

# A Decision-Support Tool for Prioritizing Wildfire Mitigation Efforts in Europe

*Development of a Pan-European system to define management priorities to mitigate fire impact*

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# Agenda

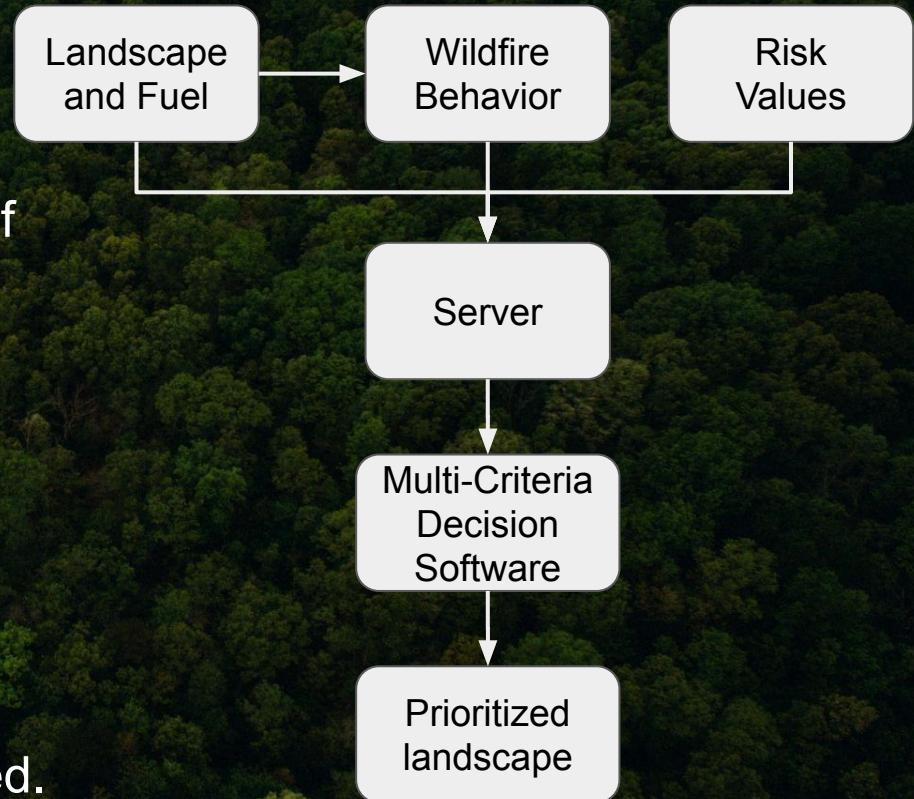
- Introduction
- Objective
- Server
- Plugin
  - Characteristics
  - Installation
  - How to use it

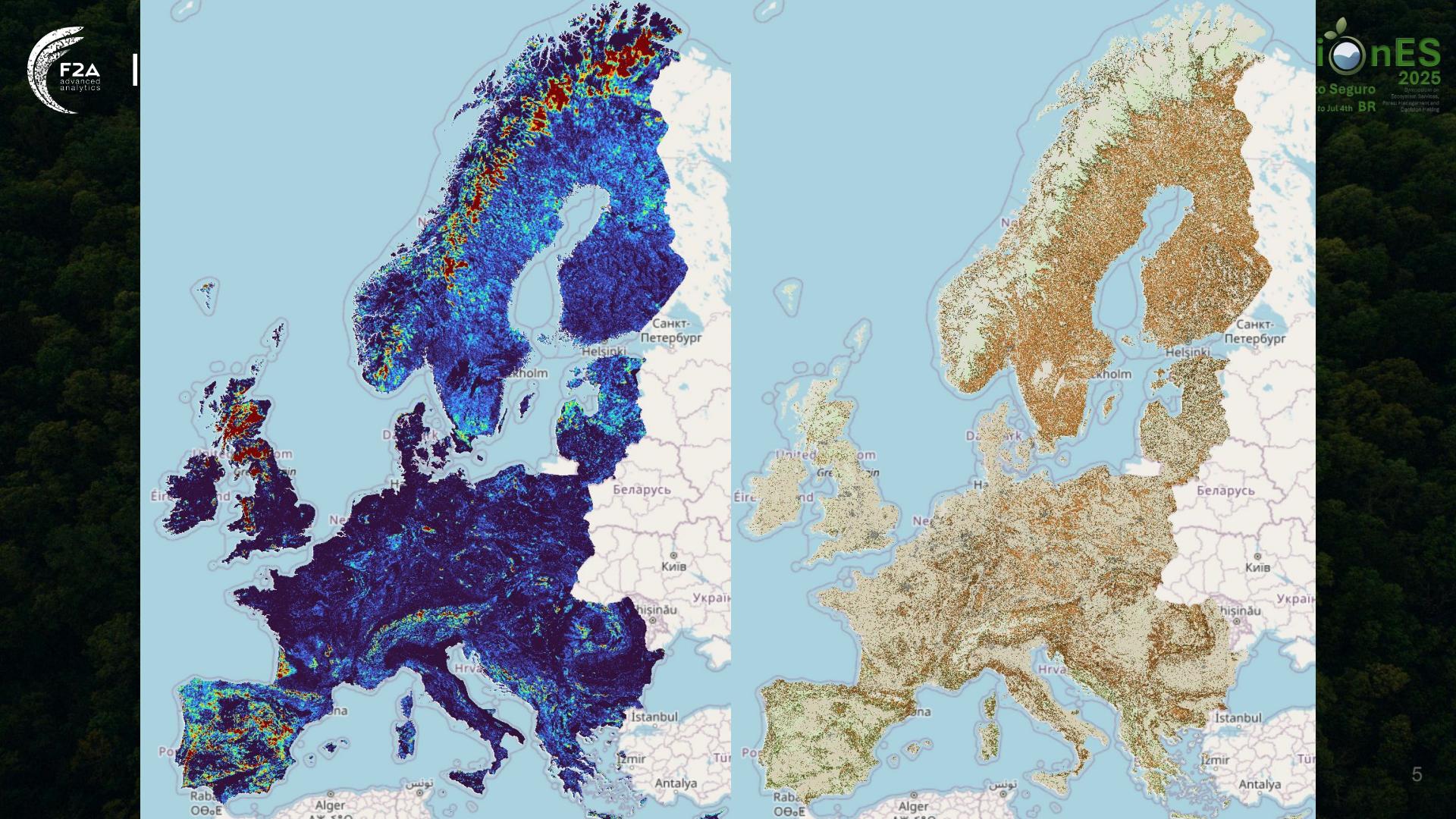
# The opportunity

- 🔥 Prevention remains critically underfunded compared to emergency response efforts.
- 🔥 There is clear evidence that investment in prevention significantly reduces long-term costs and damage.
- 🛑 ¿Where to invest?

# Context

- Part of FIRE RES project as a IA.
- Maps were produced for the whole of Europe:
  - Landscape and fuel characteristics (UNIPD)
  - Potential behavior of Wildfires (Technosylva)
  - Values to be protected (CTFC, ISCI)
- 100 m resolution.
- A decision module to select where management actions may be required.





# Objective

Create a system that allows multi-criteria analysis to spatially prioritize areas that need more resources to deal with wildfires.

The screenshot shows a map of Southern Europe, focusing on Spain, Portugal, and parts of France and North Africa. The map displays a dark, shaded relief representation of terrain, overlaid with various administrative boundaries and place names. A legend on the left side of the interface, titled 'Layers', lists several data layers that have been selected:

- NUTS 0
- Spain
  - SPA - Fire Behaviour
  - SPA - Landscape
    - SPA-Slope
    - SPA-Elevation
    - SPA-Canopy\_height
  - SPA - Risk Values
- Portugal
  - POR - Fire Behaviour
  - POR - Landscape
    - POR-Slope
    - POR-Elevation
    - POR-Canopy\_height
  - POR - Risk Values
- OpenStreetMap

The map also includes a scale bar at the bottom right indicating 1:9,000,000, distances of 0, 100 km, and 200 km, and a compass rose showing 'Metros'.

# Server

- Contains all the raster layers of the project for the whole of Europe.
- The tool allows you to:
  - Activate and deactivate the visualization of each layer.
  - Display other raster layers → Open Street Maps, Google Maps, etc.
  - Obtain general information about each layer
  - Obtain specific pixel values, attributes, and metadata.
  - Download each raster according to NUTS 0 (Spain) or NUTS 2 (Catalonia) extension.





# Server

- Fuel types
- Canopy Base Height
- Canopy Cover
- Canopy Bulk Density
- Aspect
- Canopy Height
- Elevation
- Slope
- Fireline intensity
- Rate of spread
- Crown type
- Flame length
- Spotting distance
- Burn probability
- Flame length probabilities
- Conditional flame length
- Population Density
- Protected areas
- Proximity meters
- CO2
- Density of roads

# Server

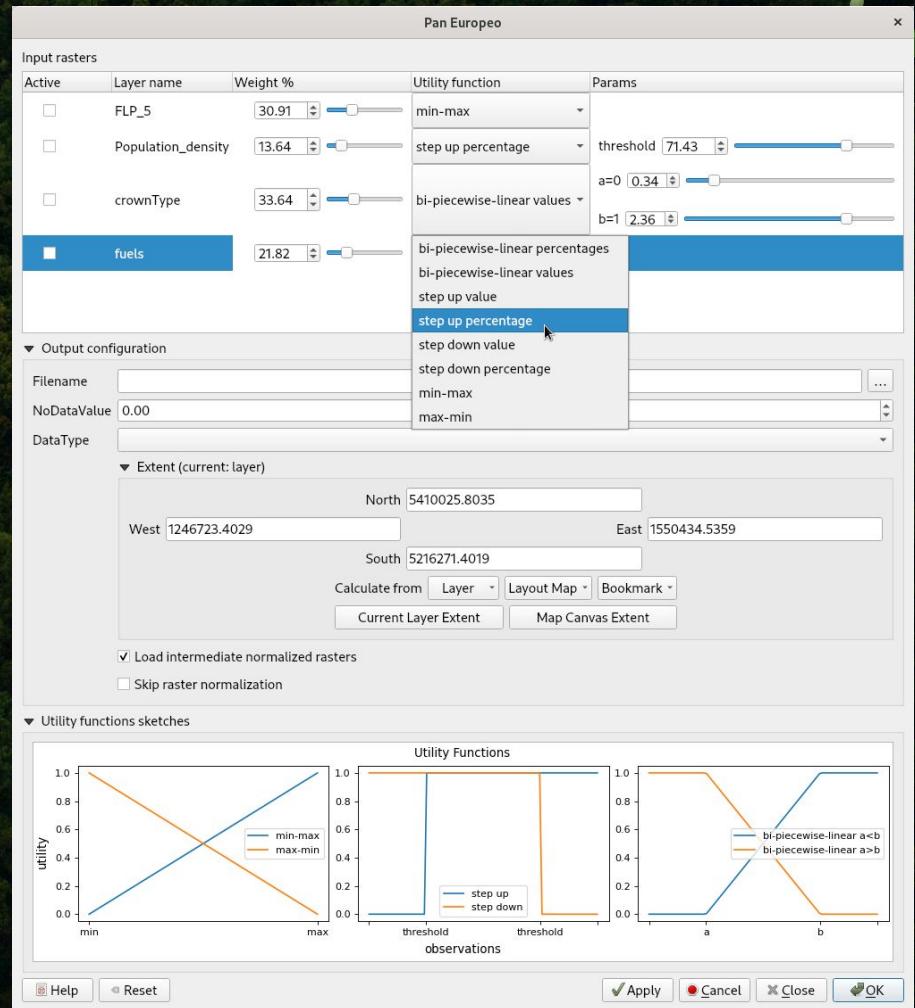
- It also includes an integrated user management system that allows us to:
  - Create accounts.
  - Organize them into groups.
  - Define access permissions at project or layer level.
- Improved security and organization of deployed data.

# Plugin

- FIRE RES Project → ~2GB for each criteria → ~20 criteria.
- It allows to handle large volumes of data in raster format for:
  - Applying a utility function to categorize its risk wise
  - Sums each criteria weighted by a relative importance between criteria.
- Result: a summary raster that prioritizes the most risky areas with 0 to 1 values.
- It could be used with regular computers due its design.
- The processing time of the plugin → the area of study.

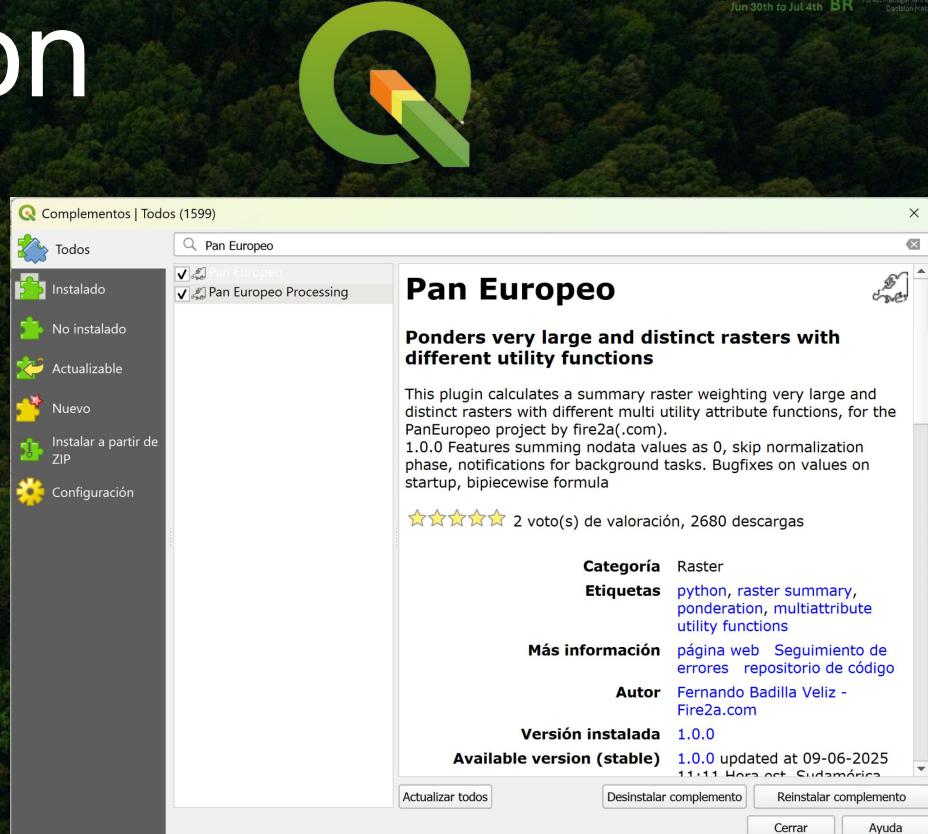
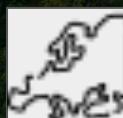
# Plugin

- Plugin parts (from top to bottom):
  - Input rasters.
  - Output configurations.
  - Utility functions sketches.
  - Final toolbox.



# Plugin installation

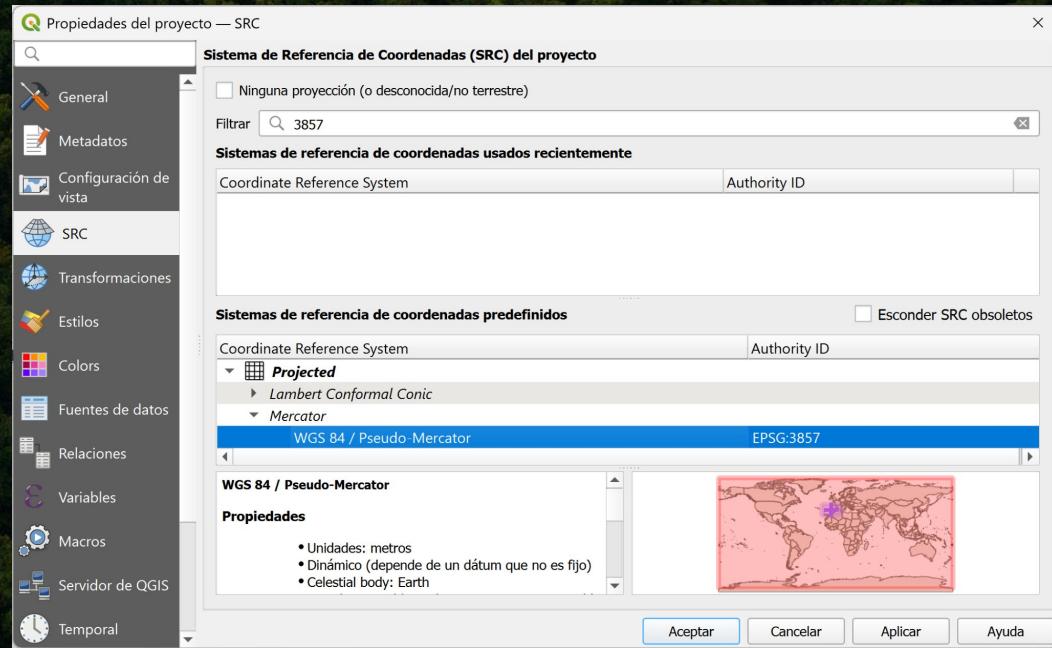
- Install QGIS
- "Plugins" → "Manage and Install Plugins".
- Select "all" and search "Pan Europeo".
- Install it!
- It will be available in plugin section or with the icon:



The screenshot shows the QGIS Plugin Manager interface. On the left, there's a sidebar with categories: Todos, Instalado, No instalado, Actualizable, Nuevo, Instalar a partir de ZIP, and Configuración. The main area has a search bar at the top with the text "Pan Europeo". Below the search bar, there's a list of installed plugins: "Pan Europeo" and "Pan Europeo Processing". To the right of the list, there's a detailed view of the "Pan Europeo" plugin. The title is "Pan Europeo" and the description is "Ponders very large and distinct rasters with different utility functions". It says the plugin calculates a summary raster weighting very large and distinct rasters with different multi utility attribute functions, for the PanEuropeo project by fire2a(.com). The version is 1.0.0, released on 09-06-2025. The plugin is categorized as Raster and has labels for python, raster summary, ponderation, multiattribute utility functions. It includes links for más información (page web, error tracking, repository), autor (Fernando Badilla Veliz - Fire2a.com), and versión instalada (1.0.0). At the bottom, there are buttons for Actualizar todos, Desinstalar complemento, Reiniciar complemento, Cerrar, and Ayuda.

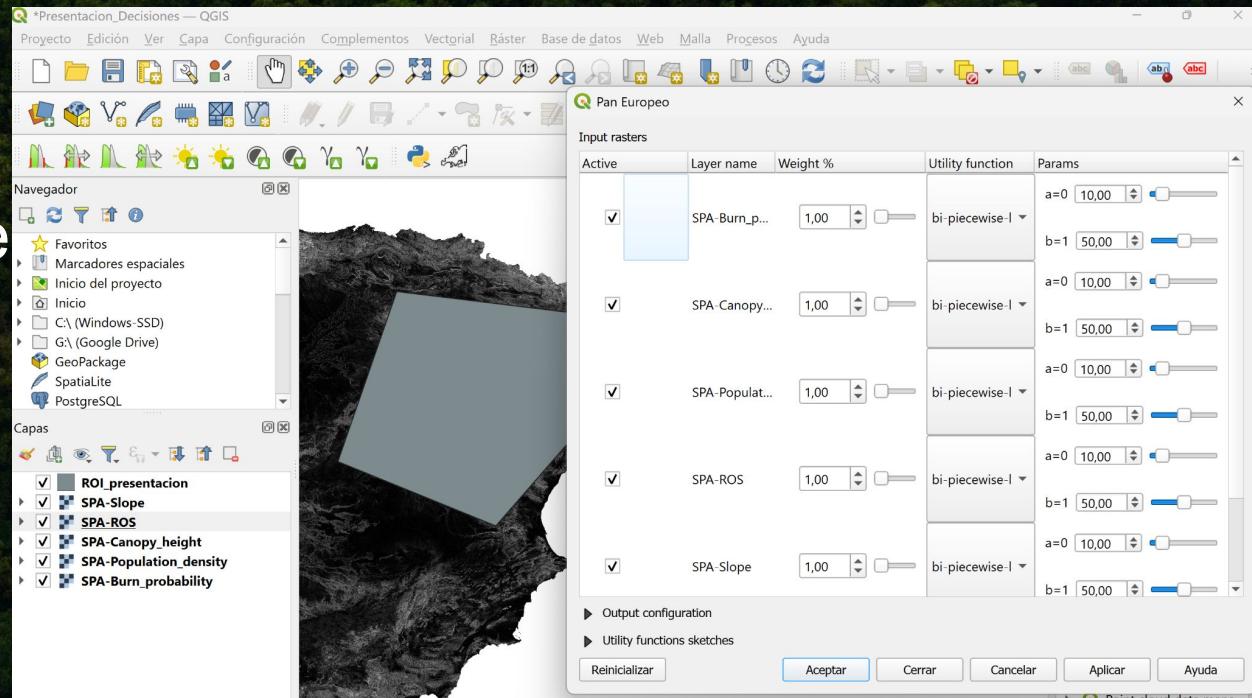
# Plugin Usage Preparation

- Set the project CRS to EPSG:3857.
- Load a set of raster layers. Layers must be local and written to disk and should have the same CRS as the project.



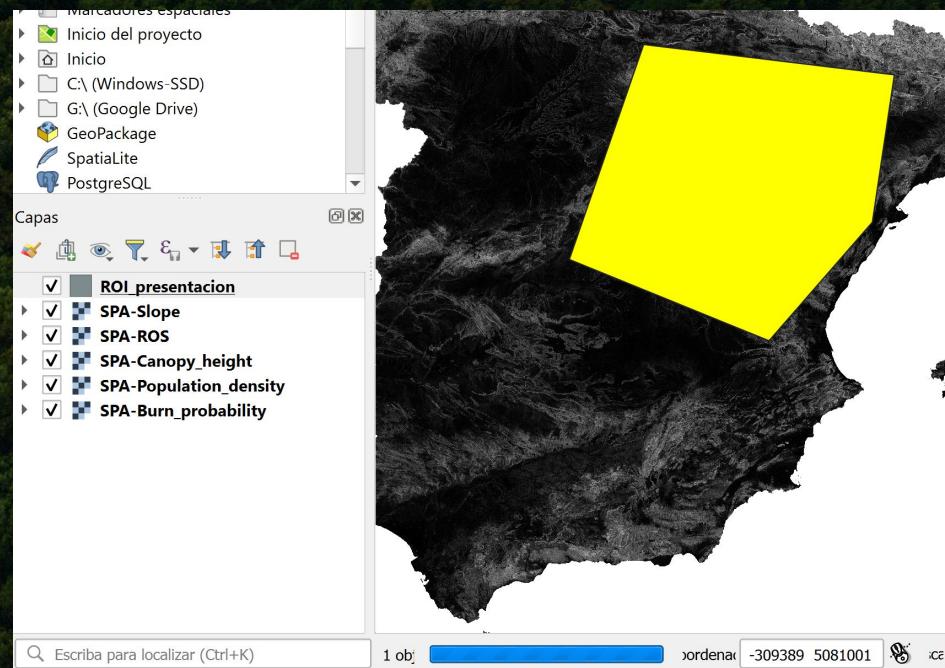
# Plugin Usage Preparation

- The user could also upload a vector file to be considered as a study area.
- Open the plugin



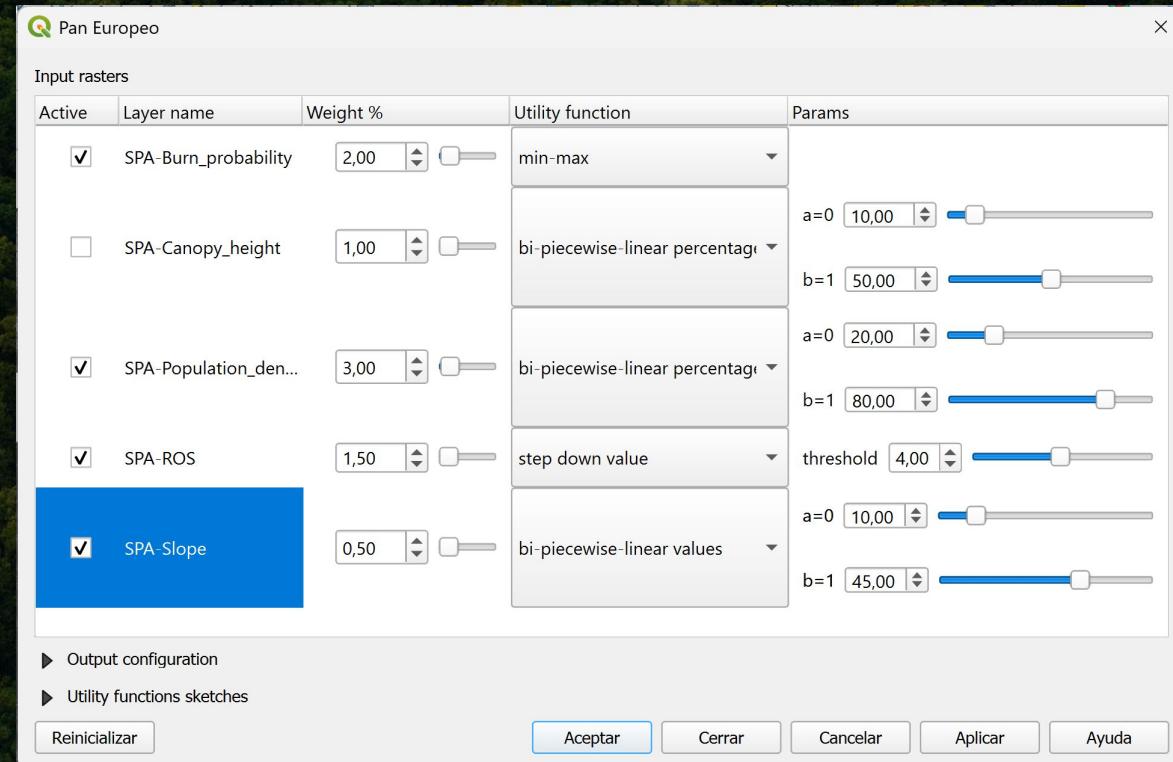
# Plugin usage

- Select the polygon to define the study area.
- Check the checkbox of each layer to include it in the prioritization.



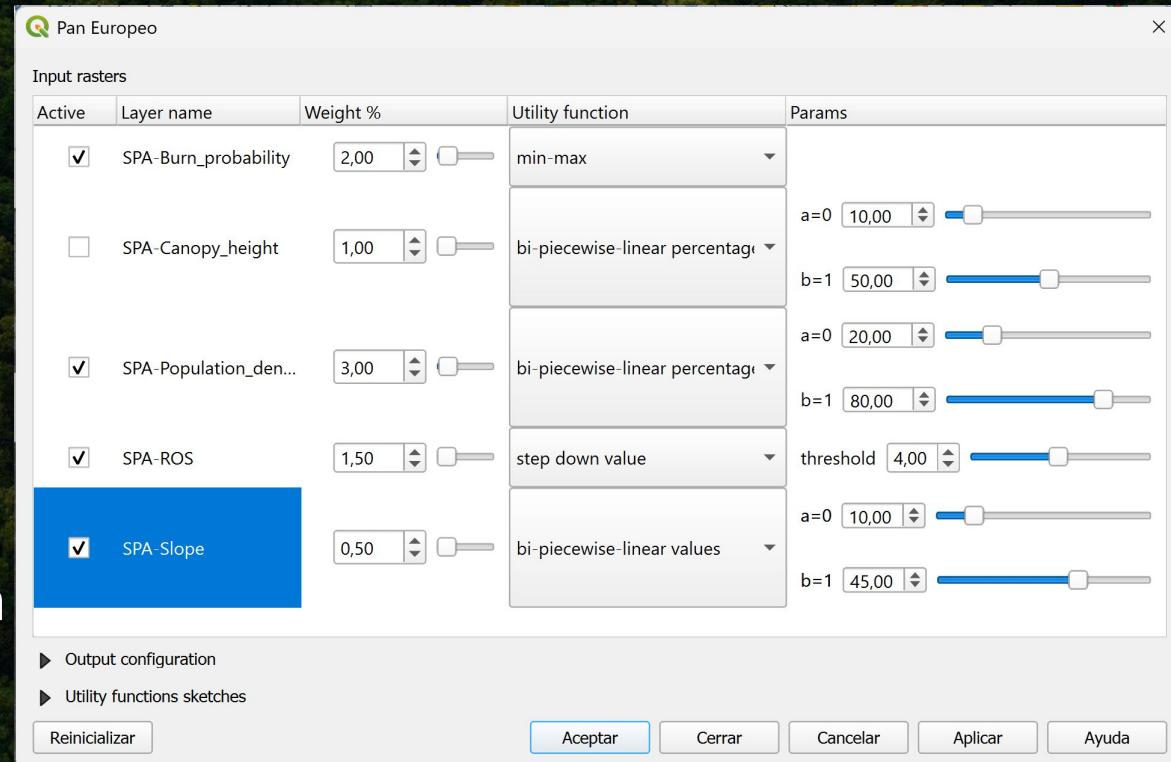
# Plugin usage

- You must wait for QGIS to load the values in the parameter section.
- Assign weights that reflect their relative influence on the multi-criteria evaluation.

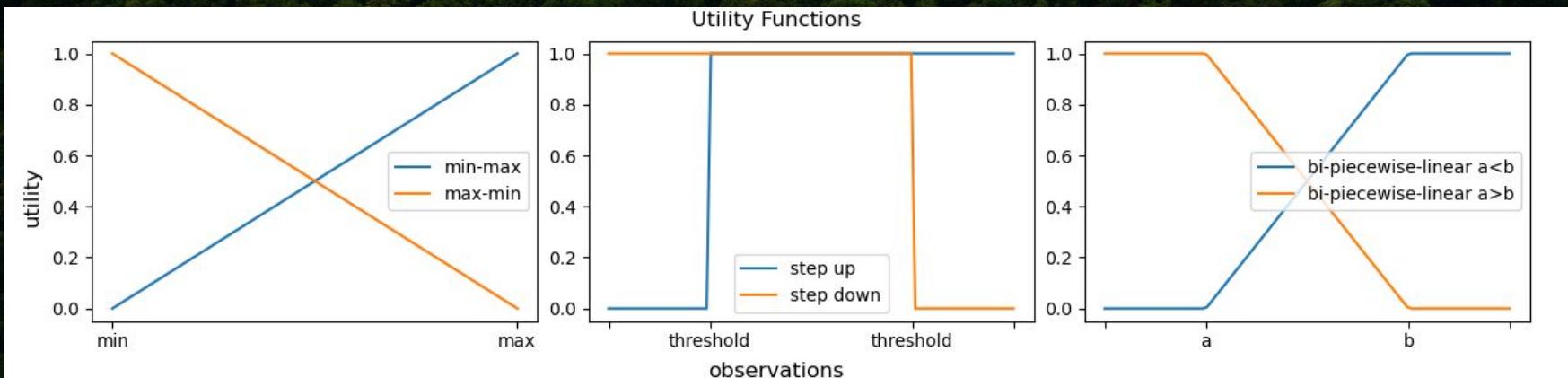


# Plugin usage

- Pick a utility function:
  - Mín-Máx or Máx-Mín (2)
  - Bi-Piecewise-Linear function with values or percentages (2)
  - Step-Up or Step down function with values or percentages (4)



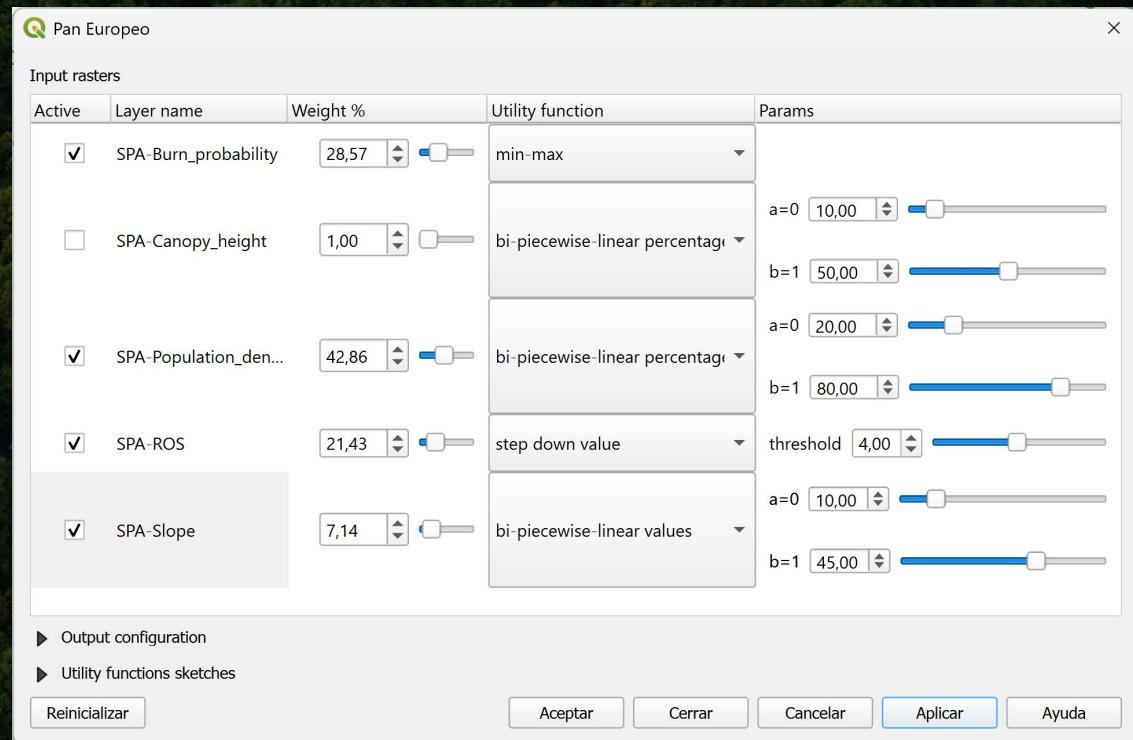
# Plugin usage



- Adjust the parameters: set breakpoints or thresholds with the numeric fields and sliders.
- This will transform your data to make it comparable.

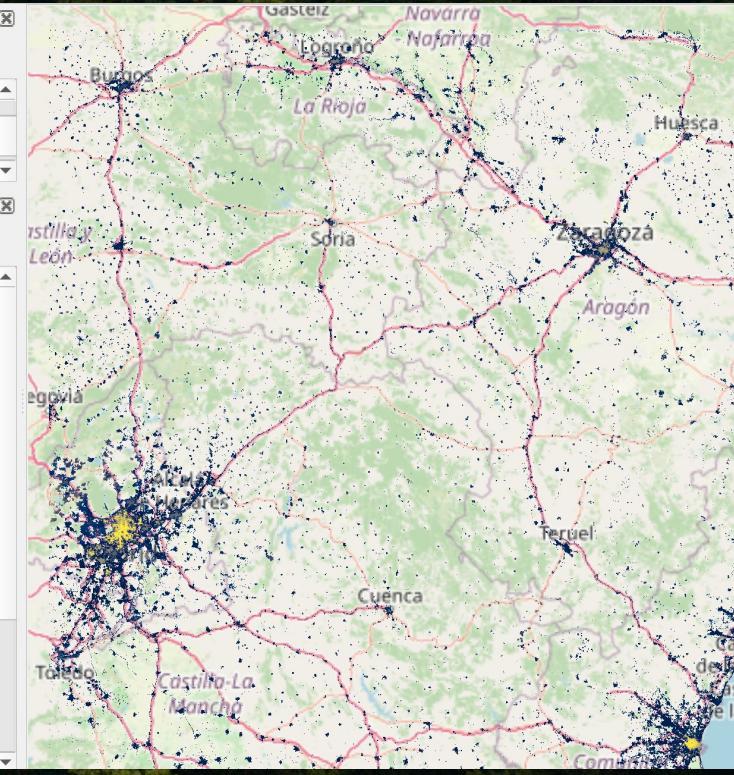
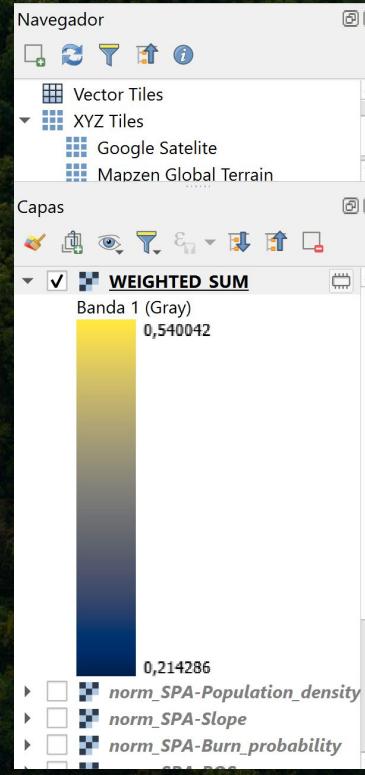
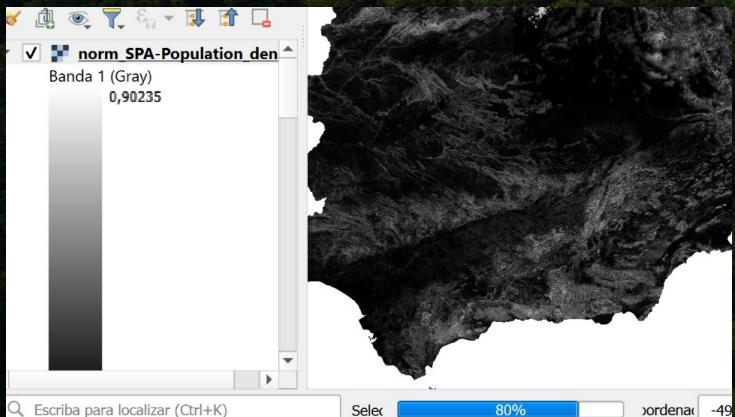
# Plugin usage

- Click the “Apply” button to recalculate the weight values.
- Click the “Ok/Accept” button.



# Plugin usage

- See the results!



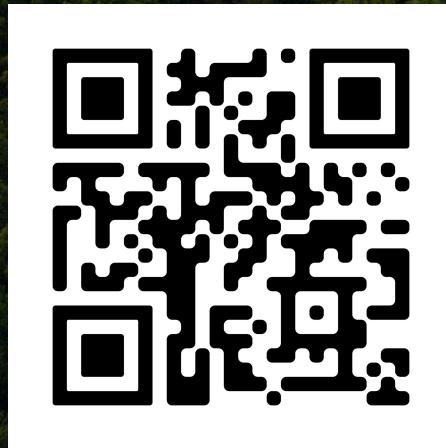
# Conclusions

- I show an example, but a proper methodology is being developed.
- The plugin offers multiple options for converting layer values into utility scores.
- It allow for high flexibility in adapting the model to local or regional contexts while maintaining consistency in the underlying logic
- A Decision-Support Tool for Prioritizing Wildfire Mitigation Efforts in Europe with all the data available through our server.

# Thanks

- European Union's Horizon 2020 research and innovation programme under the Marie SkłodowskaCurie grant agreement No 101007950.
- Innovation technologies & socio-ecological-economic solutions for fire resilient territories in Europe - FIRE-RES N°101007950.

# Thank you!



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# Plug

- En Raster de entradas:
- Reflejo y selección de las capas mostradas en el mapa.
- Columna de peso → ponderación de los datos.
- Función de utilidad → Función para normalización de datos.
- El rango mínimo y máximo de los parámetros:
  - Cambio en el área de estudio
  - Cambio en función de utilidad seleccionada.

