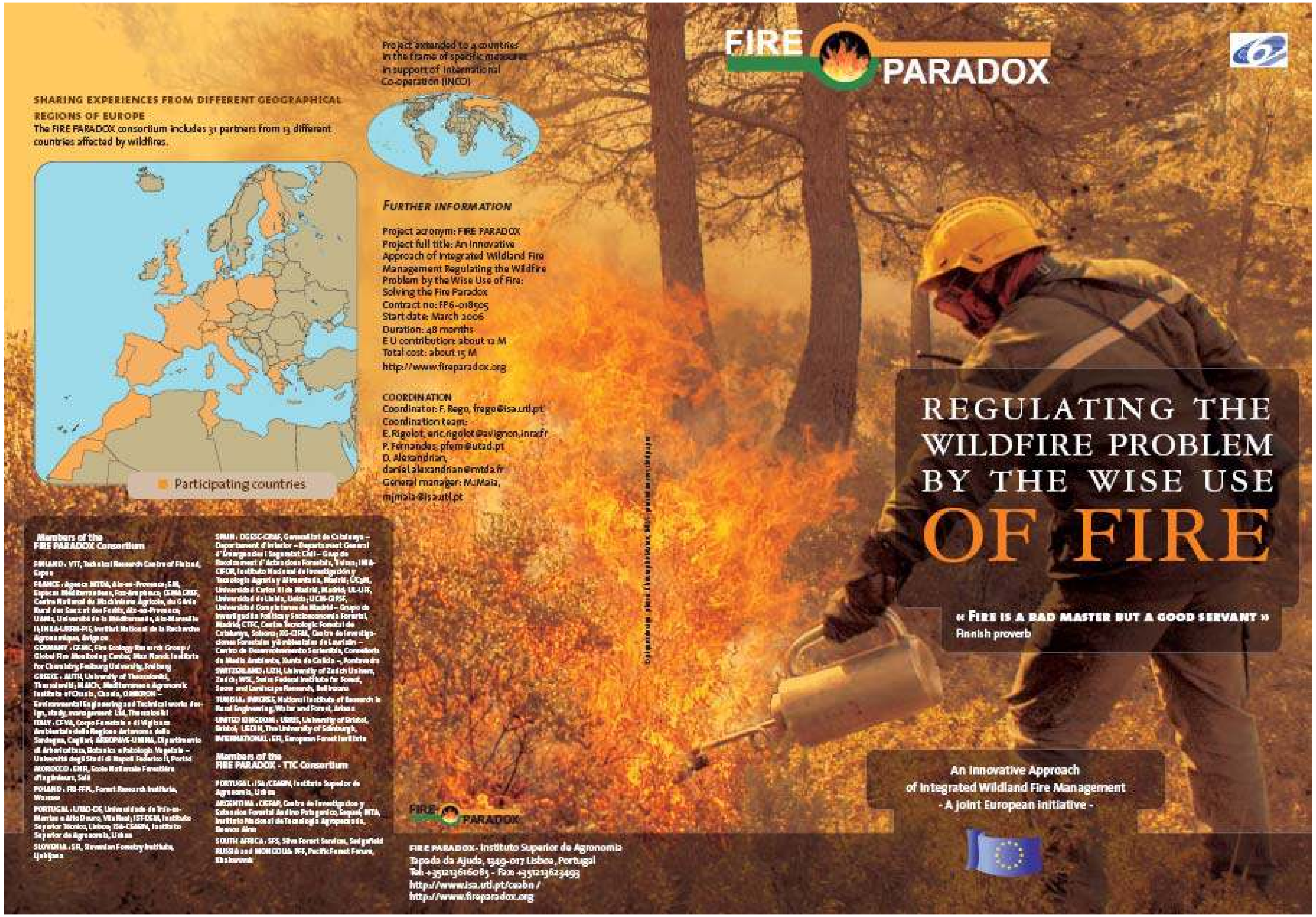
Revisiting current paradigms:

Novel approaches in forest fire risk management in the Mediterranean

Francisco Castro Rego
ISA - Univ. Lisboa
CEABN/InBio

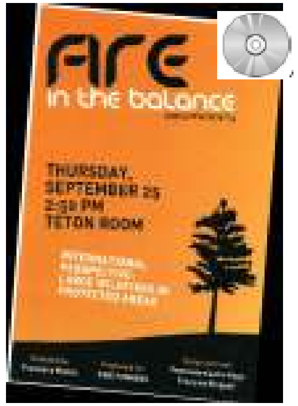
The Fire Paradox:

An international project funded by the EU (2006-2010)

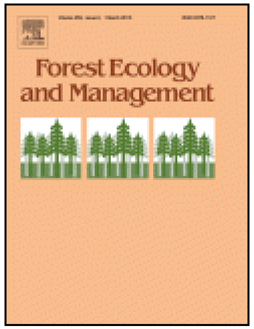


The Fire Paradox:

Communication



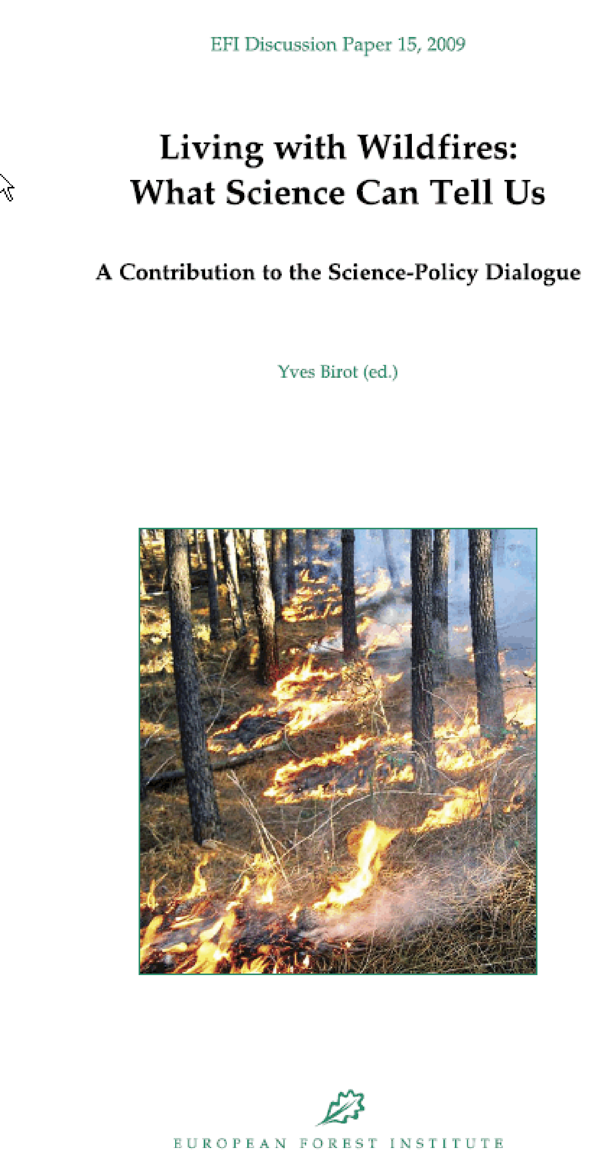
- Film production
  - Fire Paradox documentaries
  - Video-package



- Special issues of peer reviewed journals
  - Forest Ecology and Management
  - Forest Policy and Economics

http://www.isa.utl.pt/ceabn/content/2/92/multimedia-gallery#4

Communication

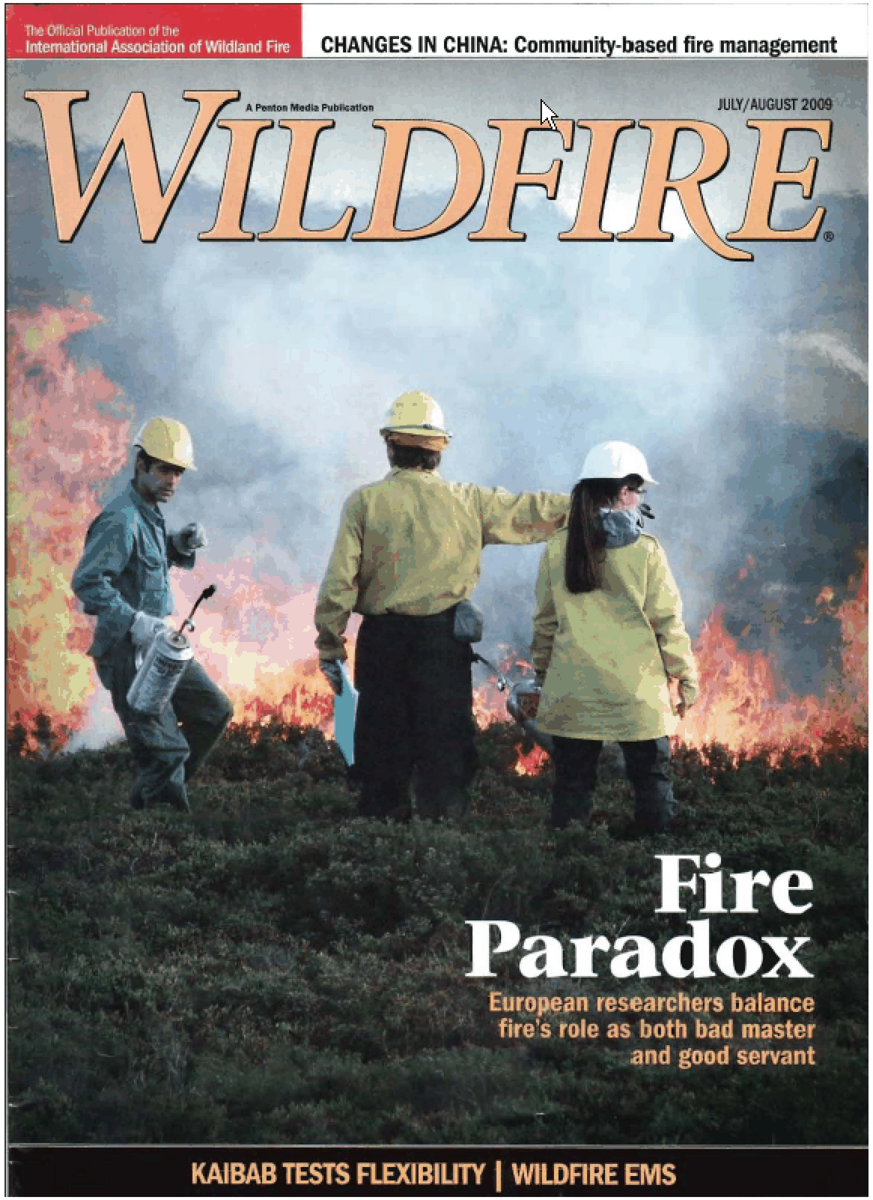

EFI Discussion Paper 15, 2009

Living with Wildfires:
What Science Can Tell Us

A Contribution to the Science-Policy Dialogue

Yves Birot (ed.)

EUROPEAN FOREST INSTITUTE



EFI Research Report 23 - Book

European Forest Institute Research Report 23

The approach taken in the Fire Paradox project was based on the paradox that fire can be "a bad master but a good servant", thus requiring the consideration of the negative impacts of current wildfire regimes (understanding fire initiation and propagation) and the beneficial impacts of managed fires in vegetation management and as a planned mitigation practice (prescribed burning together with some traditional fire uses) and for combating wildfires (suppression fire). These were the four integration pillars of the project.

This Research Report reflects the structure of the project, corresponding to its integration pillars – initiation, propagation, prescribed burning and suppression fires – and including a closing chapter which synthesizes and combines the main project outcomes. The book provides science based knowledge that can assist policy makers to develop the necessary 'common strategies' to elaborate and implement integrated fire management policies. It makes extensive use of the science and technology findings from the Fire Paradox project, focusing on policies and best management practices, as well as providing guidelines for the future.

The Fire Paradox project (2006–2010) was funded by the European Commission Research and Development 6th Framework Program. The project included 30 partners from eleven European countries and six partners from Africa, South America and Asia, with close support from an International Advisory Committee formed by nine specialists from the USA, Canada and Australia. Fire problems and solutions are found all over the world, and we see the knowledge exchange and benefits of Fire Paradox will extend far beyond Europe.

ISSN: 1238-8785
ISBN: 978-952-5453-45-4

23 *Silva et al.* Towards Integrated Fire Management – Outcomes of the European Project Fire Paradox

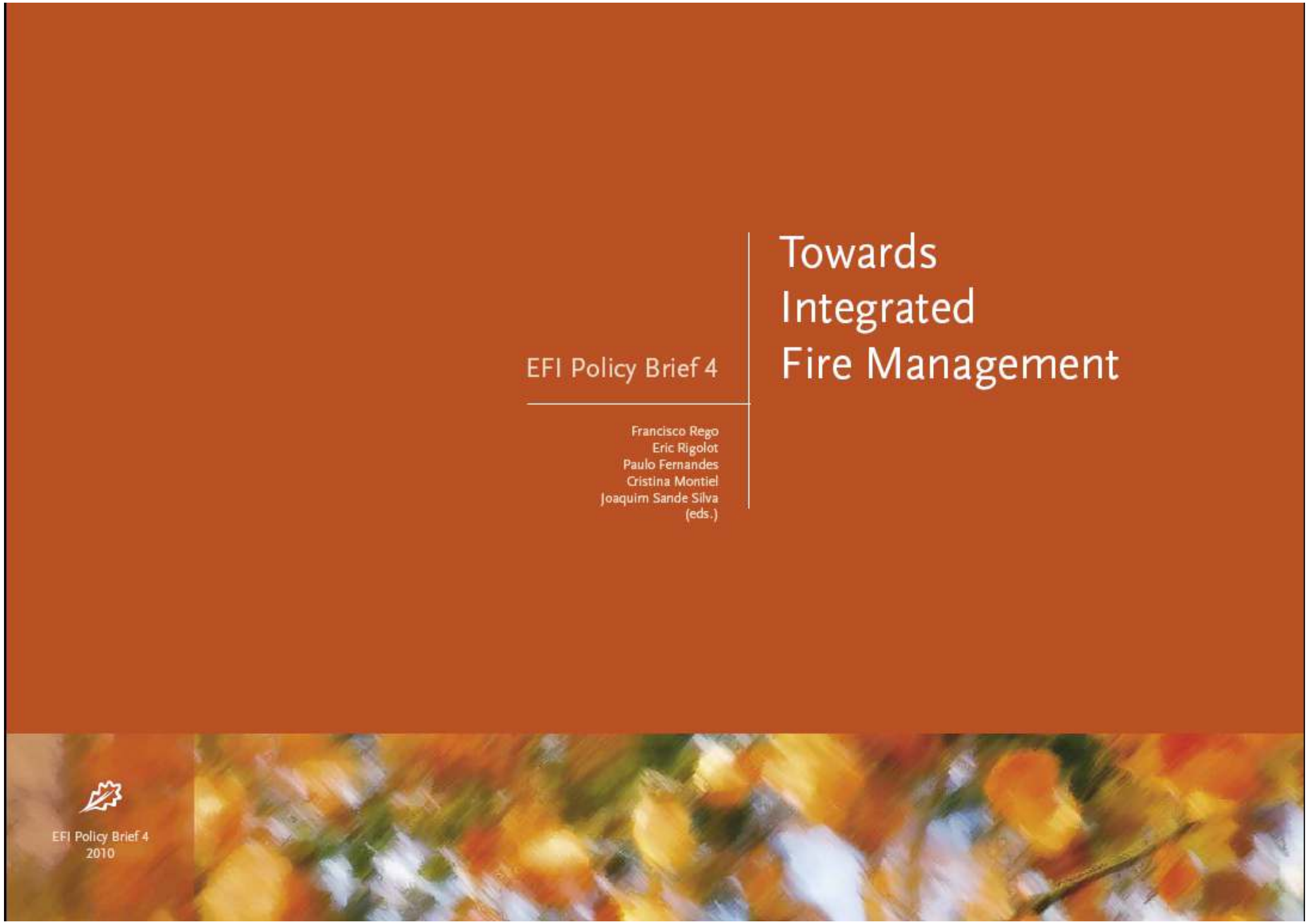
Towards Integrated Fire Management – Outcomes of the European Project Fire Paradox

Joaquim Sande Silva
Francisco Rego
Paulo Fernandes
Eric Rigolot
(editors)

EUROPEAN FOREST INSTITUTE

Photo: Pedro Palheiro GAUF/DGRF Portugal 2007

EFI Policy Brief



✓ Europe's tradition of fire use

✓ Understanding and regulating traditional fire use

✓ Reinforcing the professional use of prescribed burning

Prescribed fire in a *Calluna* heathland in Germany. The use of prescribed fire for the conservation and restoration of the biodiversity heritage of former cultivated lands, or for the maintenance of open landscape elements with aesthetic or otherwise historic value are included in the activities conducted in the frame of the Eurasian Network for Fire in Nature Conservation and the Global Fire Monitoring Center (http://www.fire.uni-freiburg.de).

✓ **Promoting suppression fire as an additional tool in fire fighting**


SUPPRESSION STRATEGIES
SUPPRESSION FIRE
FIRE USE

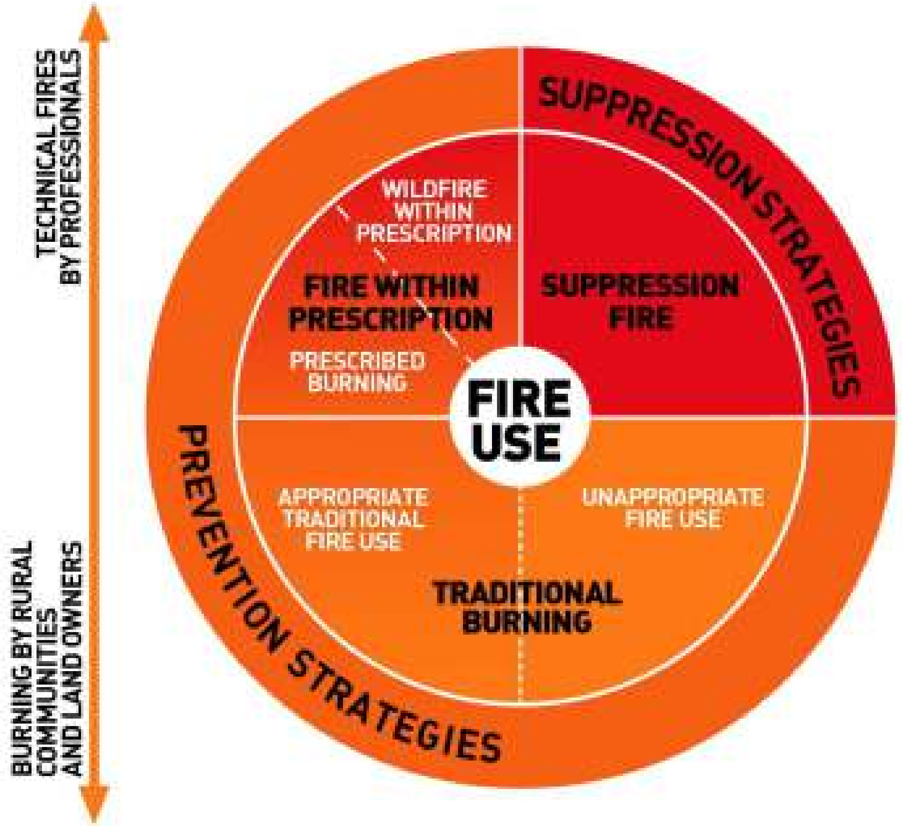

FIRE
USE
APPROPRIATE
TRADITIONAL
FIRE USE
UNAPPROPRIATE
FIRE USE
TRADITIONAL
BURNING
PREVENTION STRATEGIES


WILDFIRE WITHIN PRESCRIPTION
FIRE WITHIN PRESCRIPTION
PRESCRIBED BURNING
FIRE USE


SUPPRESSION STRATEGIES
WILDFIRE WITHIN PRESCRIPTION
FIRE WITHIN PRESCRIPTION
PRESCRIBED BURNING
SUPPRESSION FIRE
FIRE USE
APPROPRIATE TRADITIONAL FIRE USE
UNAPPROPRIATE FIRE USE
TRADITIONAL BURNING
PREVENTION STRATEGIES

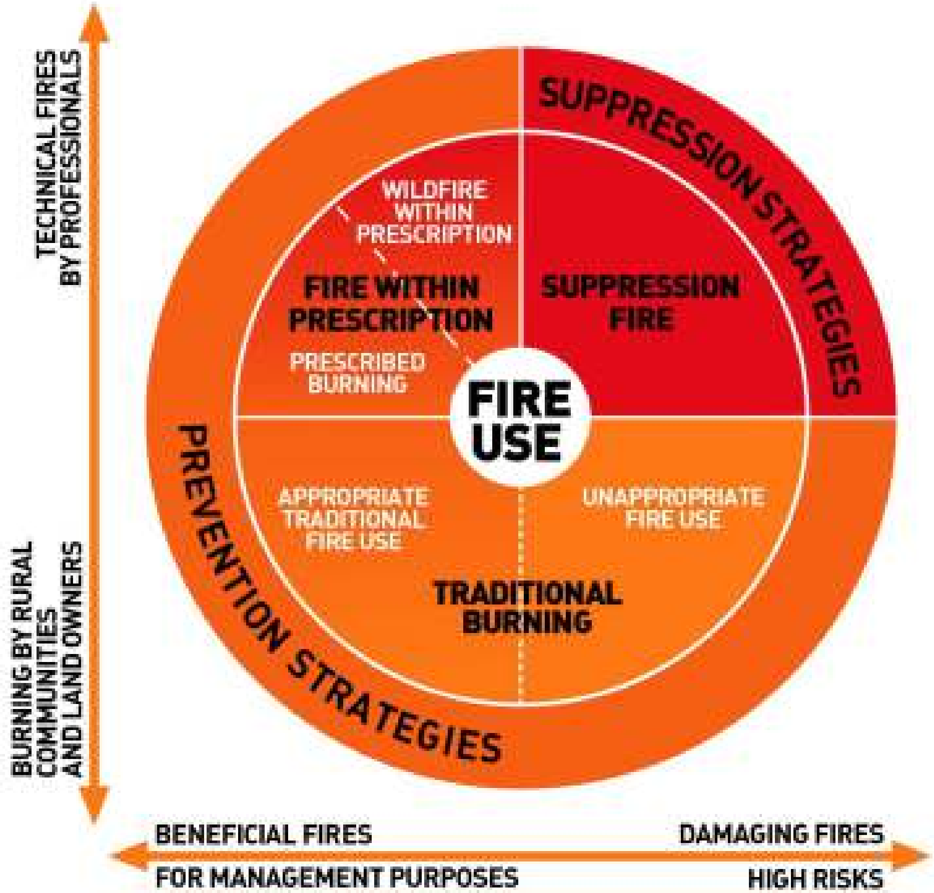
INTEGRATED FIRE MANAGEMENT

INTEGRATED FIRE MANAGEMENT

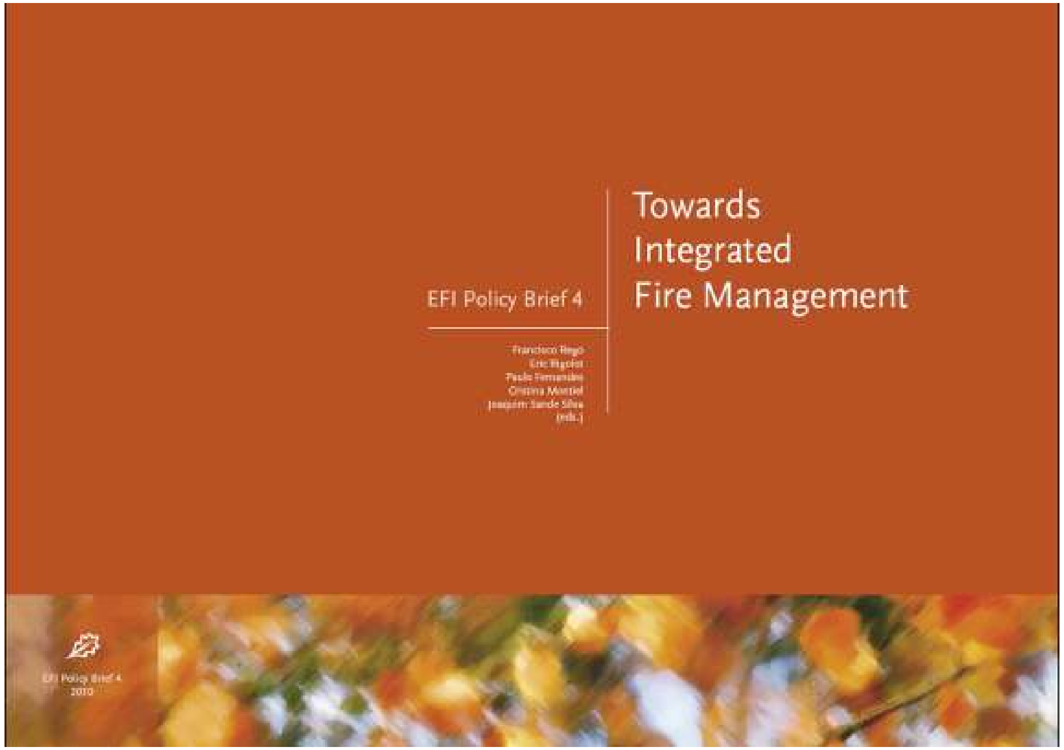


FIRE PARADOX

INTEGRATED FIRE MANAGEMENT

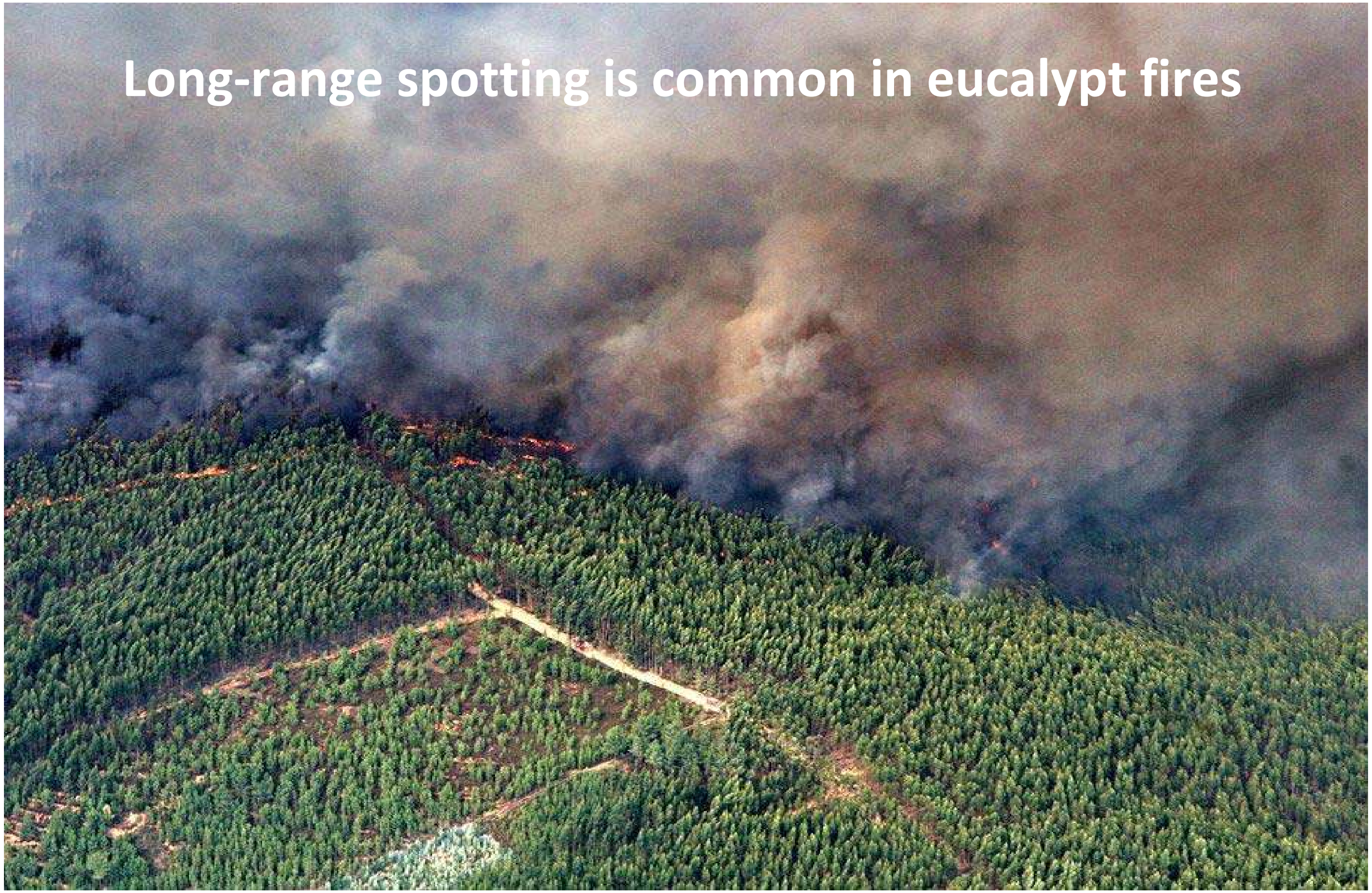


The proposal of a Framework Directive on Fire with the concept of Integrated Fire Management is influencing European Union policies, including using prescribed fire and suppression fires against wildfires, which were not previously allowed in many countries in Europe.



Still many questions to be answered by science:

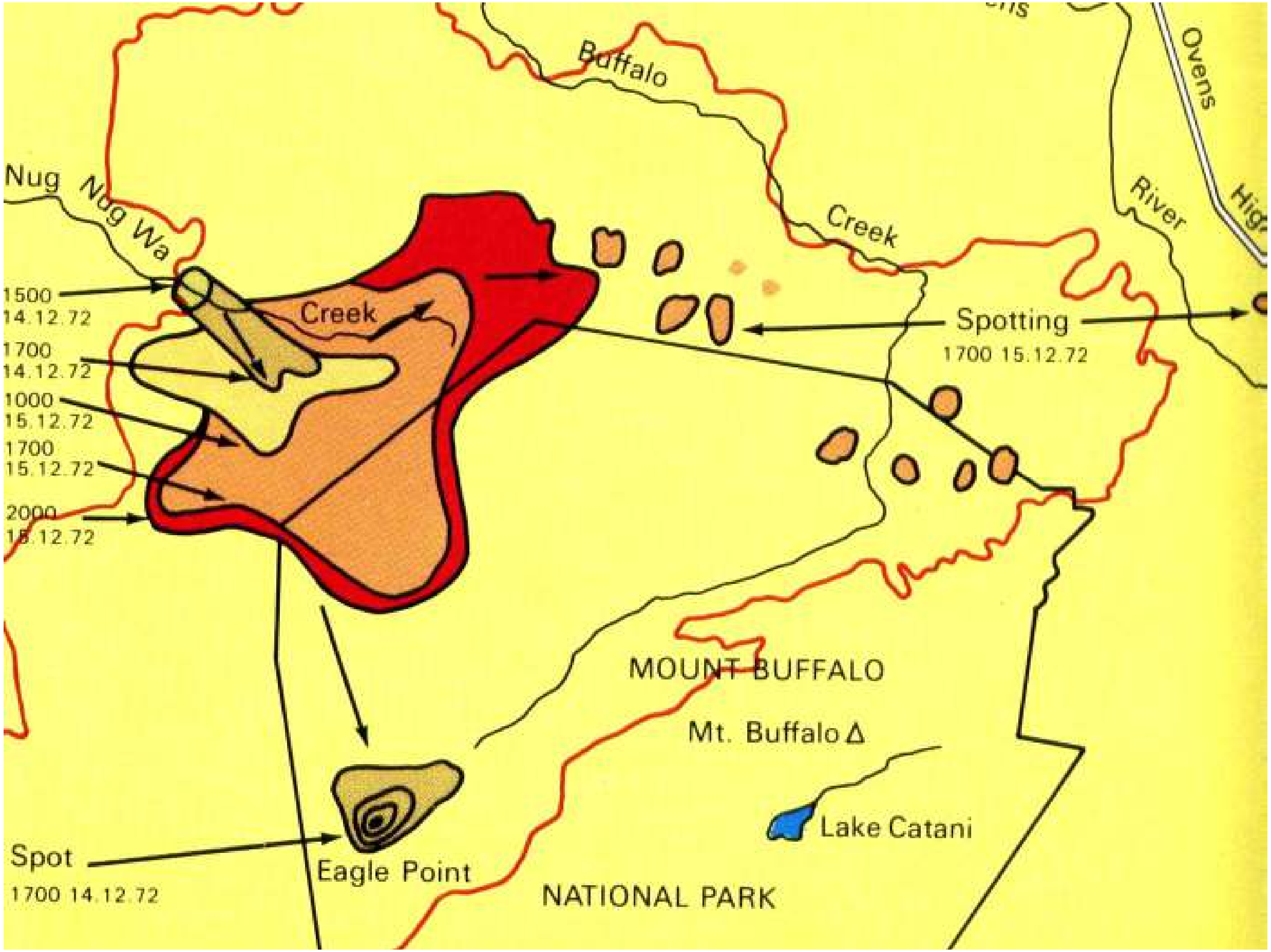
What is the maximum spotting distance from a wildfire?


Long-range spotting is common in eucalypt fires

Spotting fires

Australia

In a number of eucalypt fuel types, spotting distances of 30 km or more have been observed



Lessons from Australia:
For how long can they float in the air?

Sharing facilities:

We need good models to predict the flight of firebrands

This was possible with a vertical wind tunnel in Australia with Peter Ellis.

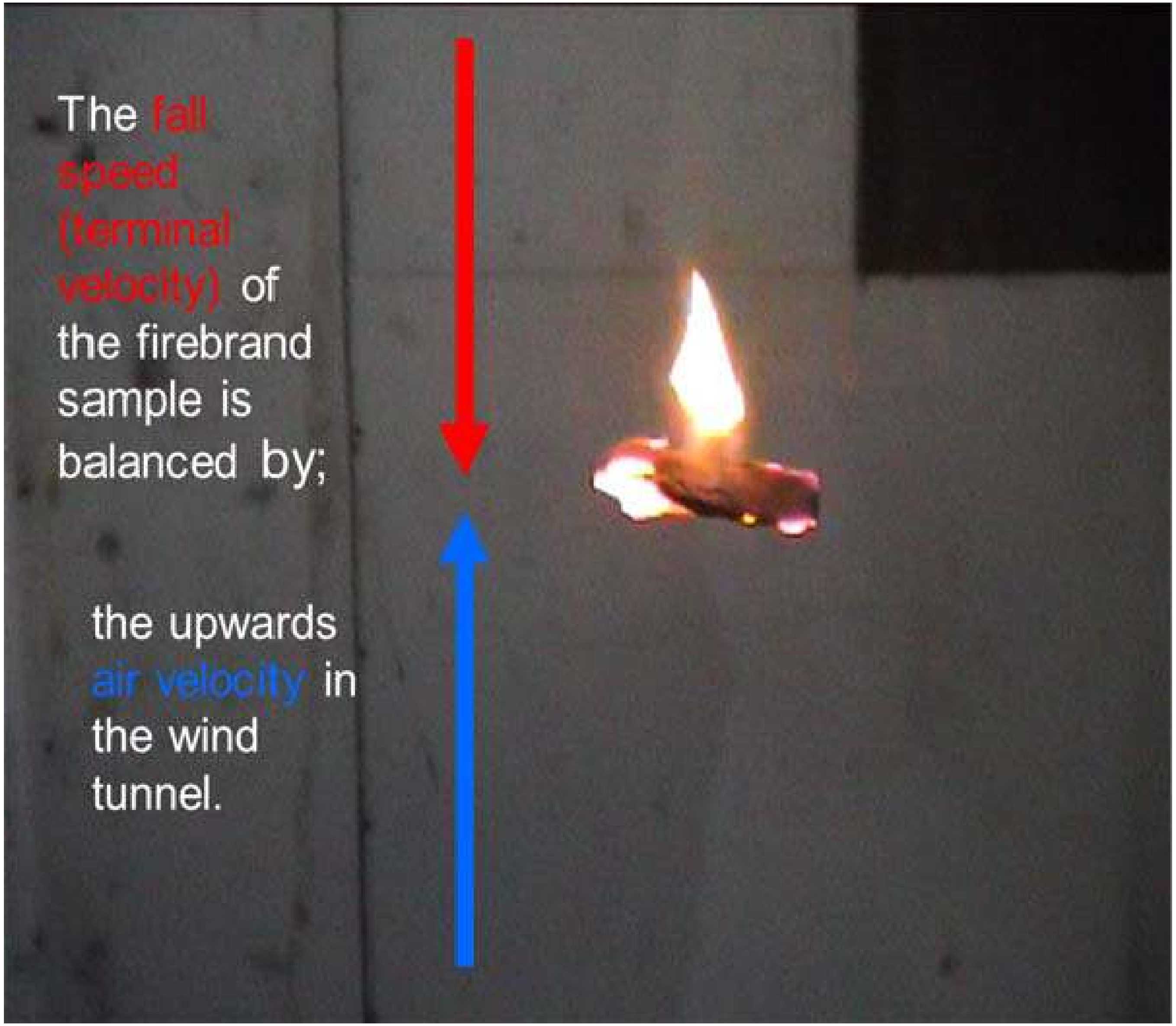
Fire Technology, 37, 87–100, 2001

The Design and Construction of a Vertical Wind Tunnel for the Study of Untethered Firebrands in Flight

I.K. Knight, CSIRO Forestry and Forest Products, PO Box E4008, Kingston ACT 2604, Australia, e-mail: Ian.Knight@ffp.csiro.au

Understanding the physical process.

The dry shedding bark of eucalypt trees is the key for the process of long-range spotting!

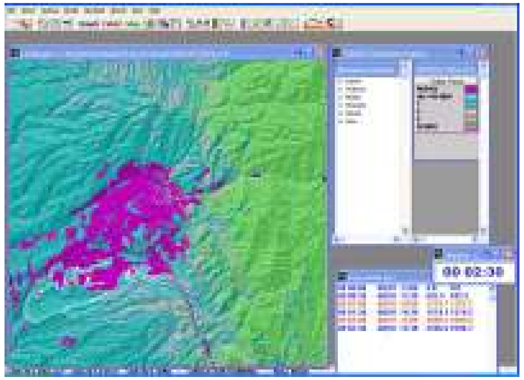


Understanding fire

Still many questions to be answered:

How do we model fire behavior with physics?

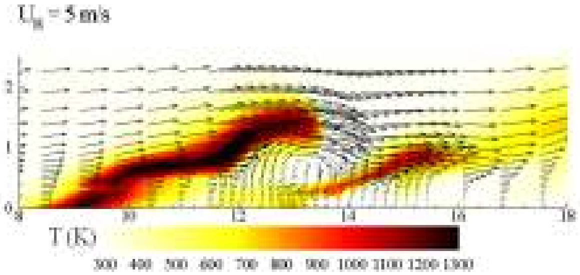
Current fire models



Farsite,

Flammap

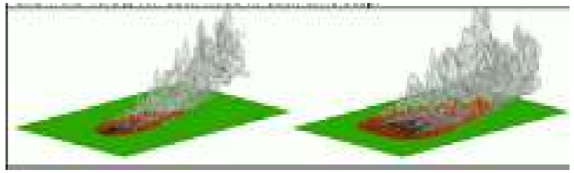
Semi-empirical models



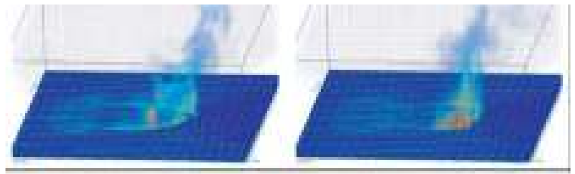
FireSTAR

2D ←——→ 3D

Tiger



FireTec

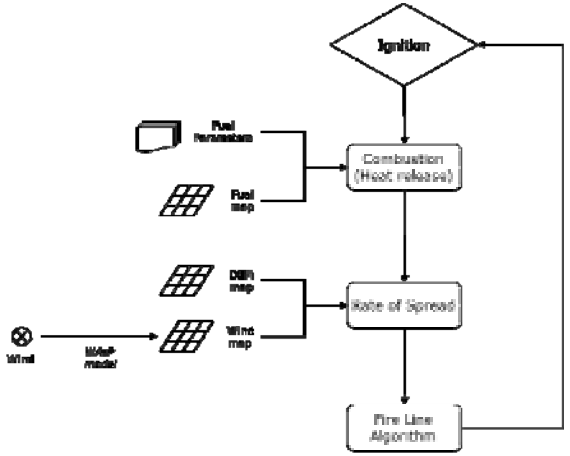


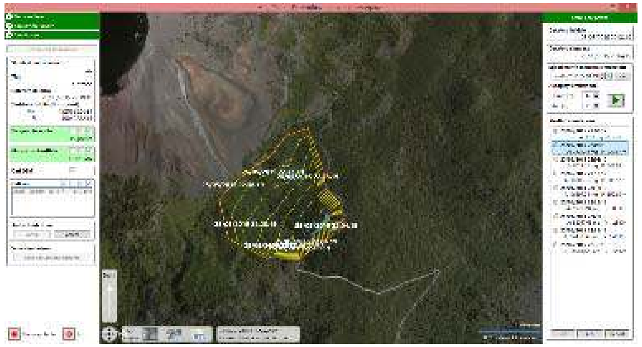
Physical models

(CFD - Computational Fluid Dynamics model)

New models from Italy

Tiger





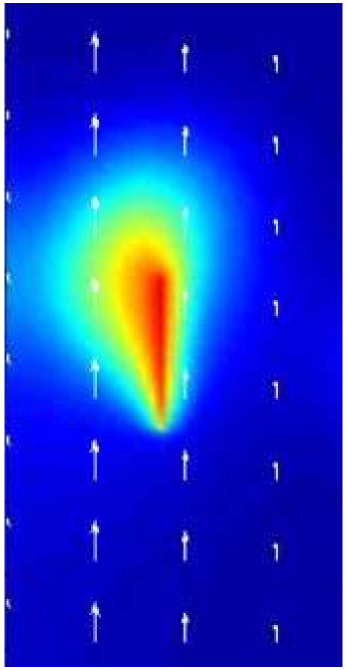
- Tiger: the model

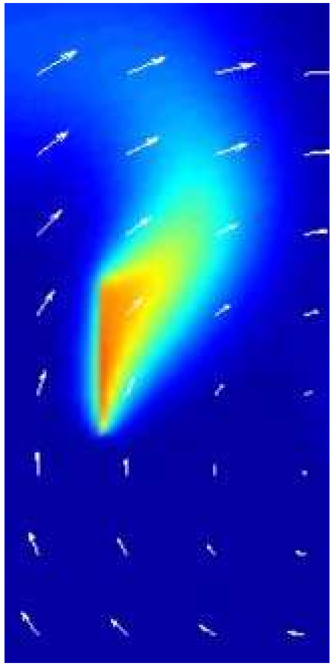
- Tiger MEG: the tool

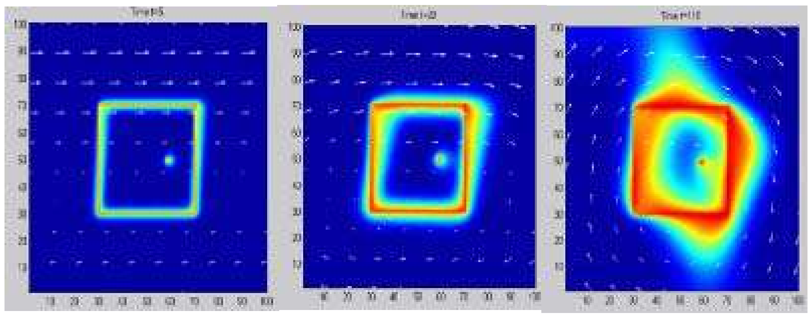
- Tiger 3D: the virtual Lab

Convection/diffusion processes

Matlab simulations to calibrate the wind influence on convection processes







The model

$$\frac{\partial T}{\partial t} = \boxed{-\nabla\cdot(v(P,t)T)} + \boxed{\nabla\cdot(\chi(P)\nabla T)} - \boxed{h(T)(T-T_\infty)} + \boxed{f(t,T)}$$

in plane convective term; in plane diffusive term; heat flux due to vertical convection; heat source due to combustion

where the quantities are:

- *T(P,t)* is the temperature scalar field
- *v(P,t)* is the wind vector field, function of space and time.

$\chi(P) = \frac{kV}{m(P)c}$ — *k* is the air conductivity, *V* is the volume of the cell, *m(P)* is the air mass in the cell, *c* is the specific heat of the air.

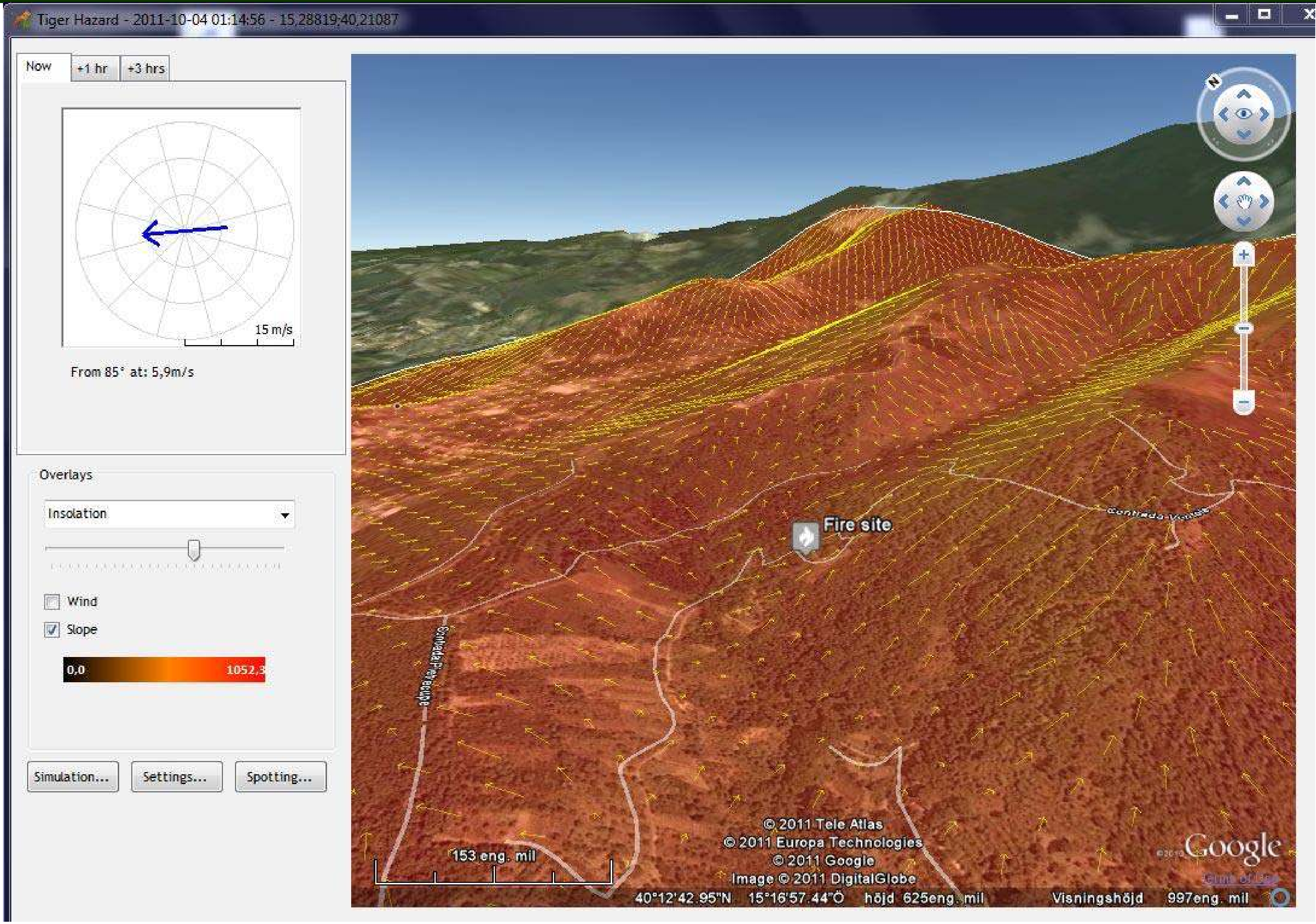
$h(T) = \frac{\bar{h}\cdot V}{m(P)c}(T-T_\infty)^{1/3}$ is the vertical convection heat transfer coefficient, being the T_∞ ambient temperature

- *f(t,T)* is the heat source due to combustion in the cell.

The in-plane convective term is responsible for the motion of the air temperature field along the lines of the wind vector field.

$$v(P,t) = v_0(P,t) + \Delta v_1(P,t) + \Delta v_2(P,t)$$

Integration of wind: WASP technology



Effects of the variation in wind conditions

FIRE PARADOX

Tiger MEG

TIGER MEG: A DSS TOOL TO ASSESS AREAS OF FIRE IGNITION

Francesco Giannino[1], Marco di Fonzo[2], Davide Ascoli[3], Duncan Heathfield[4], Vesa Kivistö[4], Francisco Castro Rego[5], Stefano Mazzoleni[1]

[1] University of Naples Federico II, Italy
[2] Corpo Forestale dello Stato CFS, Italy
[3] University of Torino, Italy
[4] World in a Box, Finland
[5] University of Lisboa, Potugal

Università degli Studi di Napoli Federico II

Corpo Forestale dello Stato

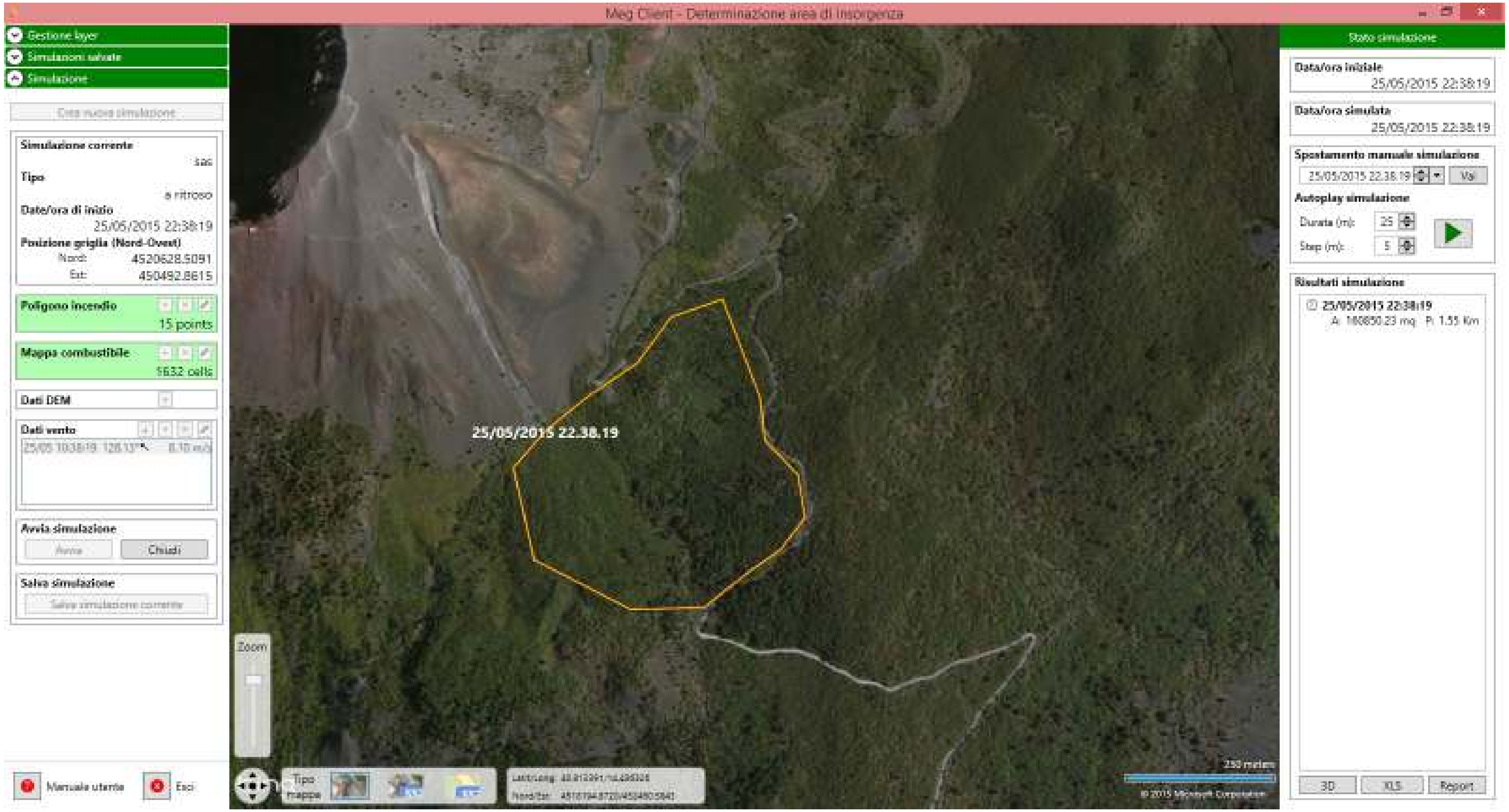
WORLD INABOX

Universidade de Lisboa

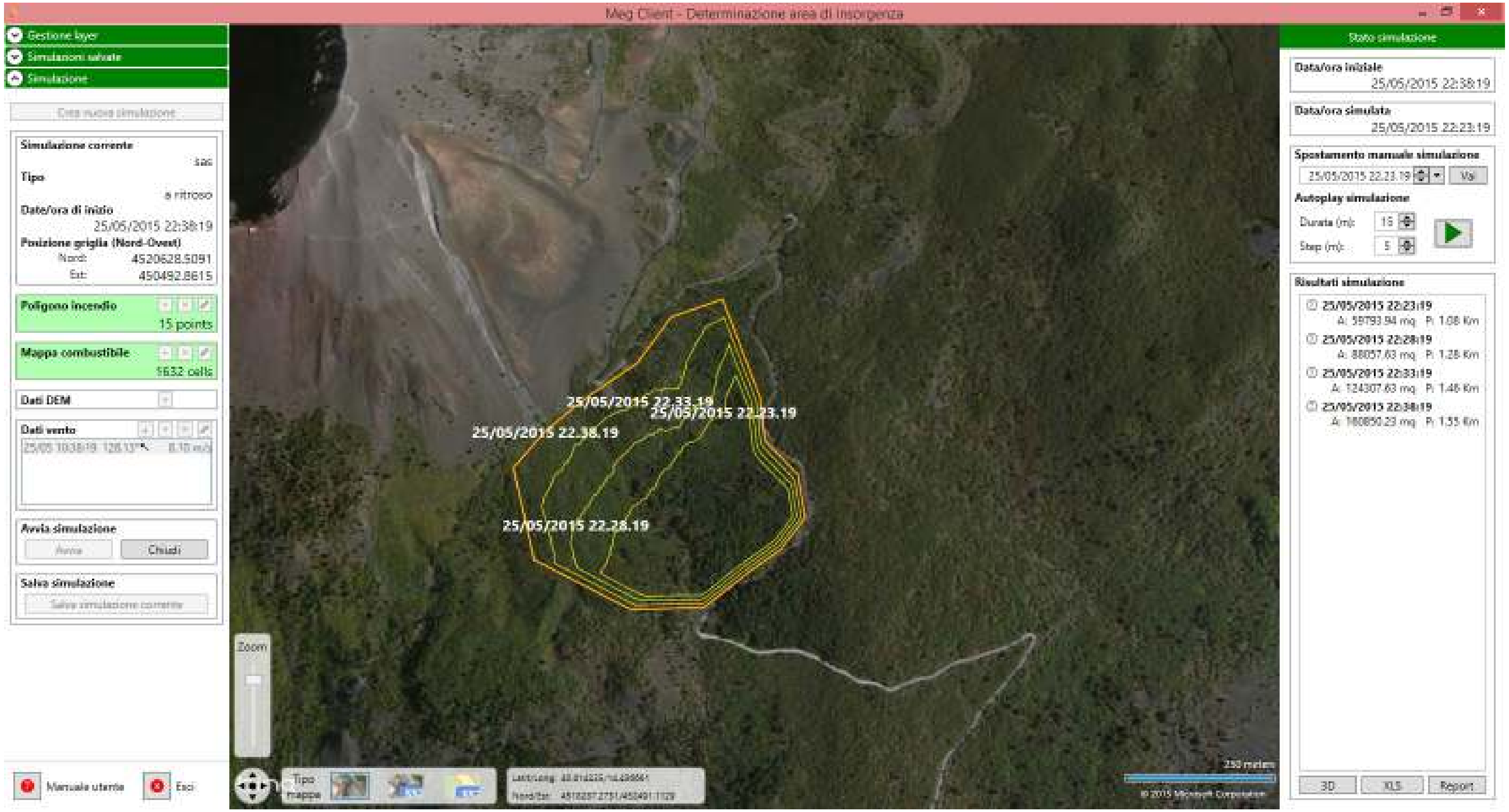
Università degli Studi di Torino

VITROCISET

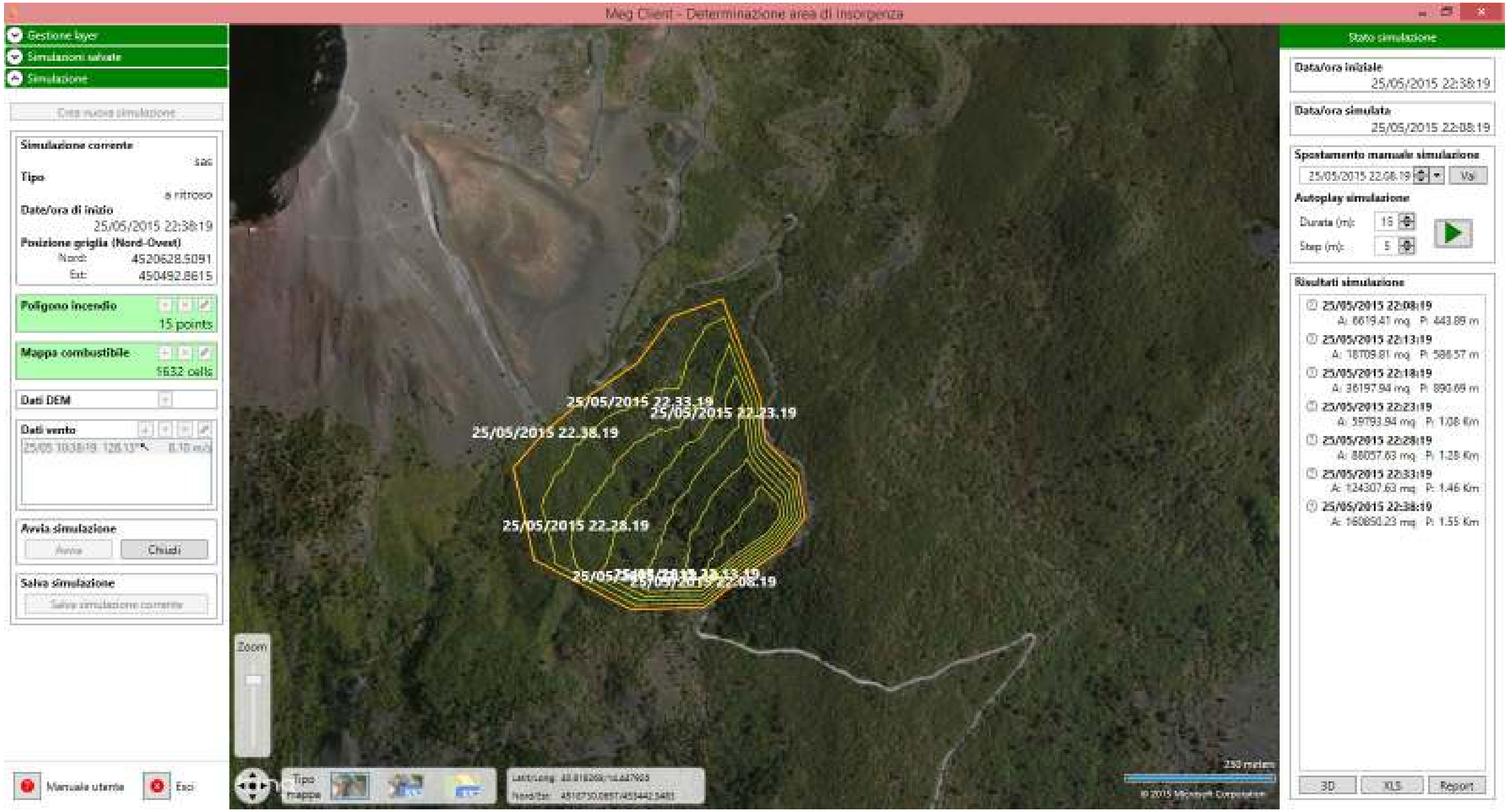
MEG client (calculations backwards)



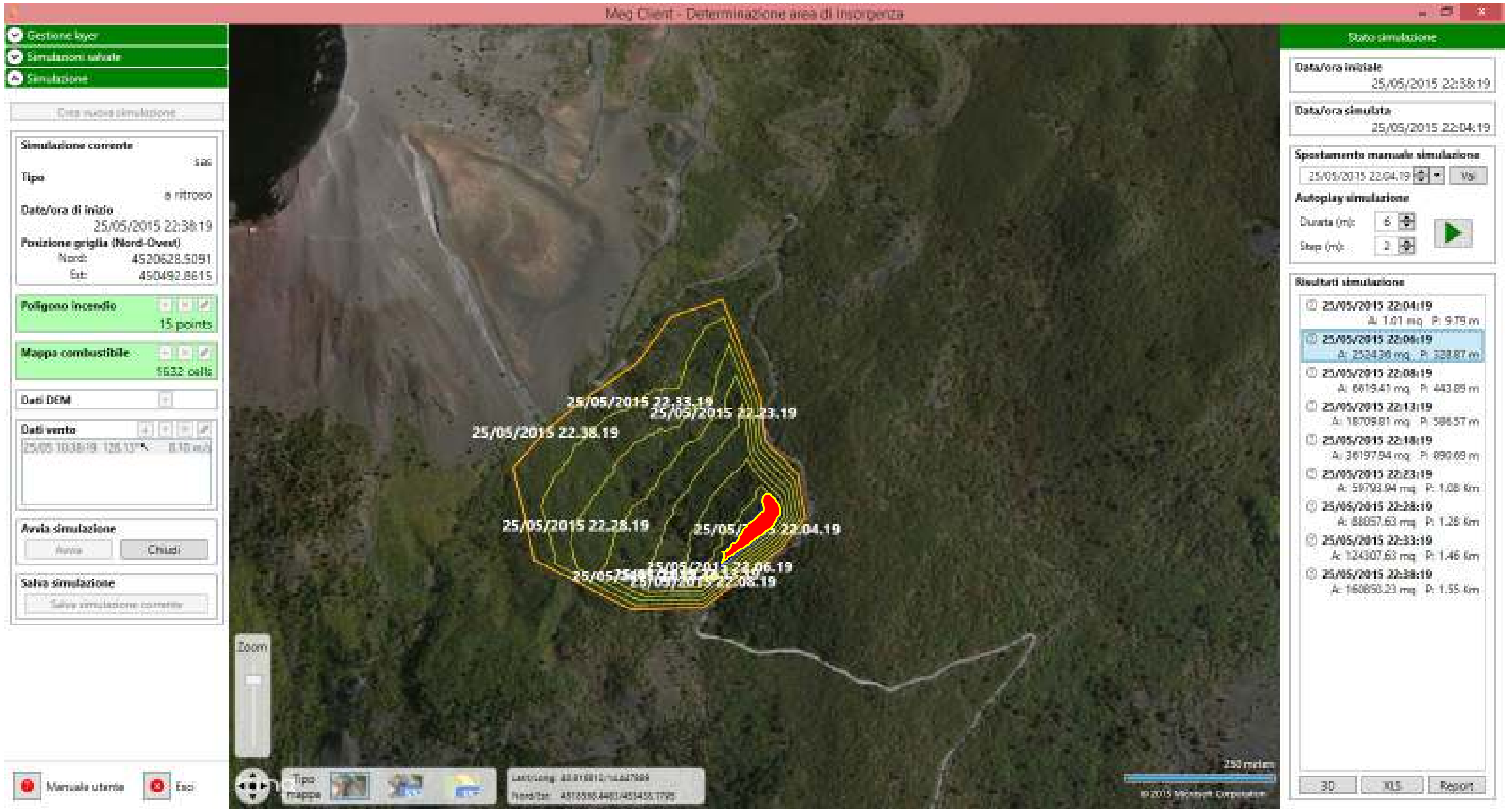
MEG client (calculations backwards)



MEG client (calculations backwards)



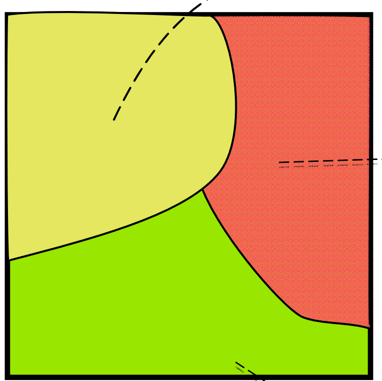
MEG client (calculations backwards)



TIGER 3D virtual lab: integration with FFAS - CFS (Forest fire area simulator)

FFAS: display of vegetation types

2D



Vegetation types
short grass
tall grass
short maquis
high maquis
shrub undergrowth
litter
conifer litter
olive grove
pines
chestnut
holly oak
deciduos oak

3D

From the scientific and technical points of view, the development of the Tiger system, now used for training Italian Forest Service officers, was an important consequence of the FIRE PARADOX project.

http://video.repubblica.it/edizione/napoli/napoli-un-avatar-contro-gli-incendi-dolosi-e-i-disastri-ambientali/214110/213282

http://www.rai.tv/dl/RaiTV/programmi/media/ContentItem-7060dd29-ff14-4539-9e16-d5557ad6d147-tg1.html


Thank you!