

# UNIVERSITY OF CORSICA - PASQUALE PAOLI

## DOCTORAL SCHOOL “Environment and Society”

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### THESIS PROJECT SHEET for YEAR 2024-2025

Form to be sent electronically ( word format ), to the Doctoral School **before January 8, 2024 at 5 p.m.** (latest deadline)

<b>Doctoral discipline</b> <i>See article 1 of the internal regulations of the ED Indicate the 7-digit number and the title (all or part depending on the case)</i>	Economics (4200043)
<b>Mention of the Doctorate</b> <i>See article 1 of the internal regulations of the ED Indicate the CNU section number and the title</i>	Economics (05)
<b>1 Major scientific field</b>	Economy
<b>1 Minor scientific field</b>	Energy , Thermal or IT
<b>Home entities</b> <ul style="list-style-type: none"> <li>- Research center (UMR LISA, UMR SPE, UR 7310, UR 7311, INRA)</li> <li>- Structuring project or UR</li> </ul>	<b>FRES - (SPE - LISA)</b> Interdisciplinary TerrRA / Fire
<b>Thesis direction</b> <ul style="list-style-type: none"> <li>- Director</li> <li>- Possible co-director considered</li> </ul> For each, give: (i) Name, first name, rank; (ii) telephone and e-mail; (iii) specify the quality of HDR ( or non-HDR) for Doctors who are neither PR nor DR; (iv) establishment of assignment for outsiders Specify whether an agreement (co-management or joint supervision) is envisaged	Director: Jean-Baptiste Filippi - CR CNRS UMR SPE (HDR) filippi@univ-corse.fr tel 04 95 45 01 58  Co- Director: Antoine Belgodere - MCF UMR LISA (non-HDR) tel 04 95 45 00 38 belgodere_a@univ-corse.fr
<b>External collaborations possible considered</b> University, Large organization, Business	
<b>Type of financing targeted</b> ( delete unnecessary references )	Doctoral contract
<b>Knowledge and skills required by the student –</b> Specify the Master(s) of which the thesis project is a continuation	Economy , geography, numerical calculation, statistics, heat transfers. Master Applied Economics , Master Info or Master Risks
<b>Thesis title</b>	Urban sprawl and the cost of fire risk: an assessment by simulation and artificial intelligence
<b>Abstract 1</b> (5-8 lines, Arial 10 font) : Concrete presentation of the thesis project – Scientific aspects <i>Purpose, methodology and issues, scientific interest, innovative nature</i>	The objective is to capitalize on a transdisciplinary simulation/artificial intelligence/economics approach already developed as part of the FireCaster program in order to study the impact of urban sprawl on the cost of fires. Urban sprawl increases the costs of fires, but can constitute a barrier to their progression. The thesis will endeavor to quantify these different impacts according to the scale and form taken by the sprawl.

<p><b>Abstract 2</b> (5-8 lines, Arial 10 font) :  Presentation of the thesis issues  <i>Adequacy with the scientific policy of the UCPP - Interest of research in the context of regional development</i></p>	<p>Risk management, and their economic and societal effects on the environment, are major themes developed at the UCPP, at the LISA laboratory, SPE and at the regional level. This cross-disciplinary subject ( Economics , IT, Physics) finds a direct application to two major territorial problems: fire risk management and control of the environmental impacts of urbanization.</p>
Explanation on next page	

## Explanation of the Thesis Project

1°) Presentation of the scientific aspects of the thesis project (approximately 1 page, Arial 10 font)  
*Purpose, methodology and issues, scientific interest, innovative nature*

The purpose of the thesis will be to study the impact of choices made in terms of land use on the importance of fire risk. The effects of urban sprawl have been the subject of abundant literature in urban economics since the 1990s. But the link between urban sprawl and fire risk does not appear central in this literature. However, episodes of endangerment and destruction of homes are increasing. When homes are not destroyed, their simple proximity to fire zones forces intervention forces to deploy means to protect human lives, contributing at least indirectly to the cost of fires.

The proximity of housing can have contradictory effects on the economic impact of a fire. On the one hand, inhabited areas are generally less rich in fuels, and can constitute a barrier against fire. On the other hand, they considerably increase the cost per hectare burned in the event of combustion.

In order to quantify these impacts, the doctoral student will rely on the simulation tools developed as part of the FireCaster program . These tools, which revolve around the ForeFire fire simulator , make it possible to simulate costs associated with forest fires in Corsica. They also integrate an uncertainty quantification module based on drawings of calibrated sets of parameters as input to the simulation model. The very large number of simulations necessary for a fine mesh of the territory is carried out thanks to a simulation emulator using deep learning techniques in artificial intelligence. It is important to note that although most of these tools have already been developed and tested, they still need to be adapted to the context of urban sprawl. The technical feasibility of the subject is thus almost assured.

The assessment of the impact of urban sprawl on fire risk will have two dimensions: the first will concern the extent of urban sprawl, the second will concern the particular forms taken by this sprawl. The first dimension will be addressed by simply comparing the fire risk of sensitive urban and peri-urban areas with a counterfactual based on land use prior to urban sprawl. The second will have to integrate alternative scenarios concerning the urban forms taken by recent residential areas (compact, dispersed, fragmented, etc.)

Although the tools developed within the framework of FireCaster have been configured for the Corsican terrain, they are naturally transposable, and will allow the doctoral student to study contexts of urban sprawl concerning agglomerations of larger dimensions than island agglomerations.

The doctoral student will have to put the results of his simulations into perspective, so as to provide public decision-makers with information on the foreseeable consequences of future urban development projects on fire risk.

**2°) Presentation of the issues of the thesis (approximately 1 page, Arial 10 font)**

*Adequacy with the scientific policy of the UCPP - Interest of research in the context of regional development.*

This thesis is part of the scientific policy of the UCPP in two ways.

On the one hand, it echoes the work of the Fire team at the UMR SPE where this subject, already transversal in the laboratory (Computer Science, Physics) finds a direct application to a major territorial problem, fire risk management.

The fire team thus collaborates with the GTI Fire within the framework of the PFENNI ( Plan for the protection of forests and natural spaces against fires ) in order, among other things, to make available research

products that can help in the management of this risk. The collaborations initiated for many years at the local level with the two fire and rescue services, the National Forestry Office and the State services finally allow us to have the relays and field expertise necessary for concrete feedback. on the methods to be developed.

On the other hand, the subject of this thesis is congruent with several issues studied by the TerRa team at UMR LISA. In particular, this team took part in the ANR FireCaster program , developing tools for assessing the cost of forest fires. In addition, the LOCUS platform offers a series of tools for analyzing land use policies. As such, the subject of the thesis, at the intersection between fire protection and urban planning issues, will be studied in a favorable context within the TerRa team .

The transversality of this subject between the two UPCC UMRs justifies its being proposed within the framework of FRES, whose mission is to promote joint projects between the federated laboratories.

This intersection between fire protection and planning issues is also of primary importance in regional development issues. The two Corsican departments are, in fact, among the most affected by fires, with an average of more than 4,000 hectares of area burned annually between 2000 and 2019. The wealth of the island's natural heritage is directly threatened by the fires. forest, and the tourist attractiveness of the island is indirectly. Furthermore, land pressure linked to urban sprawl is a recurring subject of concern on the island. If questions related to the accessibility of agricultural land or the protection of ecosystems largely explain this concern, the interference with firefighting cannot be neglected.