

Strengthening Infrastructure Resilience in Cross-Border Wildfire Management

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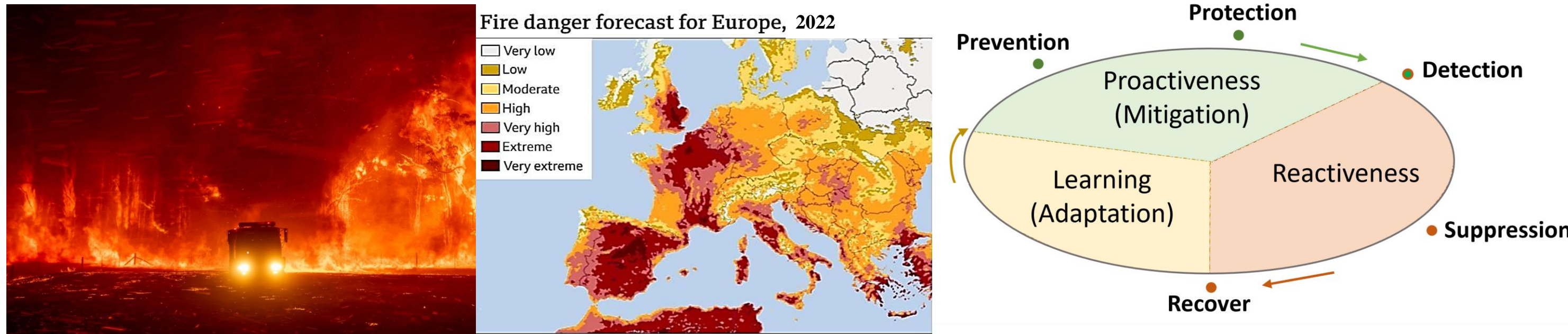
Urgent Need for a Support Tools in Wildfire Management

Climate change is leading to more frequent and intense wildfires.

Wildfire management policies are generally approached from the perspective of risk management and fire suppression. This approach is shown to be inadequate to respond effectively to the new wildfire regimes caused by climate change.

From a resilience-based perspective, these policies should aim at finding a sustainable balance between reactivity and proactivity. However, there is a lack of tools to support both phases of wildfire management, either reactive or proactive.

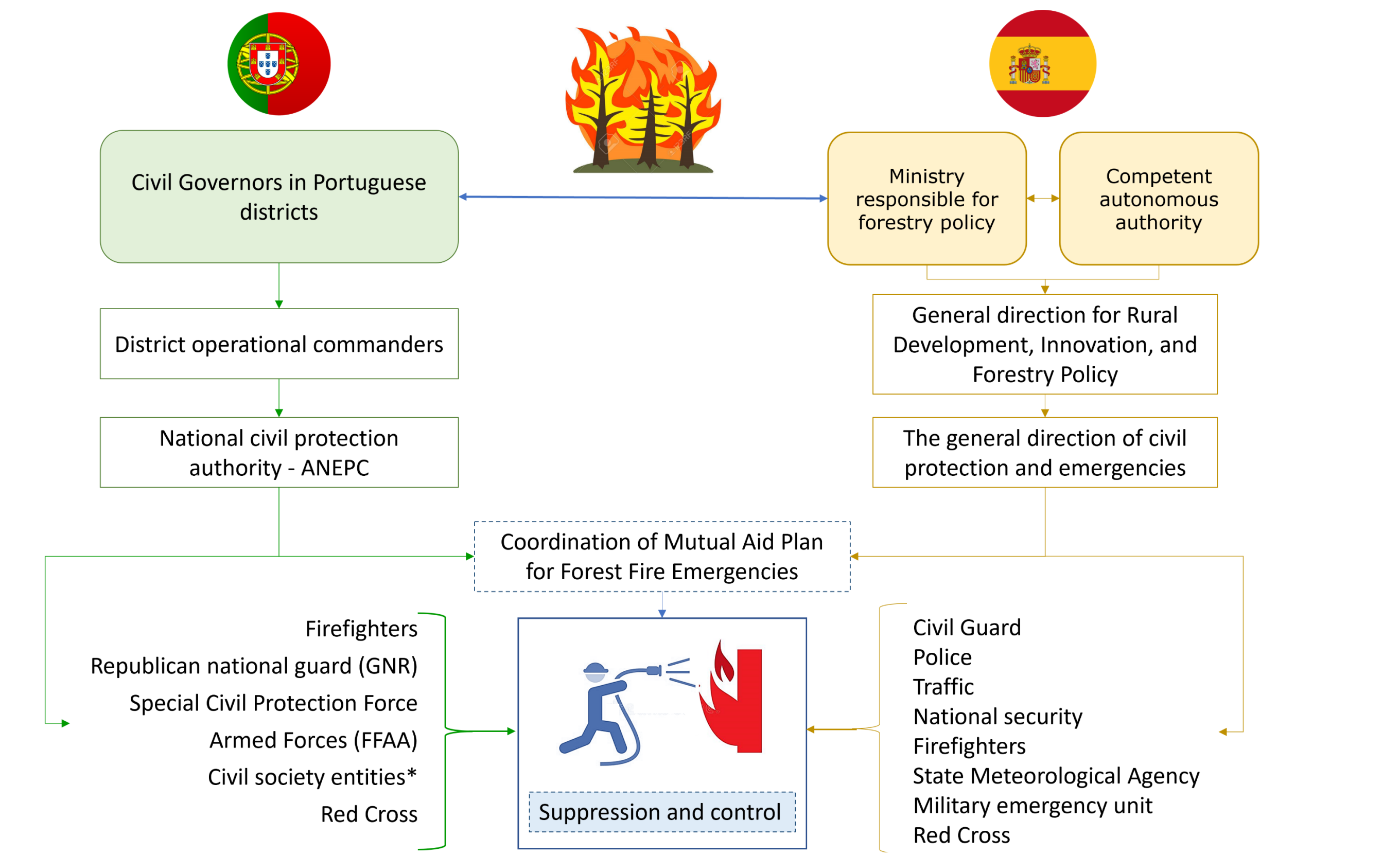
Given the mosaic-like distribution of countries in Europe, considering cross-border collaboration to combat the increasing risk of wildfires is highly relevant.



This study showcases how to enhance decision-making in resilient wildfire management in transboundary contexts. The GIS-based Methodology for Fire Analysis, GIS-FA^[1], is used to effectively address fire management in situations involving multiple borders, thus marking a significant advance in integrated fire management in border areas.

Cross-border policies: the Iberian Peninsula^[2]

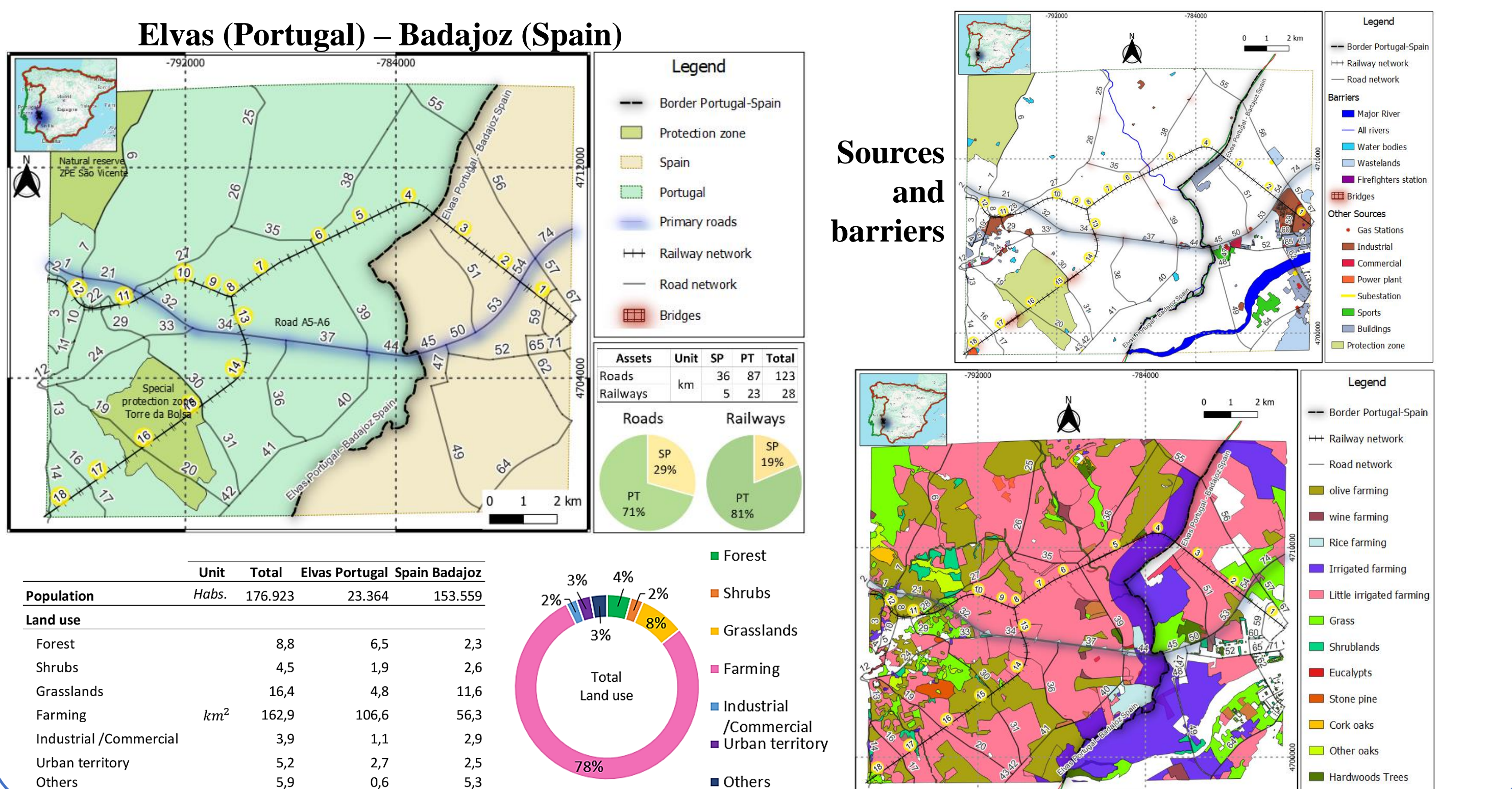
- Spain and Portugal share one of the longest land borders in Europe with about 1.200 km.
- Most of the border territory is predominantly rural.
- Similar landscapes and orography, and geography.
- Both countries are prone to wildfires.
- The main focus of the long-standing collaboration has been on suppression and emergency actions.



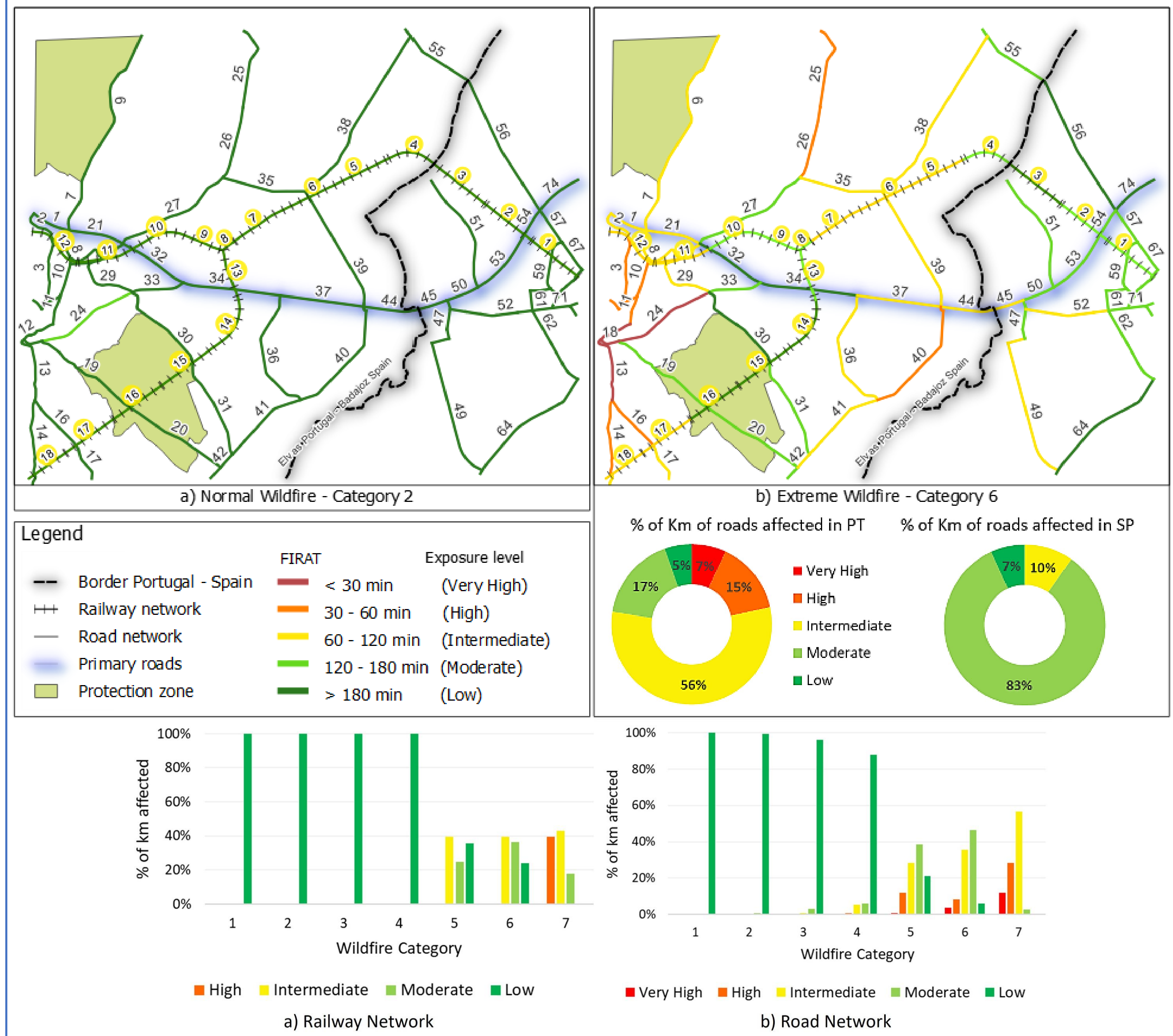
Despite, the wide variety of entities and projects aiming at cross-border cooperation, further work is needed in integration, coordination, and sharing of data and experiences to make the actions more effective. In this sense, tools to inform stakeholders and support the decision-making process can be used by both countries to identify the need for interventions and the division of responsibilities, thus improving the coordination of wildfire management.

GIS-based Methodology for Fire Analysis (GIS-FA)^[1]

GIS-FA allows the exposure assessment in terms of the FIRE Arrival Time (FIRAT) in minutes. This exposure metric considers (1) different fire sources and barriers surrounding the studied assets (i.e., land-based transport infrastructure); and (2) seven types of wildfire behavior, from normal to extreme wildfires. The outcomes are exposure maps associated with the studied assets.



Utilization of exposure analysis in wildfire management



For medium- and long-term planning (i.e., proactively):

- Decision-makers can define the degree of exposure they are willing to accept under specific wildfire conditions, intervening in the areas not fulfilling the condition, e.g., reducing the level of exposure of Road 24.
- GIS-FA allows the assessment of the intervention's impact on the existing exposure of the system, e.g., by improving vegetation management.

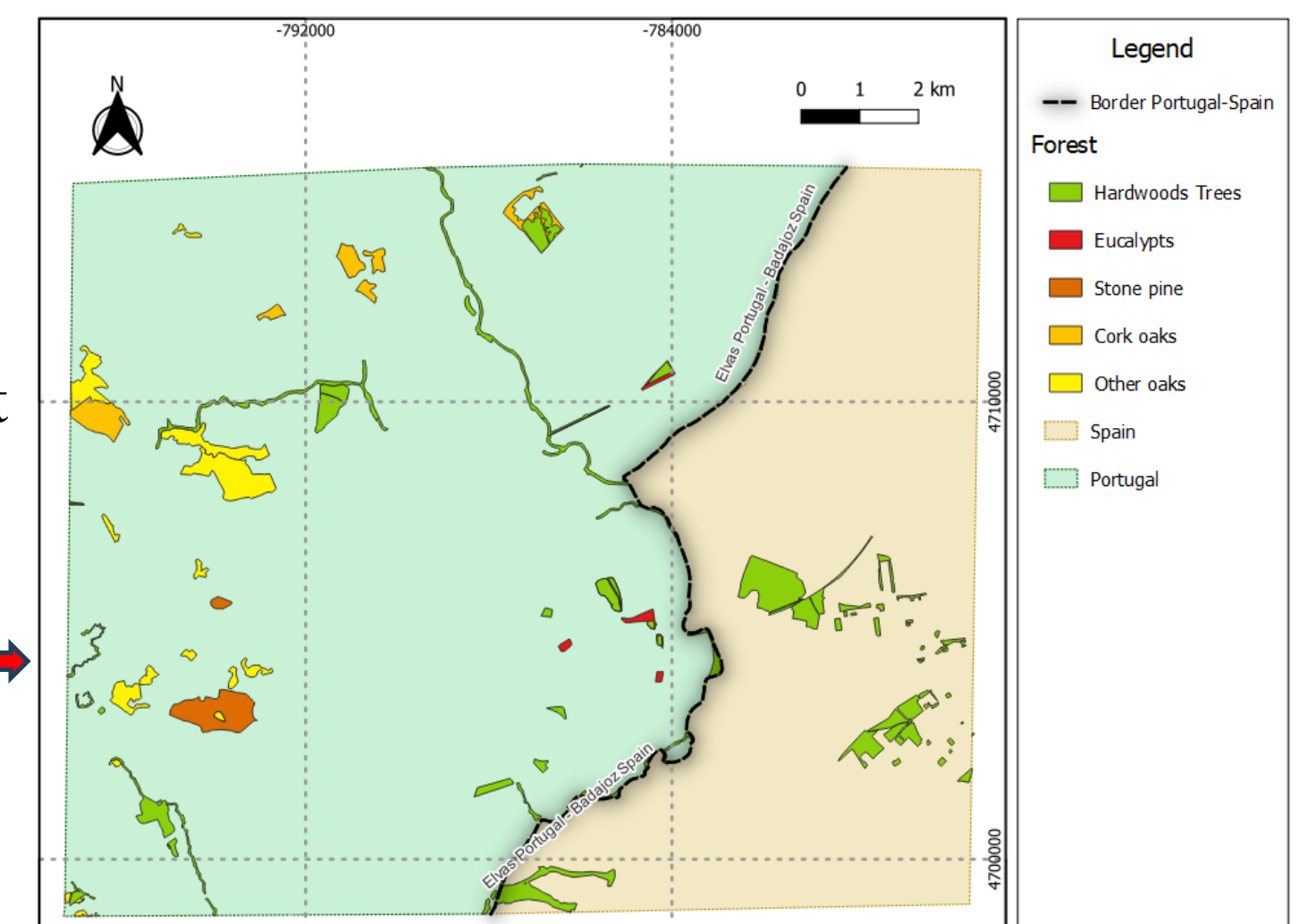
Emergency planning (i.e., reactively): Support traffic management in terms of evacuation routes and ensure users' safety. The exposure maps of the different wildfire categories serve as a basis for this purpose, in which the main objective is ensuring users' safety by avoiding potentially disconnected areas in a wildfire event.

Insights from the cross-border case study

Poor wildfire management in one country can affect the neighbouring country.

Challenges for cross-border collaboration:

- **Governance:** institutional complexity and poor joint actions between the entities in charge.
- **Infrastructure and mobility:** weak development of jointly managed cross-border public transport services.
- **Digitalization:** differences between their connectivity and digital services.
- **Hazard management:** lack of prevention and protection projects.



Final Remarks

GIS-FA USES:

- Supporting the various levels of wildfire management.
- Helping find the balance between proactive and reactive strategies.
- Determining the extent of the reliance on suppression activities.
- Supporting decision-making on different components of the built environment including cross-border areas, at the asset level (e.g., buildings and factories) and infrastructure level (e.g., road, railway and power networks).

In general, to support the paradigm change towards more resilient policies and investment in prevention and protection.

References

- [1] Arango, E., Nogal, M., Sousa, H. S., Matos, J. C., and Stewart, M. G. 2023. GIS-based methodology for prioritization of preparedness interventions on road transport under wildfire events. International Journal of Disaster Risk Reduction, vol. 99, 104126. Doi: <https://doi.org/10.1016/j.ijdrr.2023.104126>.
- [2] Arango, E., Nogal, M., Jiménez, P., Sousa, H. S., Stewart, M. G., and Matos, J. C. 2023. Policies towards the resilience of road-based transport networks to wildfire events. the Iberian case. Transportation Research Procedia 71, 61–68, XV Conference on Transport Engineering, CIT2023. Doi: <https://doi.org/10.1016/j.trpro.2023.11.058>.

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