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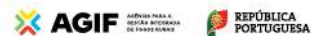
Towards an International
Framework

Porto - Portugal | **May 16-19th**, 2023

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Territorial Vulnerabilities

Assessment using an expert opinion based
multicriteria model



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Content

Rationale

Territorial vulnerability

Case study area

Multicriteria modelling approaches for territorial
vulnerability assessment

Results, discussions

Conclusion



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Rationale: risk change

Climate change
Ignition/outbreak
Propagation
Intensity

(mainly hazard and danger)

“Territorial change”

- Land Use/Land cover
 - Fuel cover
- Population/demography
 - Economy

Mainly vulnerability



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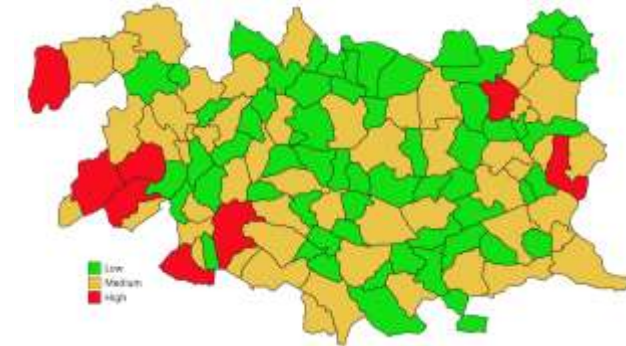
Territorial vulnerabilities

Aggregated indicators of vulnerability of a whole area (administrative entity – commune -) or any area with homogeneous land management policies

To compare several classes of “stakes” (any component of the territory that may be damaged – including persons - in case of fire)

Taking into account:

- Population of classes
- (Relative) value (importance) of classes
- Vulnerability of instances (not only classes) of stakes



Each instance of stake is characterized by :

- Its “assigned” value (example of protected areas, heritage values...)
- Its dimension (size, importance)
- Its susceptibility to be damaged (fragility, defendability, resilience)



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Expert opinion based multicriteria evaluation

- For vulnerability assessment of instances of a single class (the class « building house » at WUI)
- A way for assessment of other risk components (ignition, damages) at local scale
- Criteria are « classes » of vulnerability : farms, factories, hospitals, natural protected areas, etc...



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In complement to other approaches:

- Statistical approaches (occurrences of damages analysis)
- Simulation based approaches
- Expert opinion based analysis (multicriteria)

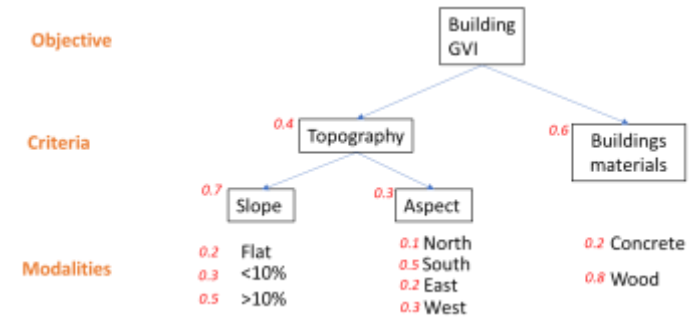


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« Multicriteria approach »

An experts' opinion-based approach

- « **Elicitation** » of experts knowledge (subjective, contextualized, etc.).
The aim is not to make « objective » this knowledge, but to turn it to « formal »



An example of hierarchy of criteria for WUI buildings vulnerability assessment

Used technique : AHP

Criteria are classes of vulnerability
Pairwise comparison with experts inquiries



Some key issues to be solved:

- Metrics for instances population of the classes weight assessment (not linear)
- Multi-heritage (classes belonging to several branches of a hierarchy...)
- Specific vulnerabilities of some given instances (and not only classes)

Outputs are normalized ([0,1]) : no absolute value
=> « contextualized » (min and max depending on a reference zone)

Final results classified: low, medium, high, very high, etc.

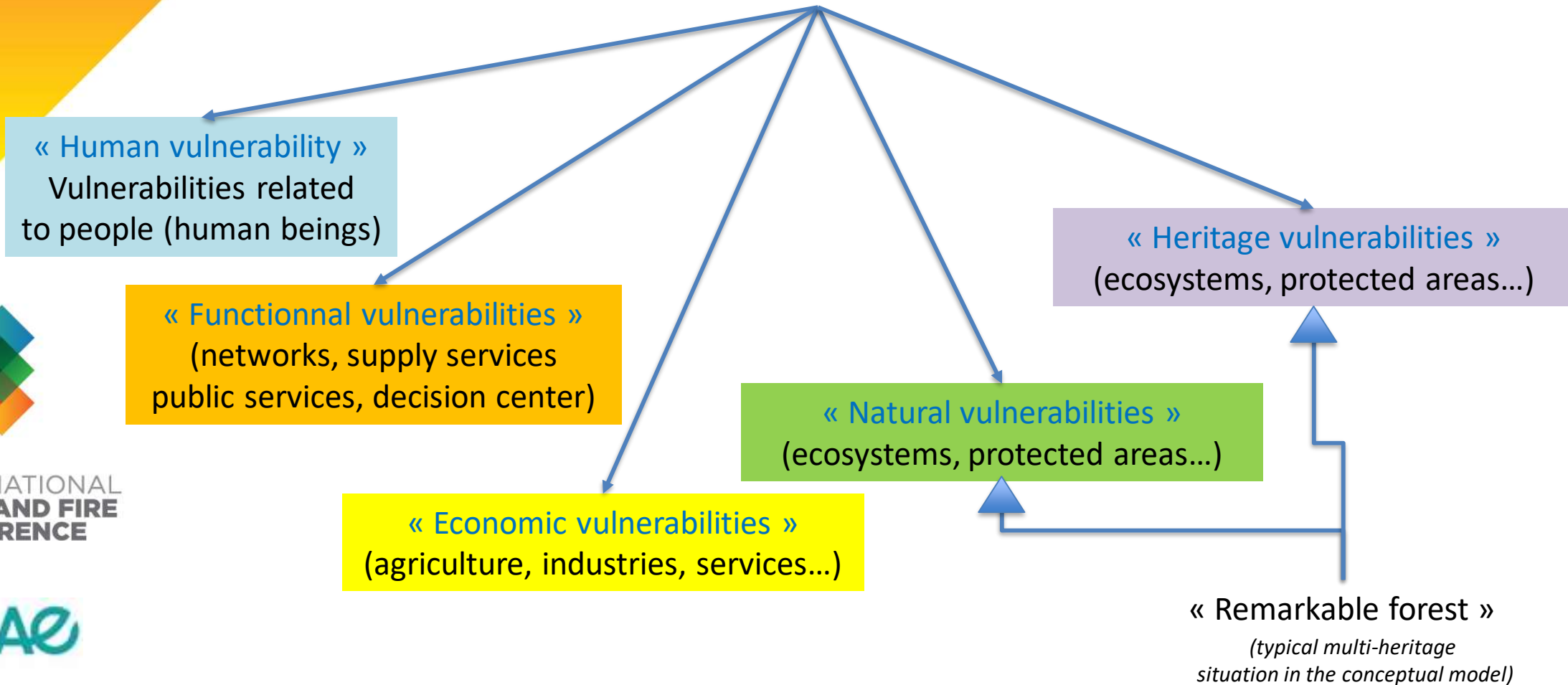


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5 main classes of vulnerability

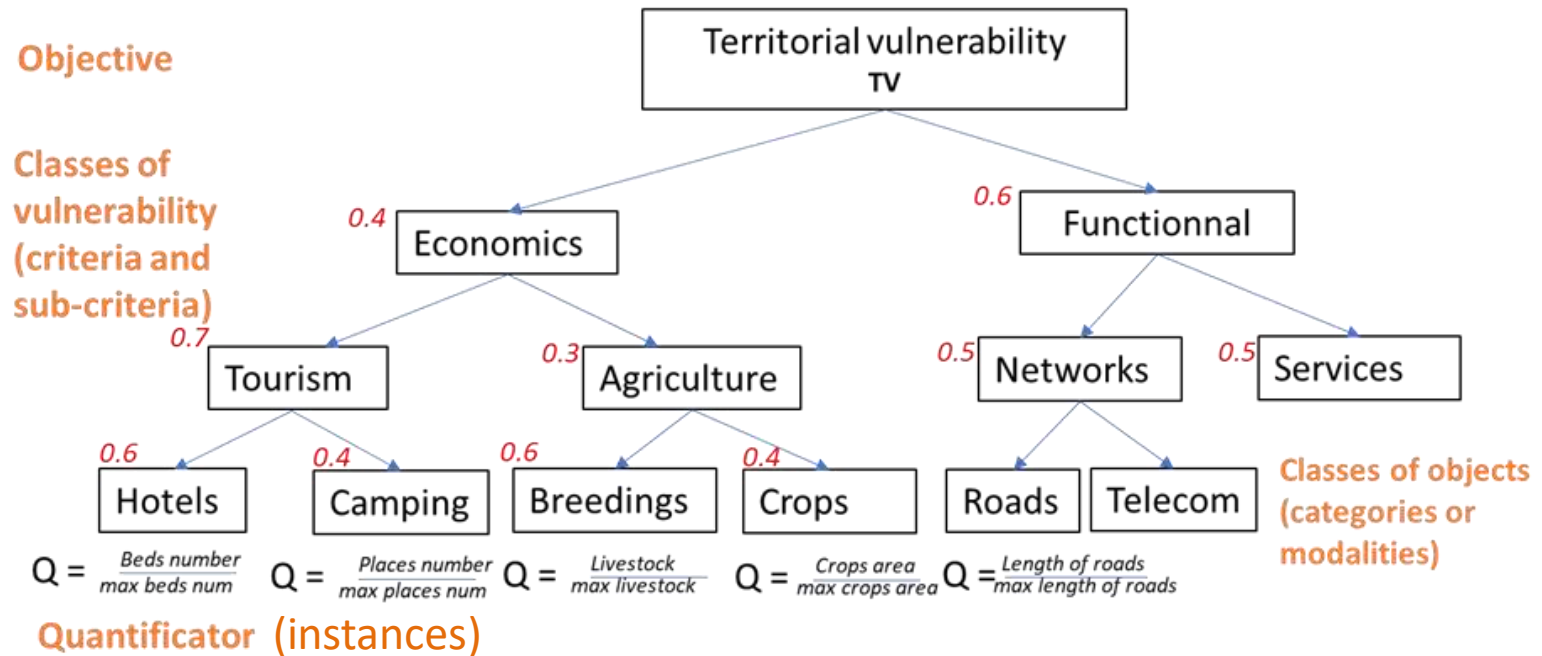
Territorial vulnerabilities



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Weighting of classes and quantifying the instances



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And also a « direct » weighting of some particular instances (some named protected areas, heritage elements)

The « Baronnies Provençales » Regional Natural Park

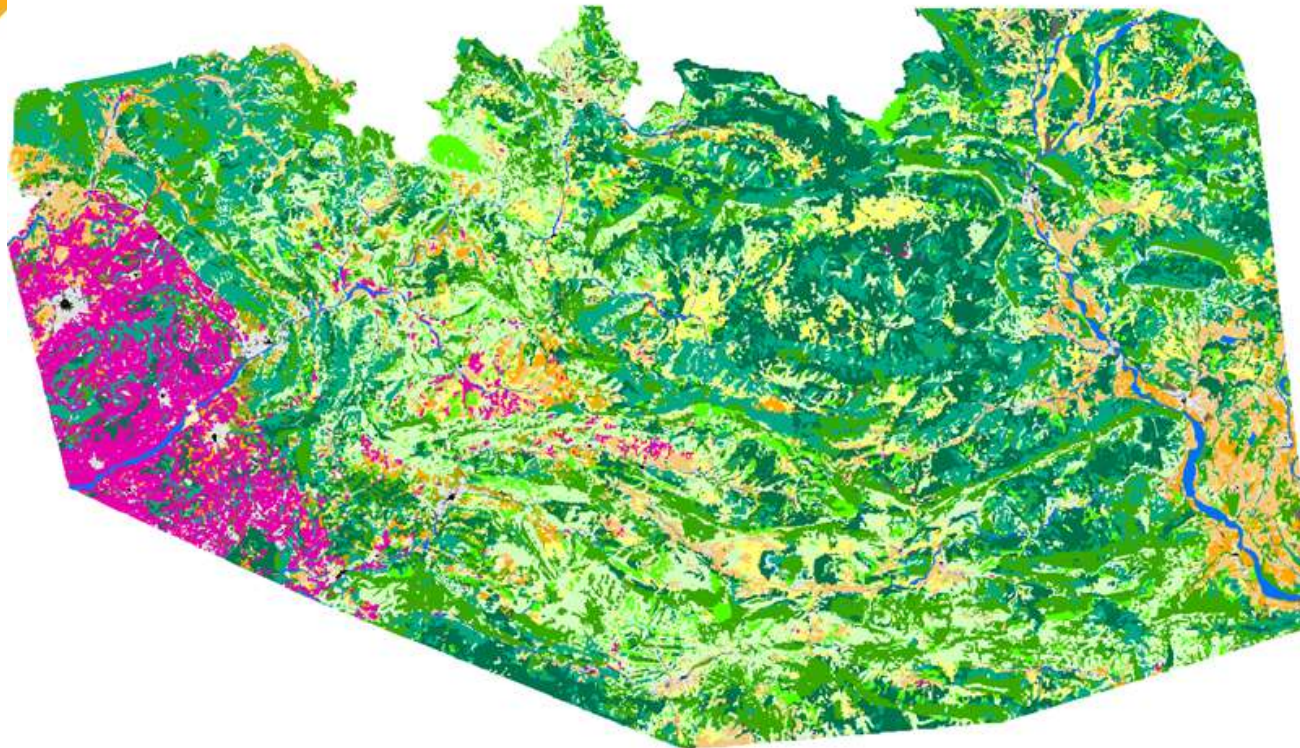
- Middle mountain area, sub-Mediterranean (500 – 1300m)
- ≈ 115 communes
- Protected area (regional Park, several faunistic – wildlife – and floristic reserves)
- Hinterlands severely affected by land abandonment during the XXth century
- Up to now little prone to wildfire (altitude), but this might radically change in the future (climate, large forest continua, increasing human presence, low risk culture...)



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Land cover : exposure of stakes to fires



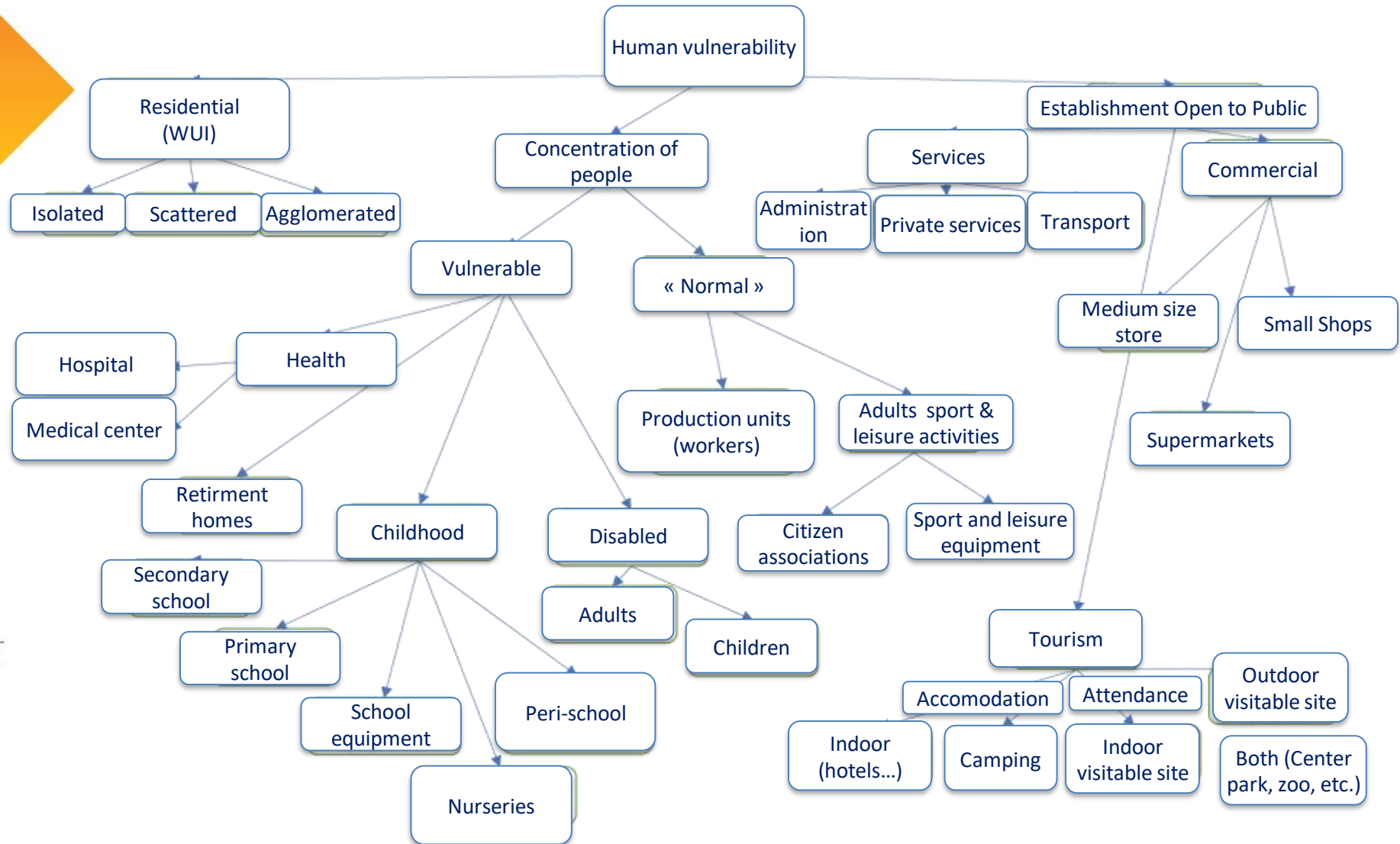
- Continuous urban
- Urban (economic activities)
- Urban (with vegetation)
- Scattered urban
- Roads
- Crops (annual)
- Vines
- Orchard
- Olive trees
- Meadows
- Agriculture complex mixes
- Coniferus
- Broadleaved
- Mixed forest
- Shrubs & sclerophyllus
- Open wildlands
- Rocky areas
- Water bodies



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Example of a hierarchy: « human vulnerability »



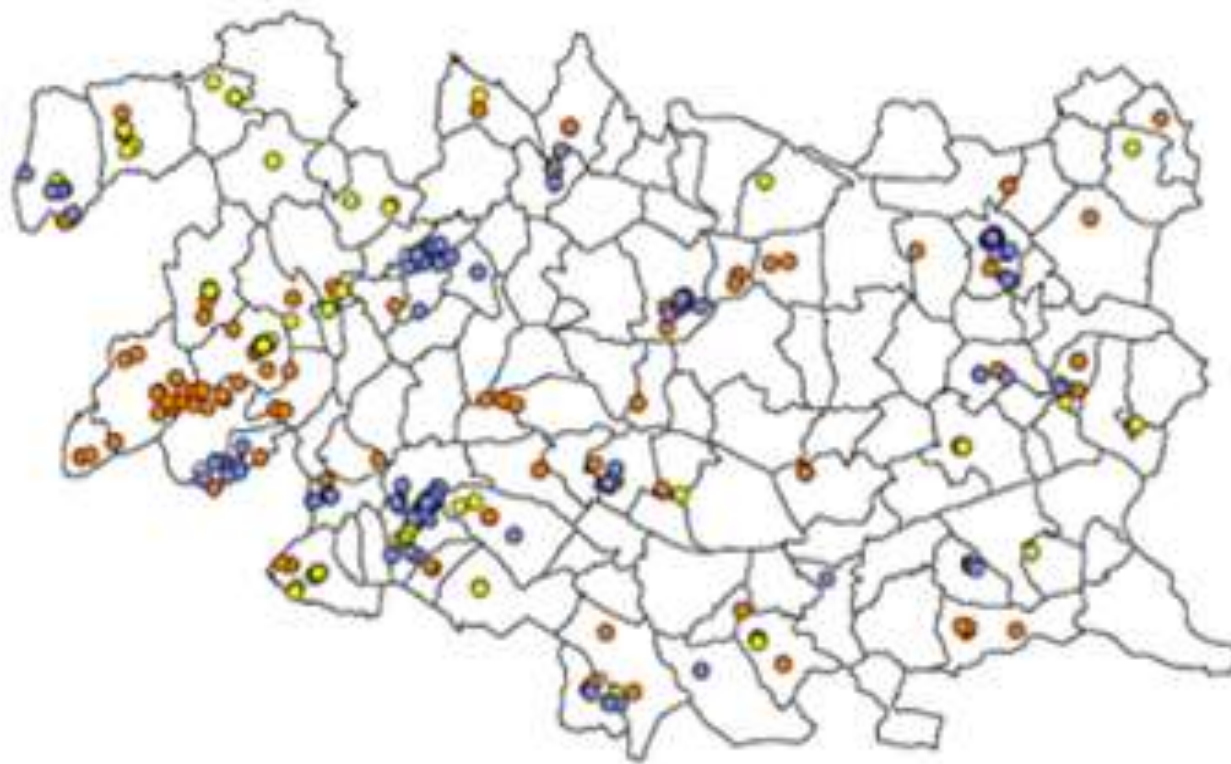
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Inventory of vulnerable stakes

(Example of punctual tourism and commercial sites)

- Accomodation
- Commercial
- Visitable sites



10 0 10 20 30 40 km

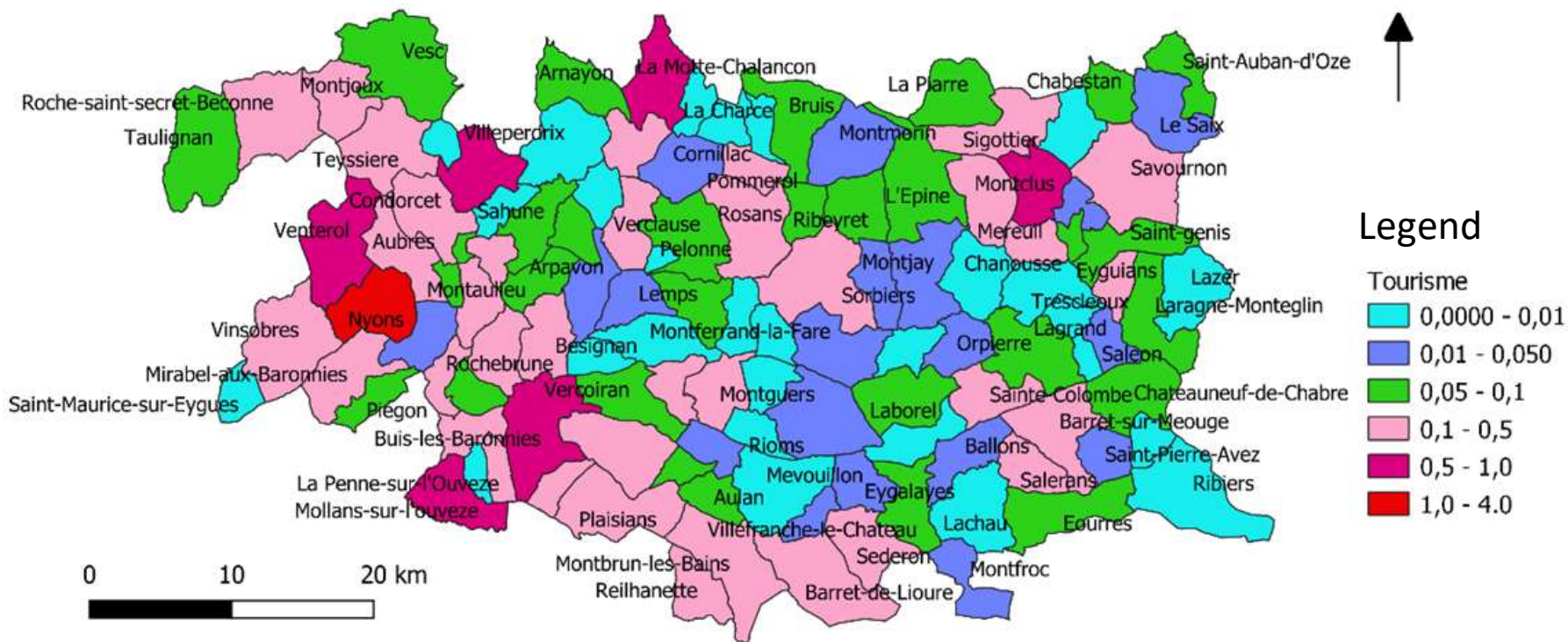


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Index calculation

Calculated vulnerability index specific to tourism activities

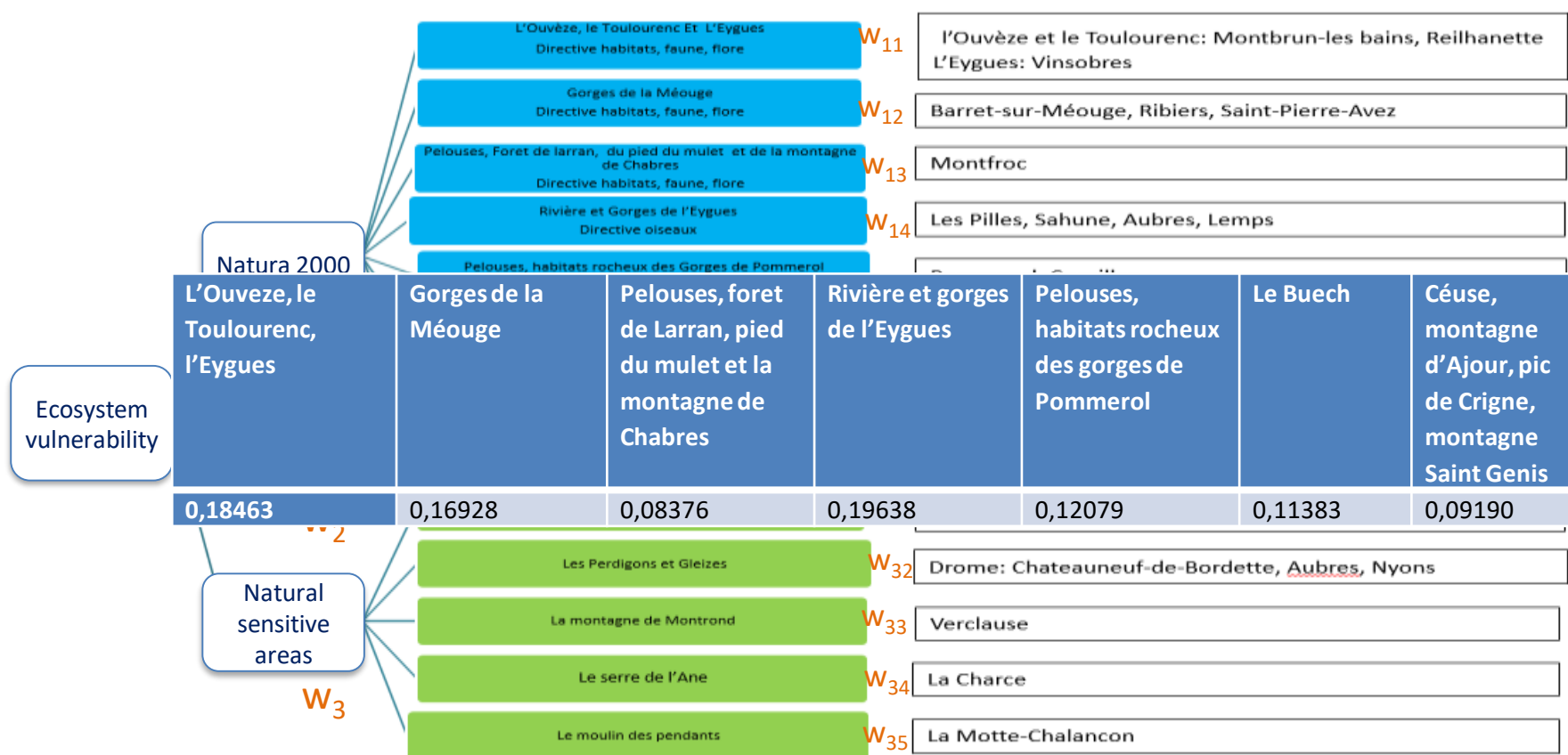


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Weighting of surface “instances” - protected areas

Name of the concerned territory

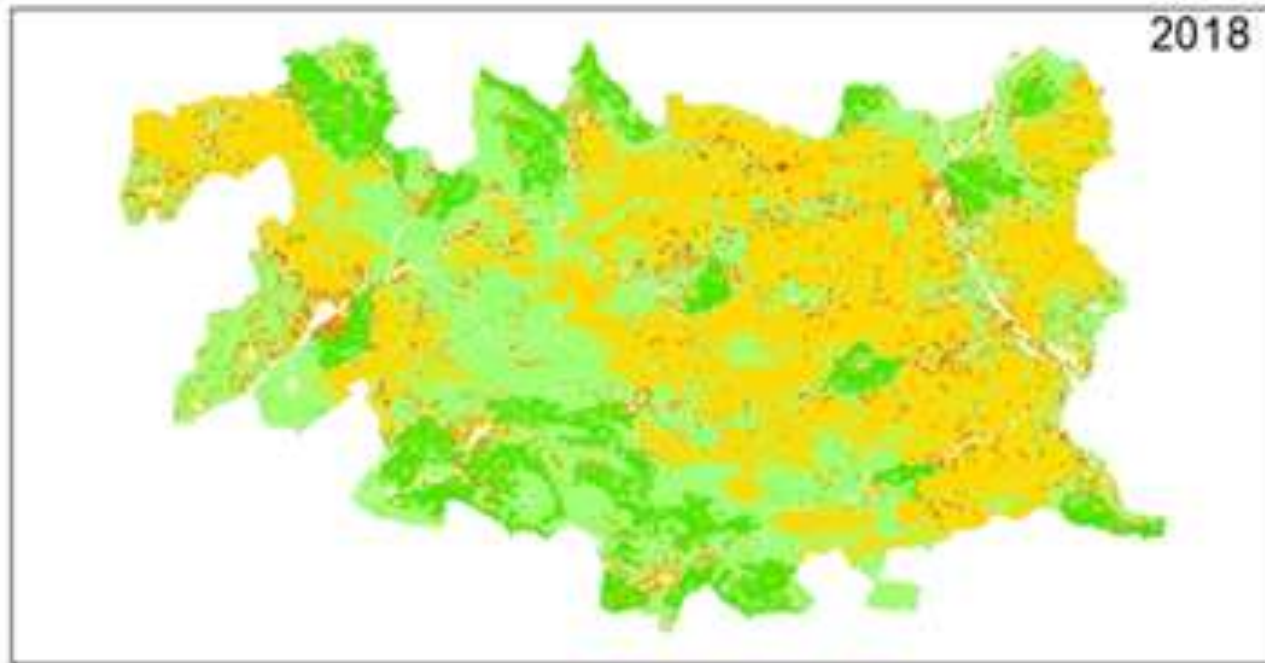


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Integration of territorial vulnerability into global risk models

Example of the subjected risk

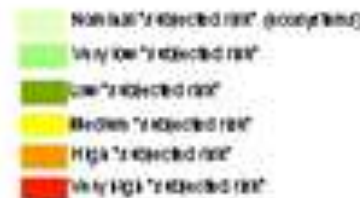
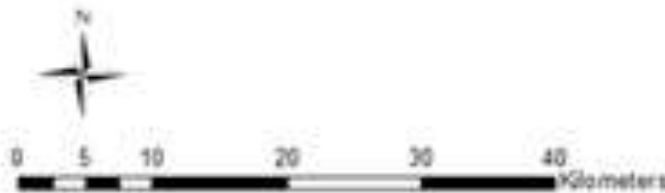


Combination with other components of the global risk (ignition, breakout, propagation, potential local intensity...)

Either calculation of field of vulnerability (spatially continuous variable) or calculation of the global risk at the scale of the territory (spatial averages)



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Conclusion

Territorial vulnerability is the results of the exposure of different stakes (including values and humans beings) present on a territory

Multicriteria methods allow assessing a global vulnerability based on experts' opinion elicitation

Statistical validation requires a great number of case studies for measuring fire global impacts on territories, up to now not available, specially on areas up to now little prone to forest fires, but will be highly affected in the future.

In such areas, contextuel vulnerability of stakes (exposure) is a key component of vulnerability, which is not assessed using WUI mapping



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