

Wildfire GPT



Hi there! I'm WildfireGPT, your friendly wildfire risk consultant. With access to comprehensive wildfire datasets, I'm here to help you understand and prepare for potential risks in your area.

To provide the most relevant information, I'll start by working through a checklist of questions about your background and concerns prior to our consultation session. Your responses will help me tailor my recommendations to your unique situation. If you're unsure about any question, feel free to say "I don't know."

Once I have a clear understanding of your needs, I'll summarize our discussion and create a plan to address your concerns. This will include the datasets we'll analyze and the types of recommendations I can provide.

When you're happy with the plan, we'll proceed according to the agreed-upon steps. Feel free to ask questions at any point in the process.

I'm looking forward to working with you to help you better understand and prepare for wildfire risks. Let's get started with our first question:

What is the location you're concerned about regarding wildfire risks? You can describe a specific address, city, or part of a region. We can also use latitude and longitude coordinates if you have them. If you're unsure, we can work together to identify the exact location. (As of now, WildfireGPT only analyzes wildfire risks within 36km (22 miles) of a given location specified by

Ask me anything?



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Northern California



Do you have specific latitude and longitude coordinates for the area in Northern California you are concerned about, or would you like me to propose coordinates for a general area?



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Chico



For Chico, California, the coordinates are approximately 39.7285° N, 121.8375° W. I will now verify this location on a map for you. Please hold on for a moment.

Please confirm the location by clicking the 'Confirm Location' button on the map provided.



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The location has been confirmed: latitude 39.7285, longitude -121.8375.



Great! Next, could you please share your primary concerns or questions about wildfires in the Chico area?



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Is there any current wildfire in the area?



Understood. Now, could you specify the time frame you are interested in for assessing wildfire risks? Here are the options:

- **Short-term (1-10 years):** Immediate mitigation strategies after a recent fire or for areas at high risk.
- **Medium-term (10-30 years):** Strategies for ongoing risk management and resilience building.
- **Long-term (30-80+ years):** Considerations for long-term planning, such as urban development, land use, and climate change adaptation.

Alternatively, if you are interested in historical data:

- **Recent (1-10 years):** Recent fire events in the area.
- **Past (10-50 years):** Historical fire risks in the area.
- **Long-term (50+ years):** Long-term trends in fire patterns in the area.

Please let me know which one applies to your interest.



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I'm interested in current data as of today



Thank you for clarifying. Could you please describe your professional background and expertise? This will help me tailor the information to your needs.



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I'm a data analyst



As a data analyst, what specific aspects of wildfire risks are you interested in exploring? For instance, are you looking at statistical trends, risk prediction models, impact assessments, or something else? If you're unsure, I can provide examples to help refine your scope.



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statistical trends, risk prediction models, impact assessments and demographics in the area



Thank you for providing that information. Let's review the details to ensure everything is accurate before I update the checklist:

- **Location:** Chico, California (latitude 39.7285, longitude -121.8375)
- **Concern:** Inquiry about any current wildfires in the area
- **Time:** Current data as of today
- **Profession:** Data Analyst
- **Scope:** Interested in statistical trends, risk prediction models, impact assessments, and demographics in the area

Please confirm if all these details are correct.



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I'm data analyst who specializes in emergency management



Thank you for the additional detail. I will update your profession accordingly.

Here's the revised checklist:

- **Location:** Chico, California (latitude 39.7285, longitude -121.8375)
- **Concern:** Inquiry about any current wildfires in the area
- **Time:** Current data as of today
- **Profession:** Data Analyst specializing in emergency management
- **Scope:** Interested in statistical trends, risk prediction models, impact assessments, and demographics in the area

Please confirm if this updated information is correct.



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Looks good



I have successfully updated the checklist with your details. Now, I have a few follow-up questions about the scope of this session to ensure we cover all aspects of your interest comprehensively. Are you ready to proceed with these questions?



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Sure



Great! Let's dive into some specifics regarding your access to data:

Have you been able to access comprehensive historical wildfire data for Chico and its surrounding areas in terms of frequency, intensity, and affected zones? If not, would you like to include this in the scope of today's session?



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I don't need the comprehensive historical data. I want to focus on the current data, like causes for recent fires and forest management



Understood, we'll focus on current data including causes of recent fires and forest management practices.

Next question: What models are you currently using to predict wildfire risks in Chico, and do they incorporate real-time environmental variables such as drought conditions, wind speeds, and recent rainfall deficits? If you are not using any models yet, would you like to explore options today?



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Let's explore options for model building



Great, we'll explore options for building predictive models that incorporate real-time environmental variables.

Finally, can you provide detailed demographic and socio-economic profiles of the population in Chico to understand which groups are most vulnerable in wildfire scenarios? If not, would you like assistance in gathering this information today?



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Sire



Thank you for your responses. I will now summarize the updated information:

- **Location:** Chico, California (latitude 39.7285, longitude -121.8375)
- **Concern:** Inquiry about any current wildfires in the area
- **Time:** Current data as of today
- **Profession:** Data Analyst specializing in emergency management

- **Scope:** Interested in statistical trends, risk prediction models, impact assessments, and demographics in the area
- **Historical Wildfire Data Access:** Not needed, focus on current data like causes for recent fires and forest management
- **Current Predictive Models Utilization:** Exploring options for model building that incorporate real-time environmental variables
- **Demographic and Socio-Economic Profiling:** Interested in gathering detailed demographic and socio-economic profiles

Please confirm if this summary is accurate and complete.



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Looks good



While I am working diligently creating a comprehensive plan, I want to touch base and let you know that I can leverage three powerful datasets that each offer unique insights into wildfire risks within a 36km (22 miles) radius of the area of interest we discussed earlier:

- Fire Weather Index (FWI) from [ClimRR](#) allows us to assess potential trends in fire danger from the historical period (1995-2004) through the mid-century (2045-2054) and up to the end of the century (2085-2094). This dataset is ideal if you're interested in understanding how fire risks may evolve over time.

- Long term fire history records from [International Multiproxy Paleofire Database \(IMPD\)](#), specifically the metadata from the North American Tree-ring Fire Scar Synthesis (NAFSS) provides a rich dataset including scientific studies derived from tree-ring records across North America, capturing centuries of wildfire occurrences. This dataset can be instrumental in analyzing wildfire risk by providing historical context and identifying patterns or cycles in wildfire activity in the long term. If analyzing long-term wildfire trends is a priority for you, this dataset is a fantastic resource.
- Recent fire incident data reported to the [IRWIN system](#): Wildland Fire Interagency Geospatial Services (WFIGS) Group wildfire incidents record allows you to retrieve yearly and monthly wildfire incident counts between 2015 and 2023. This dataset is perfect if you want to focus on recent fire incidents in your area.

Currently, these are the datasets I can access. If I mistakenly suggest analyzing types of data that are beyond my current access, please kindly point them out to me so I can adjust our plan accordingly.

In addition to these datasets, the related academic papers are compiled by the Argonne National Laboratory's [Community and Infrastructure Adaptation to Climate Change \(CIACC\) tool](#). For each retrieval, I can extract abstracts from 3 relevant published papers within the corpus and provide you with a summary of the findings.

I am currently working on creating a comprehensive, personalized wildfire risk analysis plan for you. As I work on your plan, I kindly ask for your patience. Please refrain from typing anything until I have shared the completed plan with you for your review ...

Once I have completed the plan, I will share it with you for your feedback. At that time, please let me know if you have any specific preferences or areas of focus you'd like me to prioritize in future revisions or updates to the plan.



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Here's the plan to address your concerns about wildfire risks in Chico, California:

Step 1: Data Analysis Using Recent Fire Incident Data

- I will analyze the Recent fire incident data to identify the causes and locations of recent wildfires in the Chico area. This will help in understanding current trends and immediate risks.

Step 2: Development of Predictive Models

- I will explore options for building predictive models that incorporate real-time environmental variables using the Fire Weather Index (FWI). This will allow for dynamic risk assessment and help in emergency management planning.

Step 3: Demographic and Socio-Economic Analysis

- I will gather and analyze detailed demographic and socio-economic profiles of the Chico area to understand which groups are most vulnerable in wildfire scenarios. This information will be crucial for targeted emergency response and preparedness measures.

Step 4: Literature Search

- I will search for scientific literature on effective forest management practices and wildfire mitigation strategies that have been successful in similar geographical and climatic conditions. This will provide a broader context and support the development of tailored strategies for Chico.

Step 5: Recommendations

- Based on the analysis of the datasets and the literature search, I will provide recommendations on immediate actions to mitigate wildfire risks and enhance preparedness in the Chico area.

Do you have any questions about this plan, or is there any other dataset or information you would like to include in the analysis?



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Sounds good



While I am preparing the analysis, I'd like to let you know that I can also report some census data. Specifically, I can analyze the following demographic information reported at the census block level within a 36 km (22 miles) radius of the location of interest:

- Total population
- Number of Housing Units
- Number of People Below Poverty Level

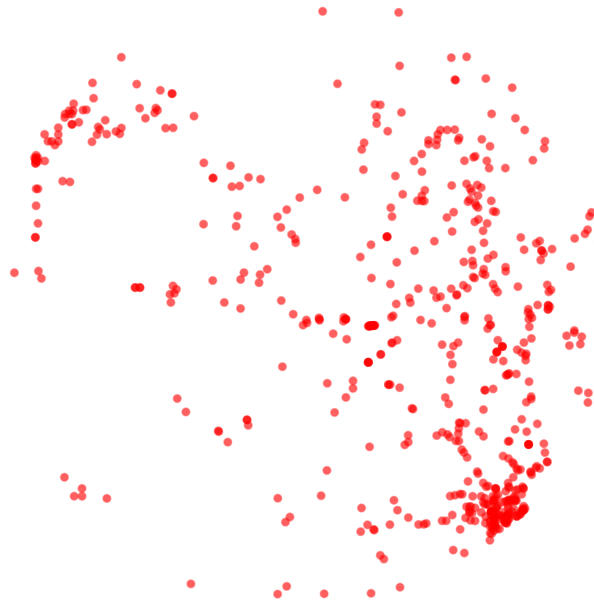
If you need to assess the potential impact of a wildfire on the local community, you can ask me to provide this demographic information by asking questions like: "who will be affected by the wildfire?"

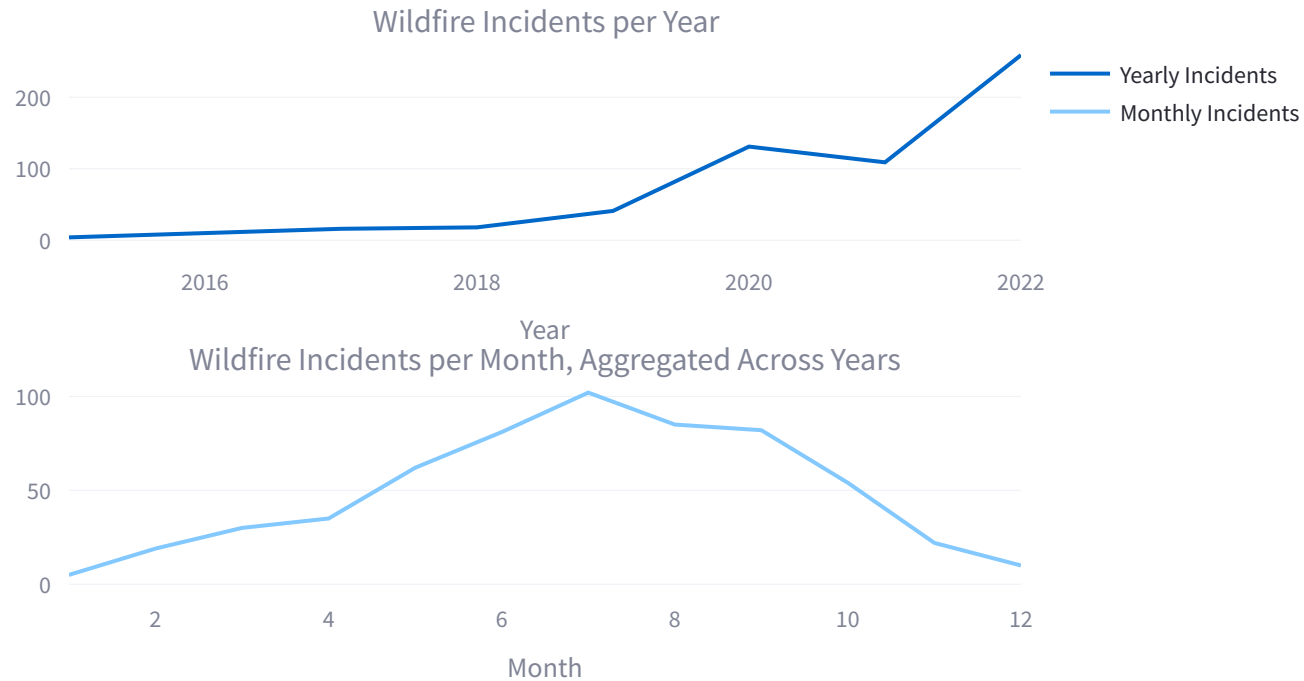


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The Fire Incident Records (shown in red dots) within 36 km (22 miles) of the location (lat: 39.7285, lon: -121.8375)



Wildfire Incidents within 36 km (22 miles) of the Location (lat: 39.7285, lon: -121.8375)

The wildfire incident data from 2015 to 2022 within 36 km of Chico, California, shows a significant increasing trend in fire occurrences. From 2015, with only 4 incidents, to a dramatic rise to 259 incidents in 2022, this data indicates escalating fire risks in the area. This trend is particularly pronounced during the summer months, peaking from July through September, which aligns with the dry and hot climate conditions typical of this region.

This rising trend in wildfire incidents underscores the urgent need for enhanced fire management and preparedness strategies in Chico. It impacts not only the safety and property of the local community but also has broader implications for the regional economy, especially sectors like agriculture and tourism that are vulnerable to fire damage.

Given your role as a Data Analyst specializing in emergency management, these insights are crucial for developing targeted risk prediction models and impact assessments. It's important to note that while these incident counts provide a snapshot of fire occurrences, they do not encompass the entire scope of fire history or severity. For a more comprehensive analysis, including burn severity, you may refer to USGS data on burn severity: [USGS Burn Severity](#).

Do you have any specific questions about these trends, or shall we proceed to the next step of exploring predictive modeling options?



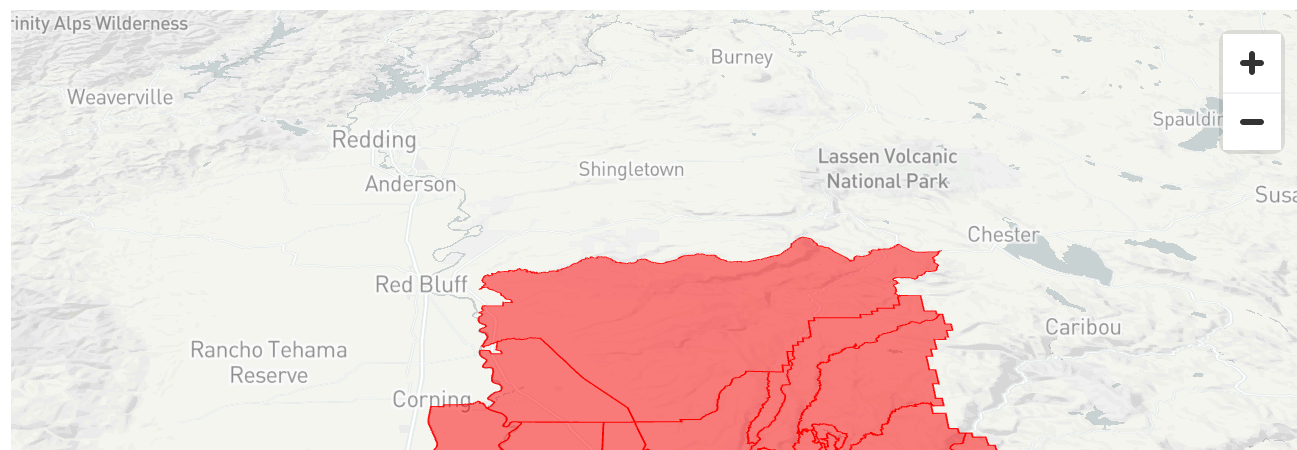
Click to provide feedback

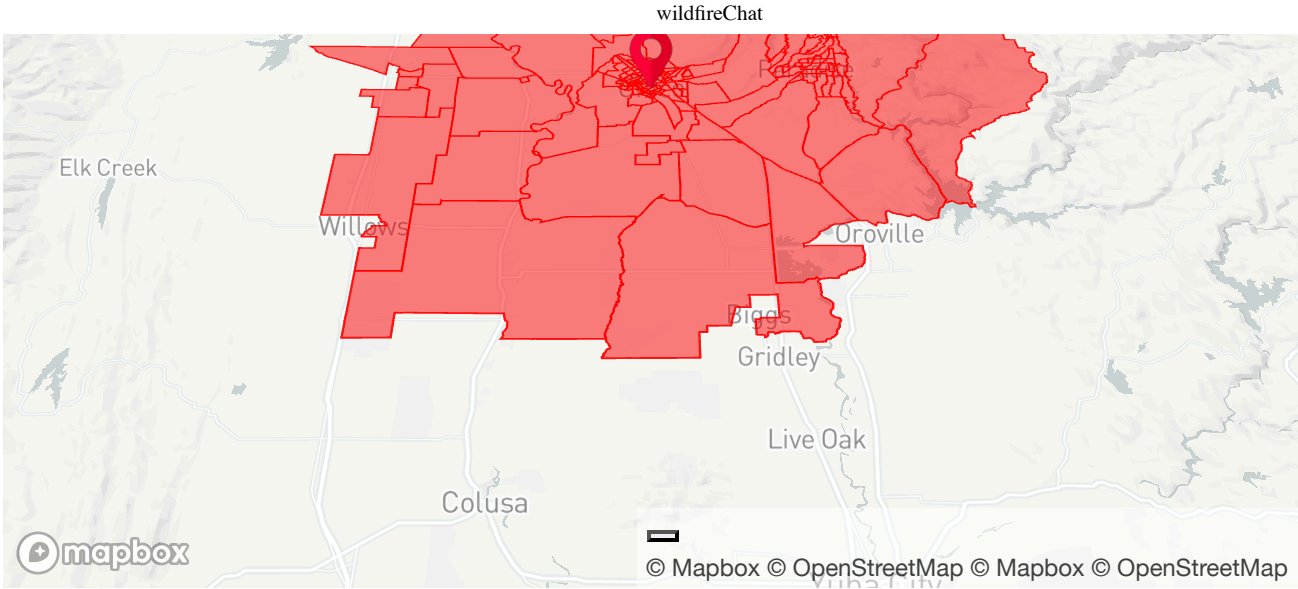


What about demographics?



The census block groups overlapping with the area within 36 km (22 miles) of the location (lat: 39.7285, lon: -121.8375)





Census Data within 36km (22 miles) surrounding location (lat: 39.7285, lon: -121.8375)

Population	Below Poverty	Below Half Poverty	Housing Units
168958	30495	15509	73564

The demographic data for the Chico area reveals a total population of 168,958 as of 2022. Notably, 30,495 individuals are living below the poverty line, with 15,509 of these residents earning less than half of what is considered necessary to meet basic living expenses. This information highlights significant socioeconomic vulnerabilities within the community.

Given these demographics, it is crucial to tailor emergency management strategies to address the needs of these vulnerable populations, particularly in the context of increasing wildfire risks. Strategies could include targeted communication plans, accessible evacuation procedures, and financial assistance programs for recovery and rebuilding. These measures can help mitigate the impact of wildfires on the most at-risk segments of the population.

For more detailed demographic data, you can refer to the U.S. Census Bureau's API: [U.S. Census Bureau Data](#).

Would you like to discuss how these demographic insights can be integrated into your predictive models and risk assessments, or is there another aspect of the project you wish to explore next?



Click to provide feedback



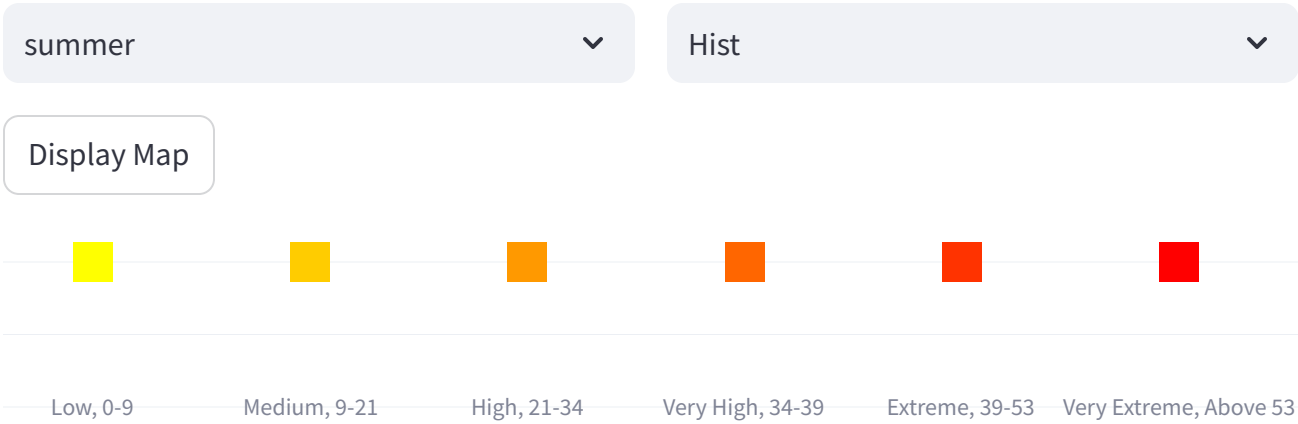
Let's jump into the predictive models and risk assessment



Fire Weather Index (FWI) Data for Location (lat: 39.7285, lon: -121.8375) within a 36 km (22 miles) radius, shown at a grid cell level. Select the season and period to view the FWI data.

Select Season

Select Period



Average Fire Weather Index (FWI) Data for Location (lat: 39.7285, lon: -121.8375) with standa

Category	Spring	Summer	Autumn	Winter
Historical(1995 - 2004)	8.6 (se: ± 2.5) Low	31.28 (se: ± 3.54) High	32.87 (se: ± 3.51) High	3.82 (se: ± 1.1) Low
Mid-Century(2045 - 2054)	9.03 (se: ± 2.64) Medium	31.64 (se: ± 3.41) High	31.92 (se: ± 3.5) High	3.57 (se: ± 0.89) Low
End-of-Century(2085 - 2094)	10.4 (se: ± 3.02) Medium	34.43 (se: ± 3.07) Very High	33.93 (se: ± 3.25) High	7.12 (se: ± 1.71) Low

Explanation each cell in the table above.

Cell	Explanation
Average	Average FWI values are calculated by pooling all the grid cells within a 36 km (22 miles) radius.
Standard Error (SE)	The standard error is calculated as the standard deviation of the FWI values across all grid cells.
Classification	The classification is based on the Canadian Forest Fire Weather Index (FWI) system, which categorizes FWI values into six classes: Low, Medium, High, Very High, Extreme, and Very Extreme.

The Fire Weather Index (FWI) data for Chico, California, indicates varying levels of wildfire risk across different seasons, with a notable increase projected towards the end of the century. Historically, the FWI during summer and autumn has been high, with values of 31.28 and 32.87 respectively, indicating a significant risk of wildfire spread during these seasons. This trend is projected to intensify, with the FWI for summer reaching a very high level of 34.43 by the end of the century.

This escalating trend in FWI values suggests that future fire risks are increasing, particularly in the warmer months. This information is critical for your role in emergency management, as it allows for advanced planning and implementation of mitigation strategies during peak risk periods. The data can be utilized to refine predictive models, focusing on high-risk periods to allocate resources more effectively and prepare the community for potential wildfire events.

The broader impact on the community and economy could be substantial, affecting housing, local businesses, and insurance sectors, necessitating proactive approaches to community

resilience and economic stability.

For more detailed information on the Fire Weather Index, you can visit the Climate Risk & Resilience Portal (ClimRR): [Climate Risk & Resilience Portal](#).

Would you like to discuss how to integrate these FWI projections into your predictive models, or is there another aspect of the project you wish to explore further?



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Can you design a linear model for me with these data you presented



To design a linear regression model using the data provided on wildfire incidents and the Fire Weather Index (FWI), we can outline the steps and variables to include in the model. This will help predict the number of wildfire incidents based on the FWI and other environmental variables.

Model Design: Linear Regression

1. Dependent Variable (Y)

- **Number of Wildfire Incidents:** This is the outcome variable we are trying to predict.

2. Independent Variables (X)

- **FWI Values:** Including FWI for different seasons as separate variables (e.g., FWI_Spring, FWI_Summer, FWI_Autumn, FWI_Winter).
- **Year:** To capture any trend over time that is not explained by the FWI.
- **Month:** As a categorical variable to account for seasonal variations in wildfire occurrences.

3. Model Formulation

- We would formulate the model as:
$$\text{Wildfire Incidents} = \beta_0 + \beta_1 \text{FWI_Spring} + \beta_2 \text{FWI_Summer} + \beta_3 \text{FWI_Autumn} + \beta_4 \text{FWI_Winter} + \beta_5 \text{Year} + \beta_6 \text{Month} + \epsilon$$
- Here, $(\beta_0, \beta_1, \dots, \beta_6)$ are the coefficients to be estimated, and (ϵ) is the error term.

4. Data Preparation

- **Scaling and Encoding:** Scale the FWI values and encode the 'Month' as a categorical variable using one-hot encoding to handle the seasonal effect properly.
- **Data Splitting:** Split the data into training and testing sets to validate the model's performance.

5. Model Estimation

- Use a statistical software or a programming language like Python or R to fit the linear regression model to the training data.

6. Model Evaluation

- Evaluate the model using the testing set with metrics such as R-squared, RMSE (Root Mean Squared Error), and MAE (Mean Absolute Error) to understand the model's accuracy and predictive power.

7. Interpretation and Use

- Interpret the coefficients to understand the impact of each FWI value and other variables on the number of wildfire incidents.
- Use the model to make predictions and inform decision-making in emergency management planning.

Would you like assistance with any specific part of this model-building process, such as data preparation, coding the model, or interpreting the results?



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Are there other variables to be considered?



Yes, there are several additional variables that could significantly enhance the predictive power of your wildfire risk model. Here are some important ones to consider:

1. **Vegetation Type and Density:** The type and density of vegetation can influence fire behavior significantly. Areas with dense, dry vegetation are more susceptible to wildfires.

2. **Previous Burn History:** Areas that have experienced fires in the past may have different risk profiles due to changes in vegetation and soil conditions.
3. **Human Activity Levels:** Regions with higher human activity, including camping sites, hiking trails, and urban interfaces, often have higher risks of human-caused ignitions.
4. **Topography:** The slope and aspect of the land can affect how quickly a fire spreads. Fires on slopes burn faster uphill due to pre-heating of the vegetation above.
5. **Weather Conditions:** Besides the FWI, other specific weather conditions such as wind speed and direction, temperature, and humidity play critical roles in fire behavior.
6. **Land Management Practices:** Controlled burns, logging activities, and the maintenance of fire breaks can influence fire risk.
7. **Infrastructure and Accessibility:** The proximity to roads and water sources can affect both the likelihood of fire spread and the effectiveness of firefighting efforts.
8. **Socio-Economic Factors:** Economic resources available for fire prevention and suppression, as well as public awareness and education on fire safety, can impact risk levels.
9. **Climate Change Indicators:** Long-term changes in climate variables, such as increasing temperatures and changing precipitation patterns, can be integrated to predict future fire risks more accurately.

Incorporating these variables could require gathering additional data and possibly using more complex modeling techniques, such as multivariate regression or machine learning models, which can handle multiple input variables and complex interactions more effectively.

Would you like to explore how to integrate these variables into your model, or do you need information on sources where you can obtain this data?



Click to provide feedback



Please provide sources on how to obtain this data



To enhance your wildfire predictive model with additional variables, here are some sources where you can obtain relevant data:

1. **Vegetation Type and Density**

- **USGS Land Cover Institute (LCI):** Provides detailed land cover data which can be used to assess vegetation types and density.
- [USGS Land Cover Institute](#)

2. **Previous Burn History**

- **Monitoring Trends in Burn Severity (MTBS):** Offers geospatial data on burn severity and extent for historical fires across the United States.
- [Monitoring Trends in Burn Severity](#)

3. **Human Activity Levels**

- **Recreation Information Database:** Contains data on recreational areas which might correlate with human activity levels.
- [Recreation Information Database](#)

4. **Topography**

- **USGS National Map:** Provides topographic data, including elevation and landforms, which are crucial for modeling how terrain influences fire spread.

- [USGS National Map](#)

5. Weather Conditions

- **NOAA National Centers for Environmental Information (NCEI):** Offers comprehensive weather data, including historical weather observations.

- [NOAA NCEI](#)

6. Land Management Practices

- **US Forest Service:** Provides information on land management practices, including controlled burns and logging activities.

- [US Forest Service](#)

7. Infrastructure and Accessibility

- **Homeland Infrastructure Foundation-Level Data (HIFLD):** Contains datasets on infrastructure, including roads and water sources.

- [HIFLD](#)

8. Socio-Economic Factors

- **U.S. Census Bureau:** Offers data on socio-economic factors that can influence community resilience to wildfires.

- [U.S. Census Bureau](#)

9. Climate Change Indicators

- **NASA's Climate Change and Global Warming:** Provides datasets related to long-term climate changes which can be used to predict shifts in fire risk.

- [NASA Climate Change Data](#)

Each of these sources can provide valuable data to strengthen your predictive modeling efforts. By integrating these datasets, you can develop a more comprehensive understanding of wildfire risks and improve your emergency management strategies.

Would you like guidance on how to integrate these data sources into your modeling process, or is there another specific aspect of the project you need help with?



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