

JOHNS HOPKINS UNIVERSITY
DATA VISUALIZATION PROGRAM
PROJECT PROPOSAL

Visualizing Fire Risk Dynamics through Meteorological Data.

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Project Type: Analytical dashboard integrating interactive data visualizations

I. Project Description

This project proposes the development of an interactive dashboard that visualizes and analyzes wildfire risk using modelled meteorological data from the Open-Meteo API (CC BY 4.0). The application focuses on Bosque Pehuén, Fundación Mar Adentro's privately protected area located in the Andean foothills of southern Chile, and its surrounding landscape.

The dashboard retrieves hourly temperature, relative humidity, wind speed, and precipitation data for the site's coordinates and computes a composite Wildfire Risk Index. This index integrates the main variables used by Chile's national fire-danger model, with one modification: the "days without rain" variable replaces a proprietary drought factor used by Chile's forestry agency. This variable is adapted from Argentina's Rodríguez-Moretti Index (IRM) (Dentoni & Muñoz, 2012), allowing the model to approximate local fuel dryness.

The result is a reproducible and open-source tool that allows users to:

- View current and forecasted risk levels.
- Compare contributing variables through animated polar and time-series plots
- Visualize regional risk gradients on an interactive map.

All computations are implemented in Python using open-source libraries and visualized through *Streamlit*.

II. Project Plan

The project will proceed in three main stages:

1. Data retrieval and preprocessing (Week 1-2)
 - Retrieve hourly and daily data from the Open-Meteo API using Python's requests library.
 - Process variables (temperature, humidity, wind, rainfall) into a unified DataFrame.
 - Implement "days without rain" logic based on precipitation thresholds (> 2 mm).

2. Risk index computation and visualization (Week 3–5)
 - Define scoring tables for each variable (0–25 pts).
 - Calculate total risk index (0–100 pts).
 - Implement visualizations:
 - o Animated polar plot showing relative contributions.
 - o Table displaying variable values and scores.
 - o Regional map of surrounding risk using `pydeck`.

3. Dashboard integration and deployment (Week 6–8)
 - Build user interface in *Streamlit*.
 - Add interactivity (date selection, forecast horizon, map radius).
 - Package the environment in `environment.yml` for reproducibility.
 - Prepare documentation and visuals for final presentation.

III. Timeline

(Note: Initial data exploration and early prototype work have already begun, including preliminary API integration, base visualizations, and environment setup. The remaining stages focus on refining functionality, interface design, and documentation.)

Week	Task	Deliverable
1	Review literature on wildfire risk indices (Chile & Argentina); set up environment	Reference notes; functional environment
2	Retrieve and clean Open-Meteo data for Bosque Pehuén	Sample dataset
3–4	Implement risk calculation functions; test output consistency	Validated scoring model
5	Create visualization prototypes (polar plot, table, trend)	Prototype plots
6	Integrate visuals into Streamlit layout	Functional dashboard
7	Add regional mapping and dynamic updates	Interactive version
8	Finalize design, documentation, and presentation materials	Final dashboard + report

IV. Current references employed

1. Dentoni, M. C., & Muñoz, M. M. (2012). Sistemas de evaluación de peligro de incendios. Informe Técnico N° 1. Plan Nacional de Manejo del Fuego – Programa Nacional de Evaluación de Peligro de Incendios y Alerta Temprana. Esquel, Chubut, Argentina. ISSN 2313-9420.
2. Open-Meteo (2022–2025). Weather Forecast API. Retrieved from <https://open-meteo.com/en/docs>