FirEUrisk: An Integrated Approach to Wildfire Risk Assessment

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Basic Information

38
Partners
Research centres, authorities, companies, first responders

4
Years
2021-2025

10
Million €
in funding

18
Countries
From Europe, North America and Oceania

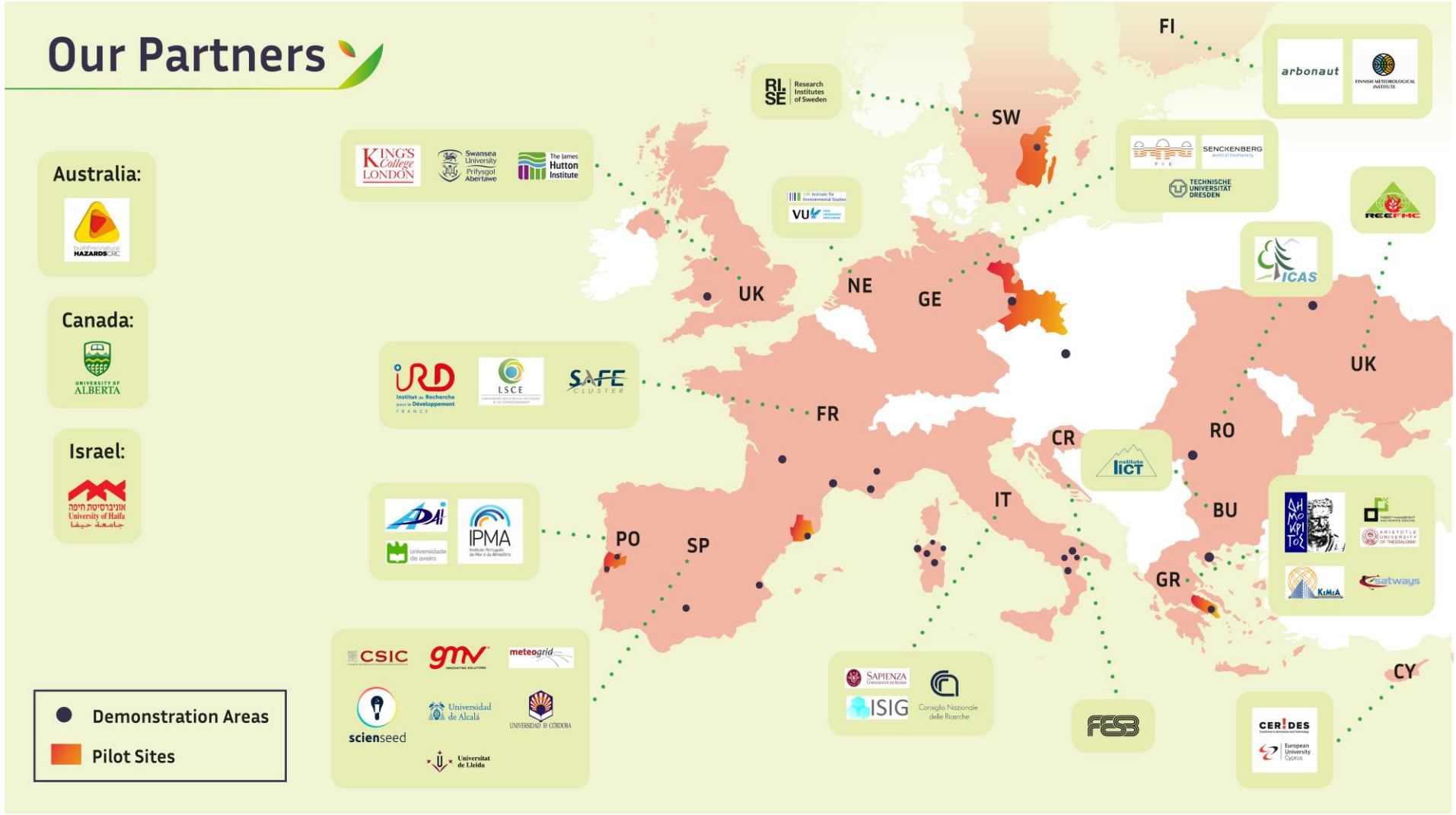
Aim and objectives

Aim: building an **Integrated and Science-Based Strategy** for wildfire risk management in Europe around

Objectives:

1. Expand the capabilities of existing wildfire **risk assessment** systems
2. Use risk-assessment to drive wildfire management and **reduce current fire risk conditions**
3. **Adapt fire management strategies** to expected future climate and socio-economic changes
4. **Integrate** all fire management phases and activities

Consortium


Our Partners
Australia:
Canada:
Israel:
Demonstration Areas
Pilot Sites
FI
SW
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NE
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FR
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SP
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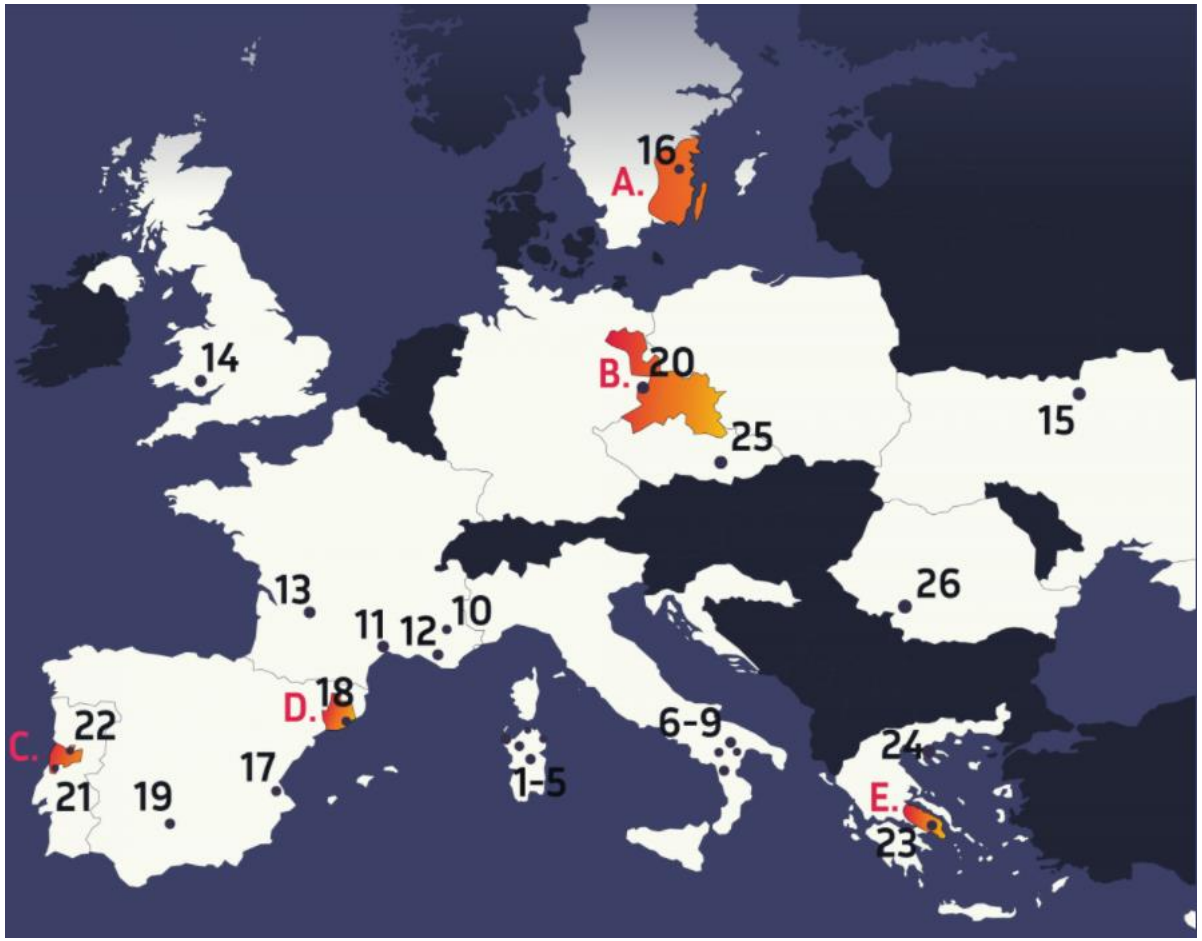
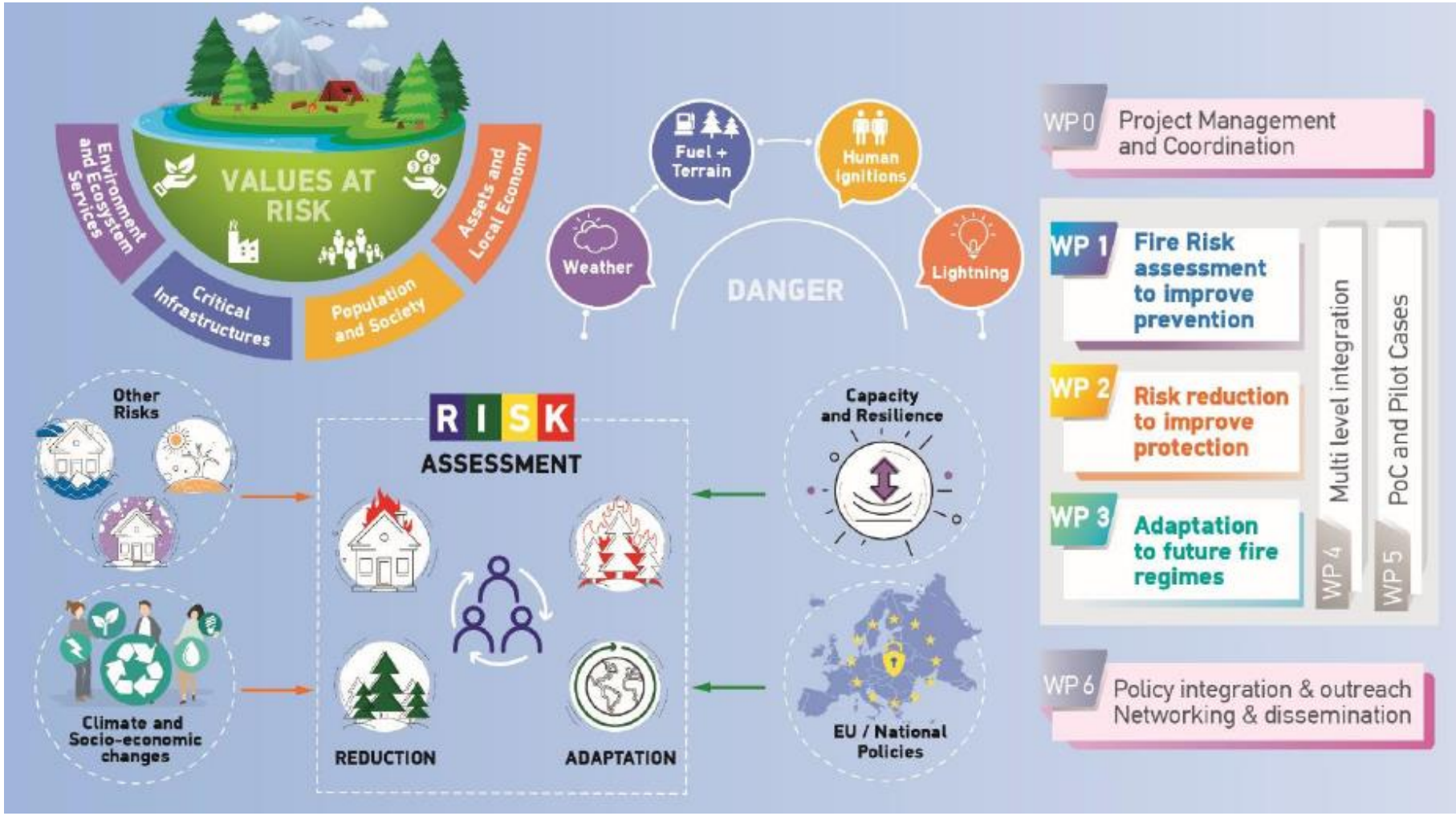
UK

Demonstration Plan



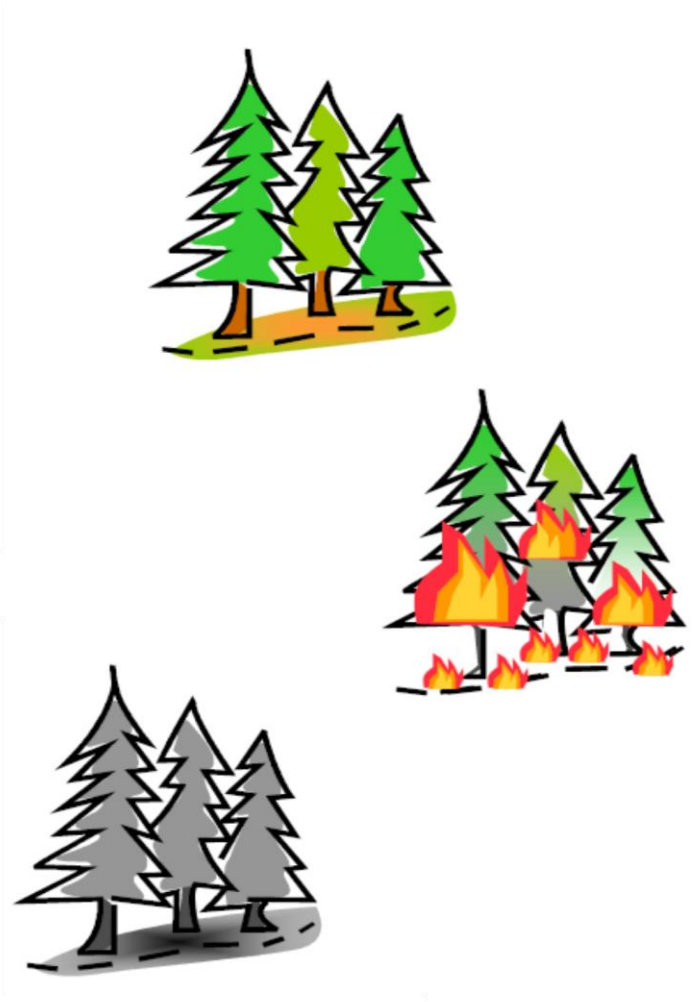
PS	Focus on
A.	Future fire risk scenarios
B.	Transboundary cascading effects
C.	Fire risk reduction and prevention, forest management and wildland urban interface (WUI)
D.	WUI forest and fuel management and resilient landscapes
E.	Catastrophic peri-urban wildfires
ET	Wildfire Risk Assessment (Pan-European)

Conceptual scheme and approach

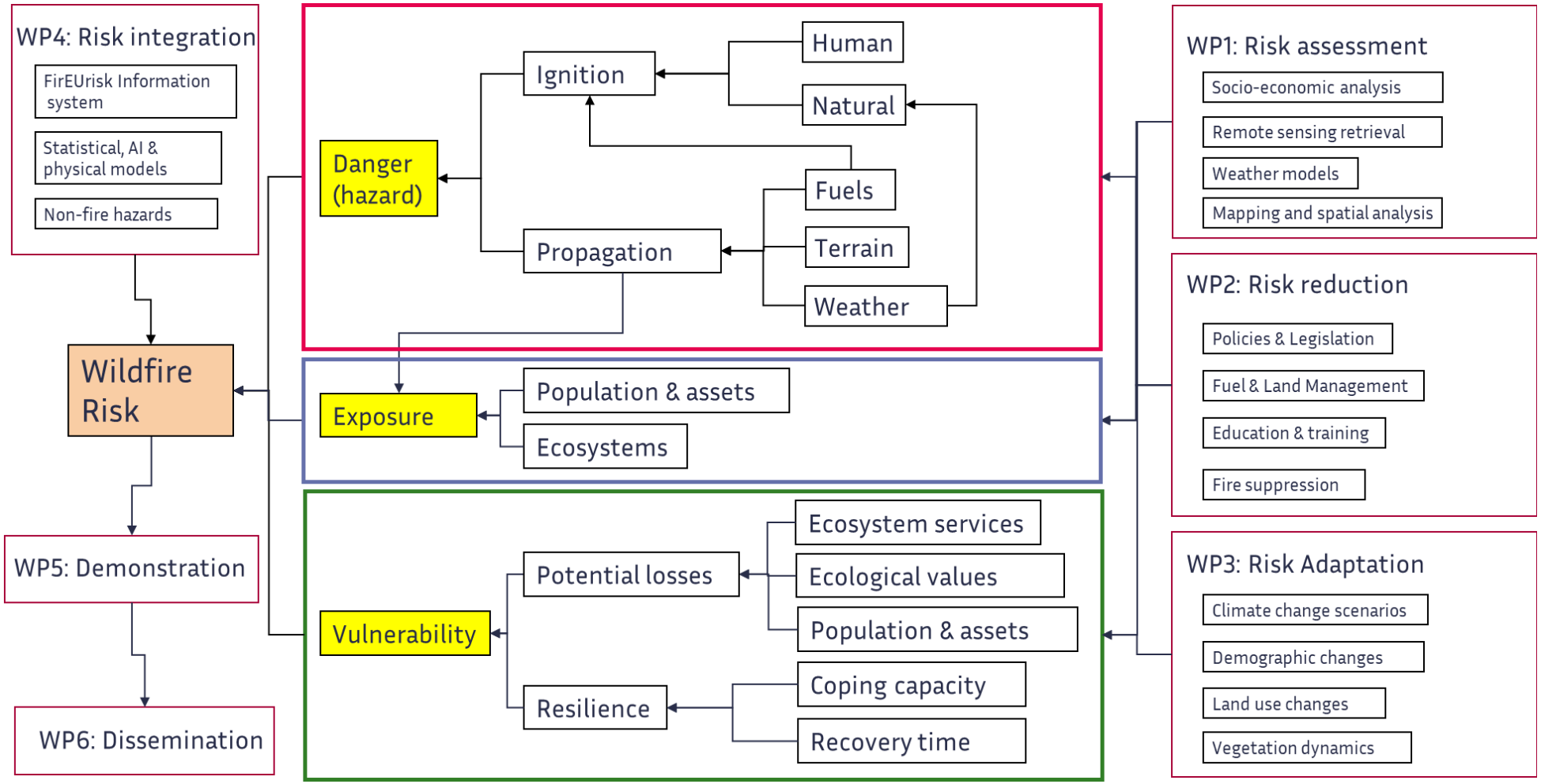


Phases of Risk management

- **Risk assessment:**
  - Where and when fires are more likely to happen?
  - Which areas are more vulnerable?
- **Risk Mitigation**:
  - Deal with emergency crisis.
  - Reduce Danger: ignition & propagation
  - Decrease vulnerability: exposure & resilience.
- **Restoration & Adaptation**:
  - Damage assessment: lessons learnt.
  - Recovery.
  - Prevent future scenarios.



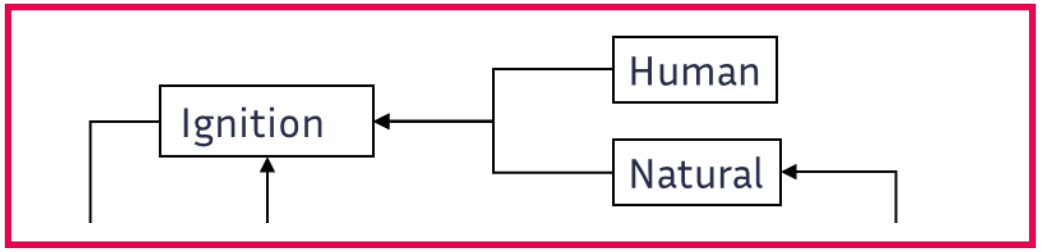
FirEURisk Conceptual Integration Scheme



FirEURisk Integrated Risk Index

- Within the risk assessment wildfire management phase, FirEURisk's integrated framework is conceptualized via an **Integrated Risk Index (IRI)**, which has three main components:
  - Danger: Updated daily; based on fuel modeling, ignitions prediction & meteorological forecasts
  - Exposure: Higher importance to wildland urban interfaces (WUIs)
  - Vulnerability: Also dynamic (updated daily), considering foreseen fire impacts due to weather conditions

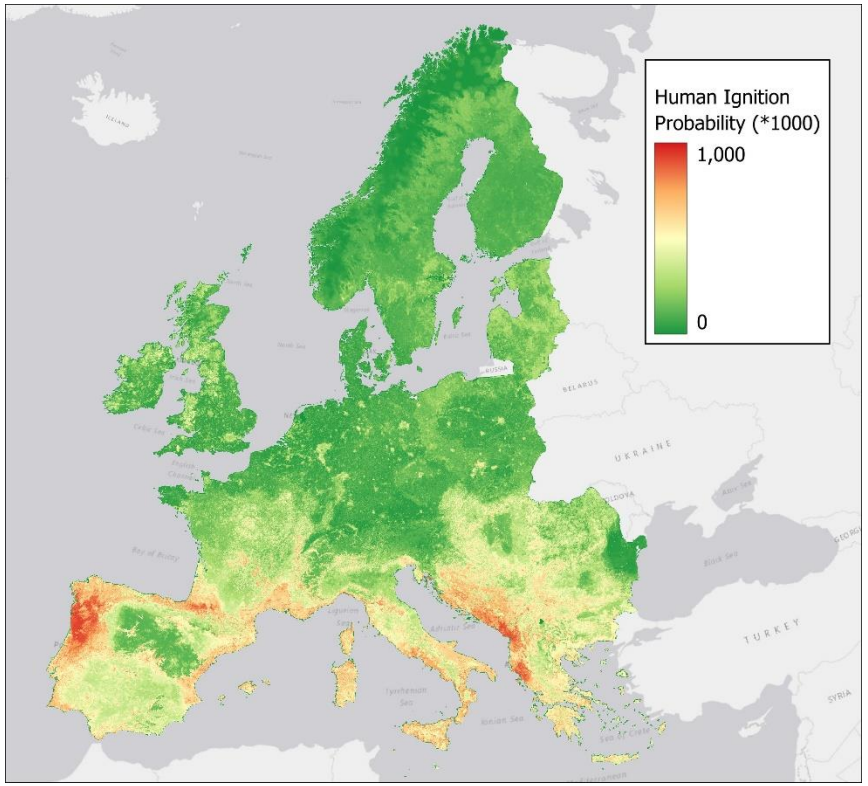
IRI – Danger: Ignition



Component	Definition
Human ignition	Probability that fire ignites from a human cause, including accidents and deliberate.
Natural ignition	Probability that fire ignites from a natural source (basically referring to lightning)

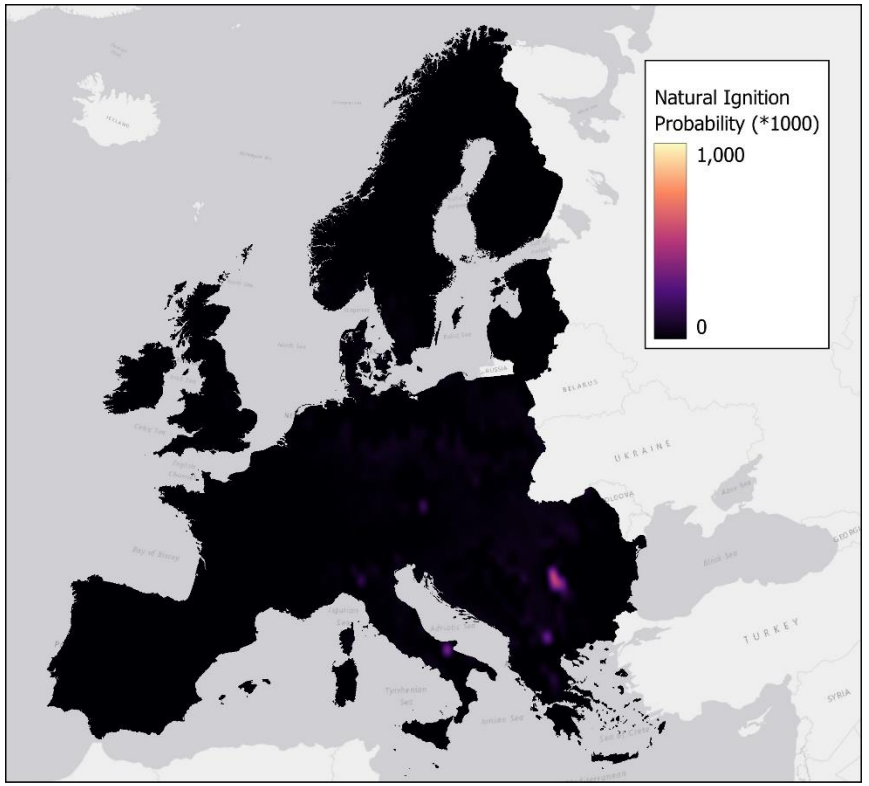
IRI – Danger: Ignition

Human Ignitions

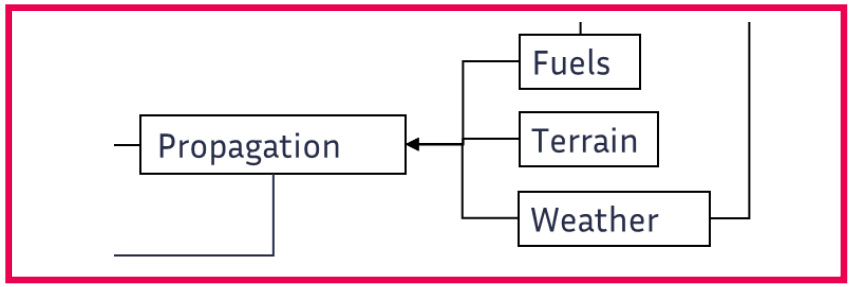


Sueur-Ochoa, C. & Chuvieco, E. (2023). Mapping the likelihood of human-caused fire ignitions in the European territory. *Applied Geography*, ***Under review***.

Natural Ignitions



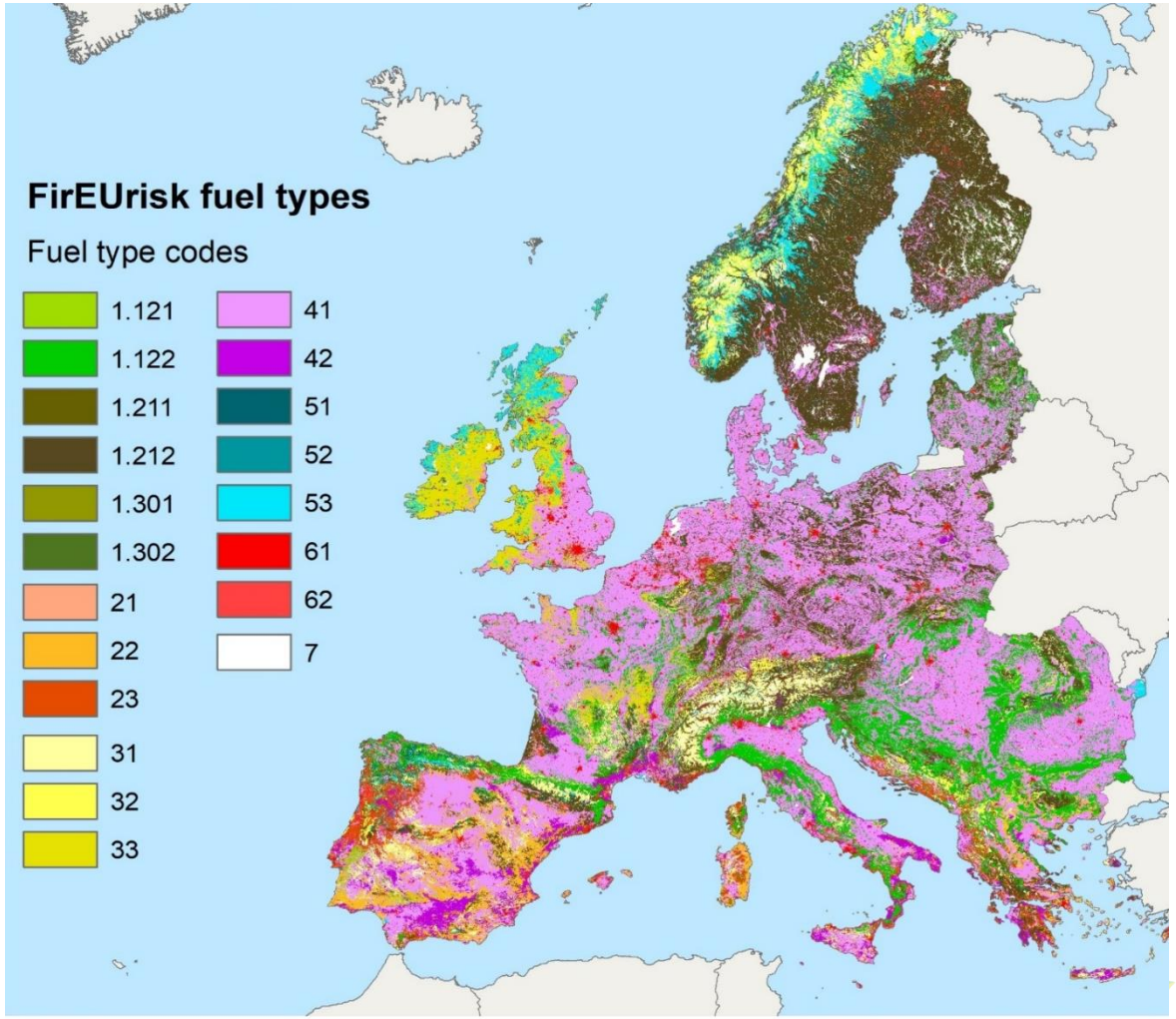
IRI – Danger: Propagation



Component	Definition
Fuel Moisture Content (FMC)	Moisture content of live and dead fuels as a proportion of dry matter weight
Fuel types	Fuel classification according to their fuel properties for fire risk assessment
Terrain	Topographic characteristics, including elevation, slope, aspect and other geomorphological characteristics
Weather (and Climate)	Atmospheric conditions associated with fire ignition or propagation. This variable may refer also to future climate conditions

IRI – Danger: Fuel Types

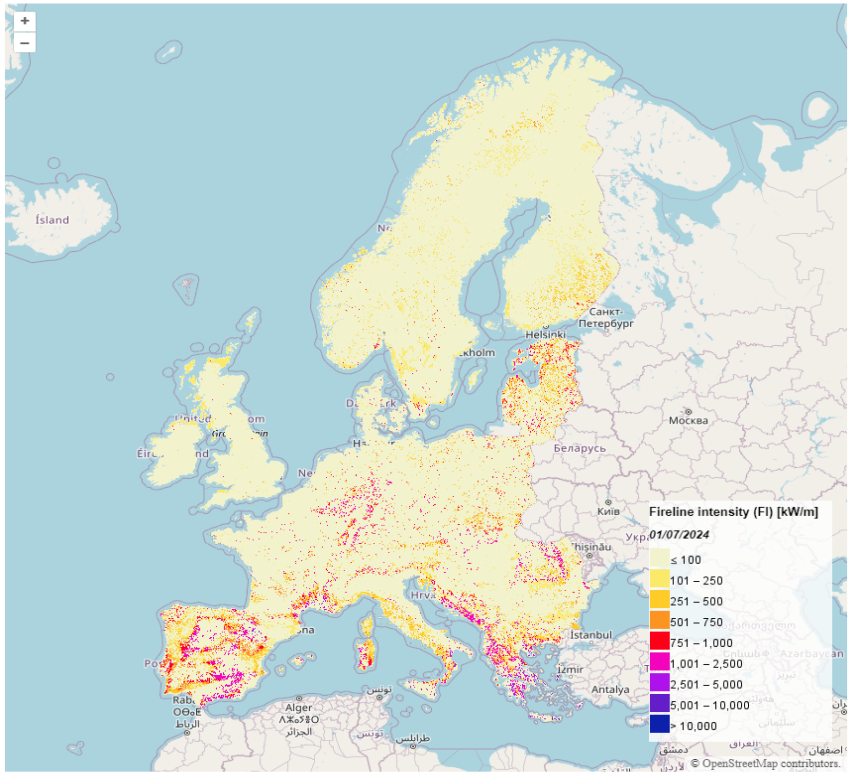
1. Forest	11. Broadleaved	112. Deciduous	1211. Open [15-70%)
			1212. Close [70-100%]
	12. Needleleaved	121. Evergreen	1211. Open [15-70%)
2. Shrubland	21. Low [0-0.5m)		
	22. Medium [0.5-1.5m)		
	23. High (≥ 1.5m)		
3. Grassland	31. Low [0-0.3m)		
	32. Medium [0.3-0.7m)		
	33. High (≥ 0.7m)		
	Type		
4. Cropland	41. Herbaceous		
	42. Woody (shrub-tree)		
5. Wet and peat/ semi-peat land	51. Tree		
	52. Shrubland		
	53. Grassland		
6. Urban	61. Continuous fabric: urban fabric [80-100%]		
	62. Discontinuous fabric: vegetation and urban fabric [15-80%)		



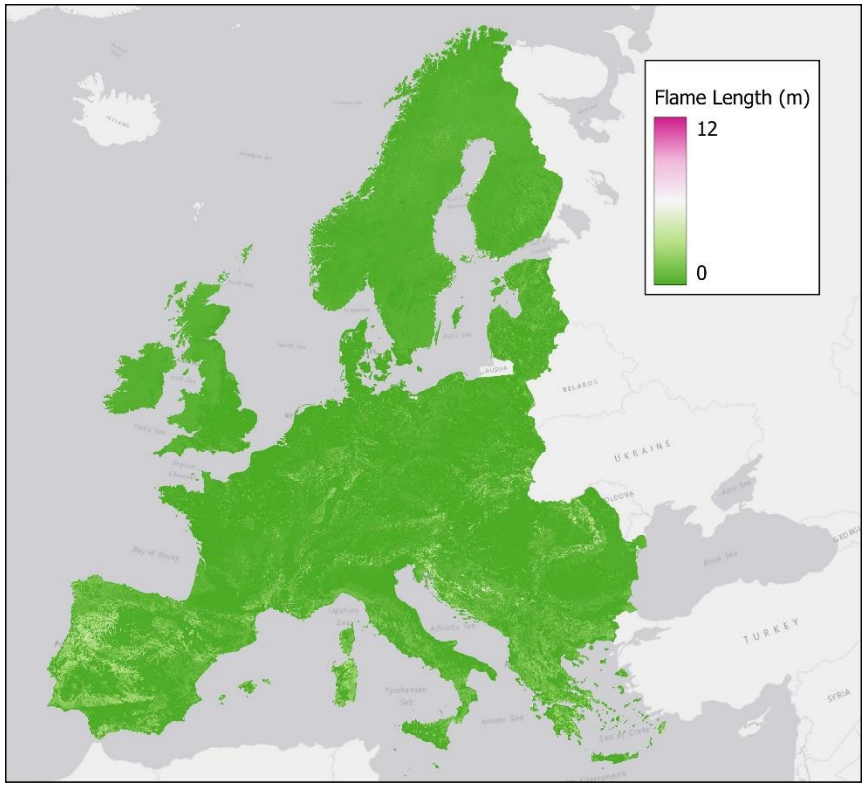
Aragoneses, E., García, M., Salis, M., Ribeiro, L. M., & Chuvieco, E. (2023). Classification and mapping of European fuels using a hierarchical, multipurpose fuel classification system. *Earth System Science Data*, *15*(3), 1287–1315. https://doi.org/10.5194/essd-15-1287-2023

IRI – Danger: Propagation

Fireline Intensity

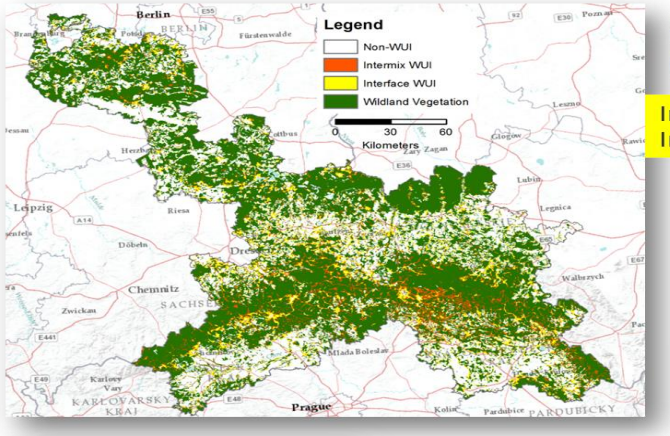


Flame Length



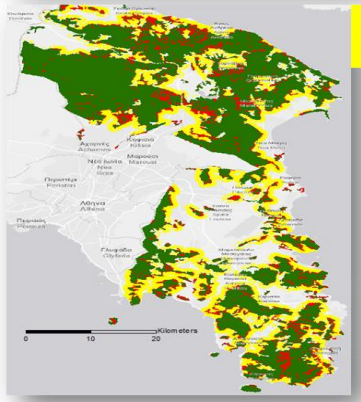
Examples of Individual Risk Components

Exposure (WUI Mapping)



PS2 Central Europe (DE, CZ, PL)

Interface: 7.1%
Intermix: 6.9%



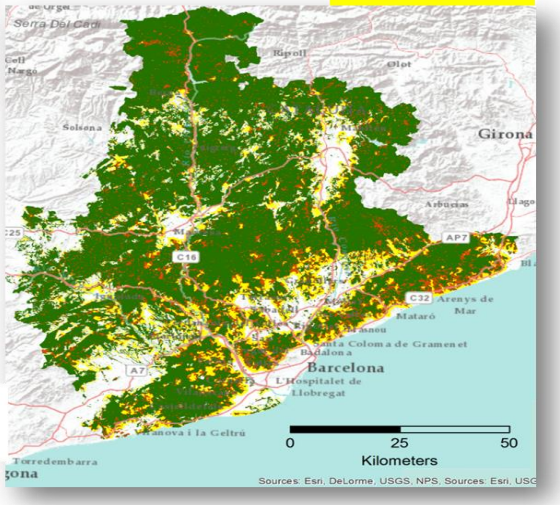
Interface: 19.9%
Intermix: 7.9%

PS5 Attica (GR)

Current mapping status

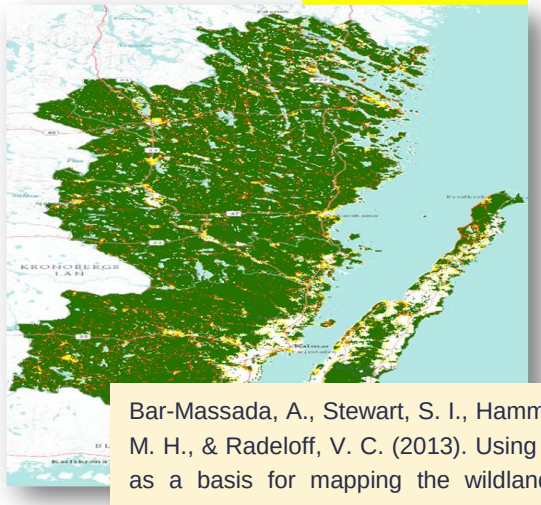
PS4 Barcelona (ES)

Interface: 10%
Intermix: 10.3%



PS1 Kalmar county (SE)

Interface: 2.09%
Intermix: 4.2%



The ET-scale WUI in 2020

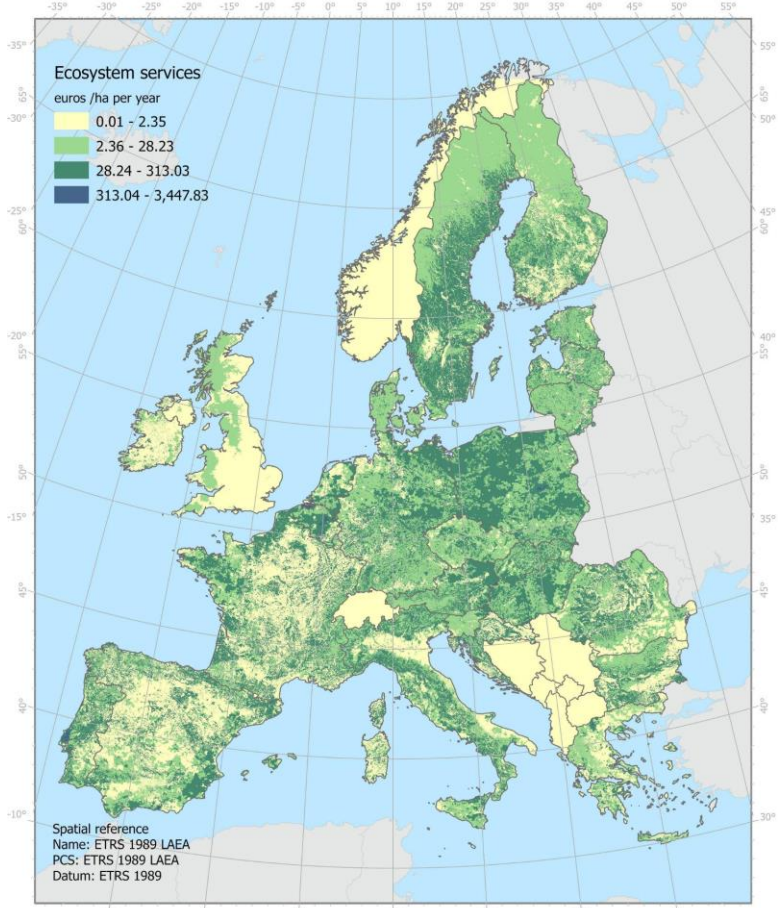
Interface WUI appears in yellow and intermix WUI appears in red. Cell size is 10m.

Bar-Massada, A., Stewart, S. I., Hammer, R. B., Mockrin, M. H., & Radeloff, V. C. (2013). Using structure locations as a basis for mapping the wildland urban interface. *Journal of Environmental Management*, *128*, 540–547. https://doi.org/10.1016/j.jenvman.2013.06.021

Examples of Individual Risk Components

Ecosystem Services

- Total value of ecosystem services in monetary units (€/ha year)
- Standard methods of natural capital used in Europe (JRC, INCA project)
- Values at local scale (pilot sites) were generated using the SEVEIF model[1,2]



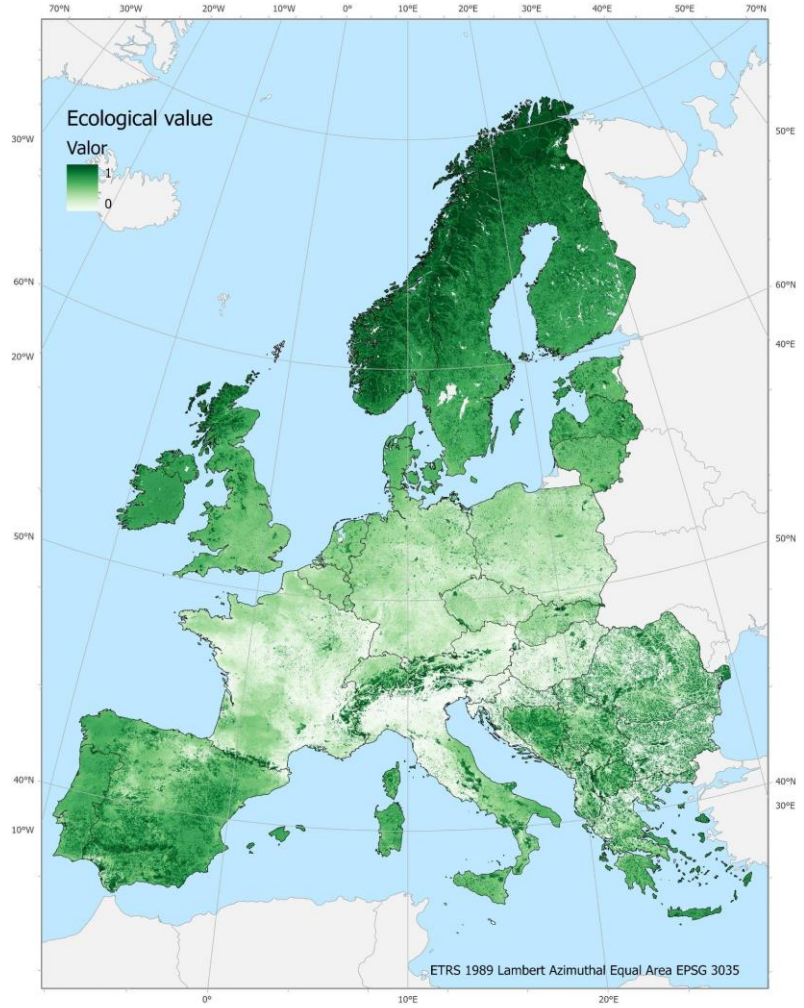
[1] Rodriguez y Silva, F., Molina-Martínez, J. R., Herrera Machuca, M. A., & Rodréguez Leal, J. M. (2012). VISUAL-SEVEIF, a tool for integrating fire behavior simulation and economic evaluation of the impact of Wildfires. In *General Technical Report PSW-GTR-245, Proceedings of the Fourth International Symposium on Fire Economics, Planning, and Policy: Climate Change and Wildfires*, Mexico City, Mexico (pp. 5-11).

[2] Rodríguez y Silva, F., Ramón Molina, J., & Rodriguez Leal, J. (2014). The efficiency analysis of the fire control operations using the VISUAL-SEVEIF tool. In *Advances in forest fire research. Social and economic issues*, 10.14195/978-989-26-0884-6_201 ed., Viegas, D.X., Ed. ADAI: Coimbra.

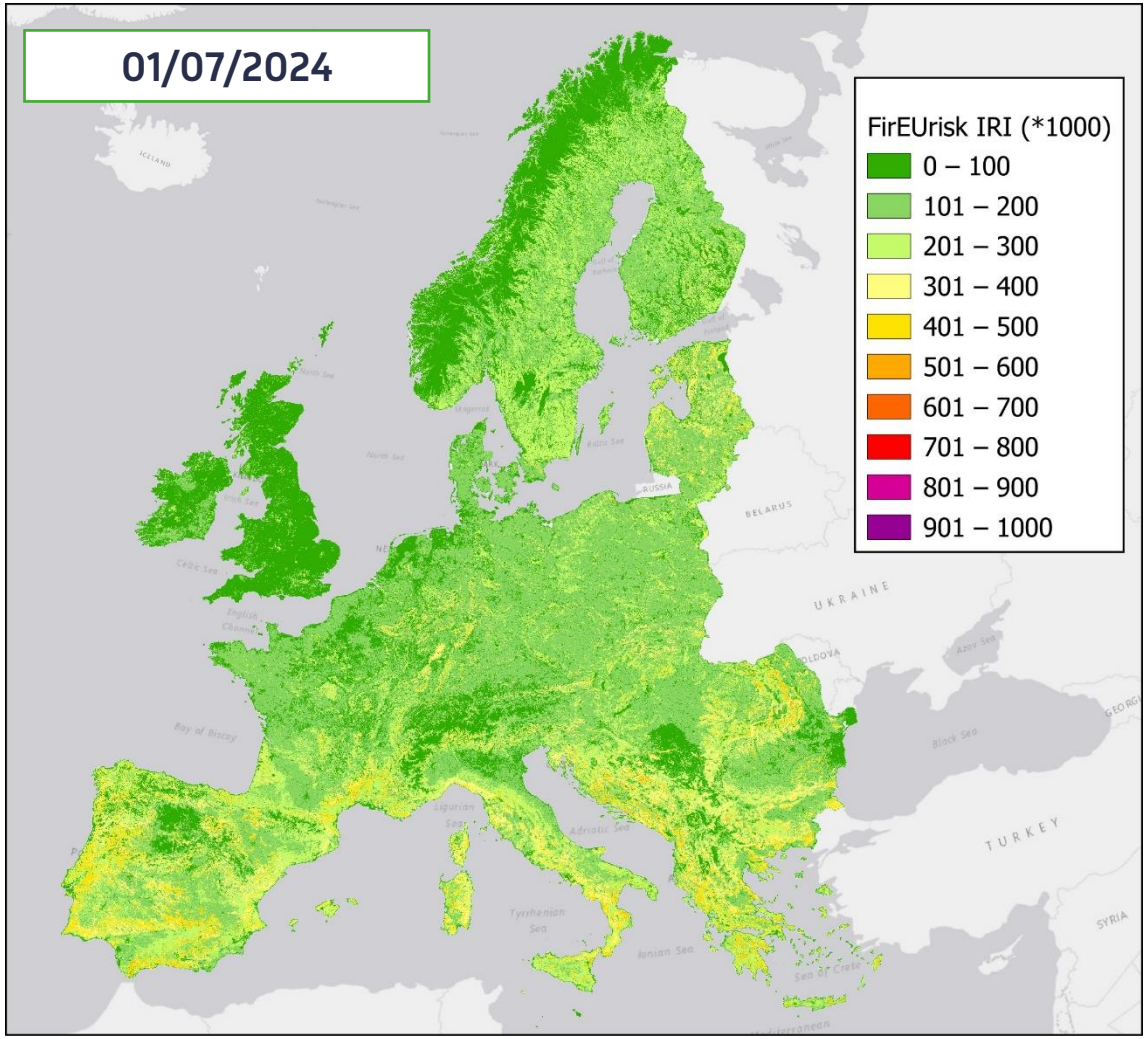
Examples of Individual Risk Components

Ecological Values

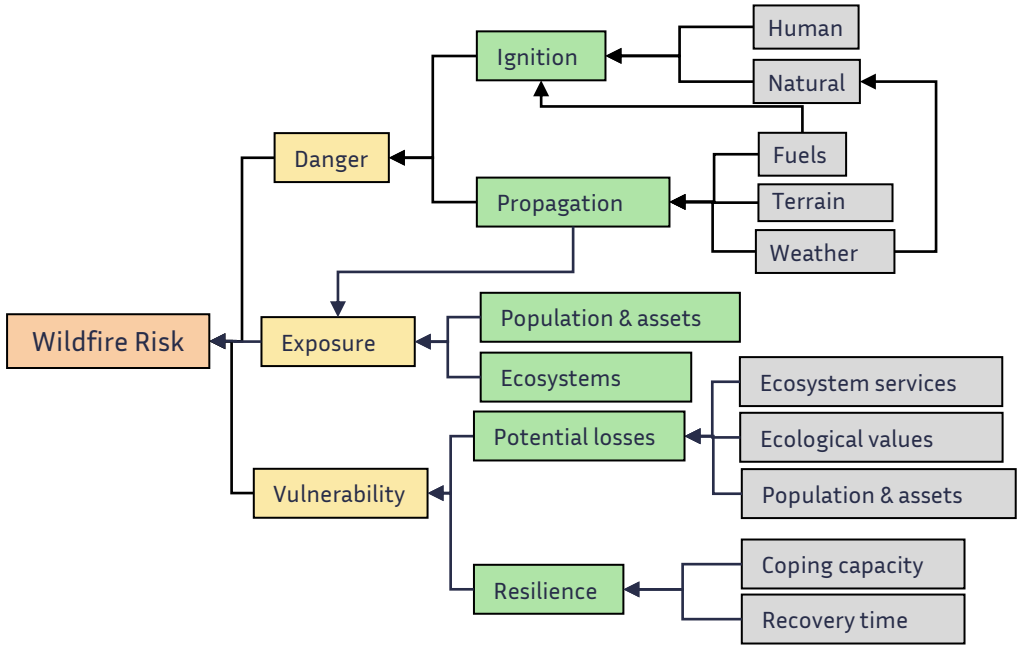
- Information assembled from various sources, considering four components:
  - **Soils** (subsoil and topsoil Available Water Content, soil depth and rock fragment, soil N and P content)
  - **Vegetation** (forest biomass, maximum tree height as a proxy of forest diversity, landscape habitat diversity based on tree cover, and tree height coefficient of variation)
  - **Fauna** (species diversity from the potential habitat data, bird biodiversity, species conservation status)
  - **Conservation value** through natural protected areas (Key Biodiversity Areas maps)
- All variables normalized in [0,1], followed by PCA analysis to identify the most important factors



Integrated Risk Index (IRI)



IRI = (0.6*Danger + 0.4*Vulnerability) * Exposure



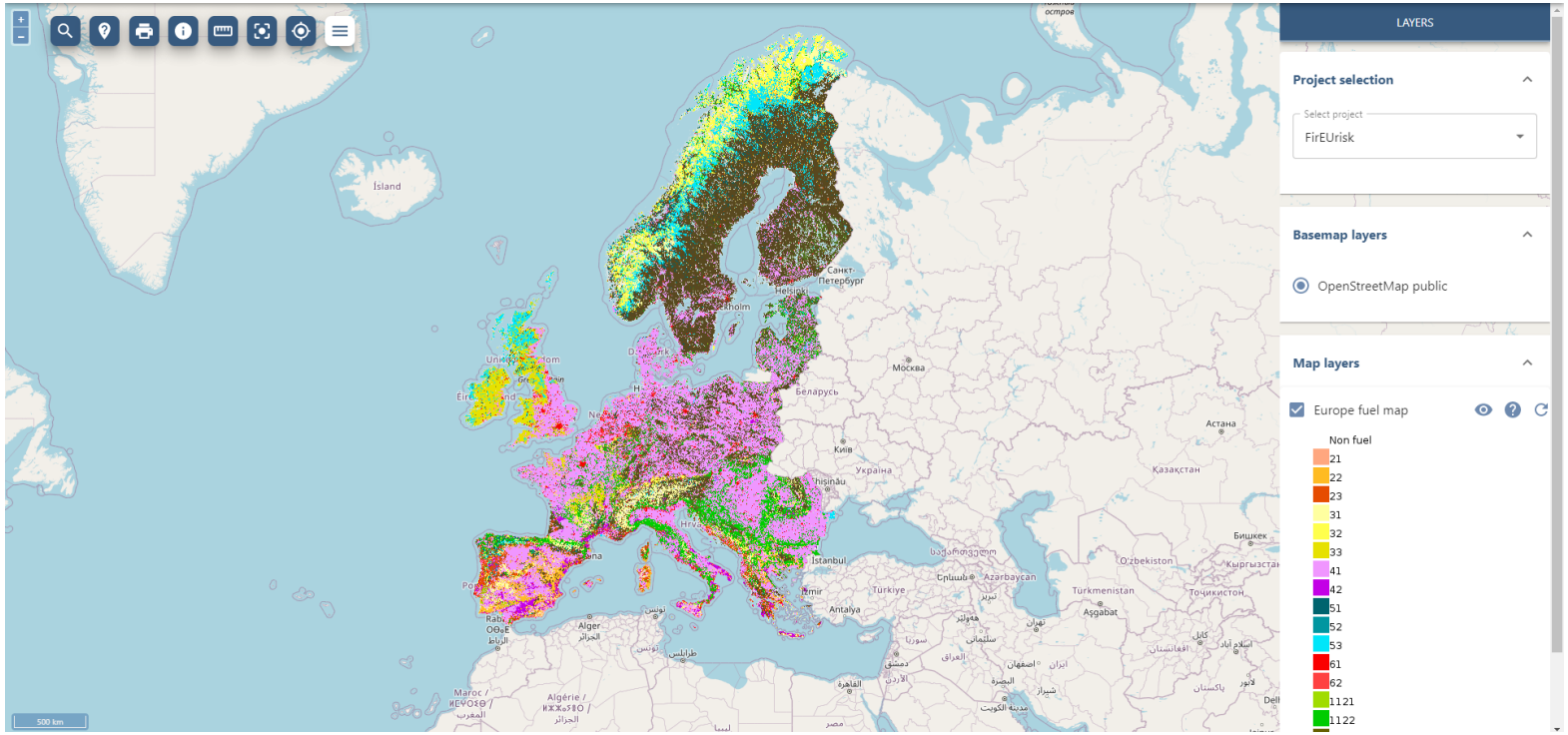
Find out more:

Chuvieco, E., Yebra, M., Martino, S., Thonicke, K., Gómez-Giménez, M., San-Miguel, J., Oom, D., Velea, R., Mouillot, F., Molina, J. R., Miranda, A. I., Lopes, D., Salis, M., Bugaric, M., Sofiev, M., Kadantsev, E., Gitas, I. Z., Stavrakoudis, D., Eftychidis, G., ... Viegas, D. (2023). Towards an Integrated Approach to Wildfire Risk Assessment: When, Where, What and How May the Landscapes Burn. *Fire*, *6*(5), Article 5. https://doi.org/10.3390/fire6050215

User Interfaces

FirEURisk platform
FirEURisk Viewer

https://fireurisk.satways.net/



Citizen-oriented mobile app

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