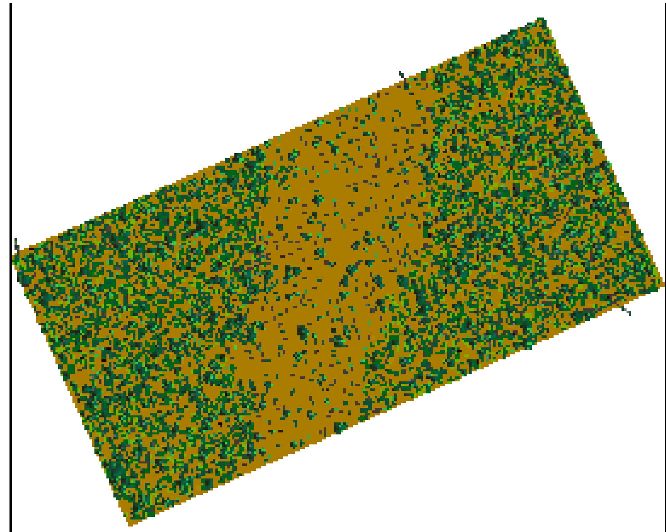
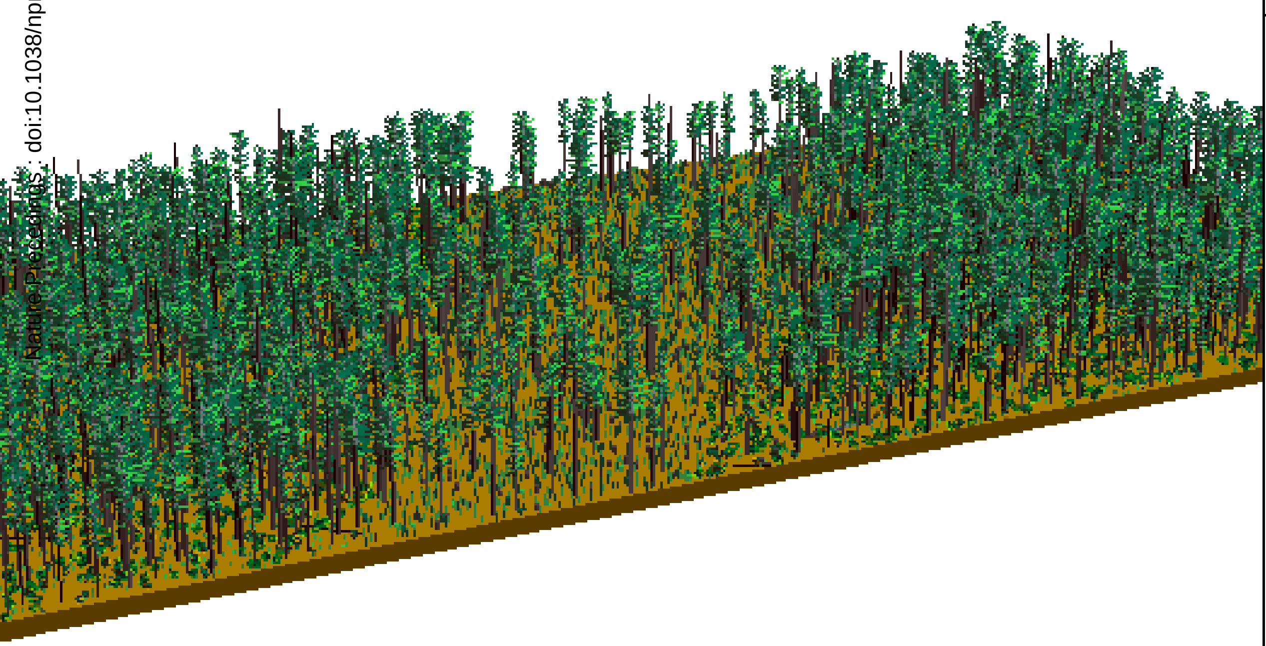
EFIMED AM 2010, Scientific Seminar " Knowledge base management of Mediterranean forests under climate driven risks: the ways ahead“, Antalya, Turkey, 15-16 April 2010



Creating “fire smart” forests and landscapes



Paulo Fernandes

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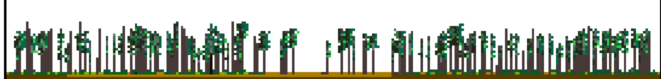
DEPARTMENT OF FOREST & LANDSCAPE

CITAB
Centre for Research and Technology of Agro-Environment and Biological Sciences

phoenix



Introduction

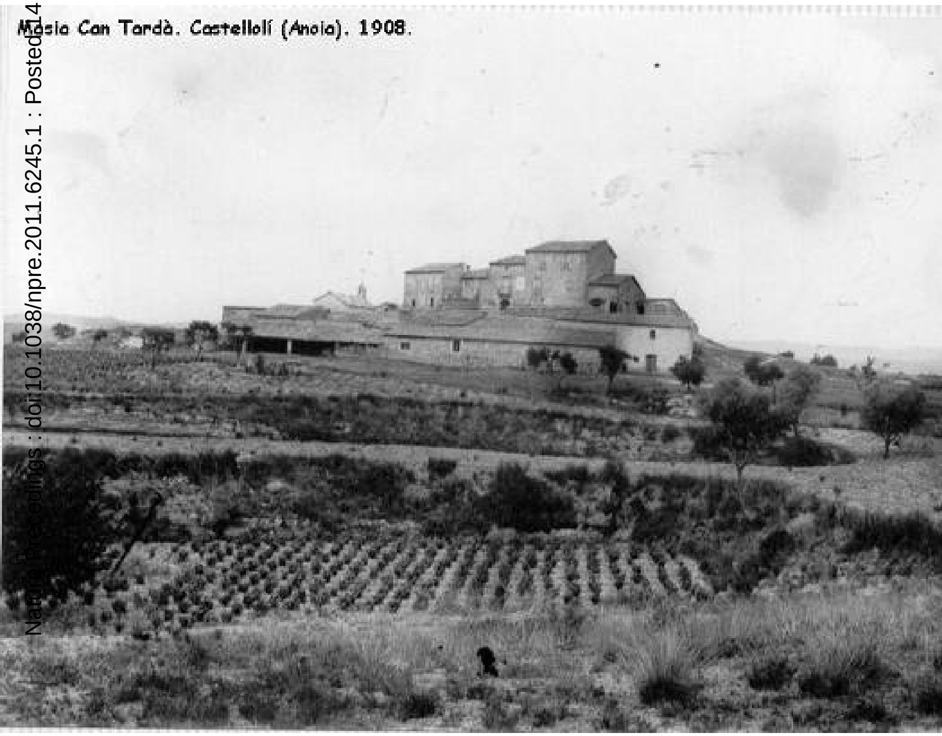
Fire control in the Mediterranean Basin

From traditional land use mosaics

… to contemporary fire management policies

Introduction

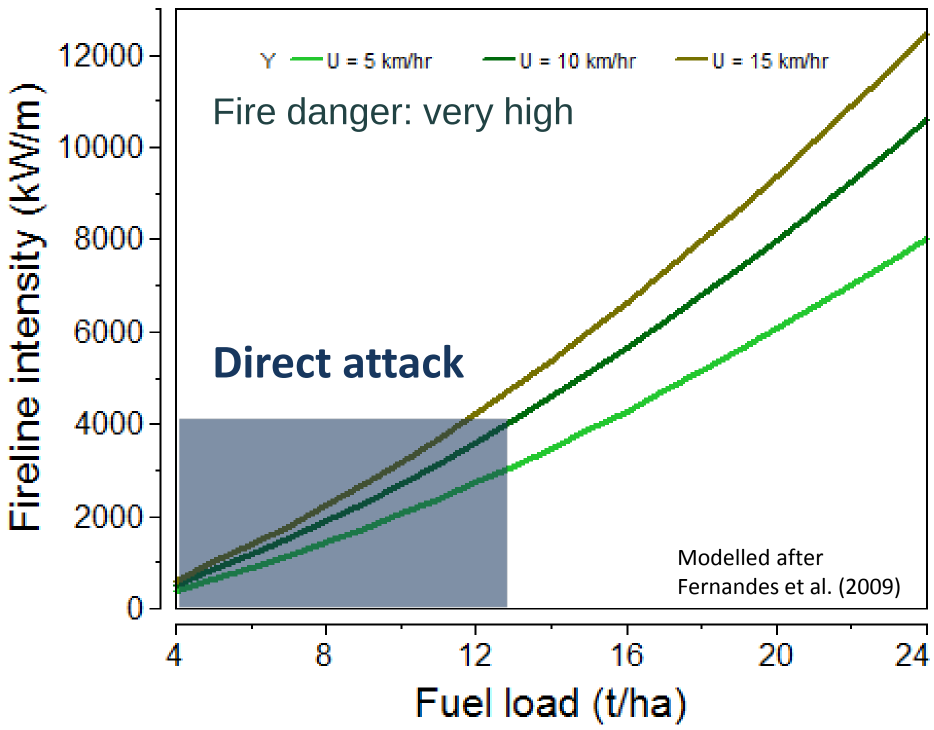
More forest and less forest management:
fuel accumulation

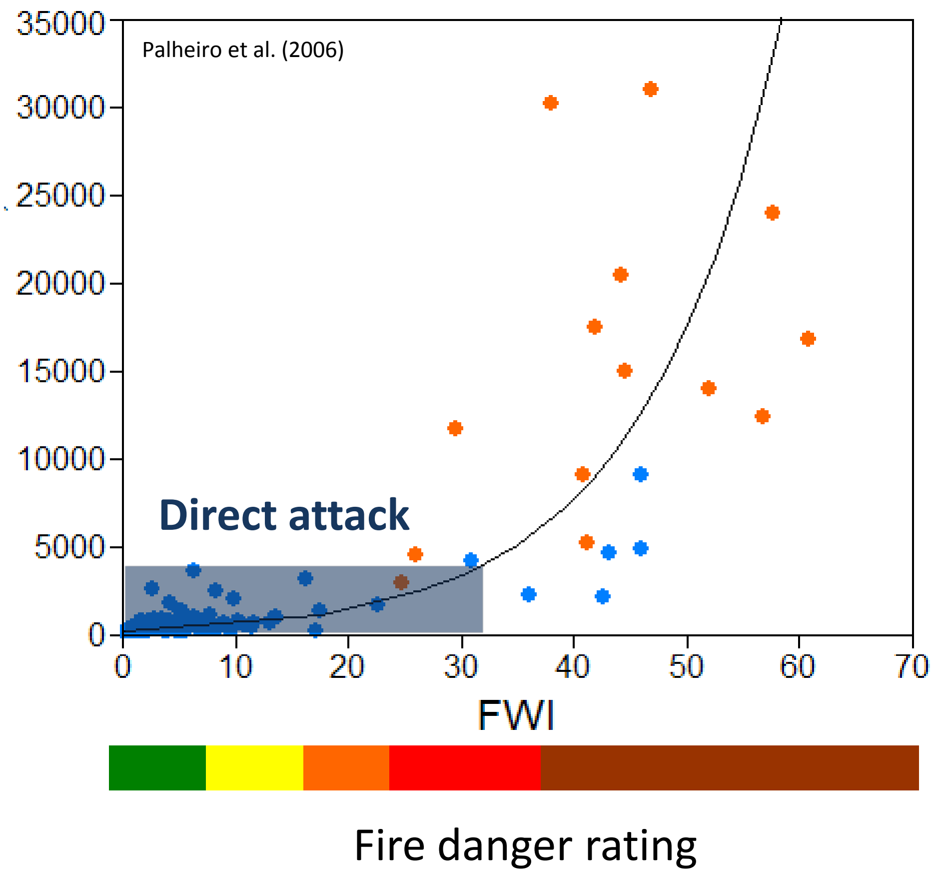


Introduction

Fire control is limited by fuel and weather

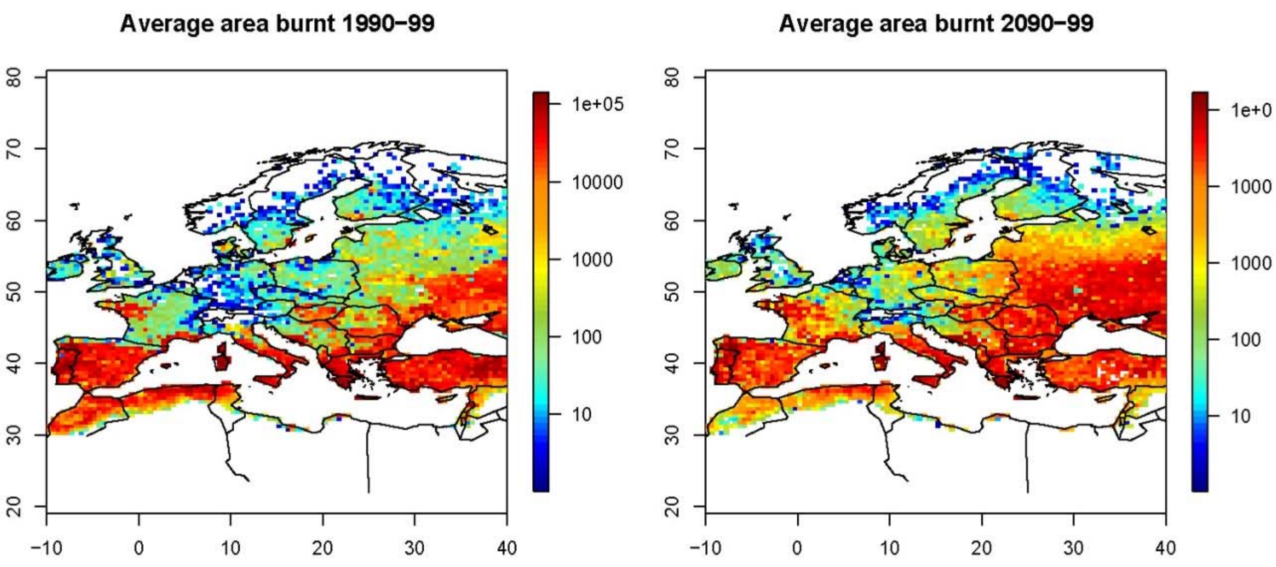
Pinus pinaster forest





Introduction

Climate change, fire danger and fire incidence



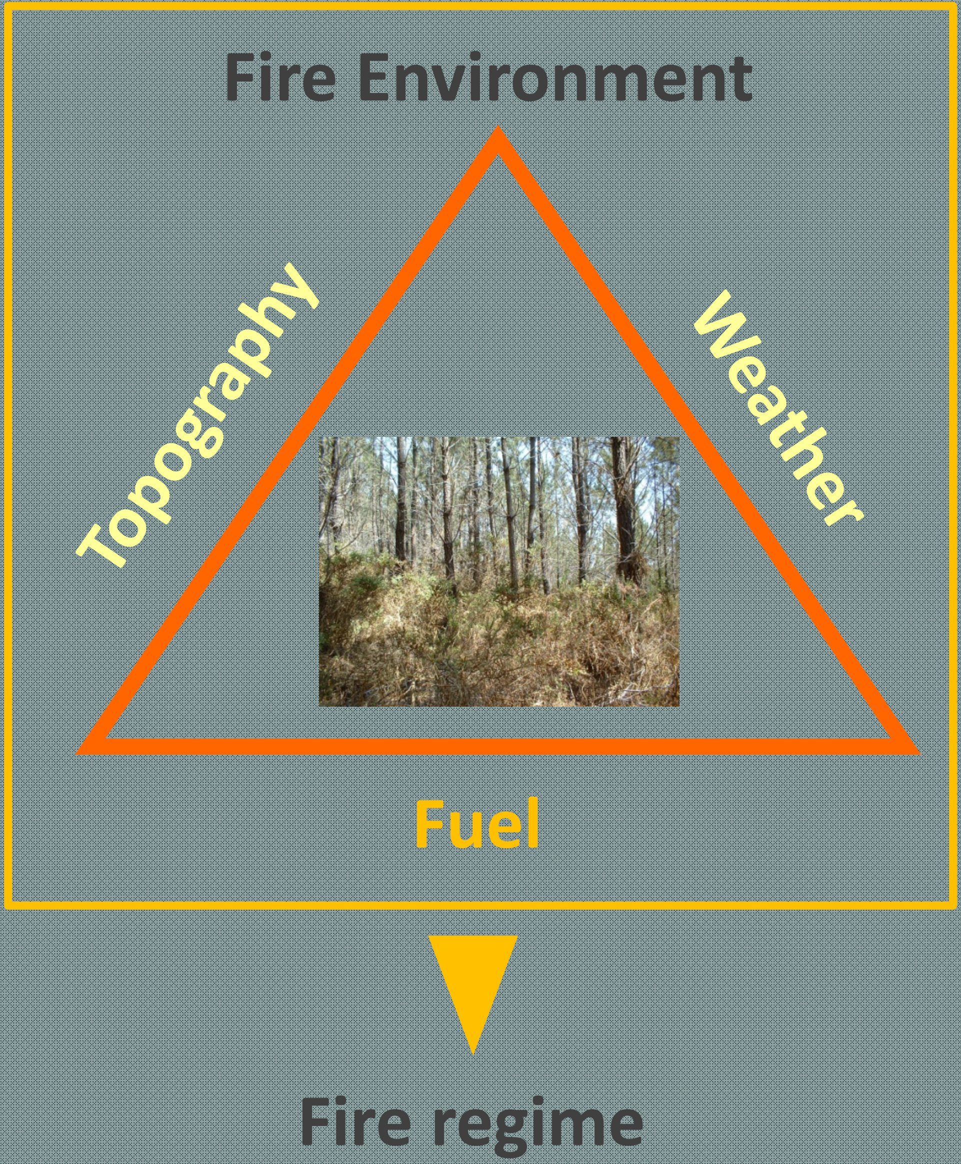
Fire activity is expected to decrease in the southern Mediterranean

Thonicke et al. (2010)

Mediterranean and boreal forests will adapt to climate change with more difficulty. Protection from wildfire will be important in these forest types, including **large-scale fuel management**, eventually through prescribed burning.

In Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the IPCC

“Fire smart” forests and landscapes



"Fire smart" forests and landscapes

Goals

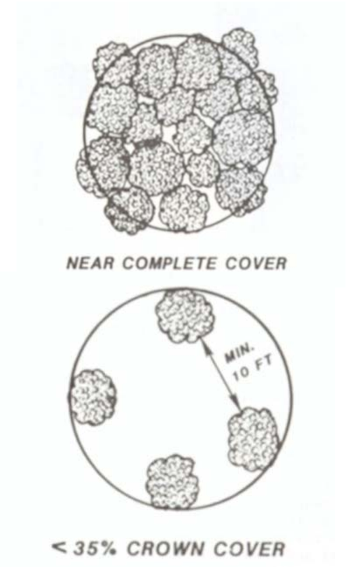
- Fire suppression capacity is expanded :

  AREA BURNED is minimized

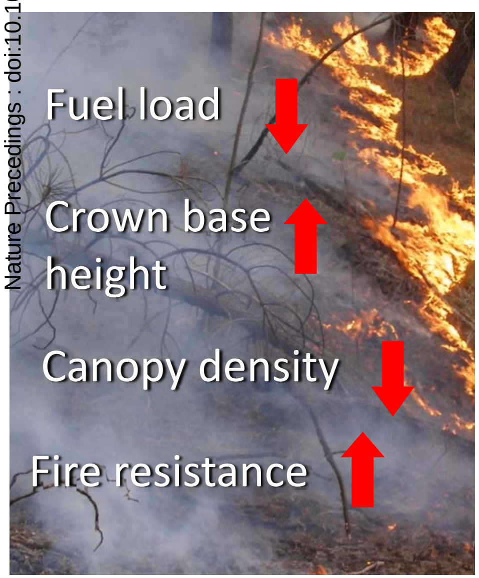
- Decreased fire severity:

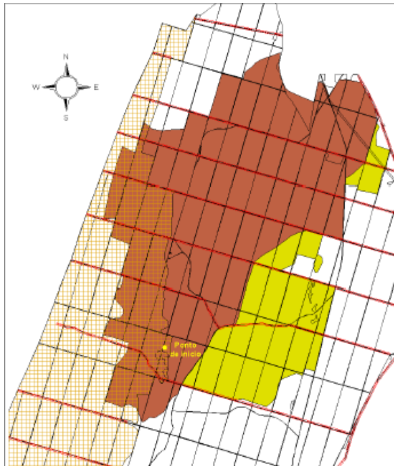
  Increased RESISTANCE or RESILIENCE to FIRE

“Fire smart” forests and landscapes: state of the art



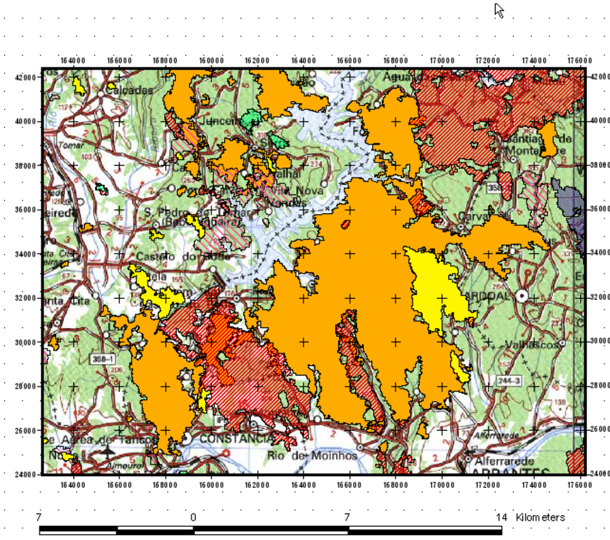
- Current “preventive silviculture” guidelines and practices are not science-based. Some published recommendations oppose empirical and scientifical knowledge.
- Objective criteria to manage forest stands against wildfire are available, but quantitative guidelines for prescription development are incipient.
- Generalized lack of experimental studies.
- Limited assessment of fuel management effectiveness from
  - Fire regime analysis
  - Fire modelling
  - Wildfire case studies
  - Evaluation by experts



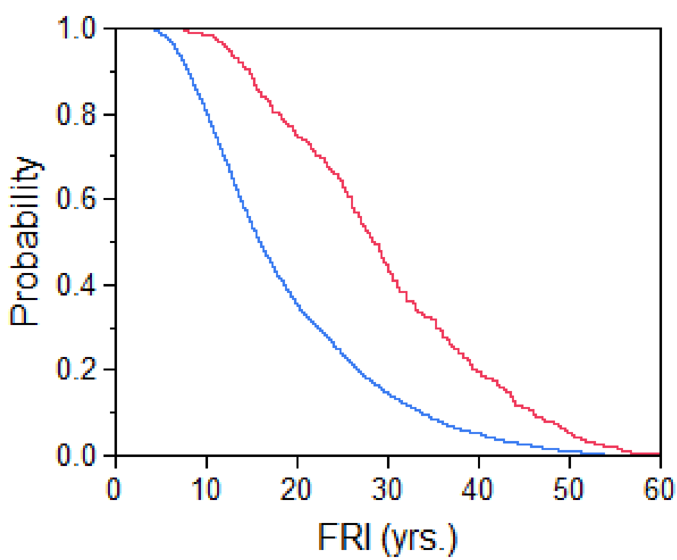


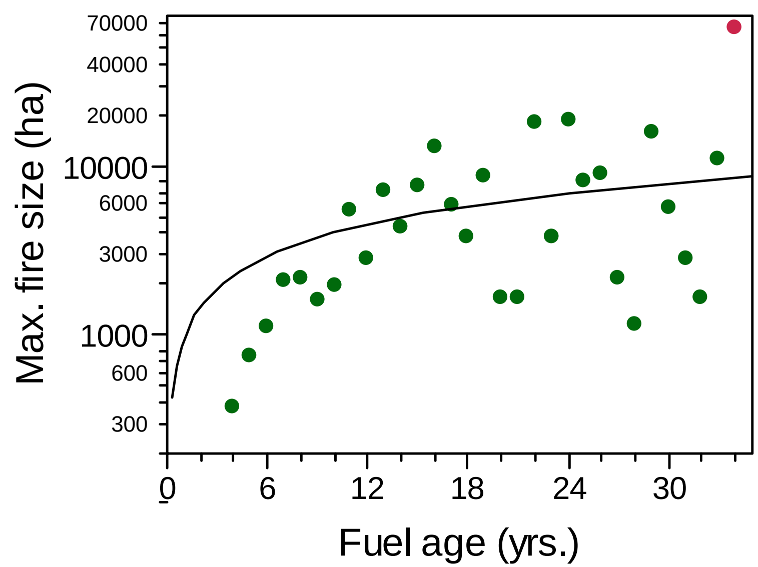
Analysis of the fire regime: control by fuel or by weather?

Fire frequency analysis (Portugal, 1998-2008)



- The control of wildfire incidence by fuel age is weak to moderate.
- However, the fuel effect on burn probability is independent from weather conditions.
- Wildfires in younger fuels tend to be smaller and less variable in size



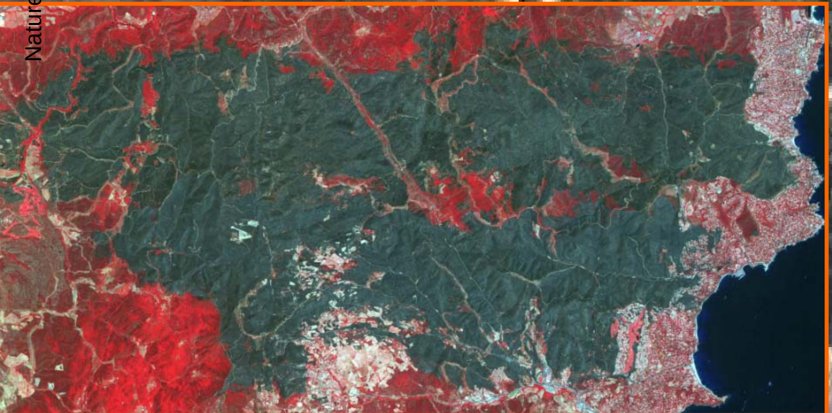


Fuel break effectiveness: wildfire case studies

(Perchat & Rigolot 2005)

Réseau Coupures de combustible

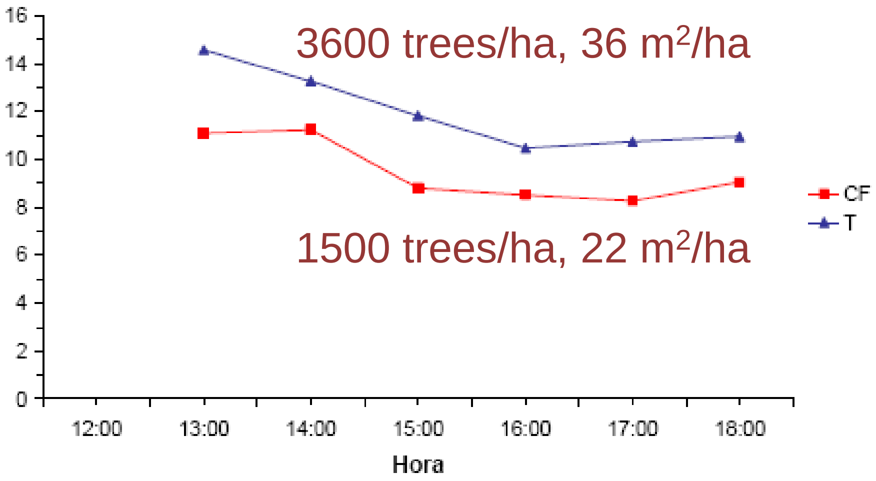
- **Most fuel breaks were crossed or transposed by headfire, but still delayed fire growth.**
- **Prescribed fire and/or grazing are recommended in the areas adjacent to the fuel breaks.**
- **Fuel breaks parallel to fire spread were very effective at restraining lateral fire growth.**
- **Reduce network density.**



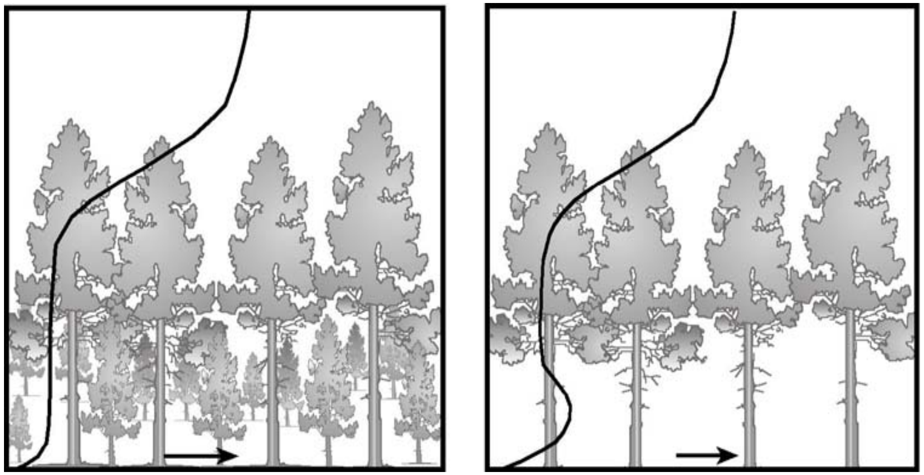
Impact of silvicultural treatments on the fire environment

Effect of thinning on fuel moisture

Pinus pinaster, NW Spain (Ruiz 2007)



Effect of thinning on wind speed



Impact of silvicultural treatments on fire behaviour: wildfire case studies

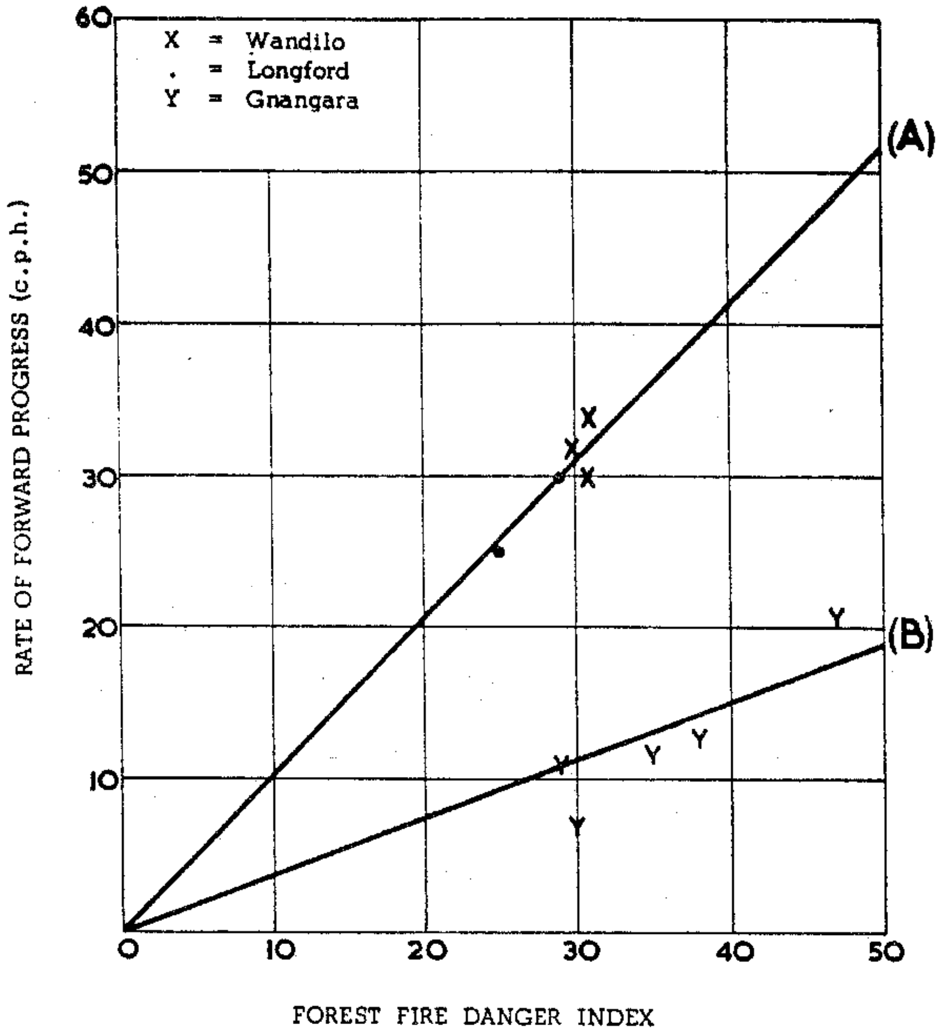
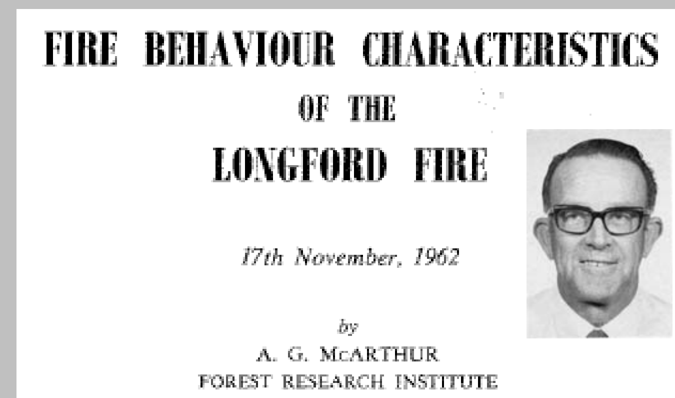


FIGURE 4.—Rate of spread in exotic pine plantations related to the forest fire danger index—
(A) in unpruned *P. radiata* plantations at Longford and Wandilo, S.A.,
(B) in pruned *P. pinaster* plantations at Gnangara, W.A.

Effect of pruning

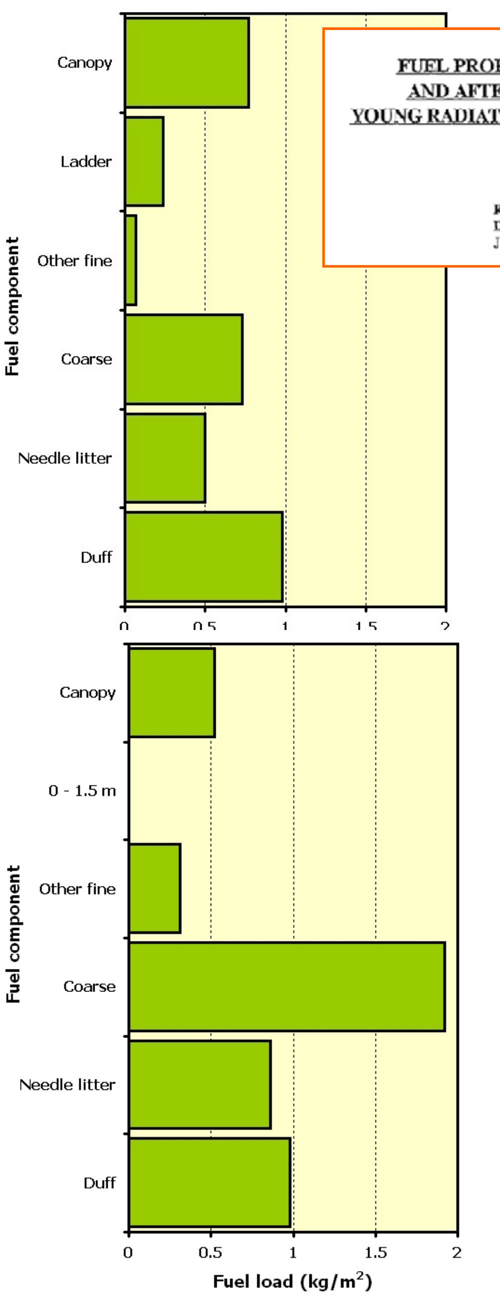
Pinus radiata & P. pinaster, Australia

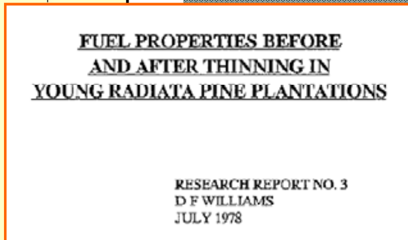

FIRE BEHAVIOUR CHARACTERISTICS
OF THE
LONGFORD FIRE

17th November, 1962

by
A. G. McARTHUR
FOREST RESEARCH INSTITUTE

Impact of silvicultural treatm. on fire behaviour: modelling studies





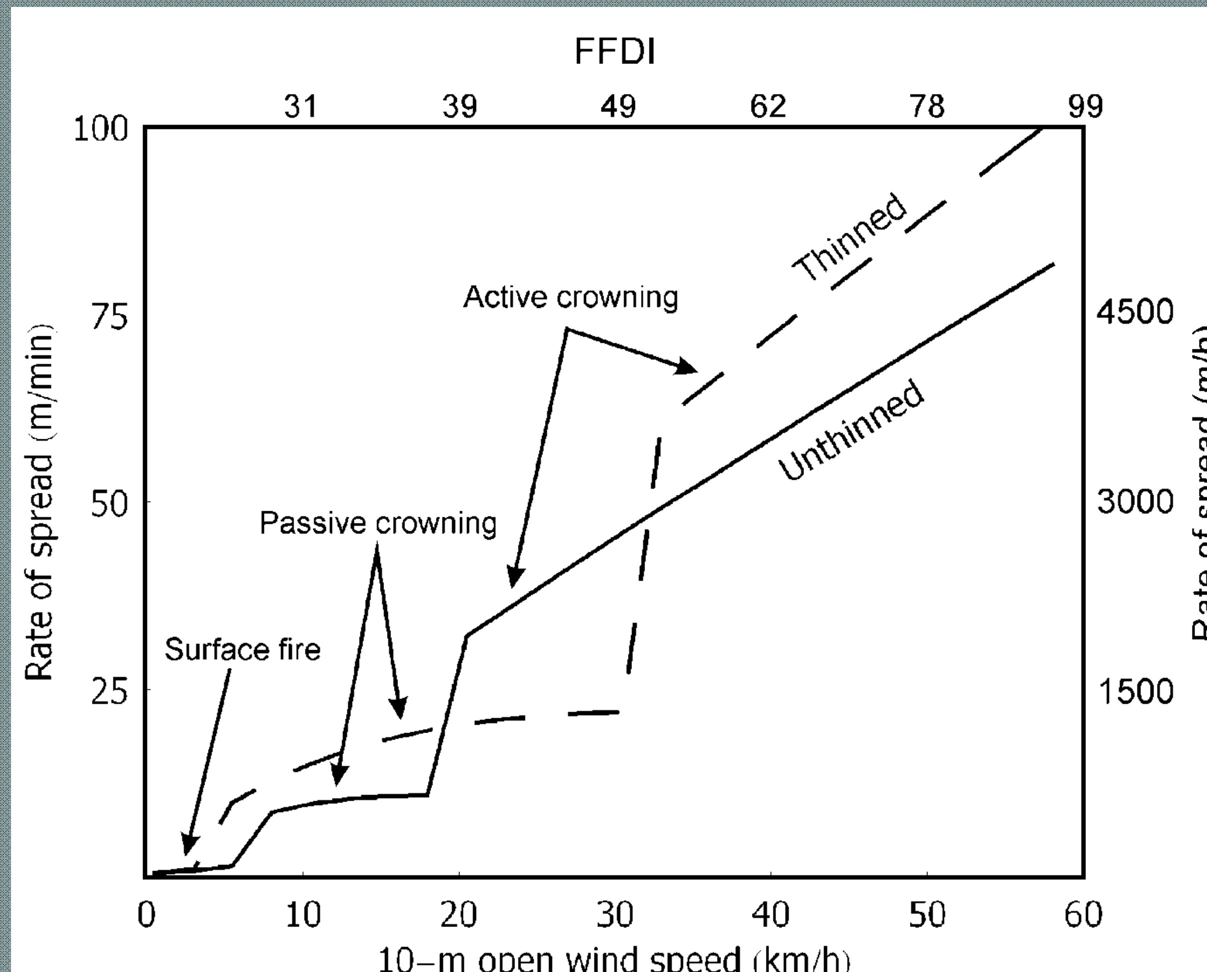
FUEL PROPERTIES BEFORE
AND AFTER THINNING IN
YOUNG RADIATA PINE PLANTATIONS

RESEARCH REPORT NO. 3
D F WILLIAMS
JULY 1978

Effect of thinning

Pinus radiata, Australia

Cruz et al. (2008) after Williams (1978)



Impact of fuel treatments on fire behaviour: experimental studies

Longevity of prescribed fire treatment

Pinus pinaster, NE Portugal

Untreated and 13-yr. old treatment

Crown fire (passive to active)

Intensity = 2000 – 11000 kW m^{-1}

Mortality = 100%

3- and 2-yr. old treatment

Surface fire

Intensity = 200–1000 kW m^{-1}

Mortality = 41-55%

Fire intensity decreased up to 10 years

(Fernandes 2009)

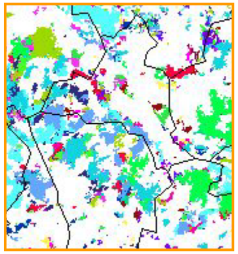
Resistance to fire and stand structure: insights from fire history

Mature, uneven-aged Mediterranean pine forests under a fire regime of low to moderate severity

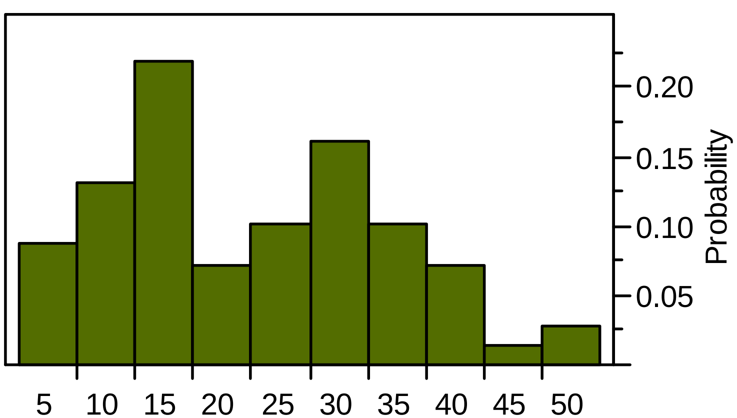
Fule et al. (2008), SE Spain, *Pinus nigra*

Vega (2000), SW Spain, Sierra Bermeja, *Pinus pinaster*

Resistance to fire and stand structure: insights from fire history



- Fire-resistant pine patches are open, vertically discontinuous, and coincide with frequent low-intensity fires. Their structure can be used as a silviculture model for fuel-breaks and other fuel-treated areas.



Fire hazard and stand structure: expert knowledge

González et al. (2007)

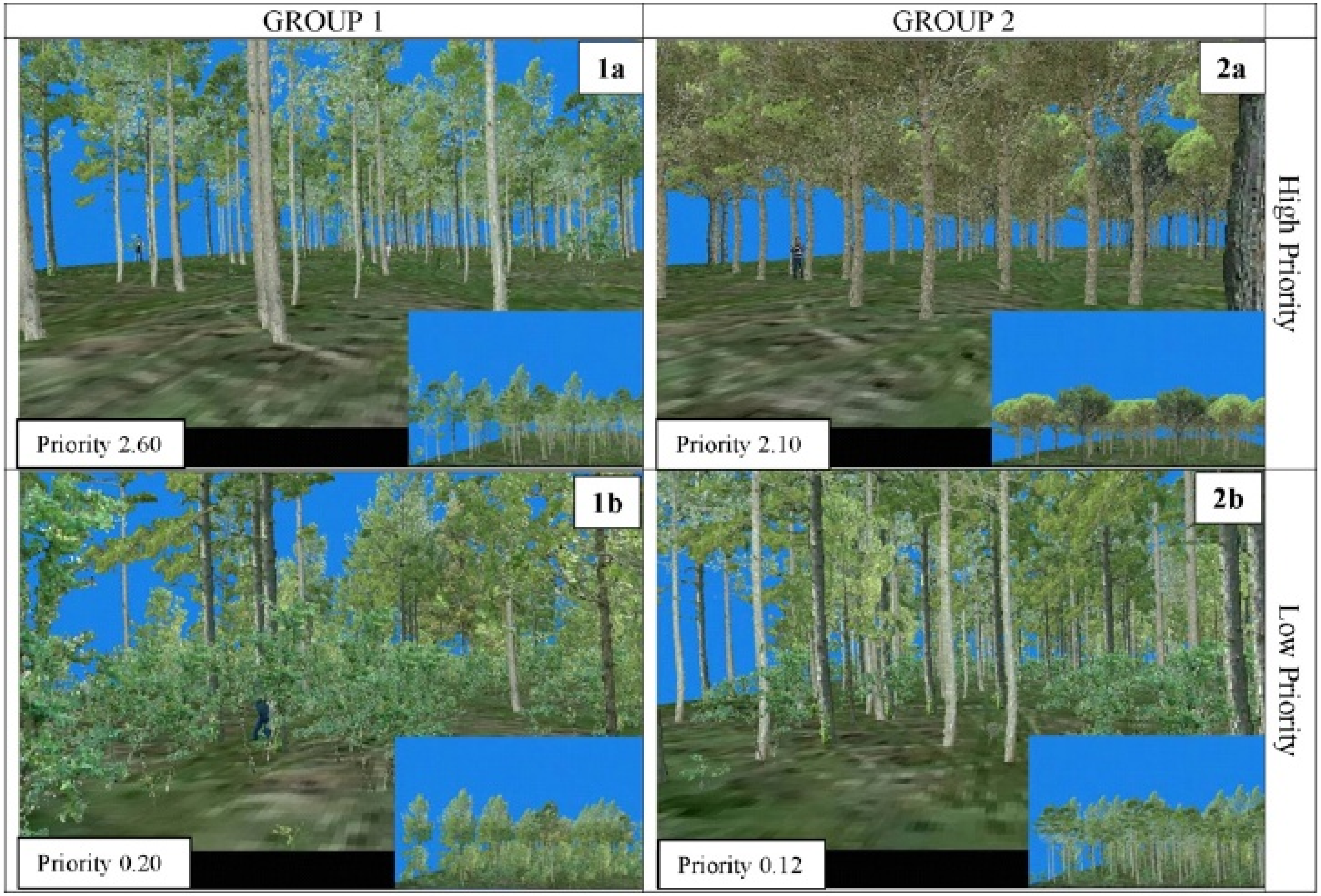


Fig. 2. Virtual reality stands and their observed priorities with respect to fire vulnerability. Lower priorities mean higher perceived vulnerability.

How do fires burn in different forest types? post-fire studies

Nature Precedings : doi:10.1038/npre.2011.6245.1 : Posted 14 Aug 2011

Fire modification in forest types adjacent to *Pinus pinaster* stands

Fire intensity:

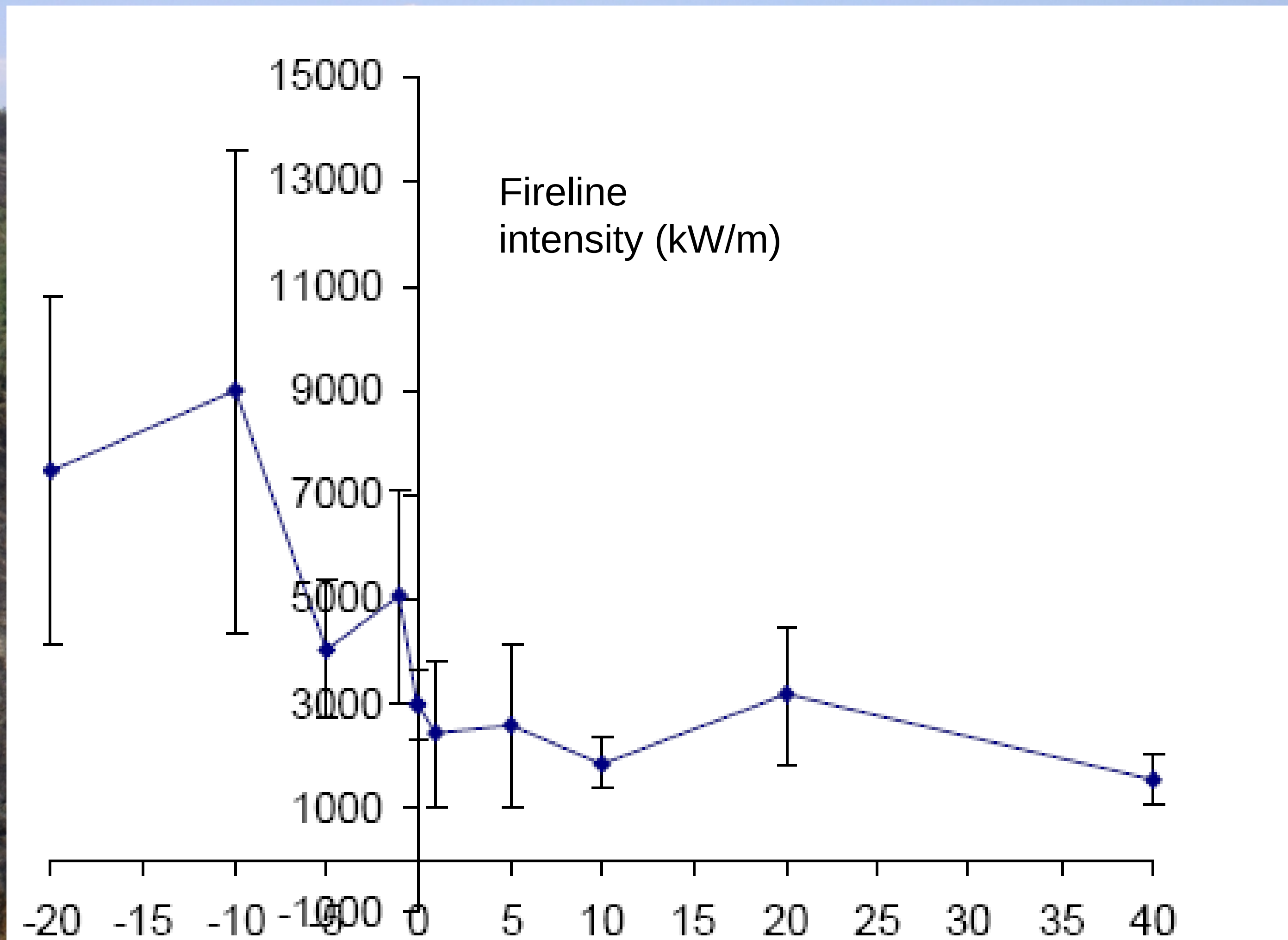
- Short-needled conifers < deciduous broadleaves < *P. pinaster*

Fire severity:

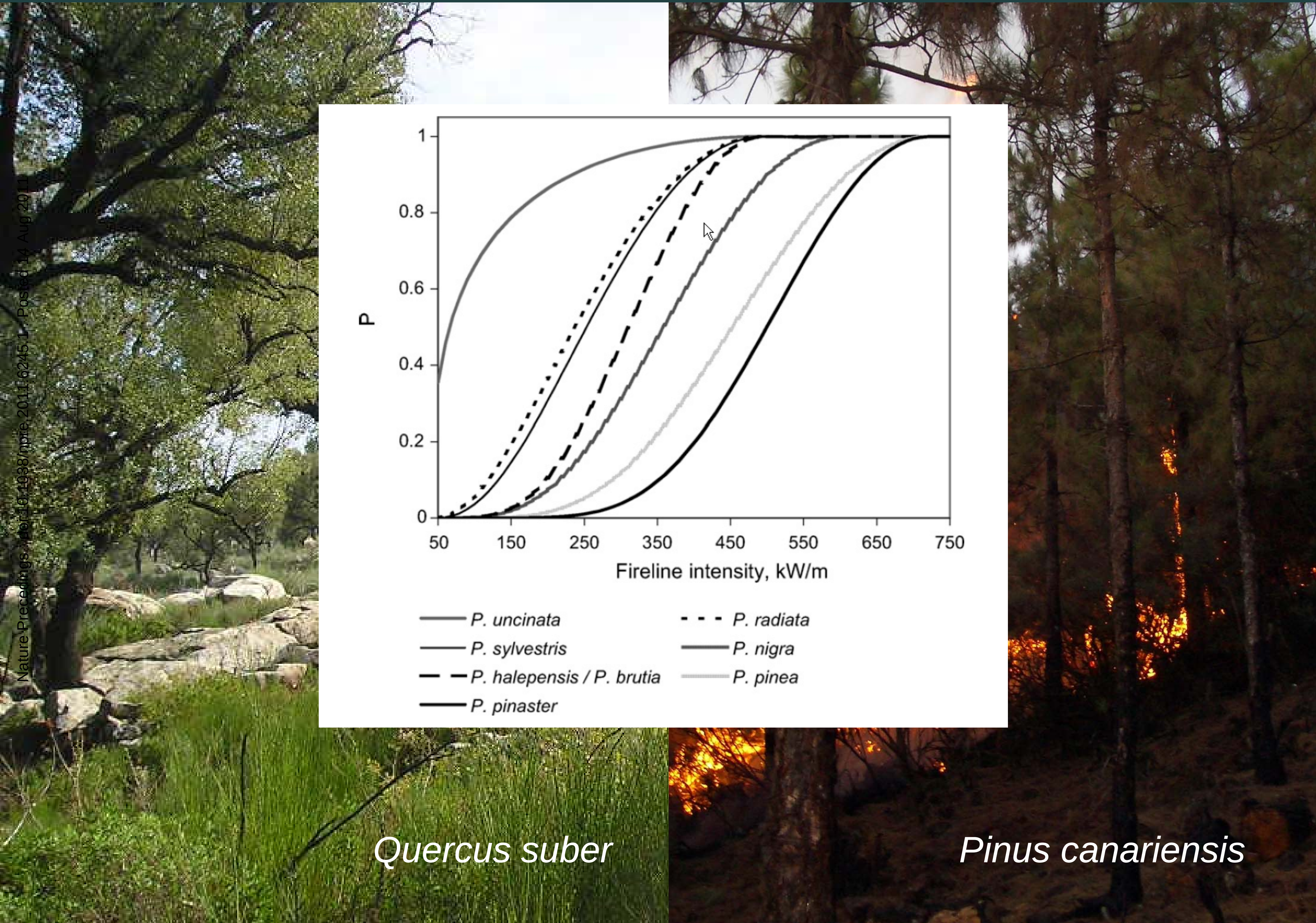
- (Short-needled conifers, evergreen broadleaves, deciduous broadleaves) < *P. pinaster*
- More abrupt decline in deciduous broadleaves
- Stand maturity decreases fire severity

How do fires burn in different forest types? modelling studies

Quercus rotundifolia, NE Portugal (Azevedo et al. 2008)

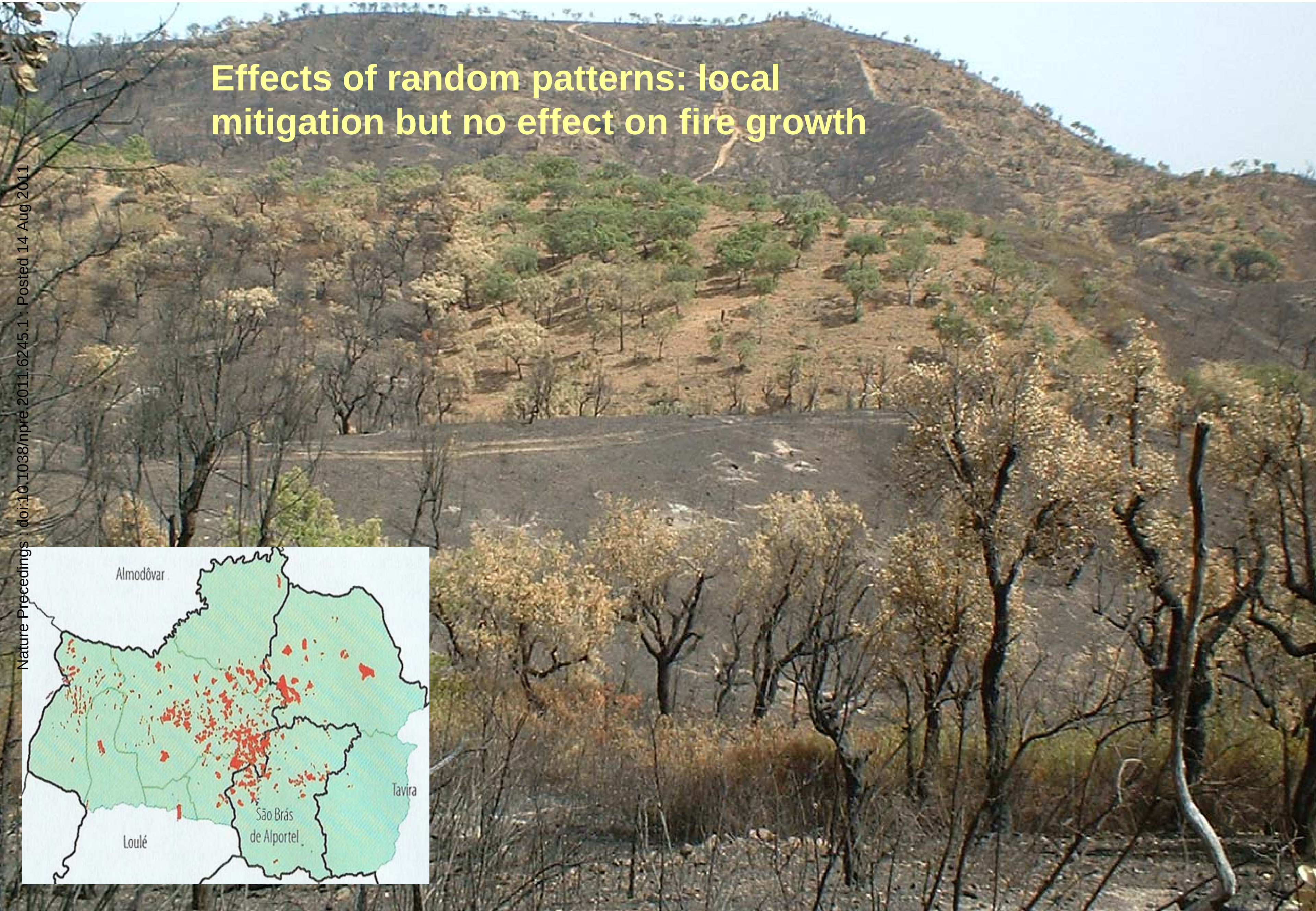


Resilience to fire and forest types



“Fire smart” landscapes and spatial patterns

Effects of random patterns: local mitigation but no effect on fire growth



Conclusion

- Current fire policies are unsustainable and often counterproductive, and are focused on fire pre-suppression and fire suppression.

- Towards Integrated Fire Management

  1. **Prevention of ignitions**
  2. **Fire pre-supression and suppression**
  3. **Fuel management, including planned fire**
  4. **Management of unplanned fires**

Conclusion

- **Management of unplanned fires (“management fires”)**

Land management objectives

Threatened values and assets

Fire danger rating

FWI < 18	ISI < 6
FFMC < 90	BUI < 50
DC < 300	

Conclusion

- “Fire-smart” landscapes are obtained by area-wide fuel modification and fuel conversion, rather than by fuel isolation. Spatial patterns are critical.
- Climate change will
  - Reduce the opportunities for type conversion into more mesic, less fire prone forests;
  - favour open dry forests, hence fire resistance.
- Research priority: experimentally improve the understanding of how silvicultural practices and fuel treatments change the fire environment, and how they impact on fire behaviour and severity.

Thank you