Reversing rural abandonment trends to reduce wildfire impacts on Mediterranean forest ecosystems

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May 2, 2016

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Forest Complexity Modelling

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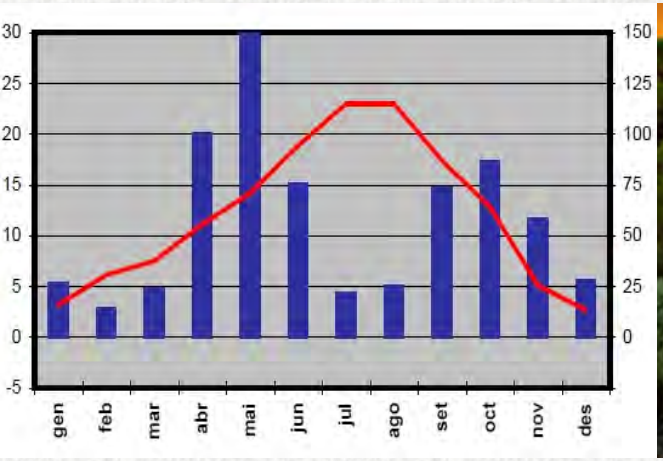
FOREST SCIENCES CENTER OF CATALONIA

CREAF

Mediterranean-climate ecosystems : hotspots of fire-adapted biodiversity

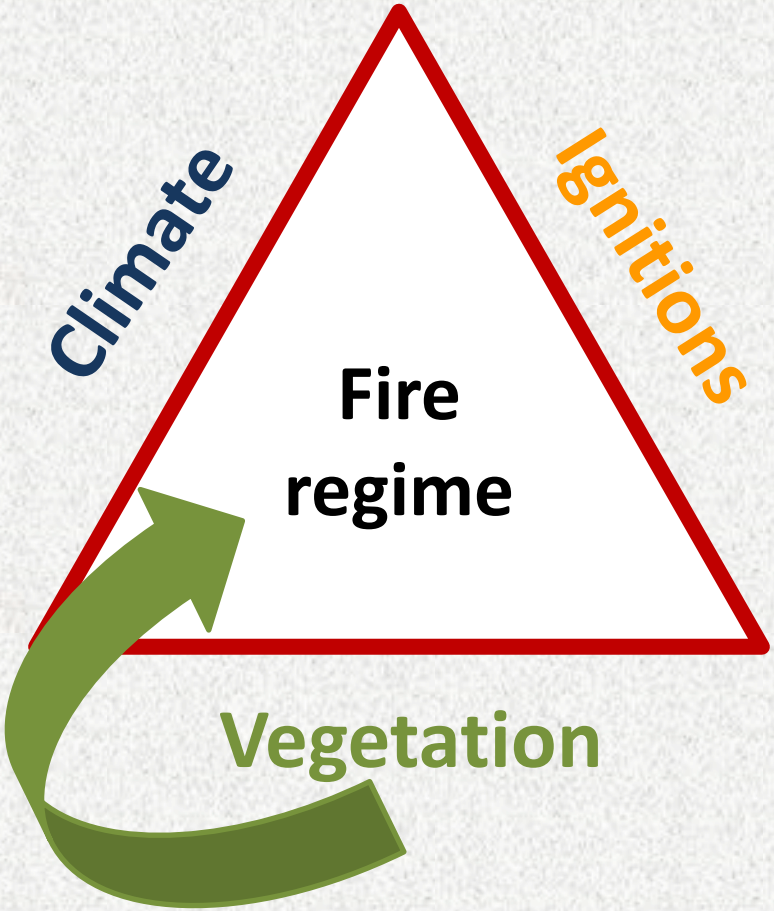
Long, dry, hot summers



Fire

Pines, Oaks, Scrubs

Landscape configuration may influence the fire regime



Reversing rural abandonment to reduce fire impacts

Idea :

Open forest landscapes with croplands and pastures

Question :

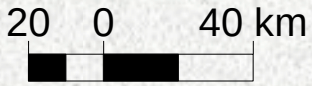
Will fire impacts decrease if landscape configuration changes ?

Decisions :

- **How much** semi-natural land is to be converted to agriculture ?
- **Where** land-cover changes should happen ?
- **How** patches-of-change have to spatially aggregate ?

Catalonia in NE Spain, a fire-prone landscape

Land-cover forest species 2010



	%
Pine	25
Oak - Decidious	18
Shurb	13
Alpine grass	4
Agriculture	31
Rock	2
Water	1
Urban	6

- **Densely populated (7.5 M hab.)**
- **Rural abandonment**
- **Urban sprawl → WUI**
- **Downturn forest management**
- **Fire exclusion policies**

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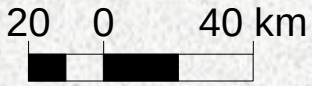
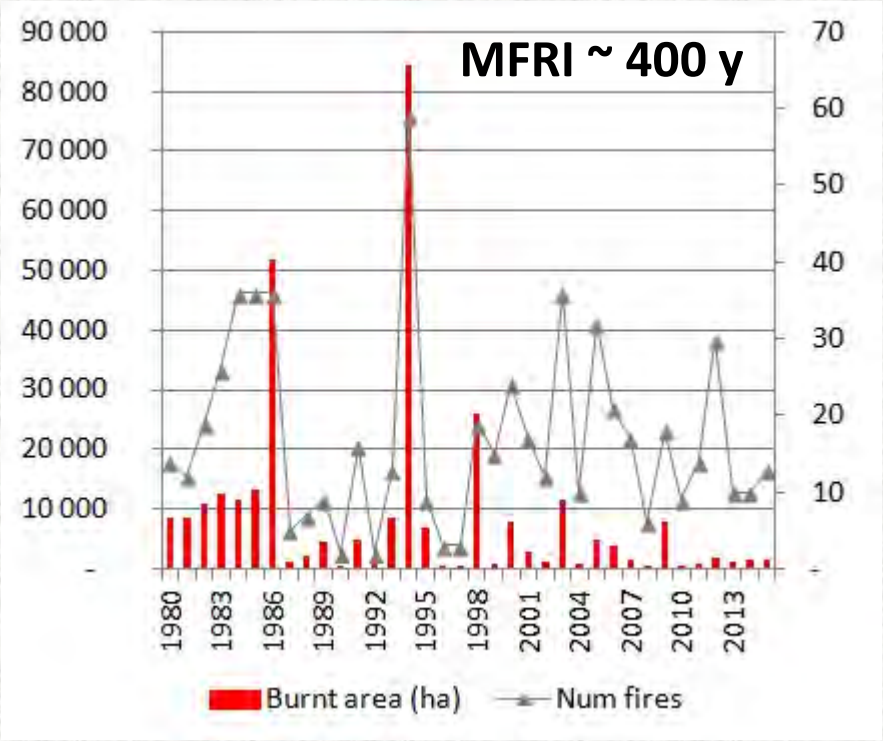
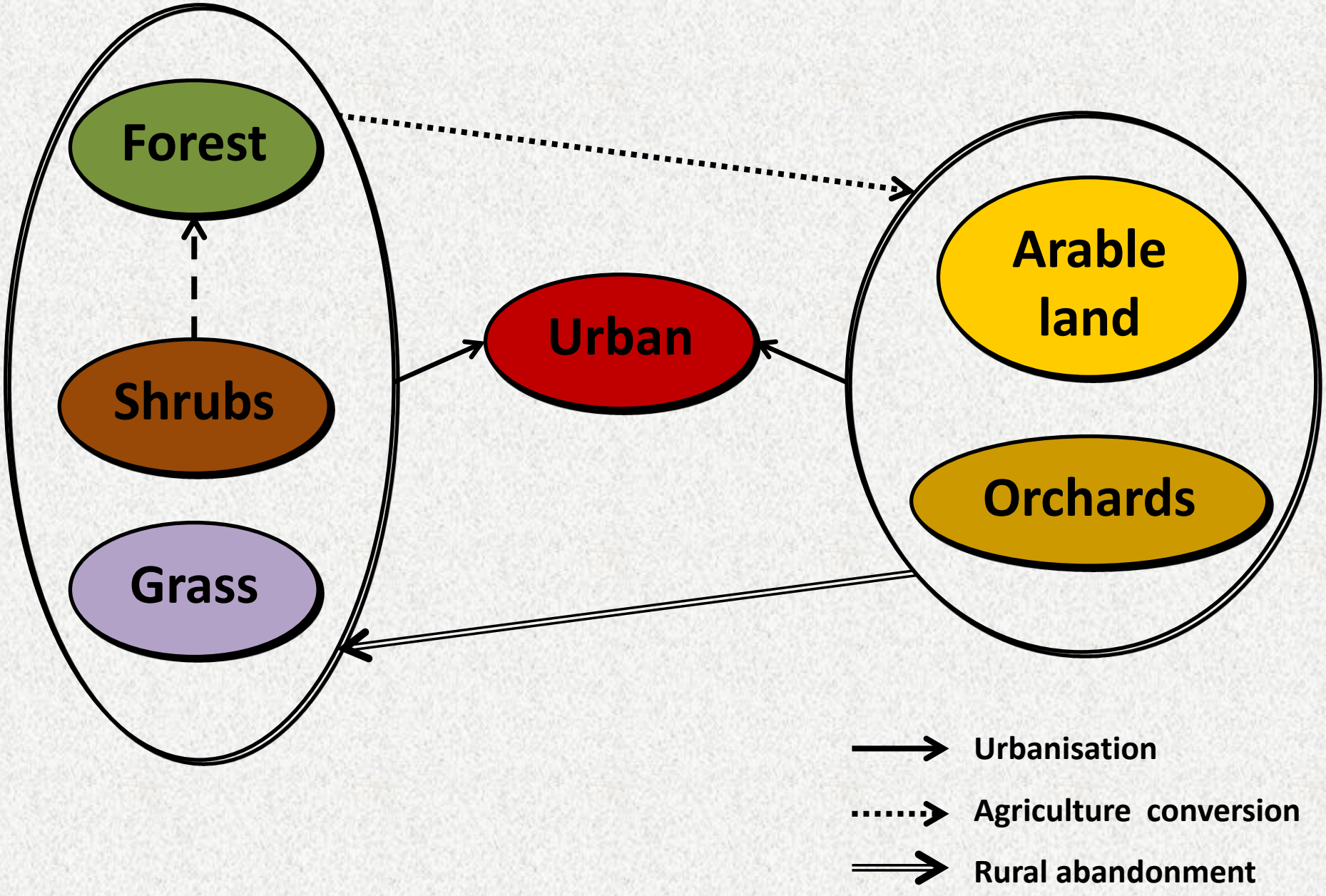




Land-cover changes and wildfires interact on the landscape



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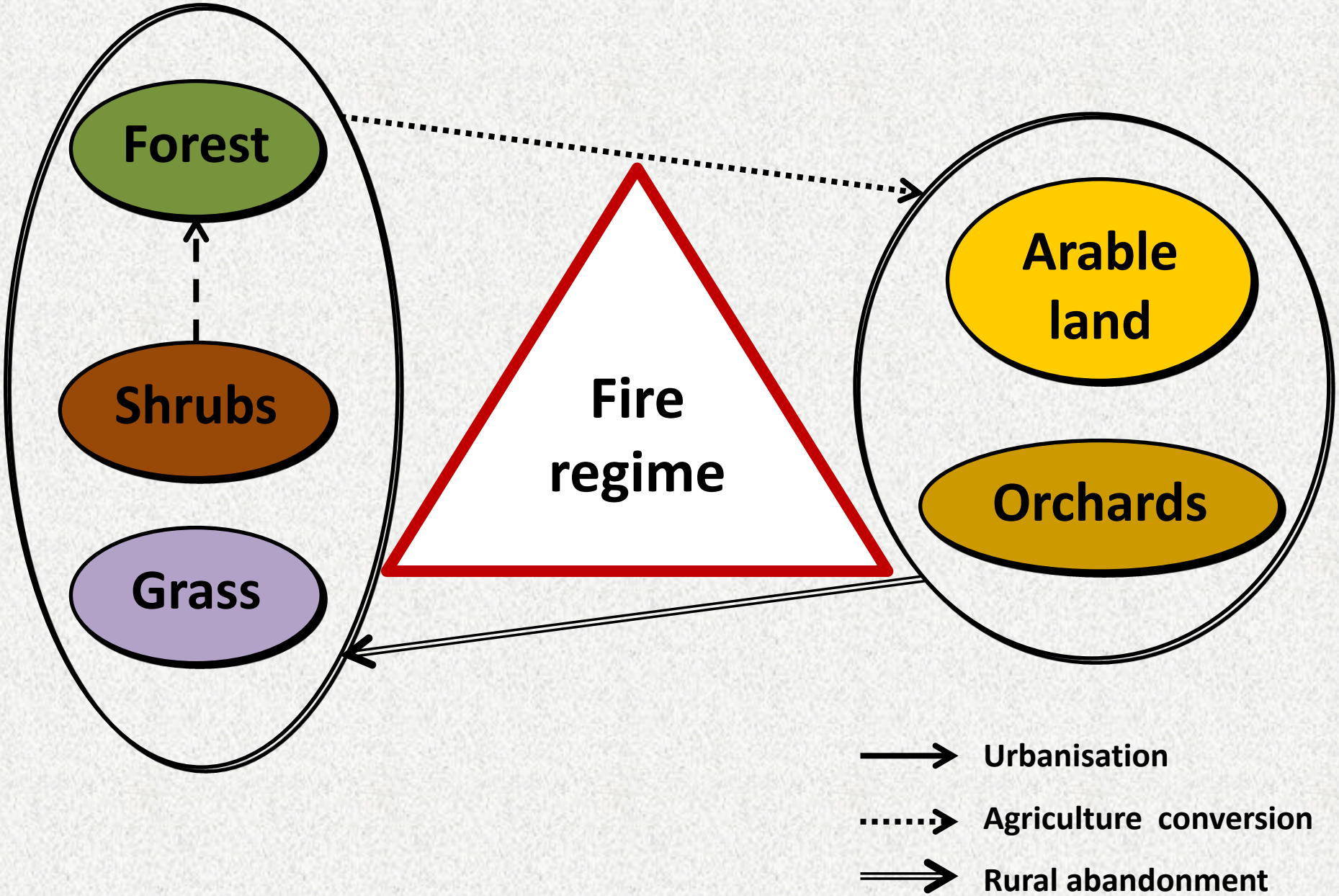
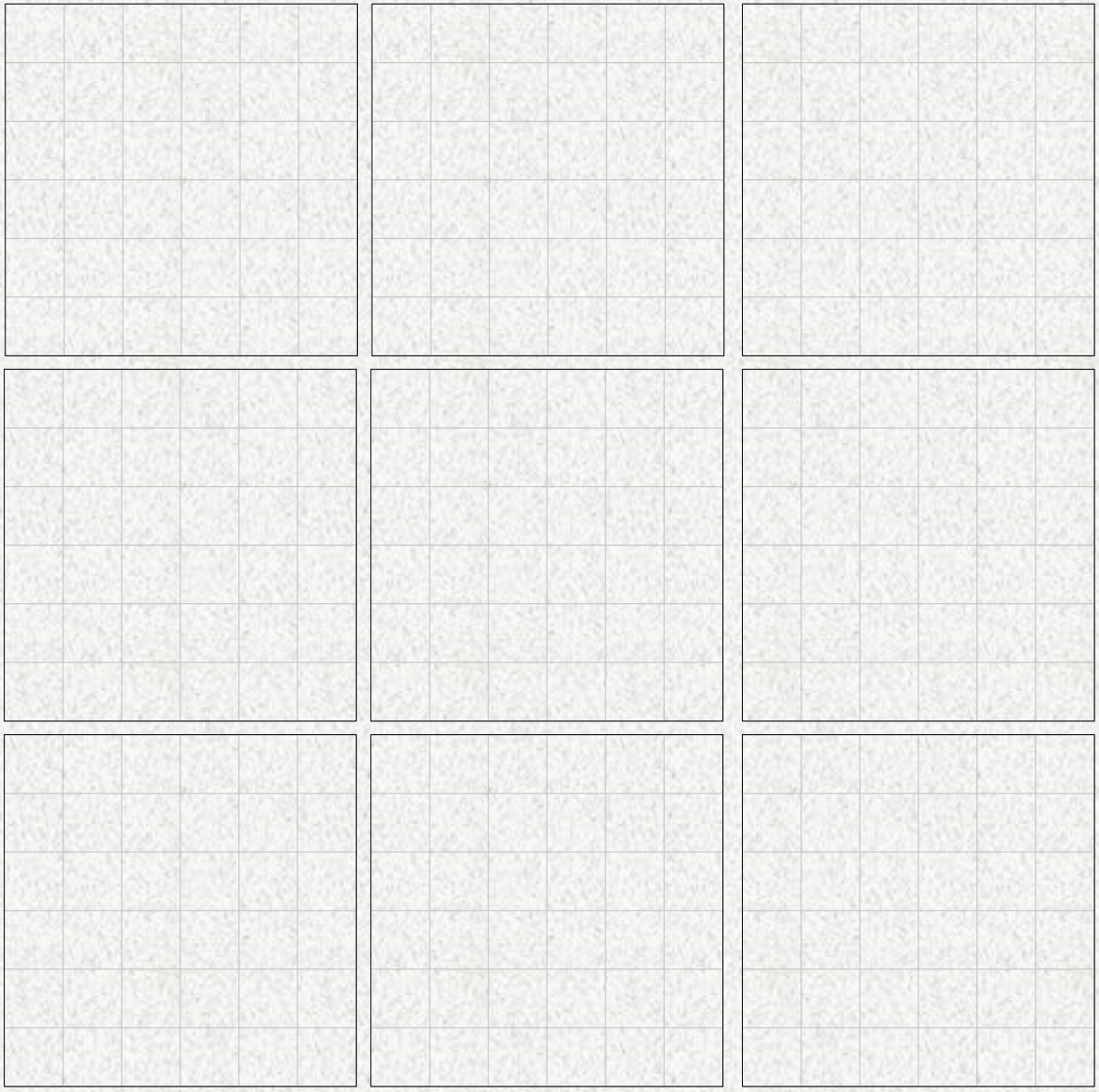


The *MEDLUCC*, a spatially explicit land-use change model

Demand

Time	Urbn	Agri	Rabn
1	D^{urbn}_{1}	D^{agri}_{1}	D^{rabn}_{1}
2	D^{urbn}_{2}	D^{agri}_{2}	D^{rabn}_{2}
3	D^{urbn}_{3}	D^{agri}_{3}	D^{rabn}_{3}

Spatial patterns of change



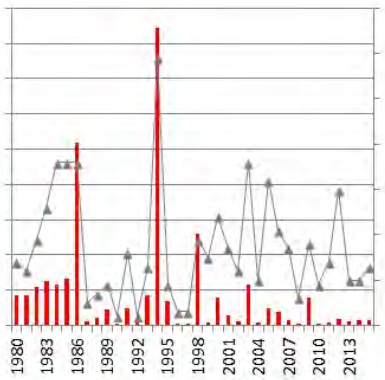
Suitability to change / land-cover transition

The *MEDFIRE*, a spatially explicit fire-succession model

Fire regime and fire spread

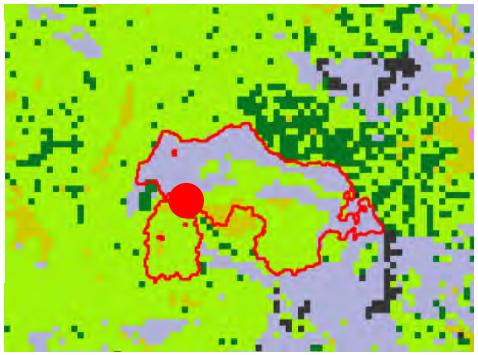
FR = ***f***(Climate severity

- Annual area burnt
- Fire size



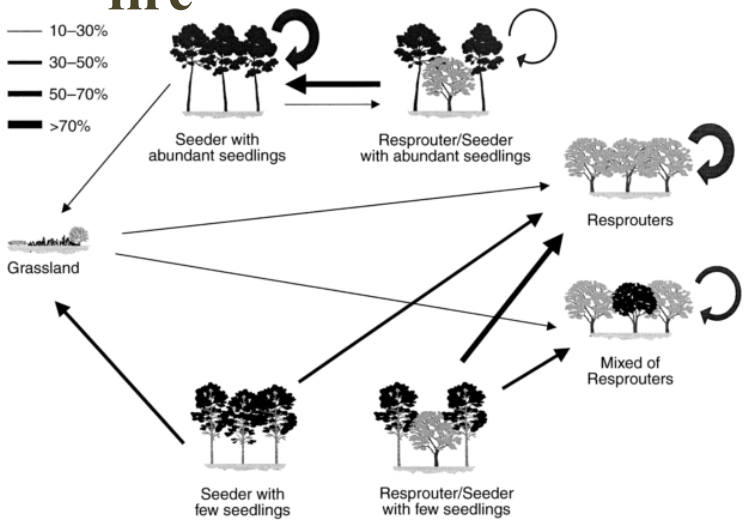
Ignitions = ***f***(Landscape, Human activity)

Fire spread = ***f***(Wind, Slope, Land-cover, Fuel)



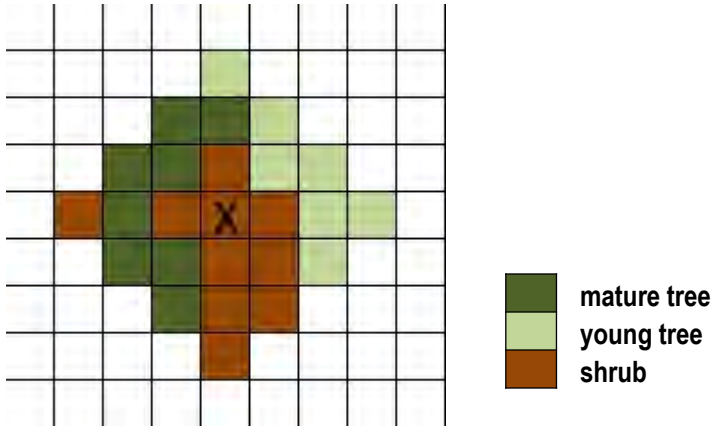
Fire fighting = ***f***(Fire spread)

Regeneration post-fire



Scrubland colonization by trees

P_coloniz = ***f***(Shrub age, # Mature trees)



Land-use change and fire regime scenarios

To answer: How much, where, which spatial pattern agriculture conversion has to happen to increase fire suppression efficiency

Time	ha
1	D1
2	D2
3	D3
. . .	. . .

Dx2

D

D/2

HIGH

MODERATE

LOW

Aggregate

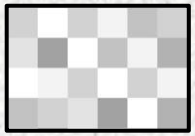
Scatter

Rural development

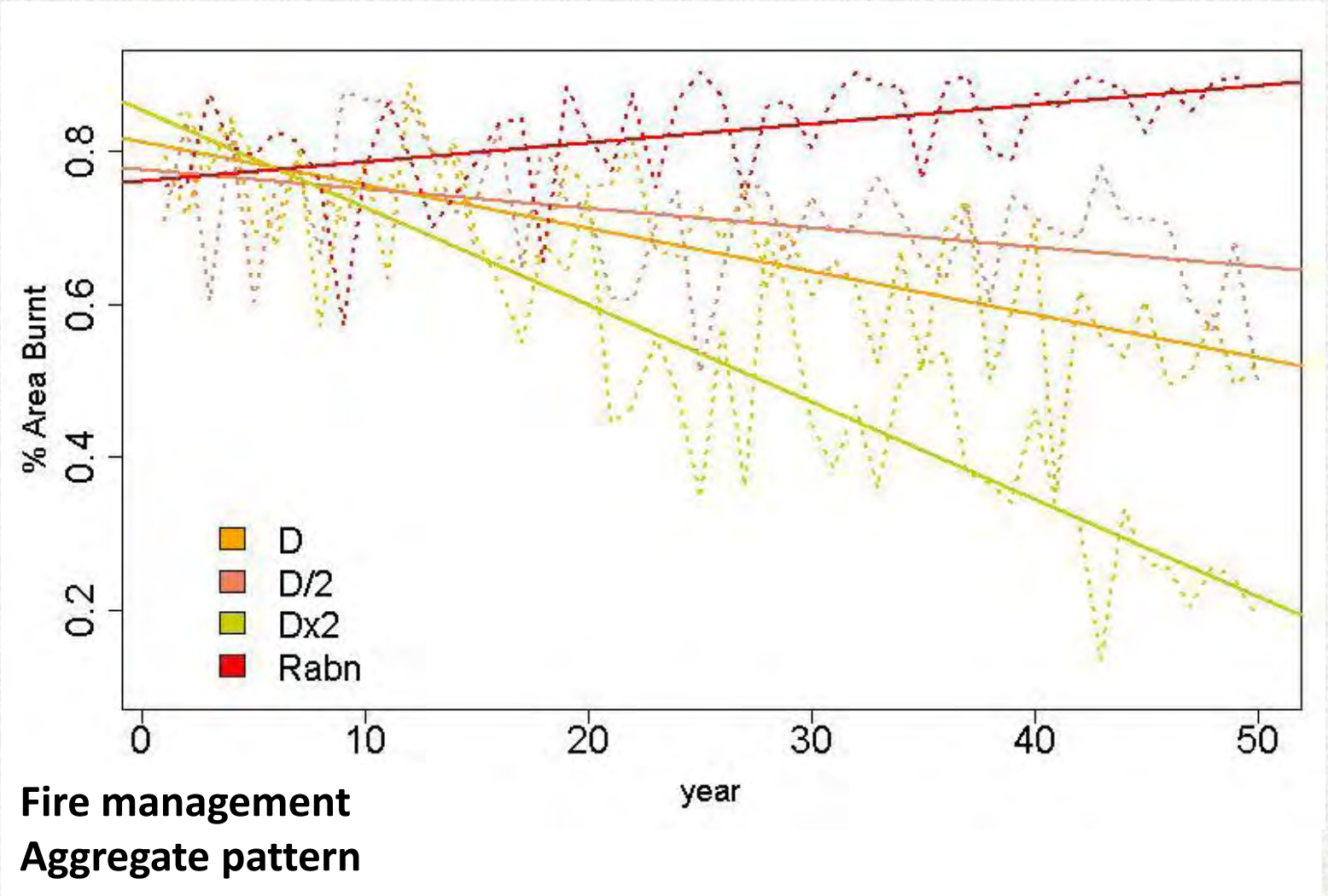
Fire management

Crop productivity

Business-as-usual



How much agriculture to reduce fire impacts ?

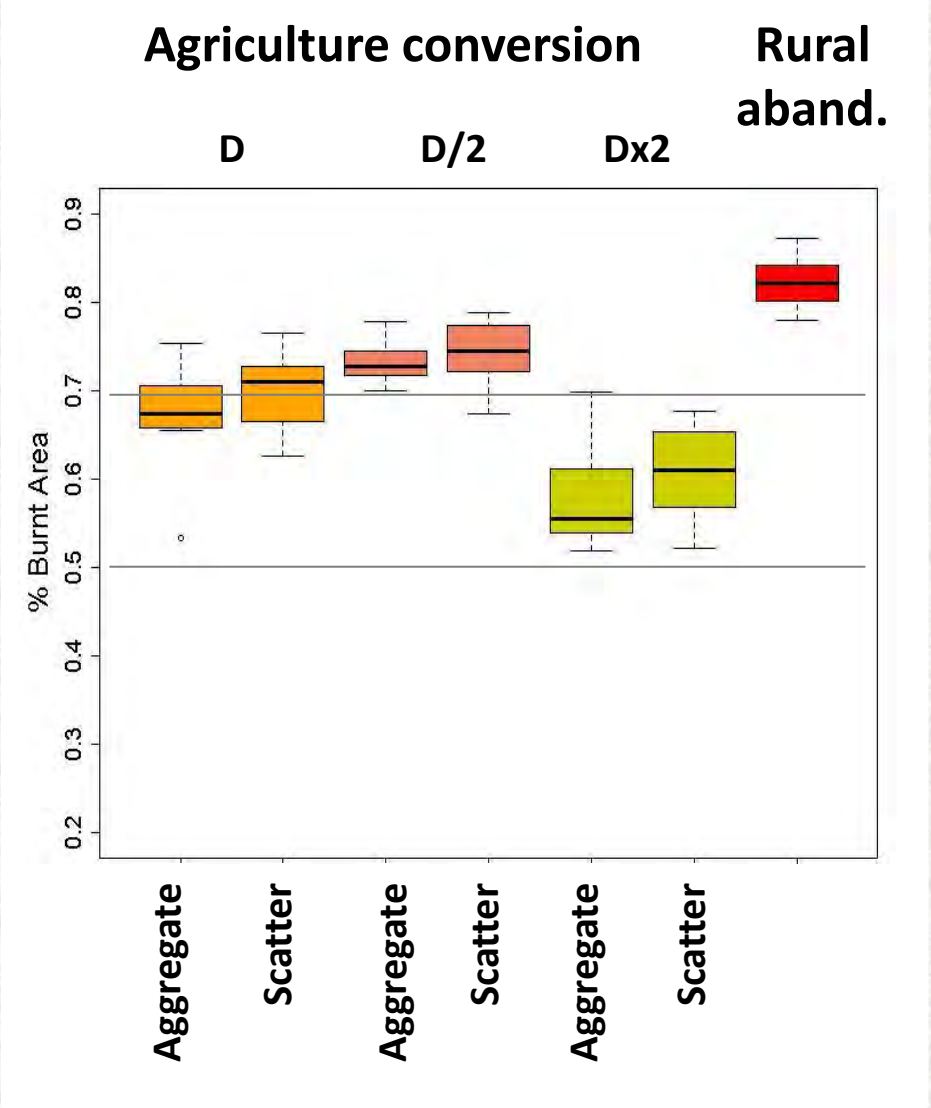


Fire management

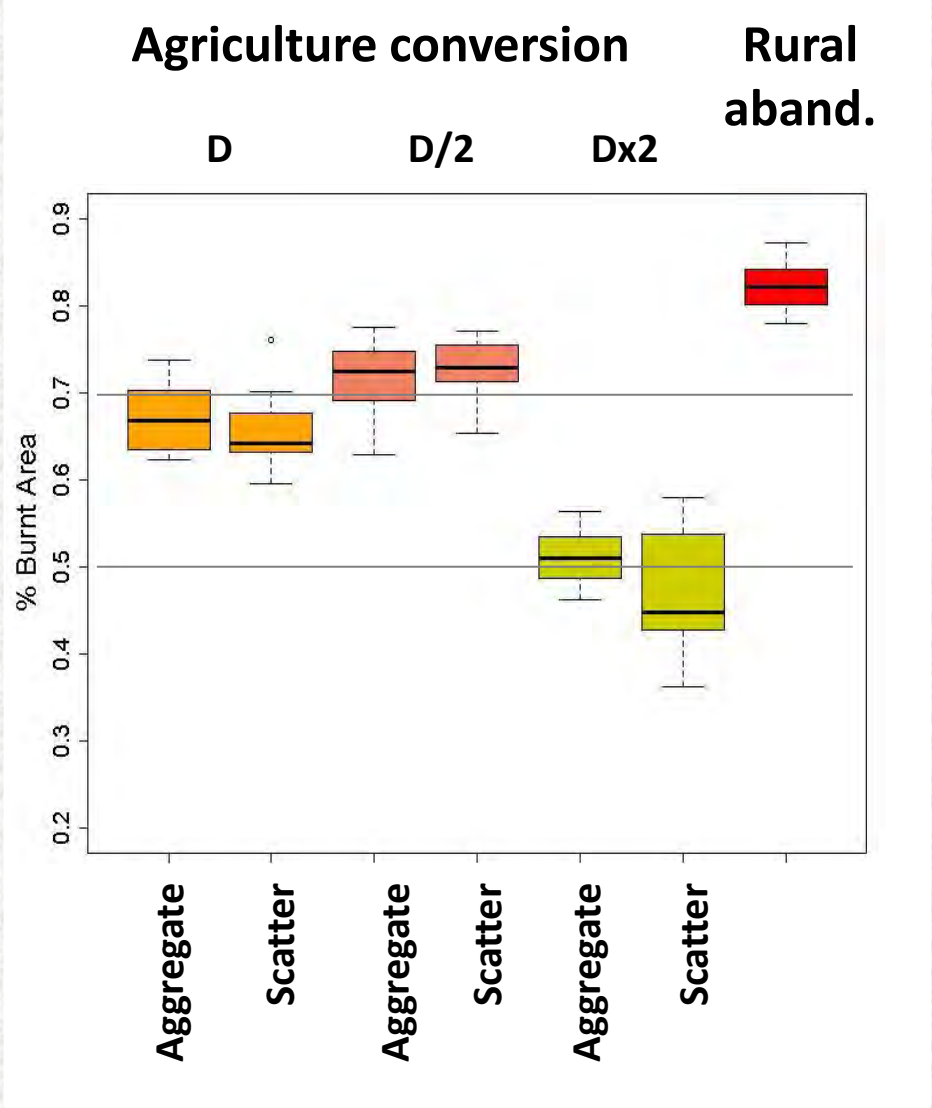
Aggregate pattern

Where to place agricultural patches ?

Rural development



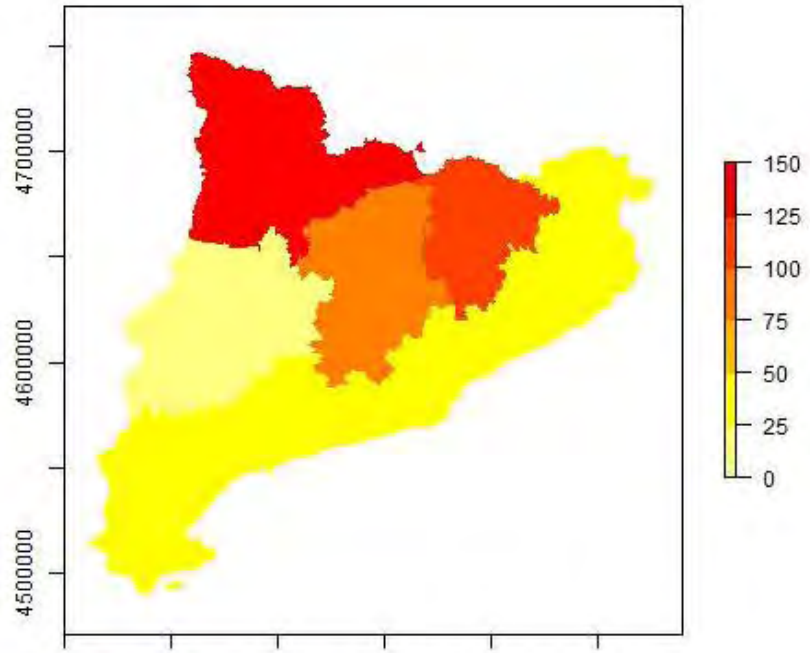
Fire management

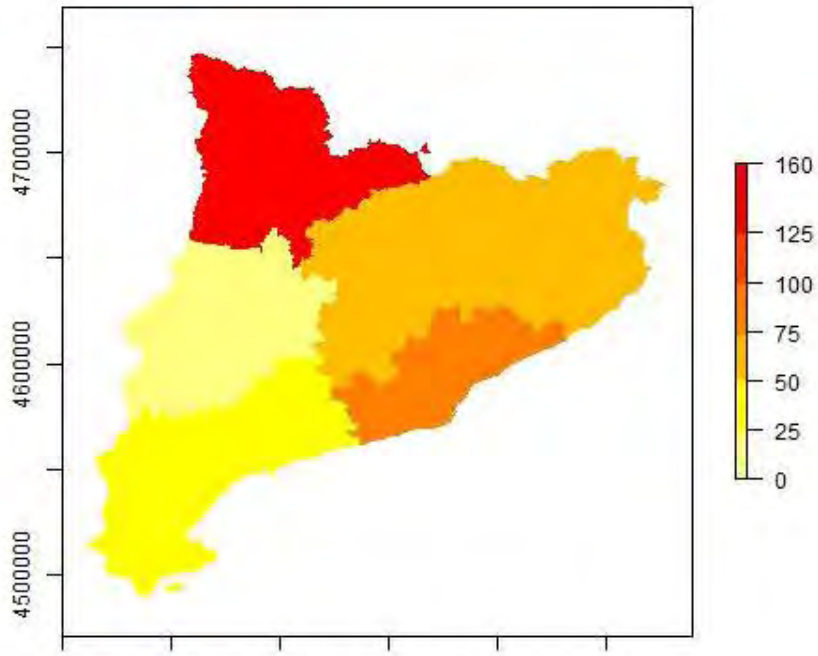


Rural development

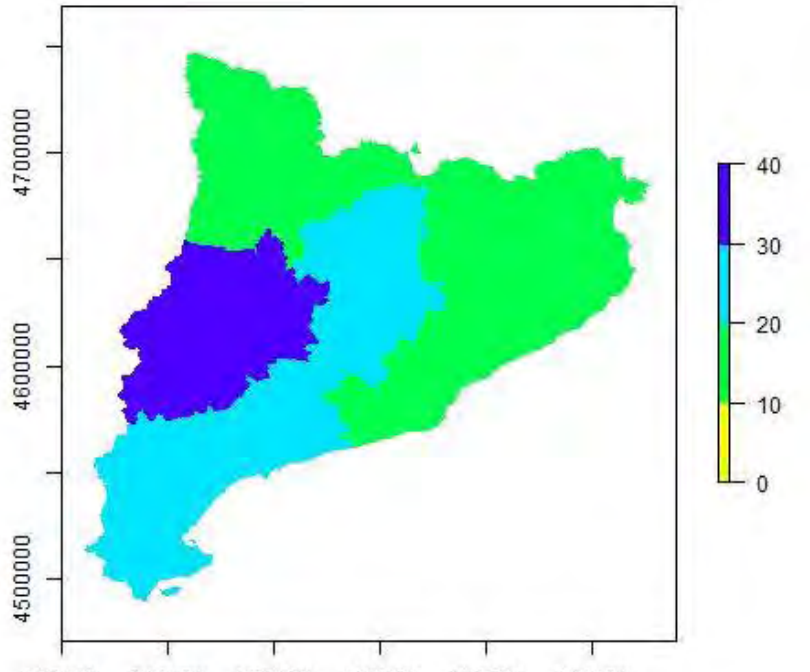
Fire management

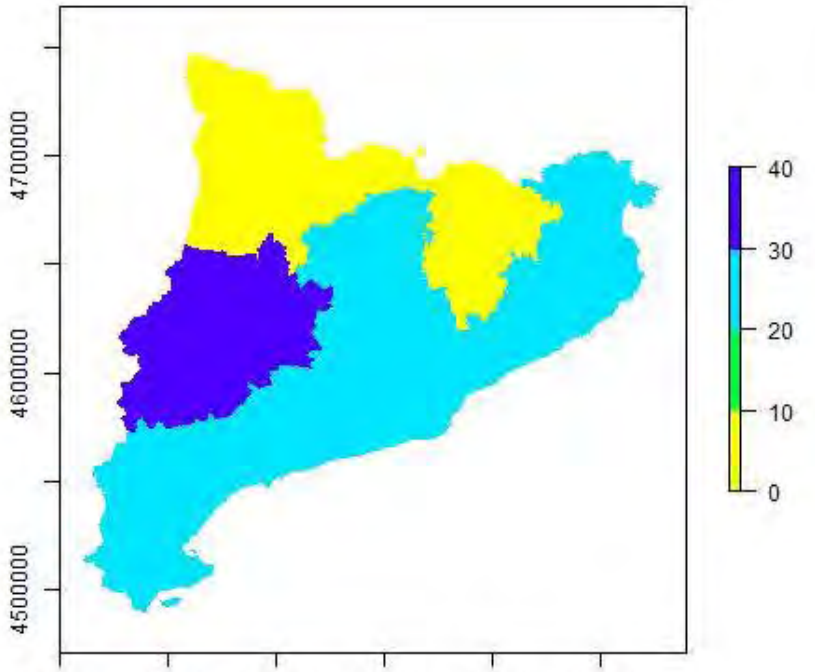
Increment cropland





% Suppressed area





Conclusions and perspectives

- **Agricultural patches create fire fighting opportunities**

- **Location of new agricultural patches matters, more than the spatial aggregation pattern**

- **Accompanied of**
  - **economic**
  - **biodiversity**
  - **ecosystem services**

  impact assessments

- **Taking into account climatic change**

Thanks !