**Part 1: Geospatial Analysis**

**Fire Station Coverage Across California  
A map with blue circles and white dots

Description automatically generated  
  
Wildfire Hotspots: Mapping Fire Severity in California  
A map of the united states

Description automatically generated**

**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.