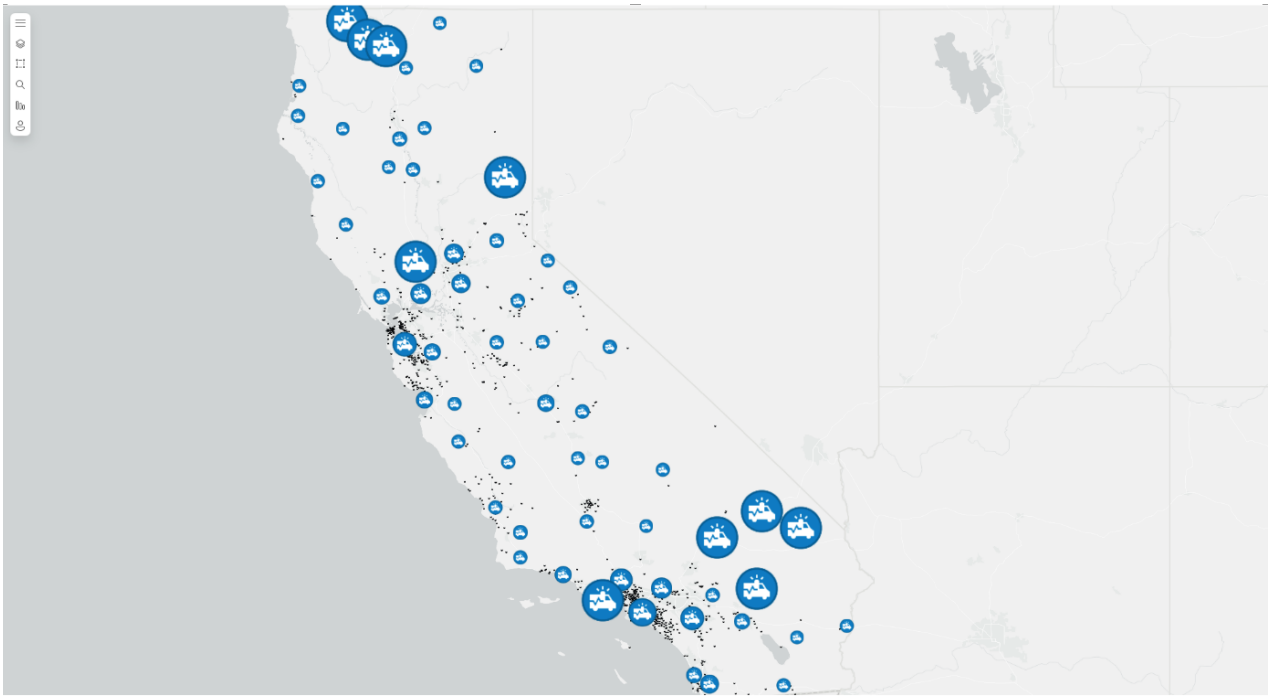
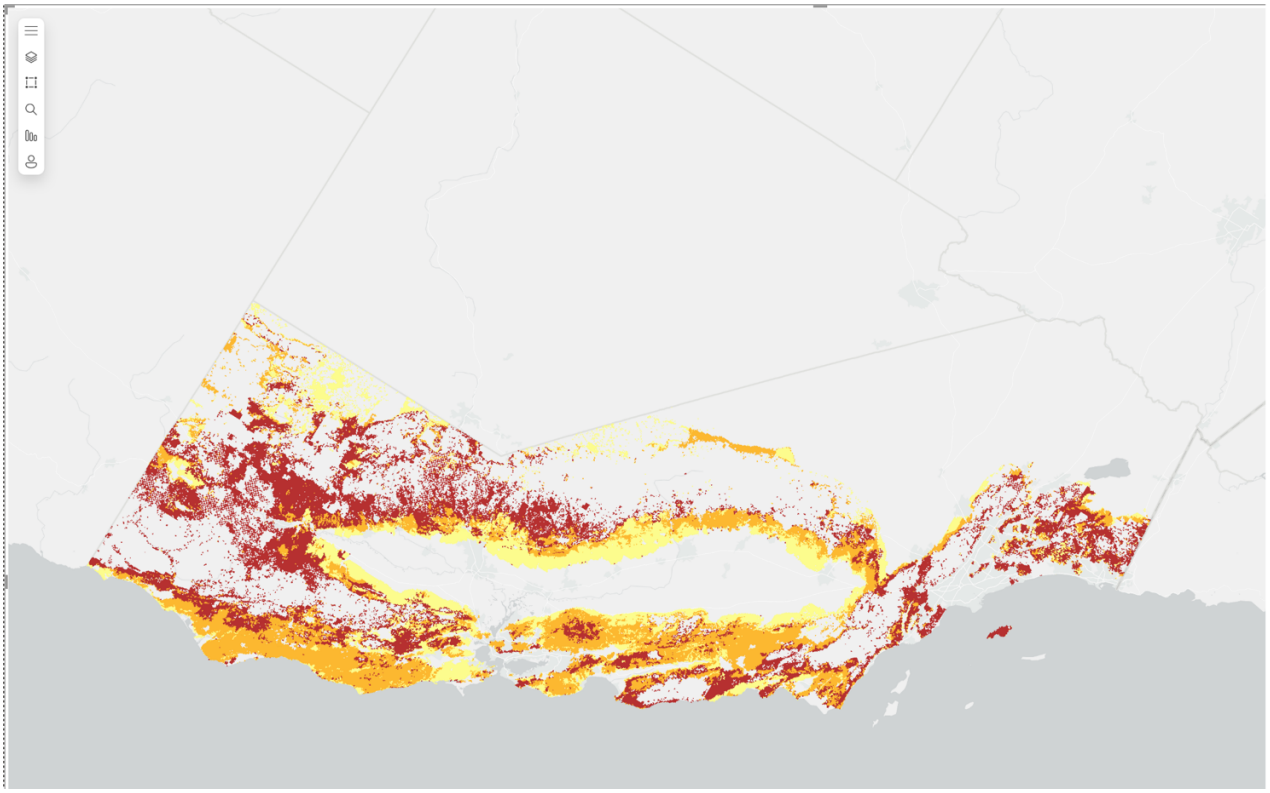
Part 1: Geospatial Analysis

Fire Station Coverage Across California



Wildfire Hotspots: Mapping Fire Severity in California



Stakeholder Spatial Needs

1. **Firefighters and Emergency Responders:**
    - **Needs:** Locate fire stations with larger units relative to high-risk areas (shown in red on the second map). Analyze spatial distribution to ensure adequate coverage during emergencies.
    - **Interaction:** Identify clusters of fire intensity and match them with nearby large-capacity fire stations.
    - **Scale:** Regional and city-level focus to optimize resource allocation.
2. **Policy Makers and Environmental Agencies:**
    - **Needs:** Assess spatial patterns of fire intensity (red areas) to prioritize funding and policy interventions.
    - **Interaction:** Compare fire-prone areas across counties or cities to analyze which regions require more fire stations or preventative measures.
    - **Scale:** Regional and state-level focus for planning and policy implementation.
3. **Urban Planners:**
    - **Needs:** Understand the spatial relationship between fire-prone areas and urban infrastructure to recommend safer development zones.
    - **Interaction:** Overlay demographic and environmental data (e.g., population density or vegetation cover) with fire intensity for a comprehensive risk assessment.
    - **Scale:** Neighborhood and city-level detail to support planning decisions.

Data Assessment

1. **Location Representation:**
    - **Fire Stations:** Represented as point locations (first map), with larger icons for higher-capacity units.

- **Fire Incidents:** Represented as grid-based measurements in a gradient color scale, where red indicates severe fire intensity.

2. **Geographic Coverage and Resolution:**
    - Coverage includes all regions within California, with high resolution for pinpointing individual fire stations and detailed fire intensity patterns.
3. **Additional Spatial Context Needed:**
    - **Environmental Variables:** Include vegetation type, proximity to water bodies, and wind patterns.
    - **Demographics:** Add data on population density, urban growth areas, and economic factors.
4. **Complementary Data:**
    - Integrate evacuation routes, transportation networks, and emergency response times to improve geospatial insights.

Initial Design Exploration

1. **Visualization 1: Fire Stations and Fire Intensity Overlay**
    - **Design:** Overlay fire station locations (points) on the fire intensity map to visualize station coverage in high-risk areas.
    - **Purpose:** Help stakeholders understand if high-intensity fire zones (red) are adequately covered by nearby fire stations.
    - **Rationale:** Enables firefighters and emergency planners to identify gaps in coverage and allocate resources effectively.
2. **Visualization 2: Fire Intensity Clusters by Region**
    - **Design:** Create a choropleth map that aggregates fire intensity by county or city boundaries.
    - **Purpose:** Provide policymakers with an overview of fire-prone regions, helping prioritize policy interventions and funding.
    - **Rationale:** Aggregated data simplifies decision-making and aligns with regional planning strategies.

Part 2: AI-Assisted Design Process

1. **AI Tools Used:**
    - **Model:** ChatGPT (OpenAI v4.0) and Llama 3.3 70B (API)
    - **Prompts:**
        - "Suggest geospatial visualizations for analyzing fire intensity and station coverage."
        - "How can I combine point-based fire station data with grid-based fire intensity data?"
        - "What additional spatial factors can enhance wildfire analysis?"
2. **Why These Prompts Were Structured:**
    - Open-ended prompts were designed to explore creative visualization ideas and ensure alignment with stakeholder needs.
    - Specific prompts focused on integrating multiple data types (points and grids) and identifying complementary variables.
3. **Implementation Plan:**
    - **Data Preparation Steps:**
        - Clean and preprocess fire station and fire intensity data, ensuring consistent coordinate systems.
        - Aggregate fire intensity by regions for the choropleth map.
    - **Tools:** Used Python libraries (e.g., Pandas) for data processing and Matplotlib/Plotly for visualizations. Selected for their ability to handle spatial data and produce high-quality maps.
    - **Interactive Features:** Consider adding hover-over tooltips to show fire intensity and station capacity for specific locations in future dashboards.
4. **Evaluation of AI Suggestions:**
    - **Helpful Suggestions:** The recommendation to overlay fire station data on intensity maps provided a clear visualization for responders. The suggestion to create choropleth maps was also practical for policymakers.

- **Limitations:** AI didn’t account for technical challenges like aligning different data formats (point and grid-based) or optimizing visual clarity in overlapping regions.
- **Best Practices Missed:** AI didn’t emphasize the importance of selecting complementary color schemes for the overlay, which was manually adjusted for better readability.