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PRESERVING AND MANAGING FOREST HABITATS IN THE MEDITERRANEAN AREA

WORKSHOP - MONDAY DECEMBER 4, 2023

Co-funded by the European Union

NATURA 2000

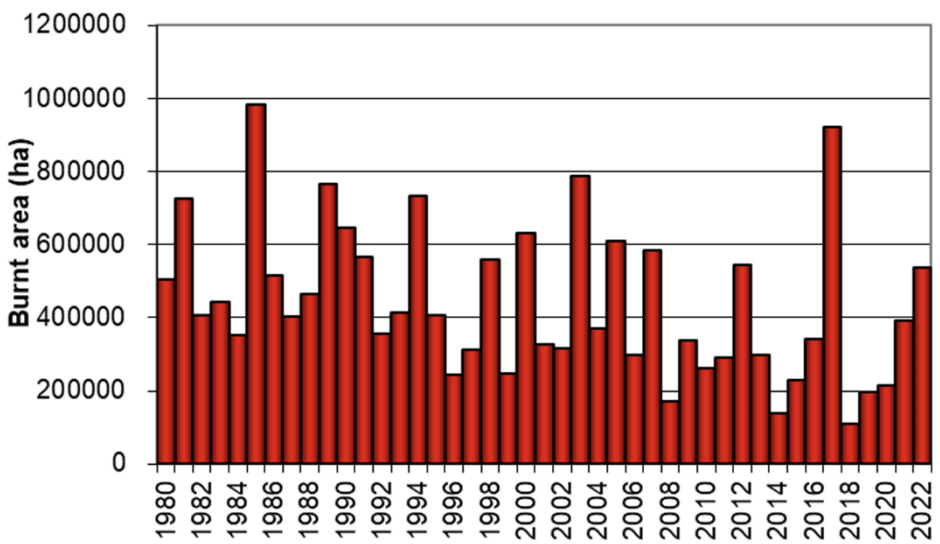
Conservazione della biodiversità e prevenzione degli incendi

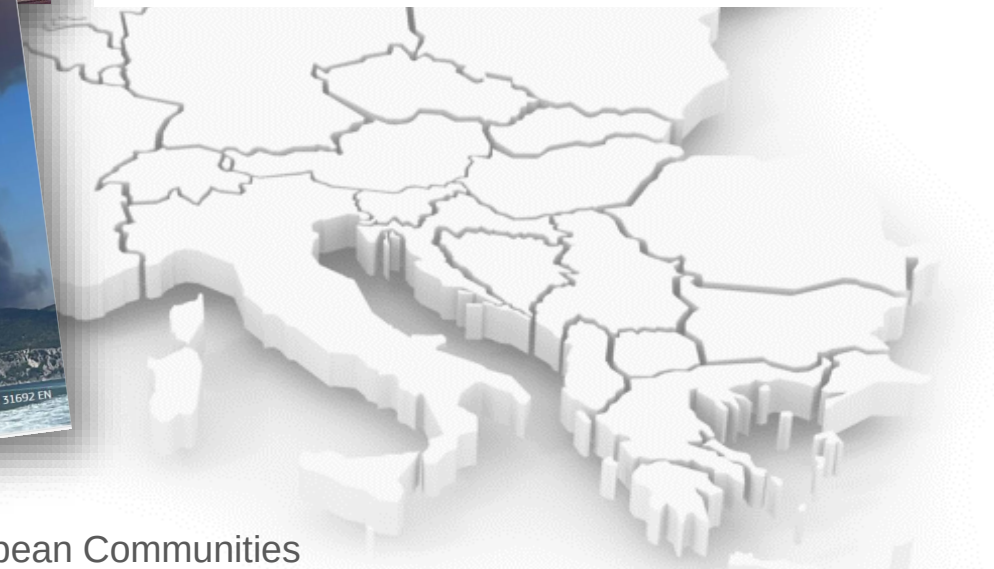
Biodiversity conservation and wildfire risk mititgation

DAVIDE ASCOLI – ROBERTA BERRETTI
LUCA MUSIO – RACHELE GAMBA

DISAFA
UNIVERSITY OF TORINO

Wildfire impacts in Europe





Source: Forest Fires in Europe 2022. European Communities

Wildfire impacts in Europe

Southern Europe from 1980 to 2022

Burnt area: 19 millions of hectares (es. ~ 2 x forest area in Italy)

Deaths due to wildfires (fire fighters-civils): ~34 persons/year

Economical losses: about **3 billions Euro/year**

Wildfire Impacts in 2017

Burnt area: 1 millions of hectares

Deaths (fire fighters-civils): 127

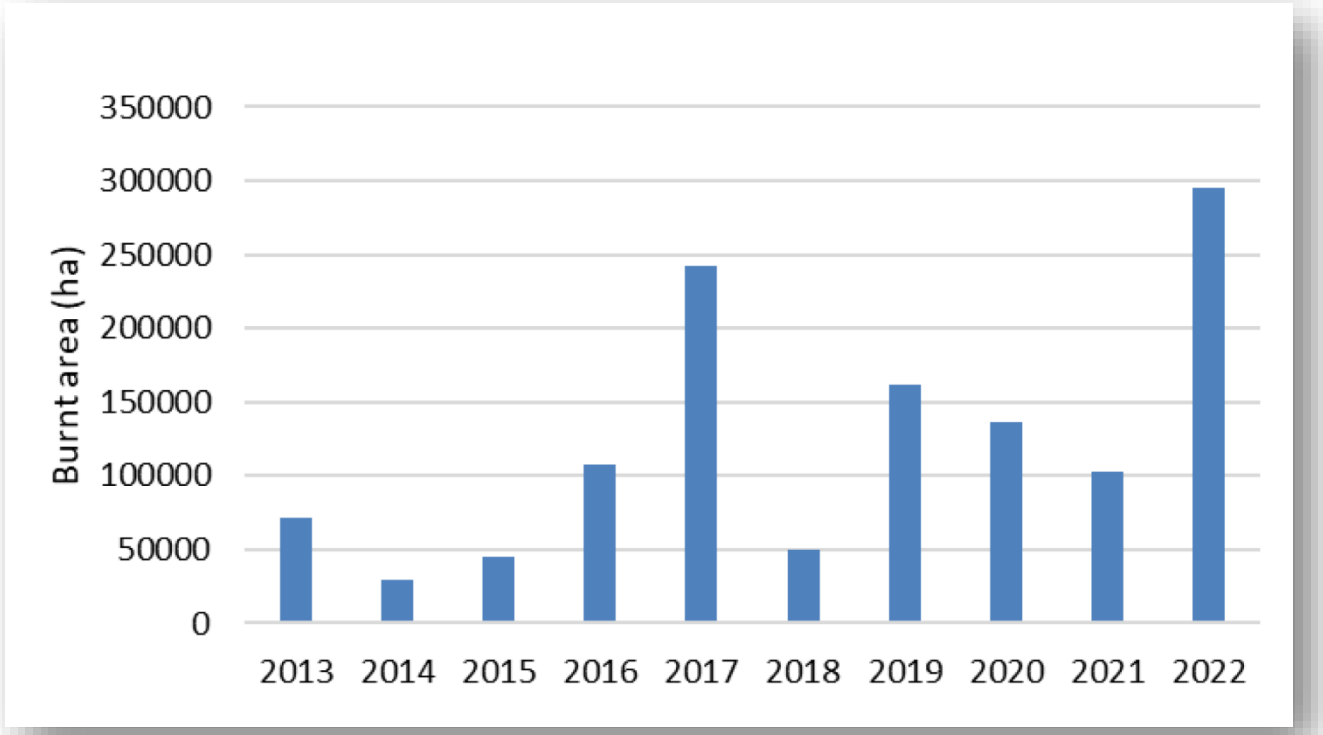
Losses: > 9.8 billions Euro

Source: San-Miguel Ayanz, EFFIS, JRC

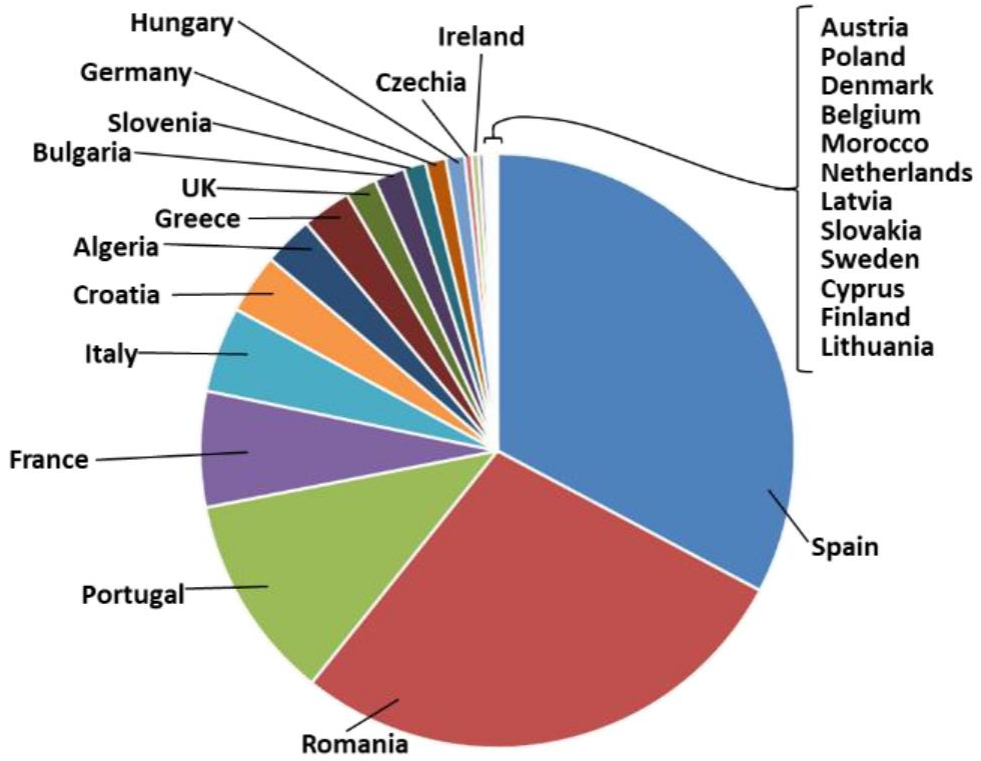
Pedrograo Grande
June 2017

Wildfire impacts in Natura 2000 sites

Burnt area in Natura-2000 since 2013



% Burnt area in Natura-2000 in 2022



Source: Forest Fires in Europe 2022. European Communities

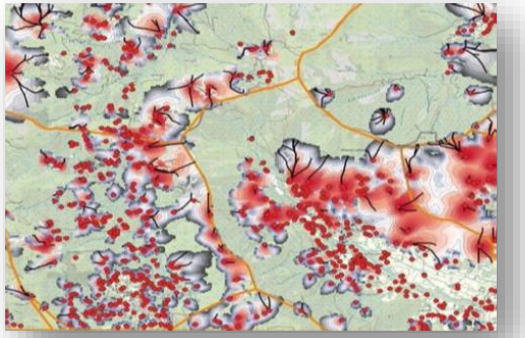
Introduction

Wildfire risk mitigation and biodiversity conservation

Two scales of analysis

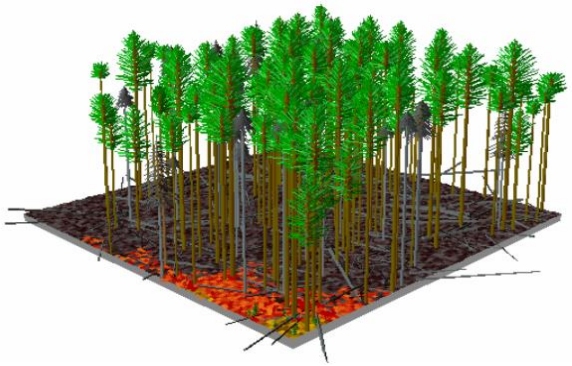
1) **Landscape scale**

   How to integrate **goals** for **biodiversity conservation** into **planning tools** for **strategic wildfire risk mitigation** at the landscape scale

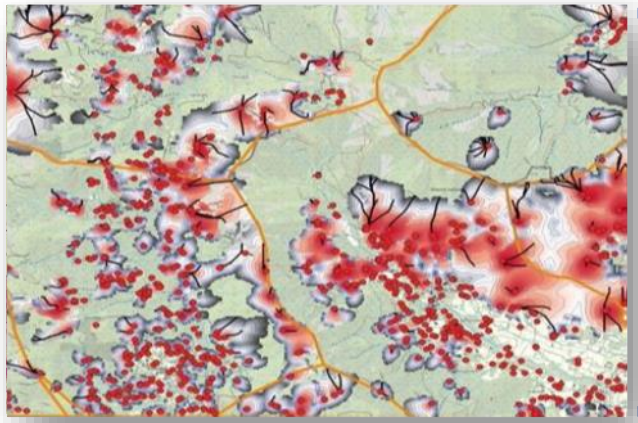


2) **Stand scale**

   How to **reconcile** criteria for **reducing flammability** and increasing **fire-fighter safety** with the prescribed **biodiversity requirements**



Landscape: strategic wildfire risk mitigation



Expert assessment

Analysis tools

Burn probability

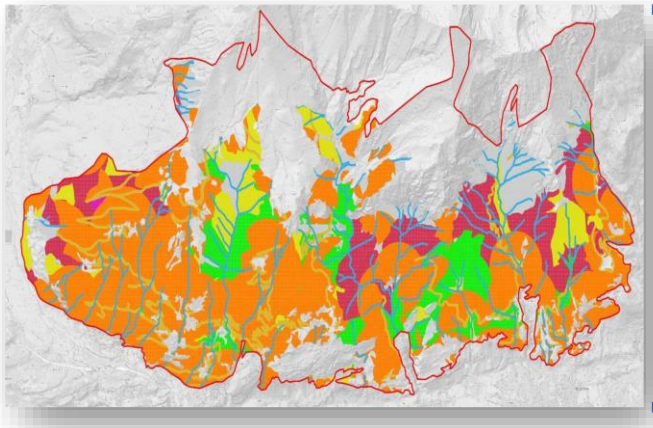
Preferential trajectories

Potential intensity

Fire hazard

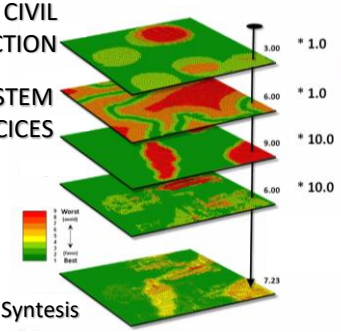
MItigation scenarios

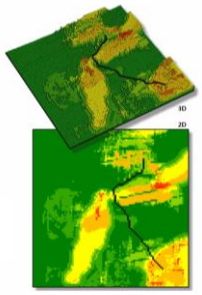
Wildfire risk



CIVIL PROTECTION

ECOSYSTEM SERVCICES





Multicriteria analysis

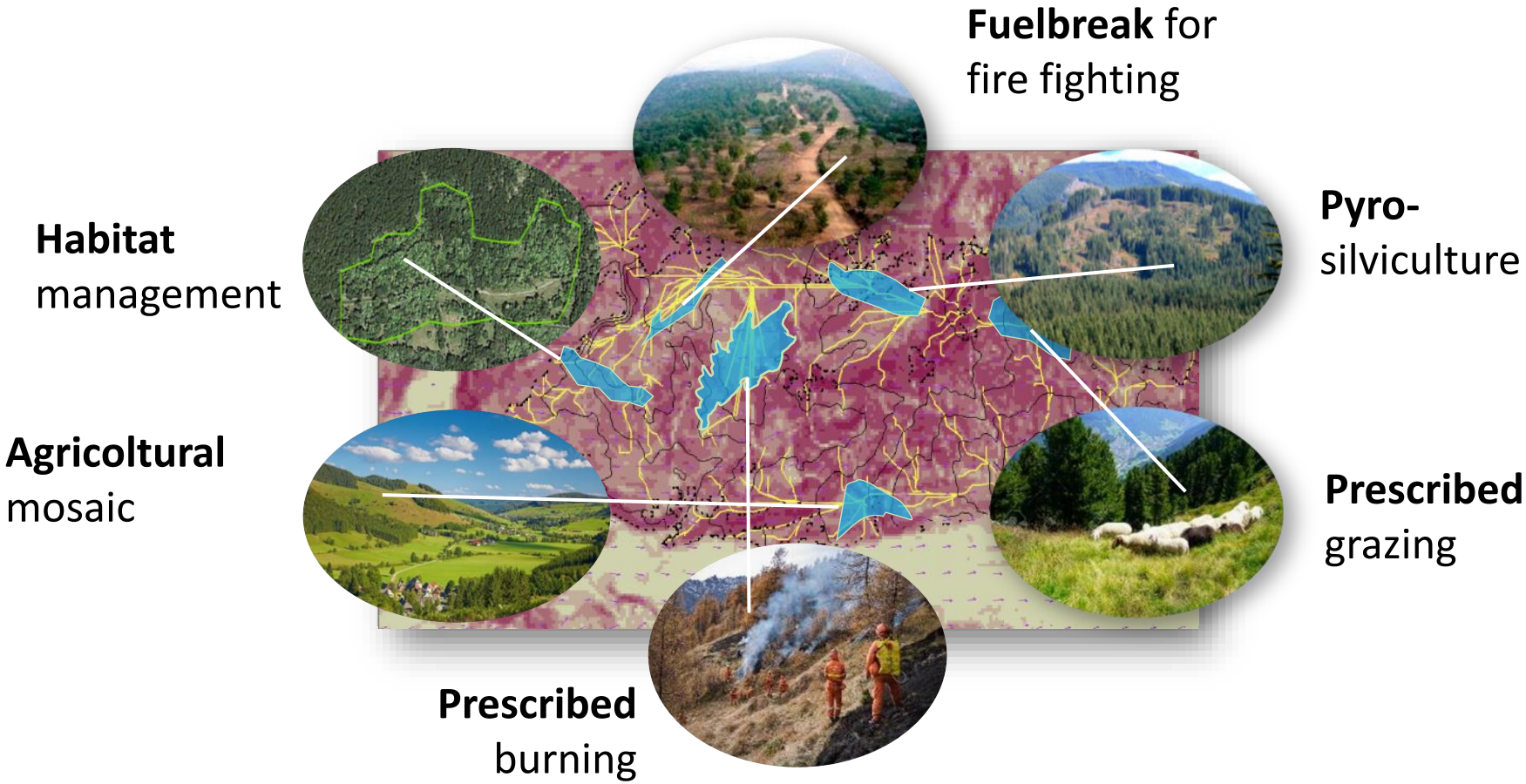
Vulnerability to fire

Spatial ditribution

Preventive infrastructures

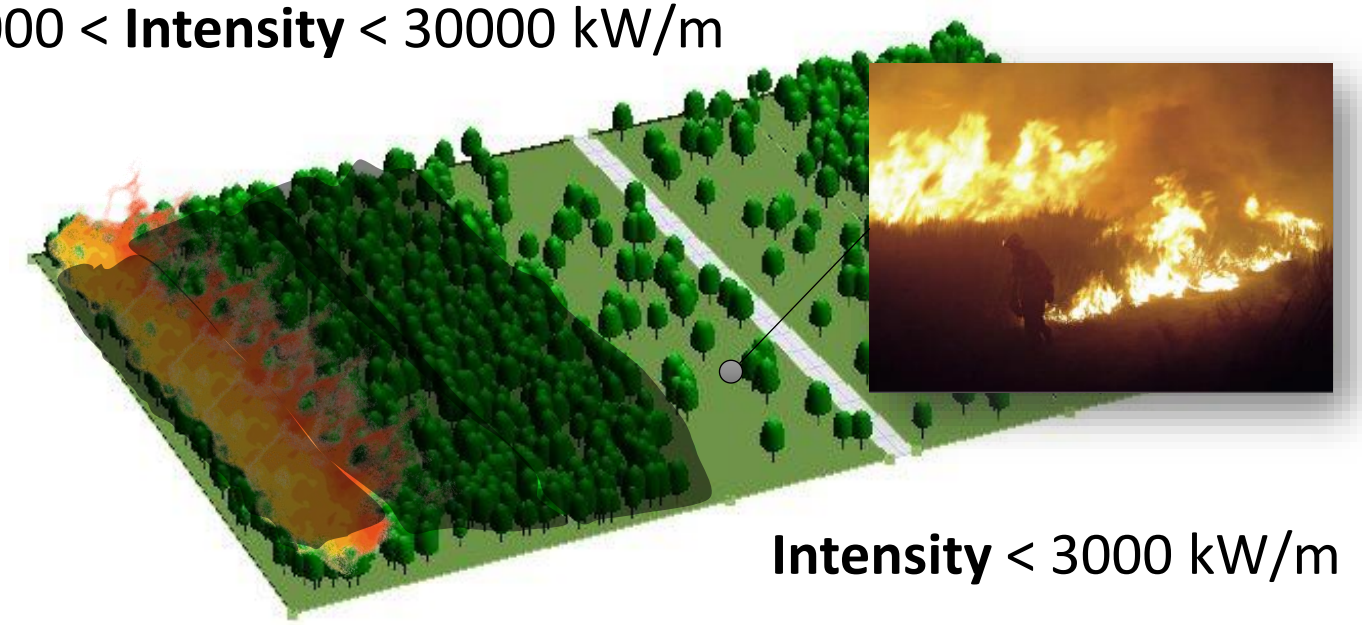
Landscape: strategic wildfire risk mitigation

Wildfire **risk mitigation plans** identify the **spatial distribution** and sizing of **preventive infrastructures** based on the risk analysis and the **expected behavior of large fires**



Infrastructures to increase fire fighting capacity and safety

3000 < **Intensity** < 30000 kW/m



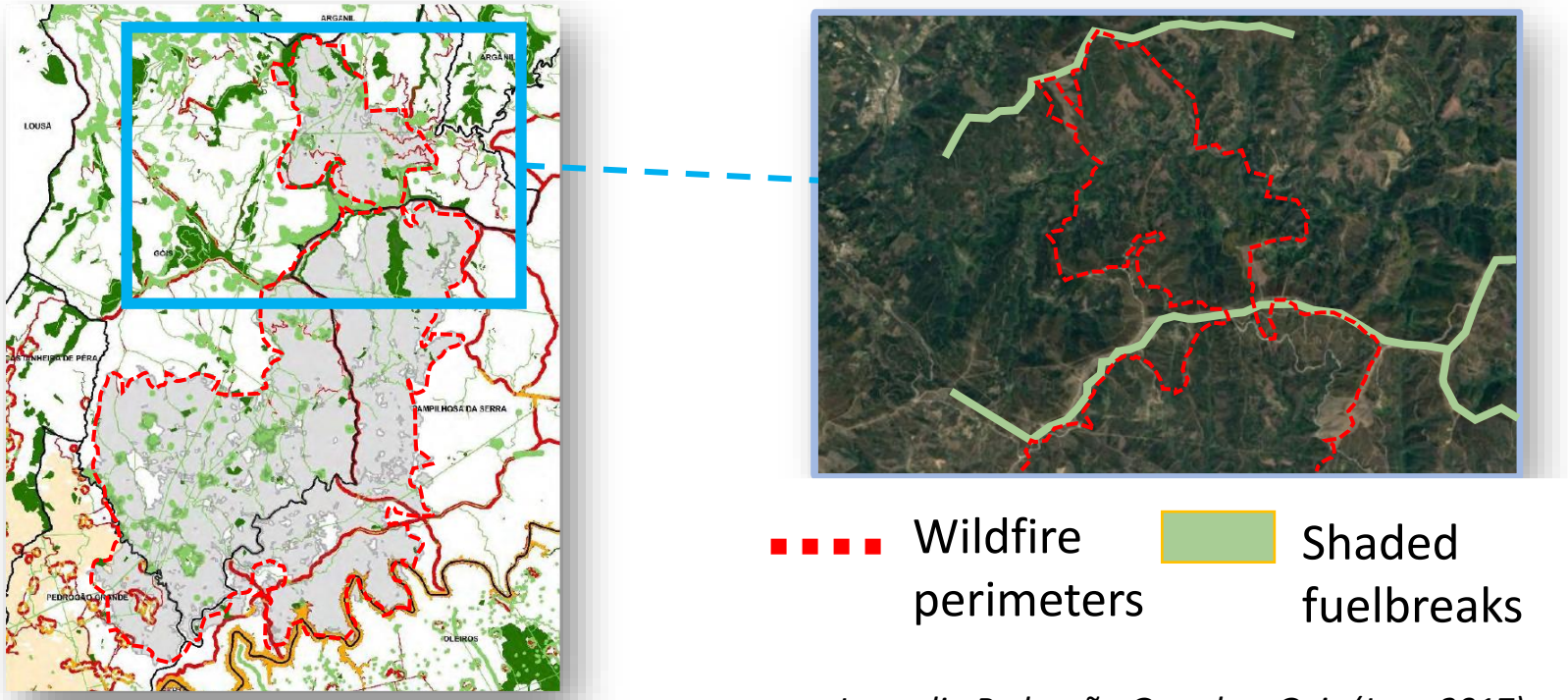
Intensity < 3000 kW/m

E.g. Shaded fuelbreaks

To make **active firefighting** more **effective** and **safer**, the fuel-break must **mitigate** the intensity and make it **compatible** with direct or indirect attack

(e.g. intensity < 3000 kW/m flame length < 3m)

Infrastructures to increase fire fighting capacity and safety



Wildfire perimeters

Shaded fuelbreaks

Incendio Pedrogão Grande e Gois (June 2017)

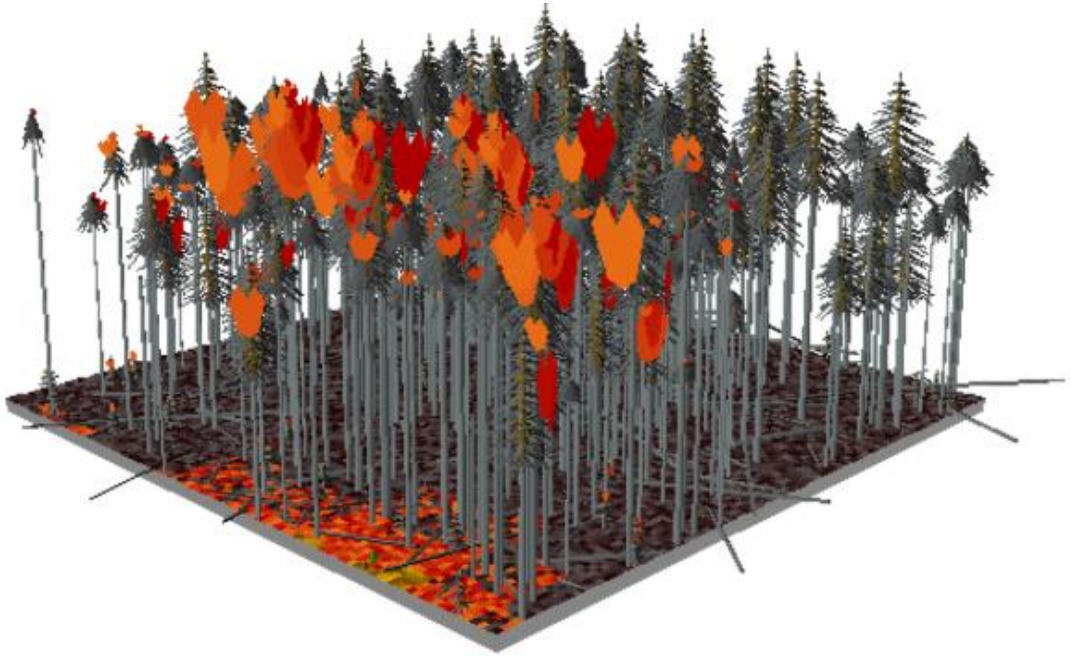
Fonte: Commissione Tecnica Indipendente - Portugal

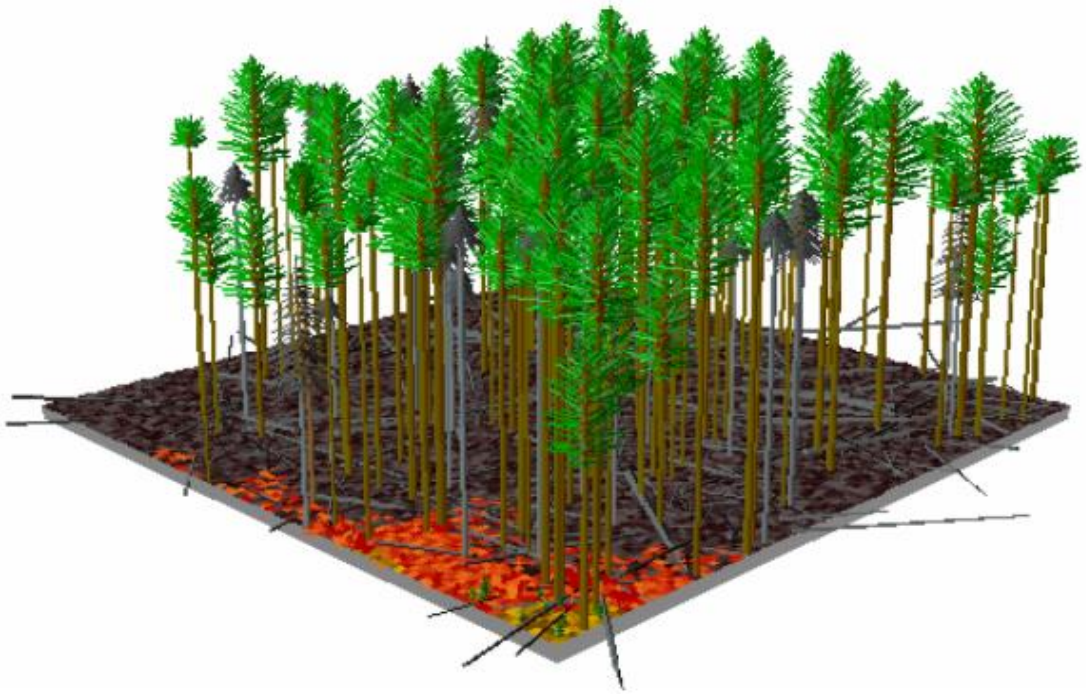
Strategic fuel-breaks

The network of strategic fuel-breaks in Portugal planned based on recurring historical fires made it possible to stop the head of one of the large wildfires of 2017

Infrastructure to increase stand self-resistance

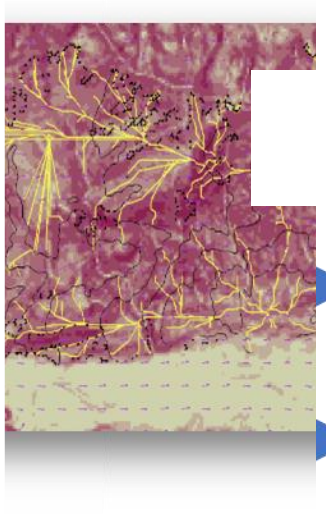
Increase the **resilience properties** of the population and **mitigate** the **potential fire behavior** so that the **flame front intensity is below** the **resistance** threshold of the tree individuals



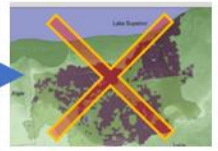


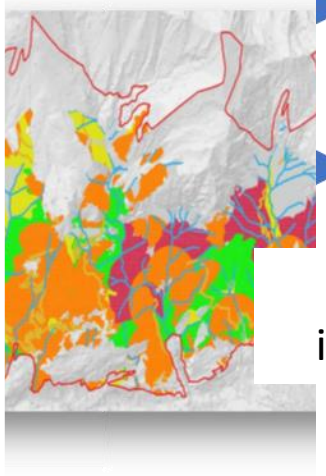
Infrastructure to increase stand self-resistance

Landscape: how to integrate goals?



Mitigation scenarios





Preventive infrastructures

Carta interventi 1

Carta interventi 2

Carta interventi 3

Carta interventi N

Urban planning policies

Rural development policies

nanagement

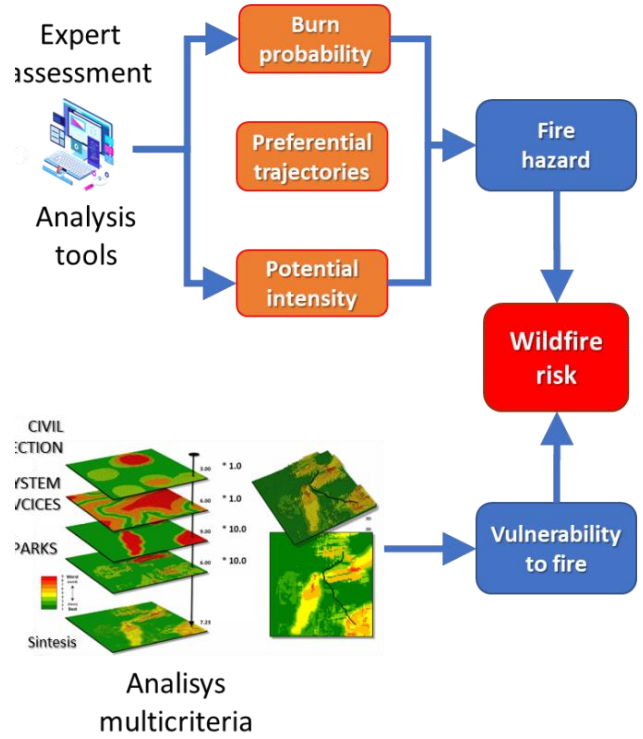
narios

Habitat conservation policies

Landscape: strategic wildfire risk mitigation

Integrating **goals** for **biodiversity conservation** into planning tools for **strategic wildfire risk mitigation** at the landscape scale

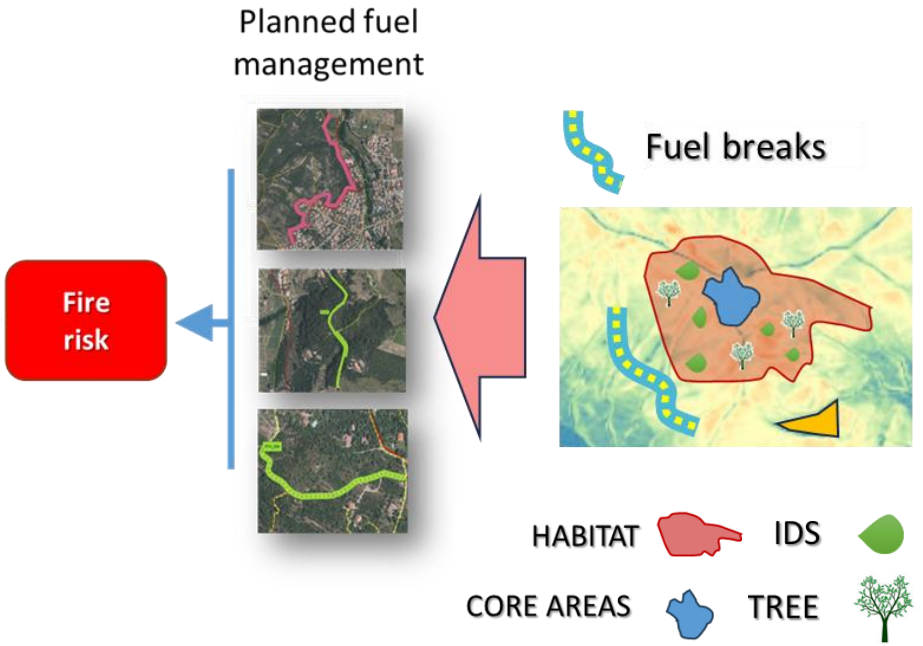
- How to account for **biodiversity conservation** in **fire risk analysis** and the **strategic planning** of **preventive infrastructures**?
- Are there **trade-offs between** biodiversity **conservation** and other **targets** of strategic prevention planning, particularly the **civil protection of people**?



Landscape: strategic wildfire risk mitigation

Integrating **goals** for **biodiversity conservation** into planning tools for **strategic wildfire risk mitigation** at the landscape scale

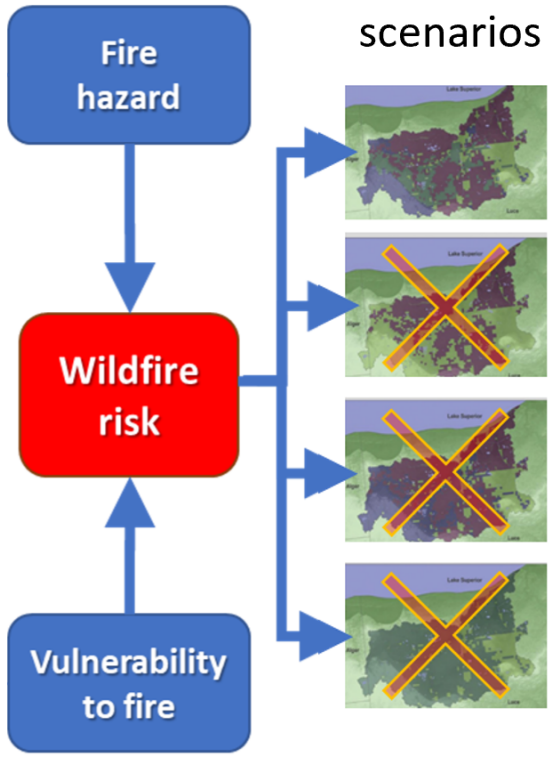
- What should be the **spatial distribution** of preventive infrastructures **in relation** to biodiversity conservation **targets** in **Natura 2000** sites, e.g. distribution of protected **habitats**, senescence **islands**?
- Under what **circumstances** do we choose to **plan** infrastructures **outside** or **inside** protected areas and **Natura 2000** sites?



Landscape: strategic wildfire risk mitigation

Participatory processes with **stakeholders**

Fuel management scenarios

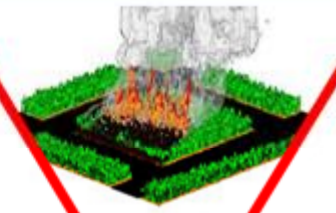


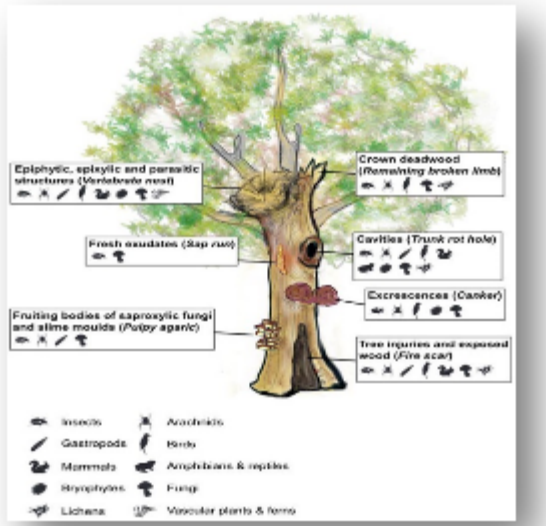
Properties aggregation

Sustainable **Value chain**

Stand scale: reconciling prescriptions

Pyro-silvicoltural
criteria



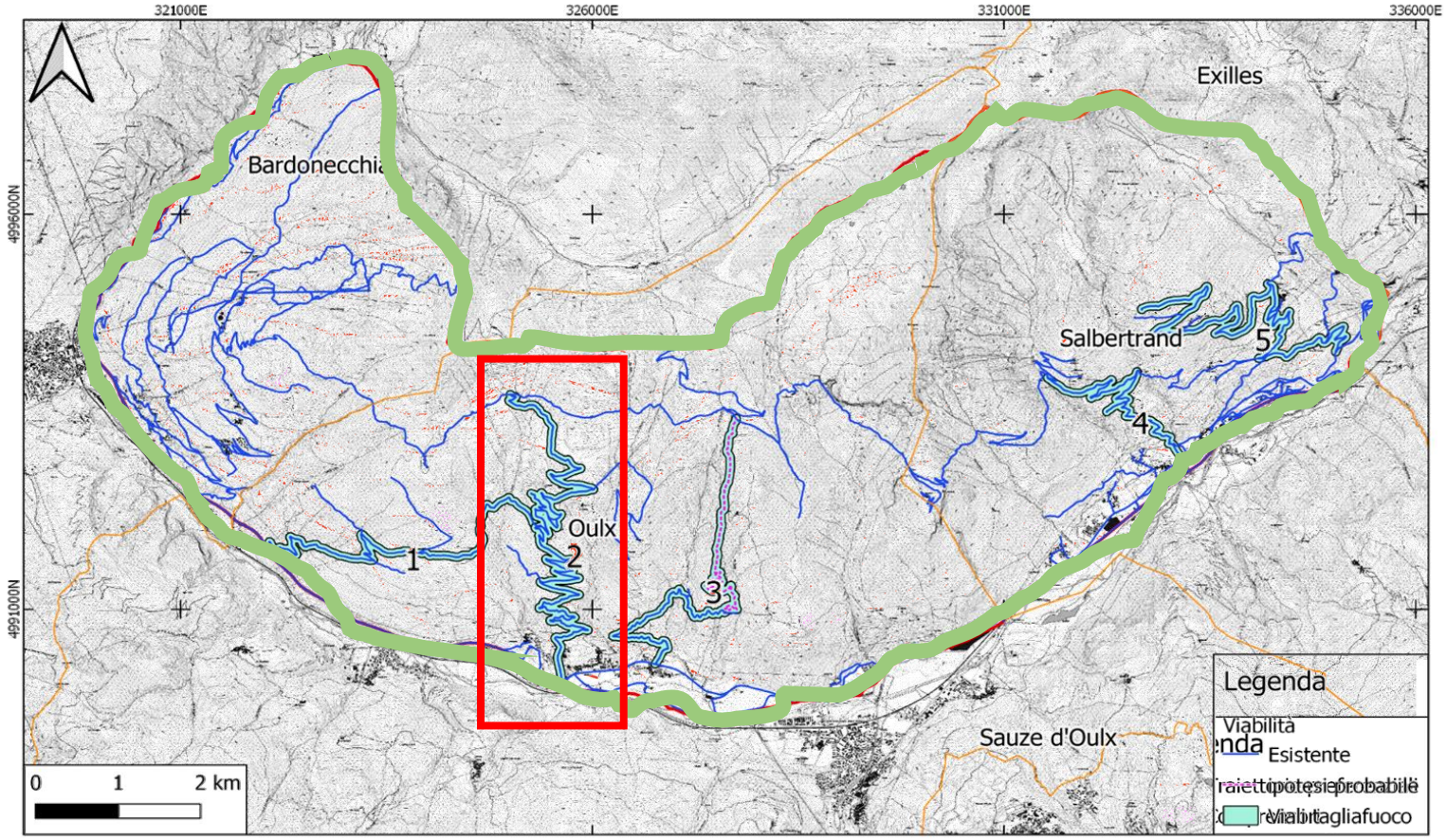


Integrated silvicoltural
prescriptions

Habitat conservation
measures

Stand scale: reconciling prescriptions

Shaded fuel break to support fire-fighting



Protected
Area (Natura 2000)

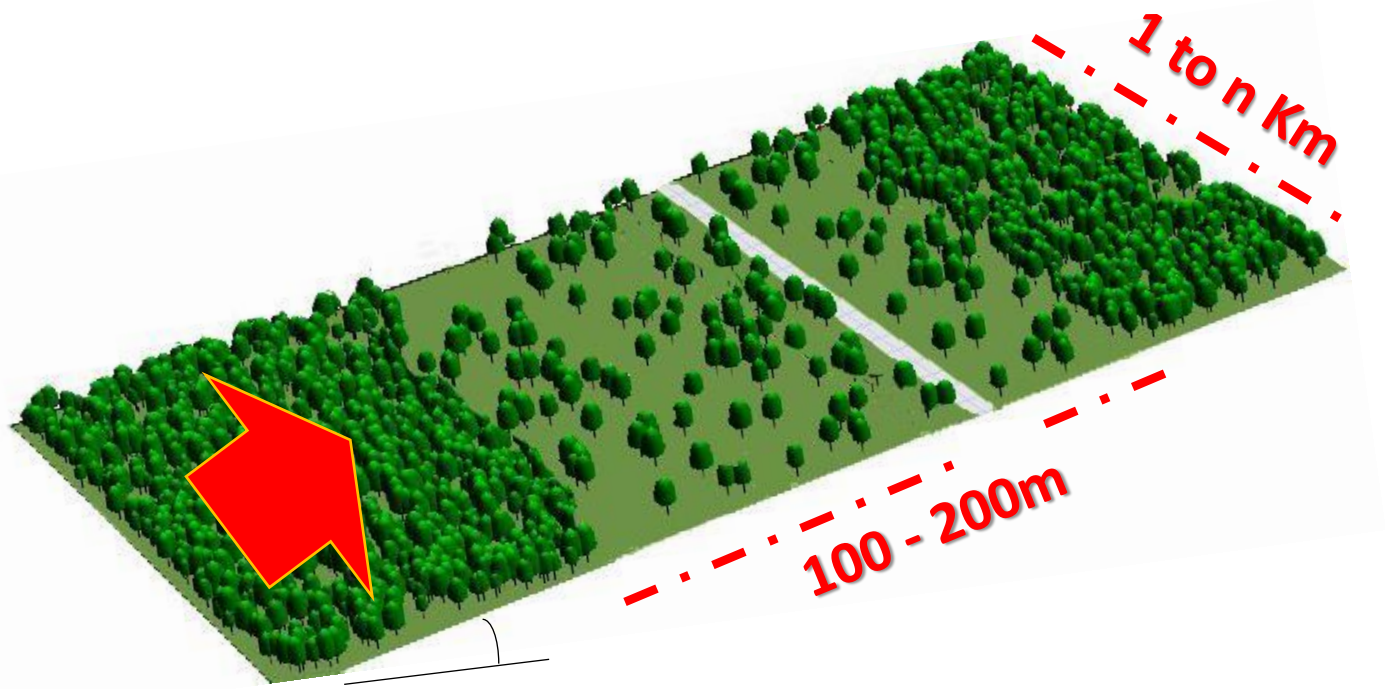
Preferential
fire trajectories

Self-resistant
forests

Shaded
fuel-breaks

Stand scale: reconciling prescriptions

Shaded fuel break to support fire-fighting



Sizing

The **dimensions** must be **large enough** to guarantee **safety** distance

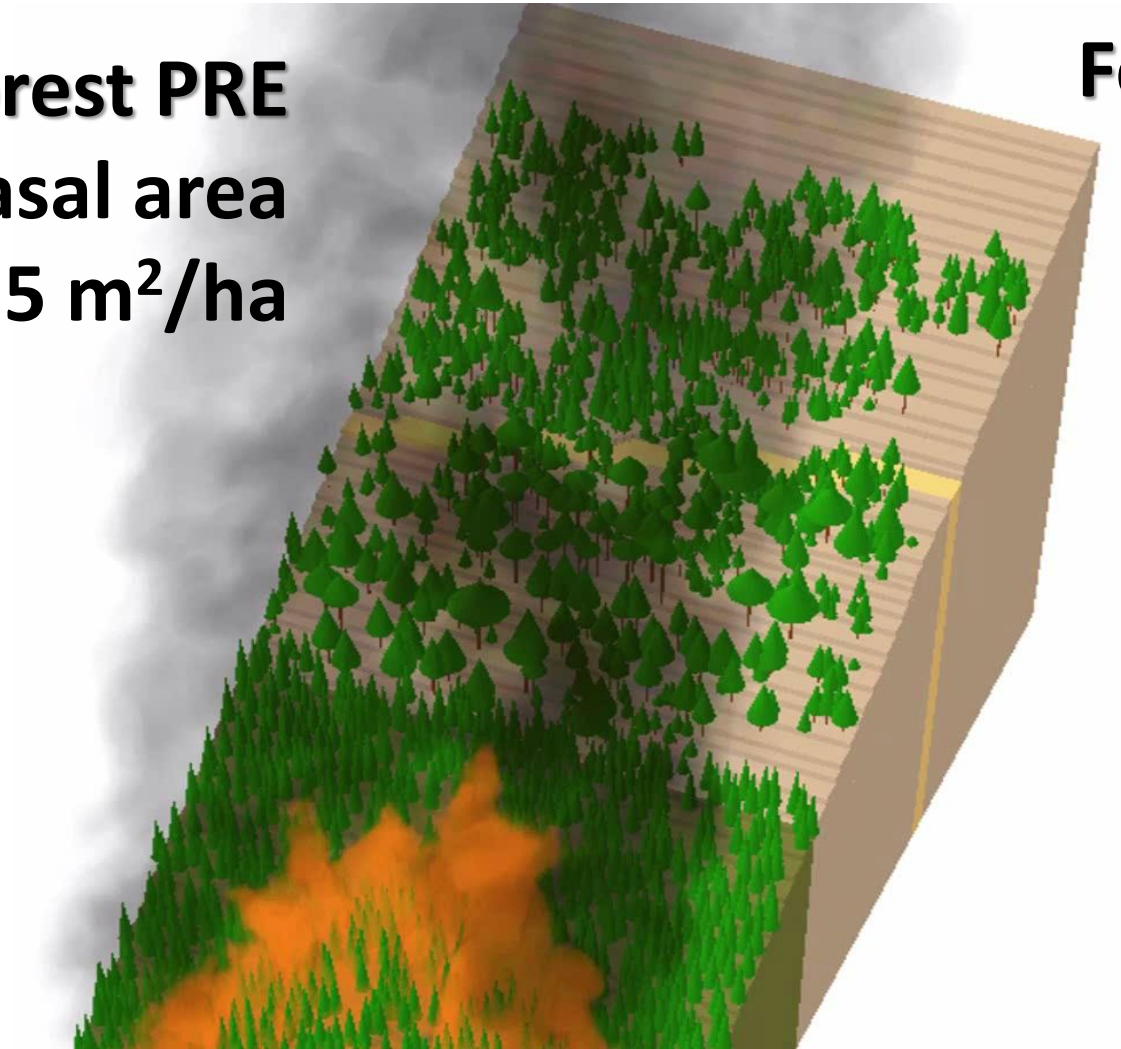
Tree density < 150 tree/ha

Surface fuels < 8 tons/ha

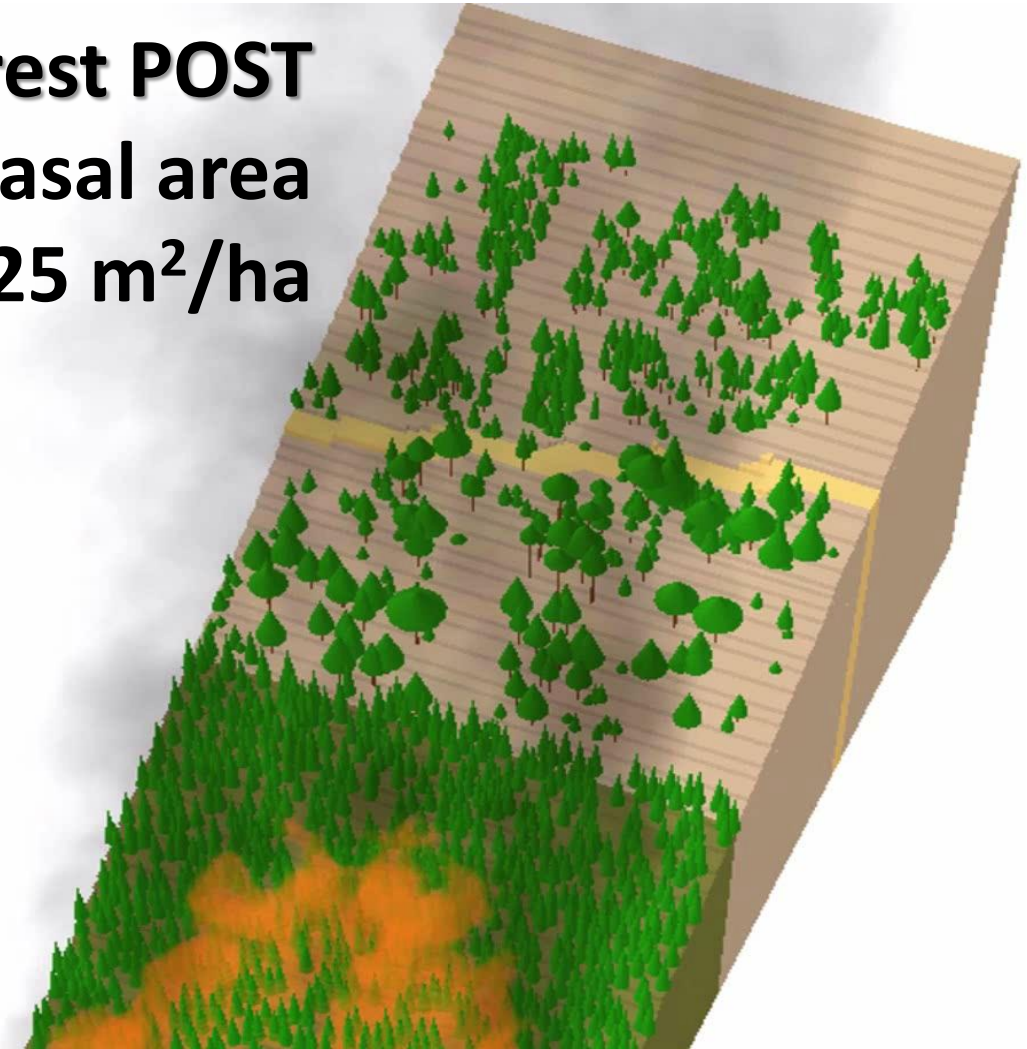
Stand scale: reconciling prescriptions

Self-resistance and resilience to fire disturbance

Forest PRE
Basal area
55 m^2/ha



Forest POST
Basal area
25 m^2/ha



Stand scale: reconciling prescriptions

Self-resistance and resilience to fire disturbance

Pyro-silvicultural modules are **complemented** by **surface fuels treatments** that modify the **flammability** of the understory using various techniques such as mechanical shredding, prescribed burning, or prescribed grazing

Mastication

Prescribed burning

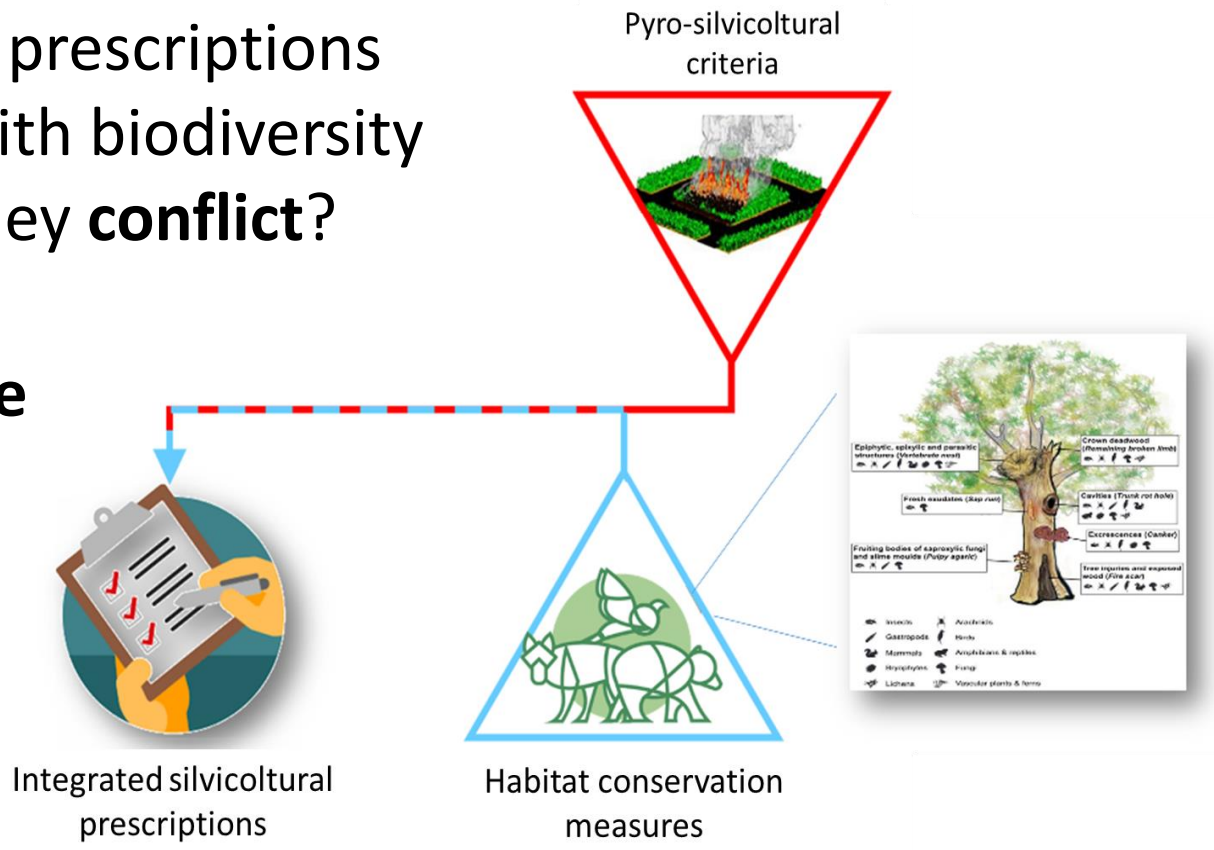
Prescribed grazing

Stand scale: support fire-fighting and self-resistance

How to reconcile **criteria for reducing flammability** and increasing fire-fighter safety with the **prescribed biodiversity requirements**

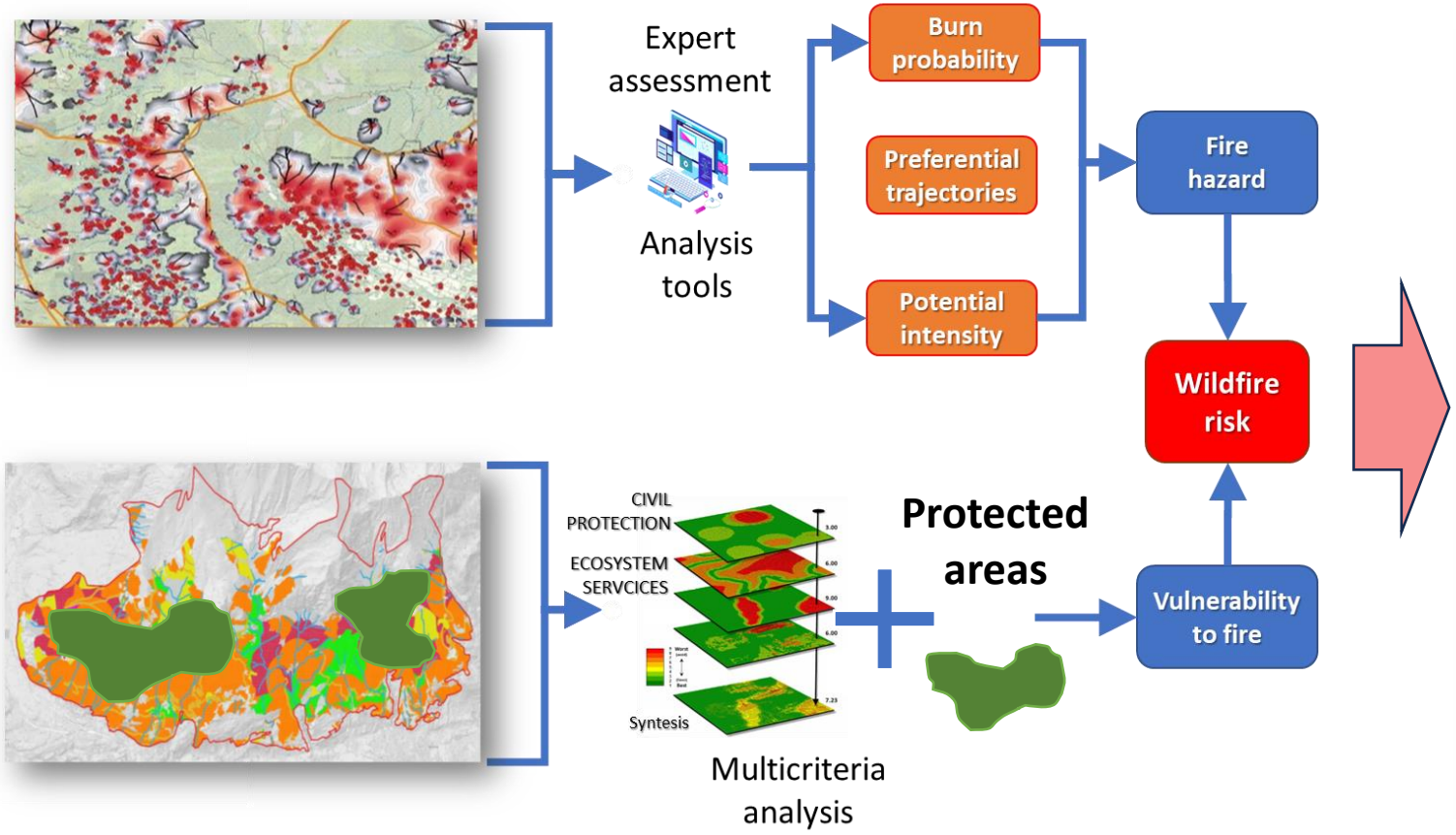
- To what extent pyro-silvicultural prescriptions are **consistent** and **synergistic** with biodiversity conservation **measures**, or do they **conflict**?

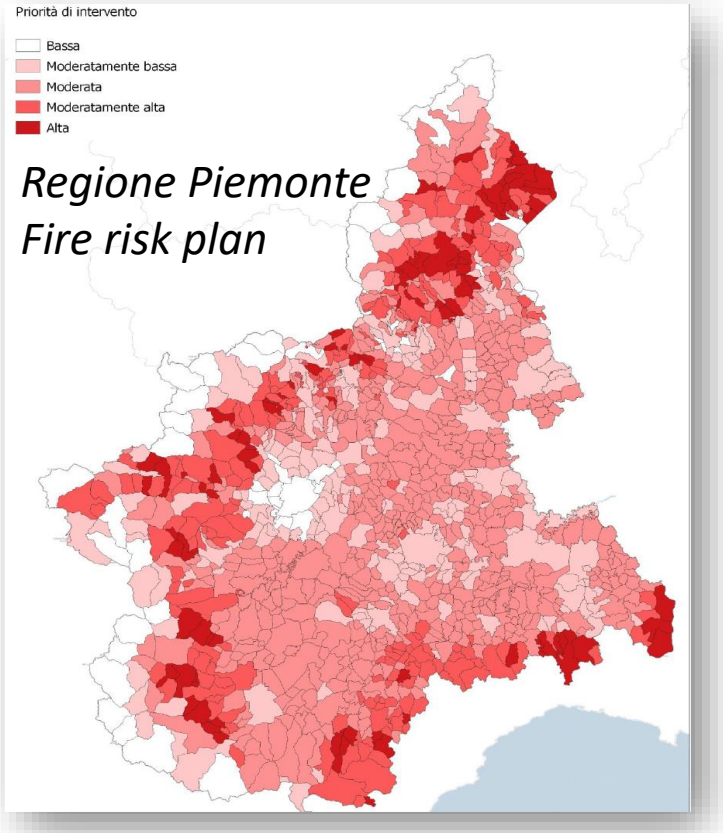
- How can we ensure the **presence** of adequate levels of **deadwood** and **microhabitats**?



Wildfire risk assessment and biodiversity conservation

Standard approaches recognizes that a fire is **always a concern** for the **management** of a **protected area**, **regardless** of the **real impact** that fire may have on biodiversity, fire represents an **administrative burden** (e.g., costs, constraints, accessibility).

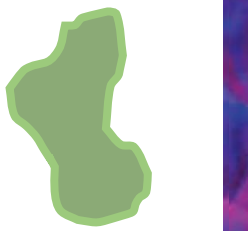


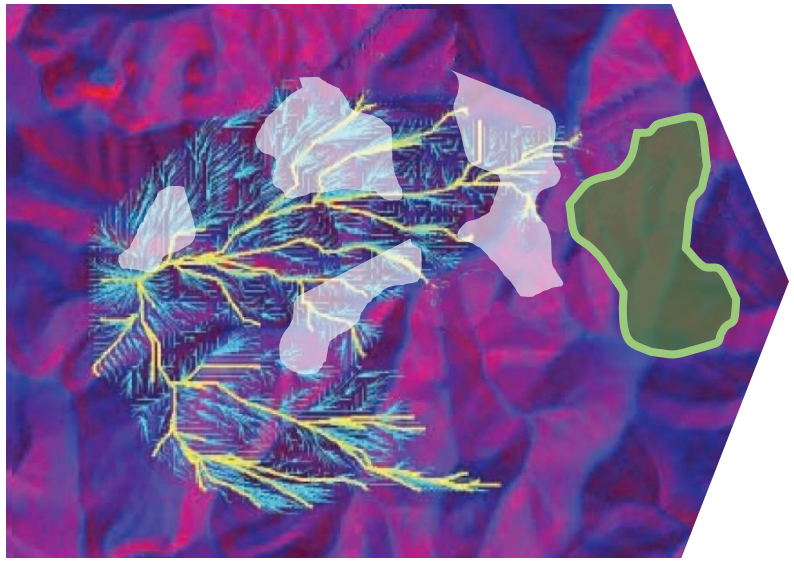


Wildfire risk assessment and biodiversity conservation

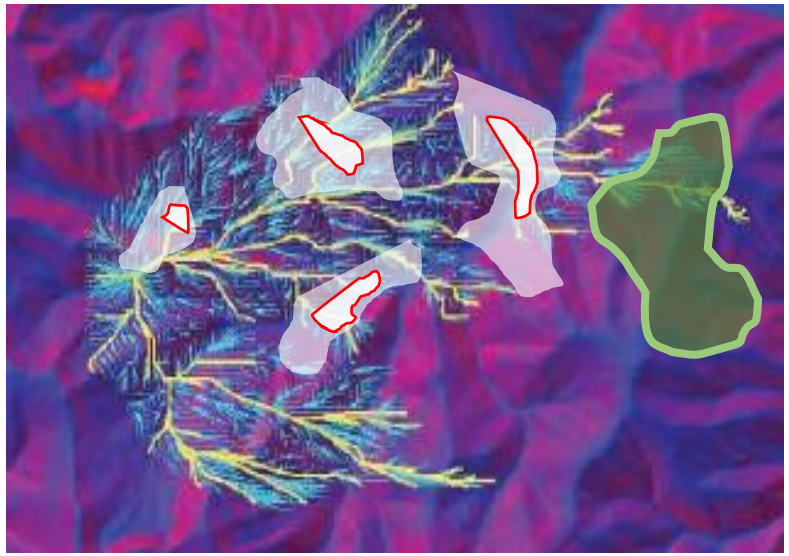
Simplistic approach. It is not feasible (and not desirable) to completely exclude fire from protected area. **Limited resources** for prevention must be **optimized** based on **multi-criteria analysis** that consider trade-offs between needs, including biodiversity conservation, **civil protection**, rural development, and **production**.

Protected area





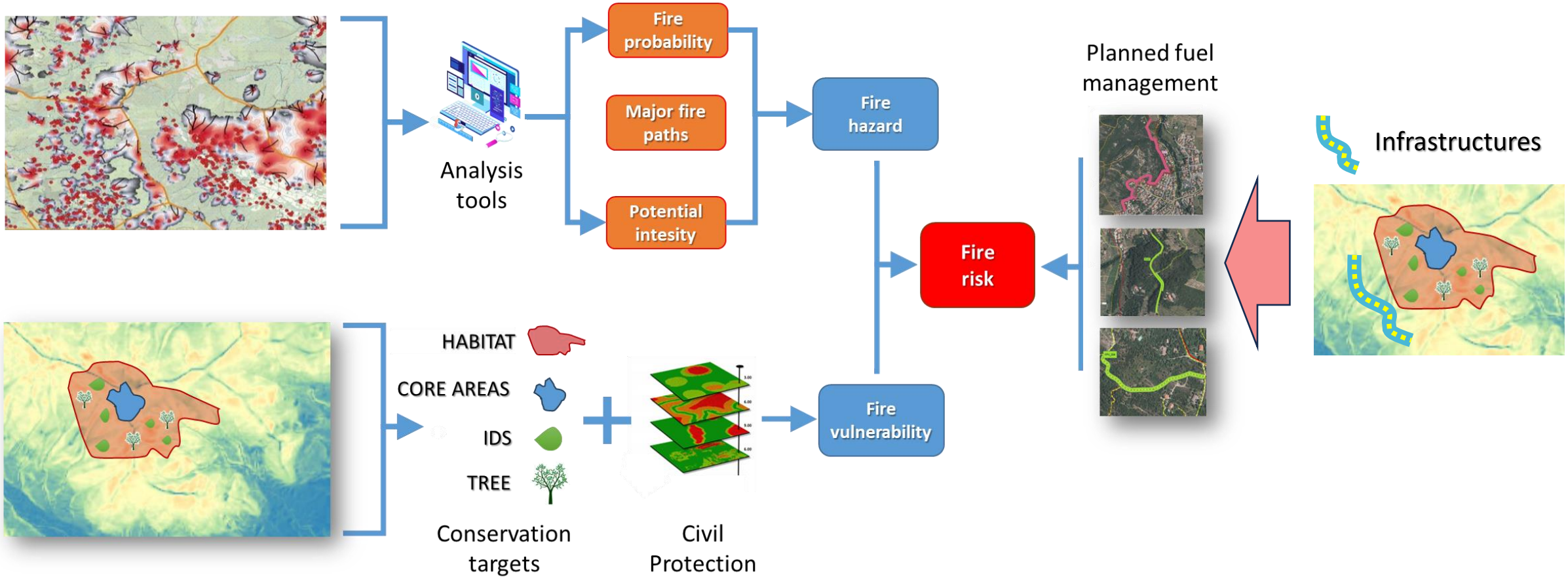
Ideal situation in which I can treat large areas to avoid fire



Resources must be **optimized** to treat max 10% of the landscape

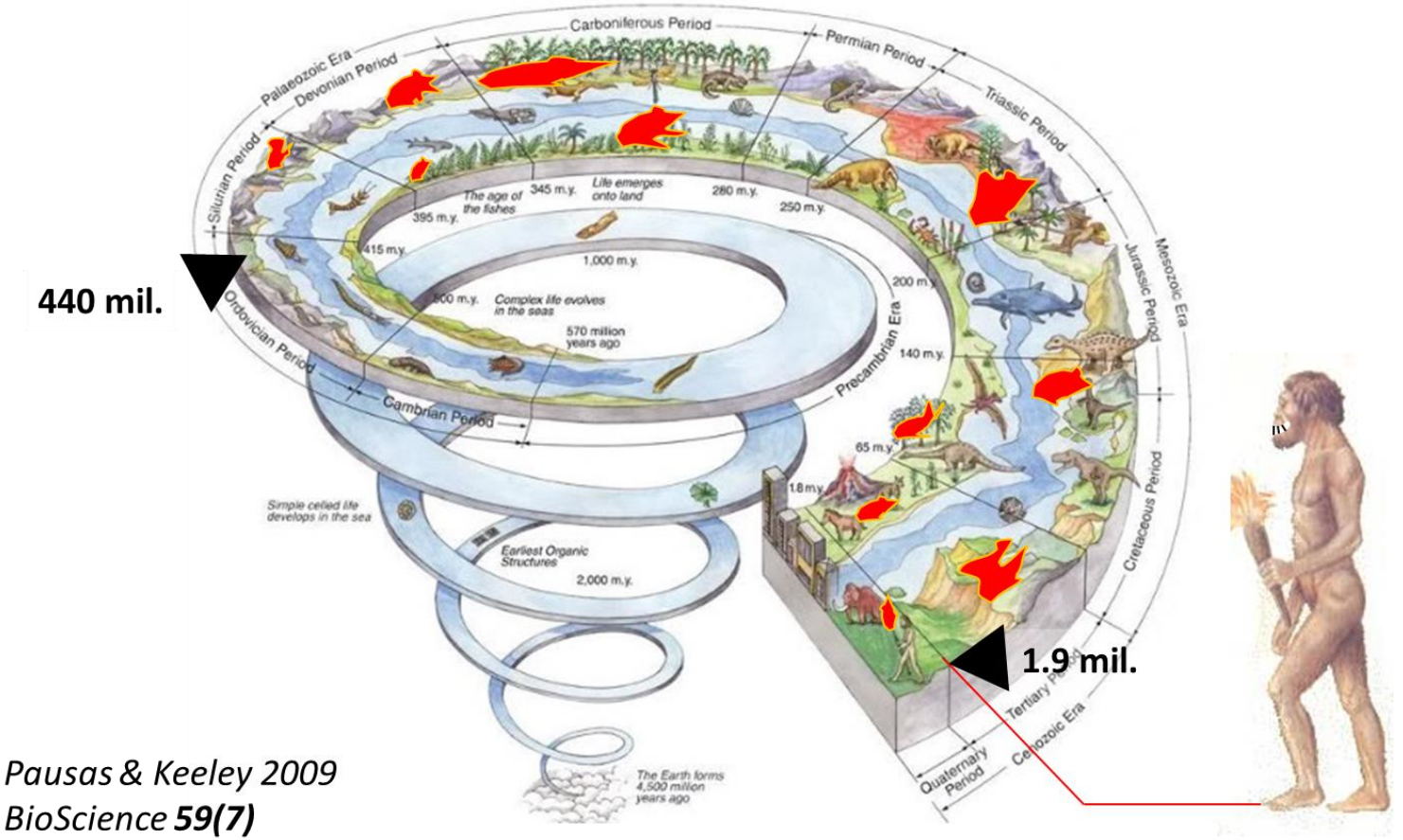
Wildfire risk assessment and biodiversity conservation

Within a protected area we need to **identify targets** to be protected, such as **fire sensitive habitats**, **island** of senescence, **core areas**



Habitat sensitivity/adaptation to specific fire regimes

Plant and animal **species functional traits** have been selected by specific **fire regimes** (seasonality, frequency, severity, return interval)

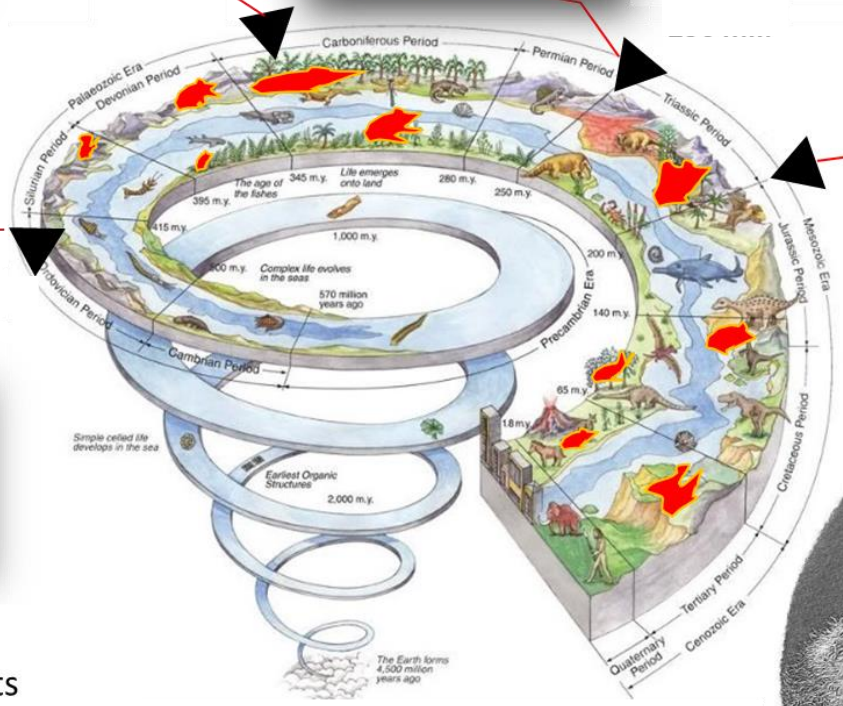


Pausas & Keeley 2009
BioScience ***59(7)***

Habitat sensitivity/adaptation to specific fire regimes

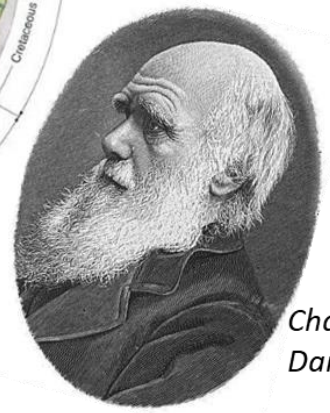
Regenerative Capacity (Asexual)
Herbaceous, shrubby, and tree species (oaks, beech, chestnut, ash, maple).

Sexual regeneration Capacity
Some species develop serotiny (maritime pine and Aleppo pine), while others renew through resprouting (oaks, beech, Scots pine)



High Flammability
Many species hold flammable fuels (grasses, Mediterranean shrubs, pines, oak and chestnut litter)

Fire Resistance
Thick bark (larch), deep roots (oaks), high crown insertion (beech), bud protection (pines).



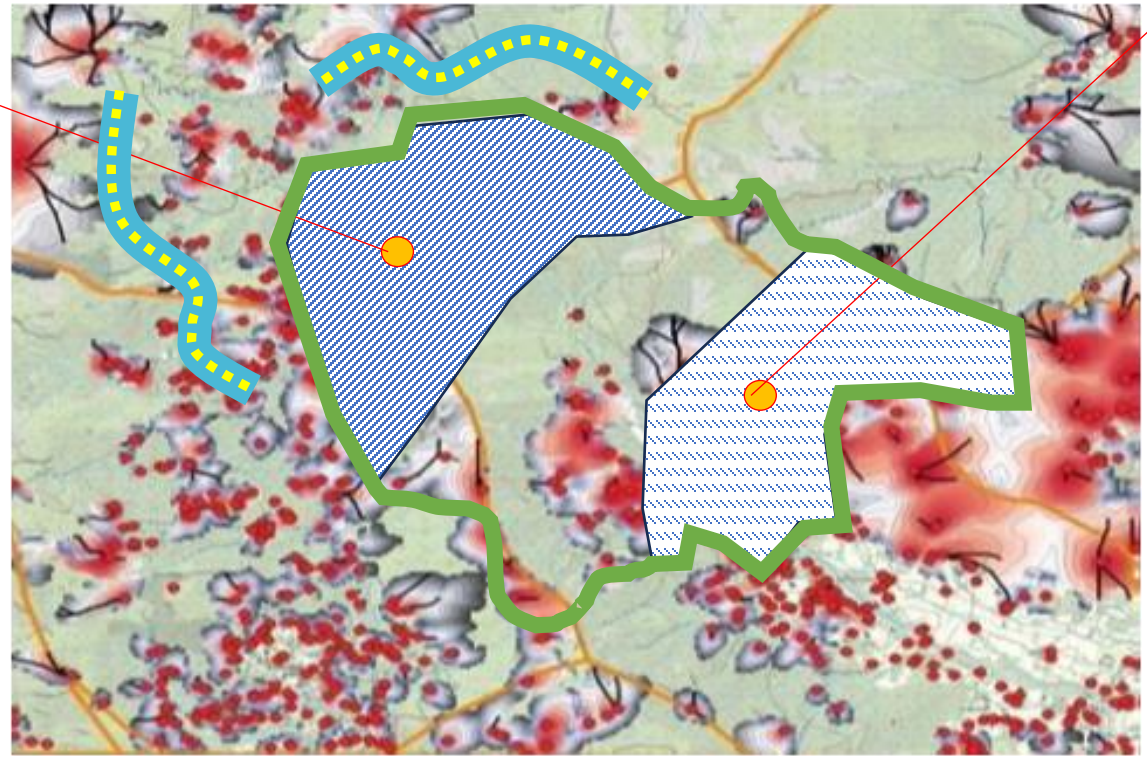
Charles Darwin

Habitat sensitivity/adaptation to specific fire regimes

Fire sensitive habitat

E.g. 9580*
Mediterranean Taxus baccata woods

Preventive infrastructures



Protected area

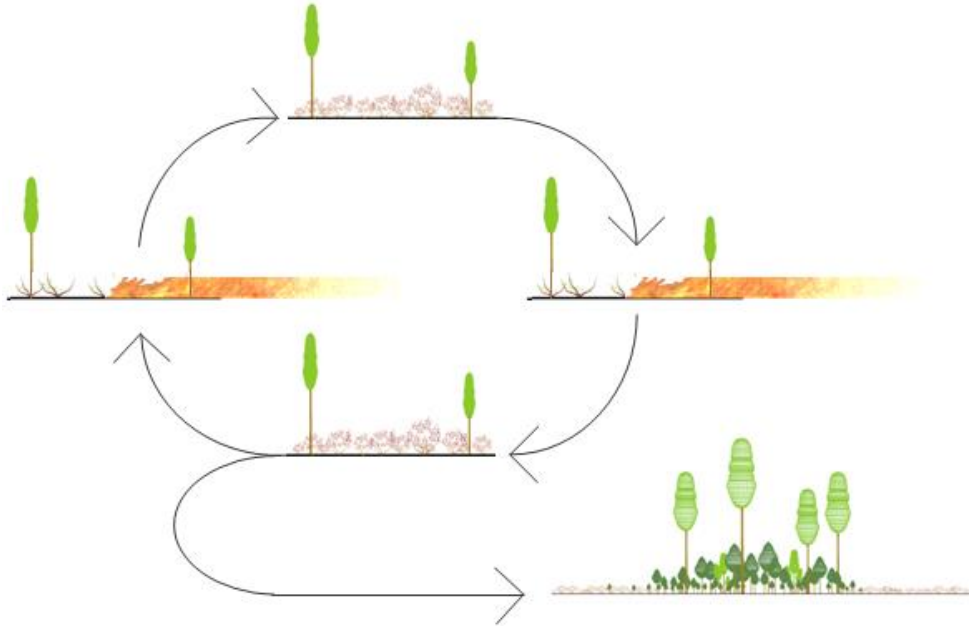
Fire adapted habitat

E.g. 4030
European dry heaths

Habitat sensitivity/adaptation to specific fire regimes

Habitats **requiring** a **specific fire regime** — relying on the **stochasticity** of wildfire is not sufficient. **Prescribed burning** regulates the fire disturbance

Conservation management of habitat HD/92/43/CEE



Prescribed burning

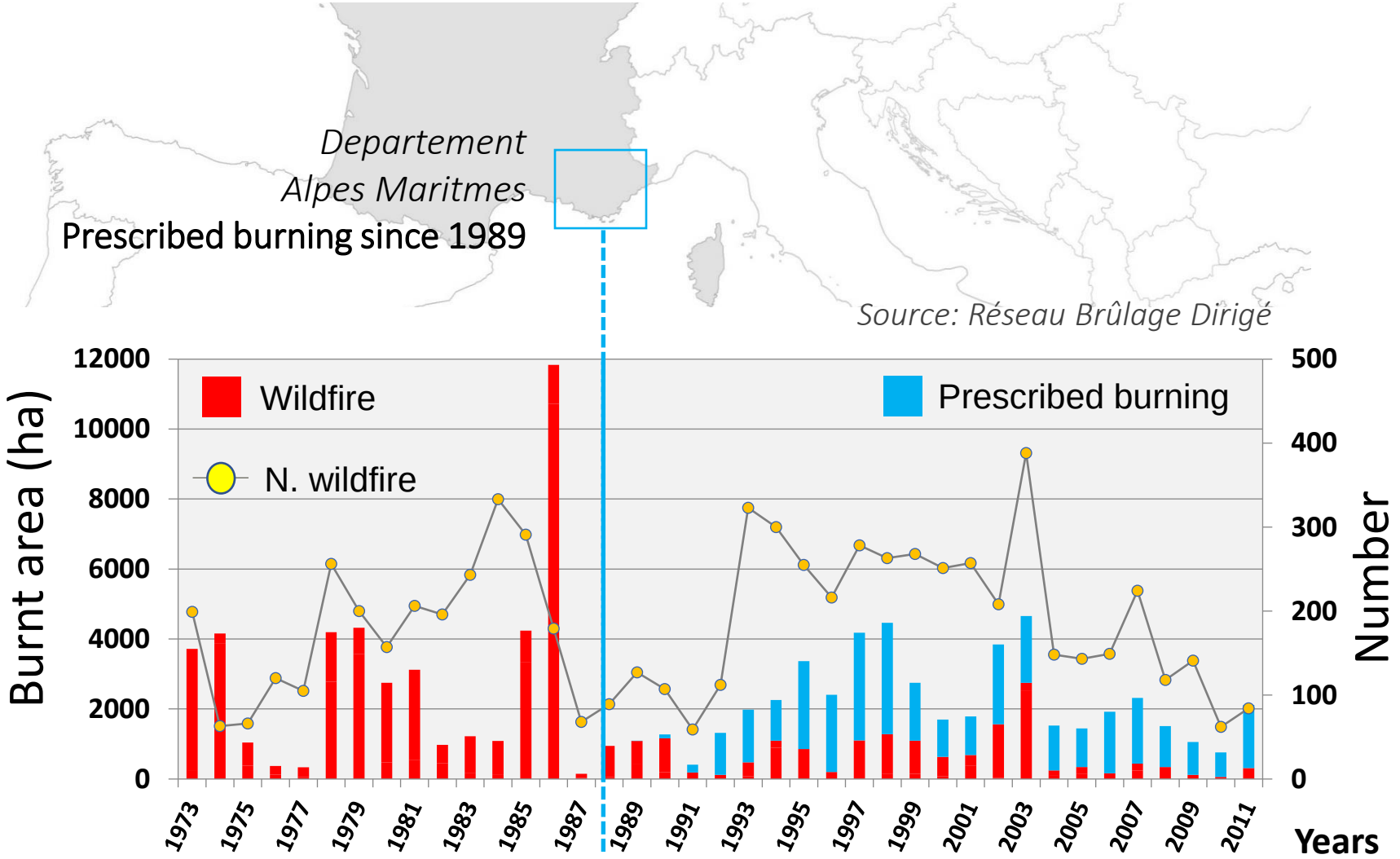
Conservation of cultural landscapes and **priority habitats** and of EU interest (e.g. 6210*, 4030, 62A0, 6410)

Maintenance of open areas to create **ecotone** zones for **wildlife**

Habitat sensitivity/adaptation to specific fire regimes

Prescribed burning

Planning the fire regime with prescribed burning allows for **adjusting** the **fire treatment** for **biodiversity needs**, letting fire regulate biomass, preventing the **stochastic effects** of uncontrolled wildfires, and **avoiding** future **extreme wildfires**

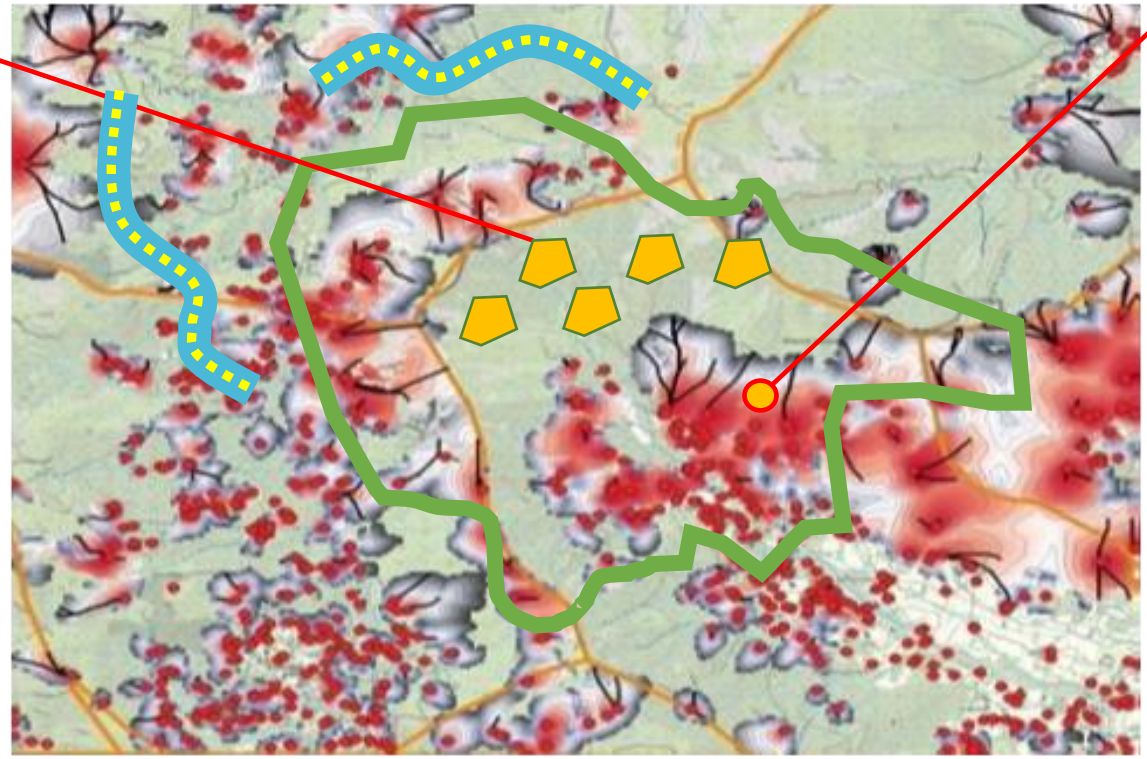


Protections of senescence islands, but…

Senescence islands

IDS spatial location should take into account **fire hazard**, **avoiding** large concentrations and **continuity** where **landscape flammability** is higher

Preventive infrastructures



Protected area

Senescence island

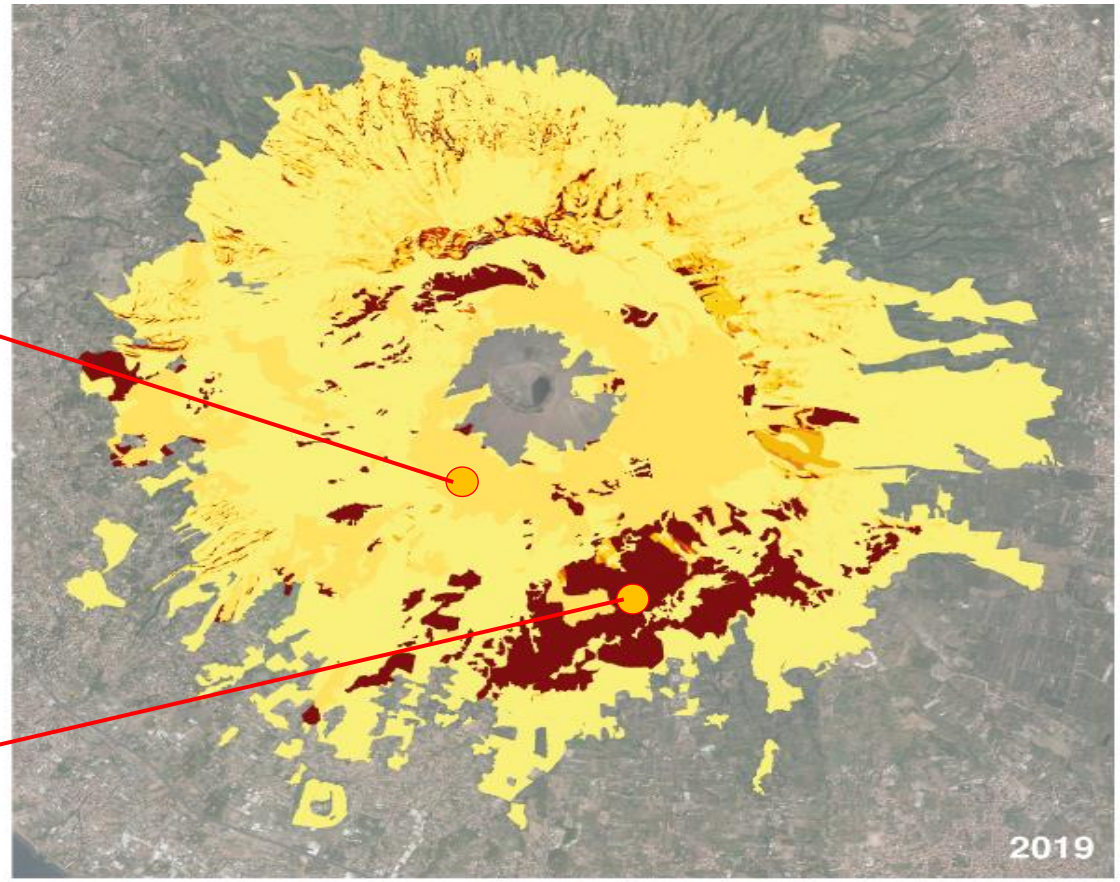
Fire might trigger naturalness

E.g. beech

Protections of senescence islands, but…

Vesuvio National Park – Wildfire 2017

Protections of senescence islands, but…



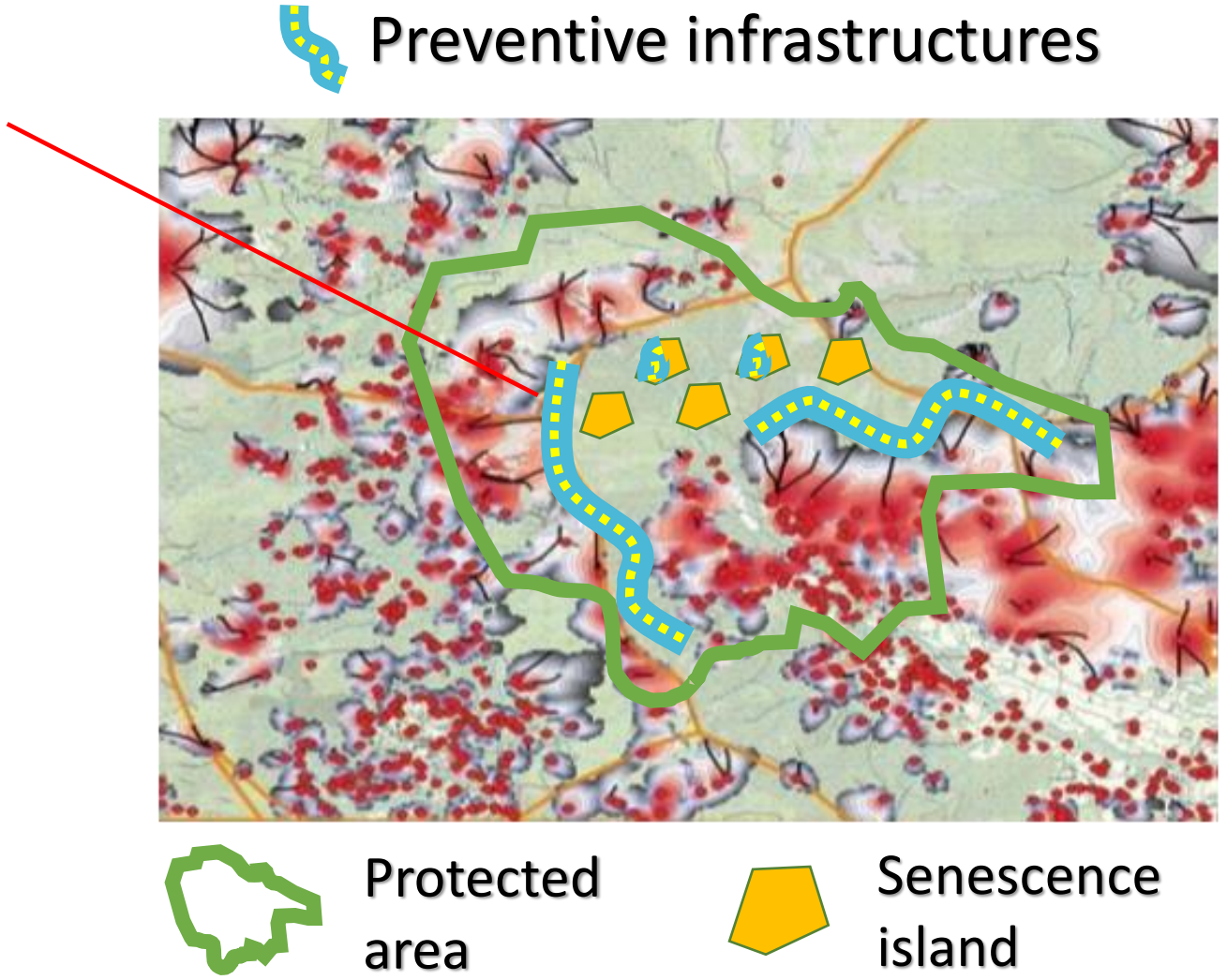
Potential wildfire intensity (kW/m) after fire

0 - 500	1800 - 3100	8600 - 14100
500 - 1000	3100 - 5200	14100 - 23000
1000 - 1800	5200 - 8600	> 23000

Protections of senescence islands, but…

Infrastructures within protected areas

Not all fires can be stopped before entering a protected area. Planning infrastructures within the protected area might be necessary, increasing both **opportunities for firefighters** and implementing measures to **enhance the resistance** and resilience of **forest stands** of interest for **biodiversity conservation**



Pyrosilviculture in protected areas

Example: shaded fuel breaks network in the Merse ZCS IT5190006-07

Shaded fuelbreaks
Standards for fire-fighters safety **have priority** over other needs.
It may be necessary to **deviate** from **specific ZCS conservation measures** within the fuelbreak (basal area, tree cover, deadwood retention, habitat trees)

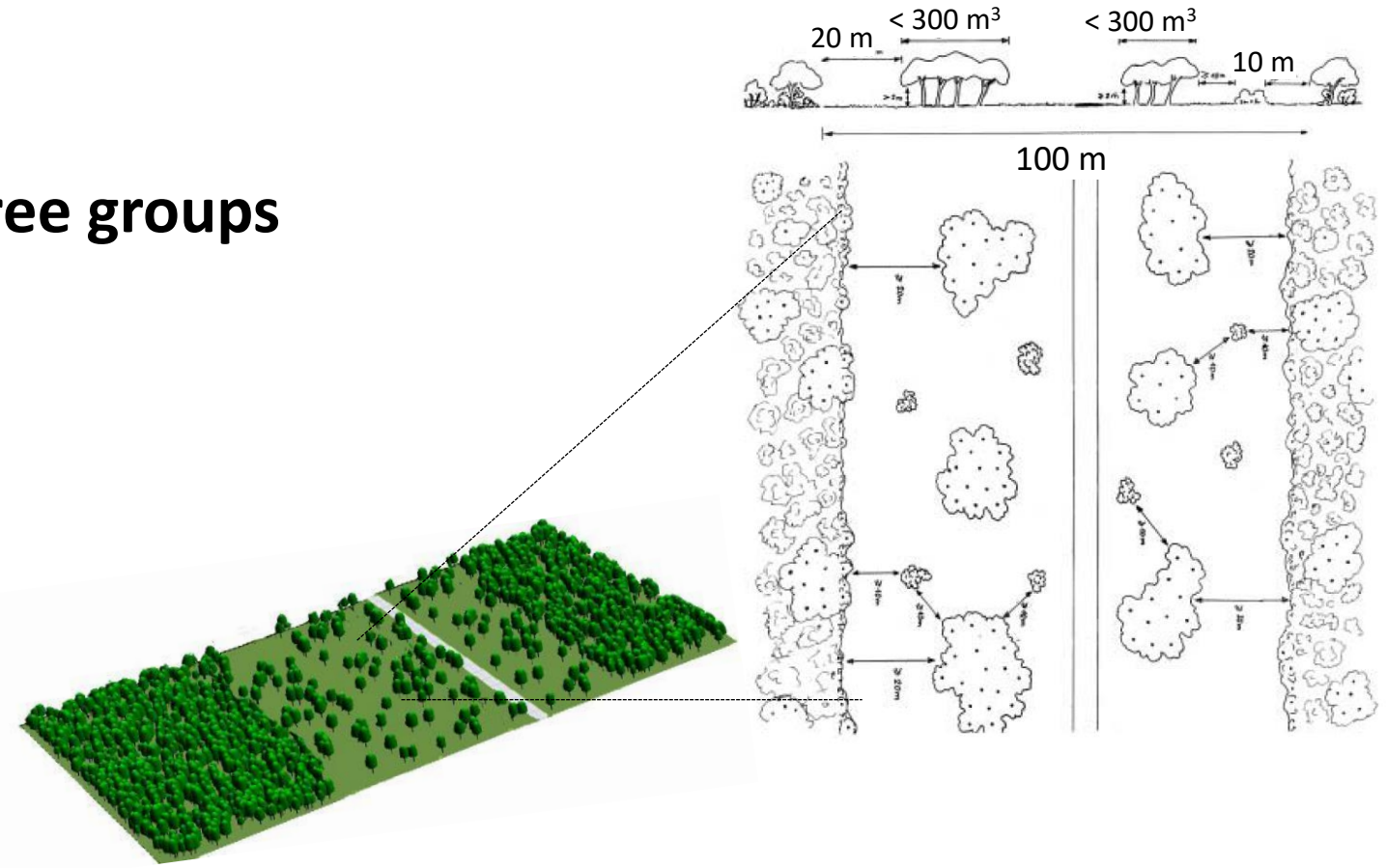
Pyrosilviculture in protected areas

Example: shaded fuel breaks network in the Merse ZCS IT5190006-07

prescriptions

Shaded fuel breaks with **tree groups**

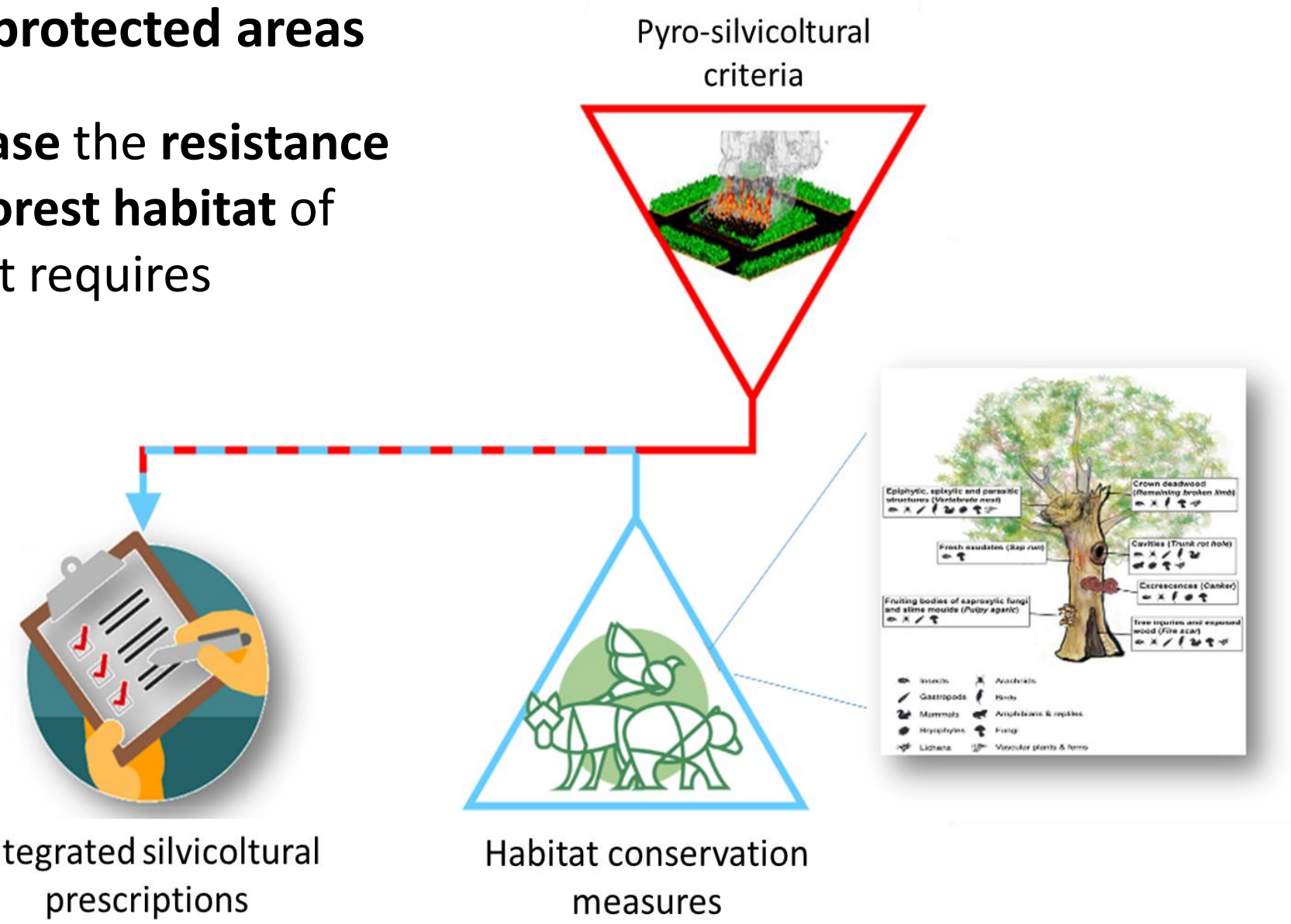
- density < 150 tree/ha + volume group < 300 m^3
- group distance (> 20 m)
- crown insertion > 6 m
- surface fuels < 4-8 t/ha
- no decaying trees
- few dead trees and deadwood



Rigolot É., Costa M. (coord.). *Conception des coupures de combustible.* Réseau Coupures de combustible RCC n°4 - Éd. de la Cardère Morières, 2000, 154 p.

Pyrosilviculture in protected areas

Intervening to **increase** the **resistance** and **resilience** of a **forest habitat** of conservation interest requires **compromises**



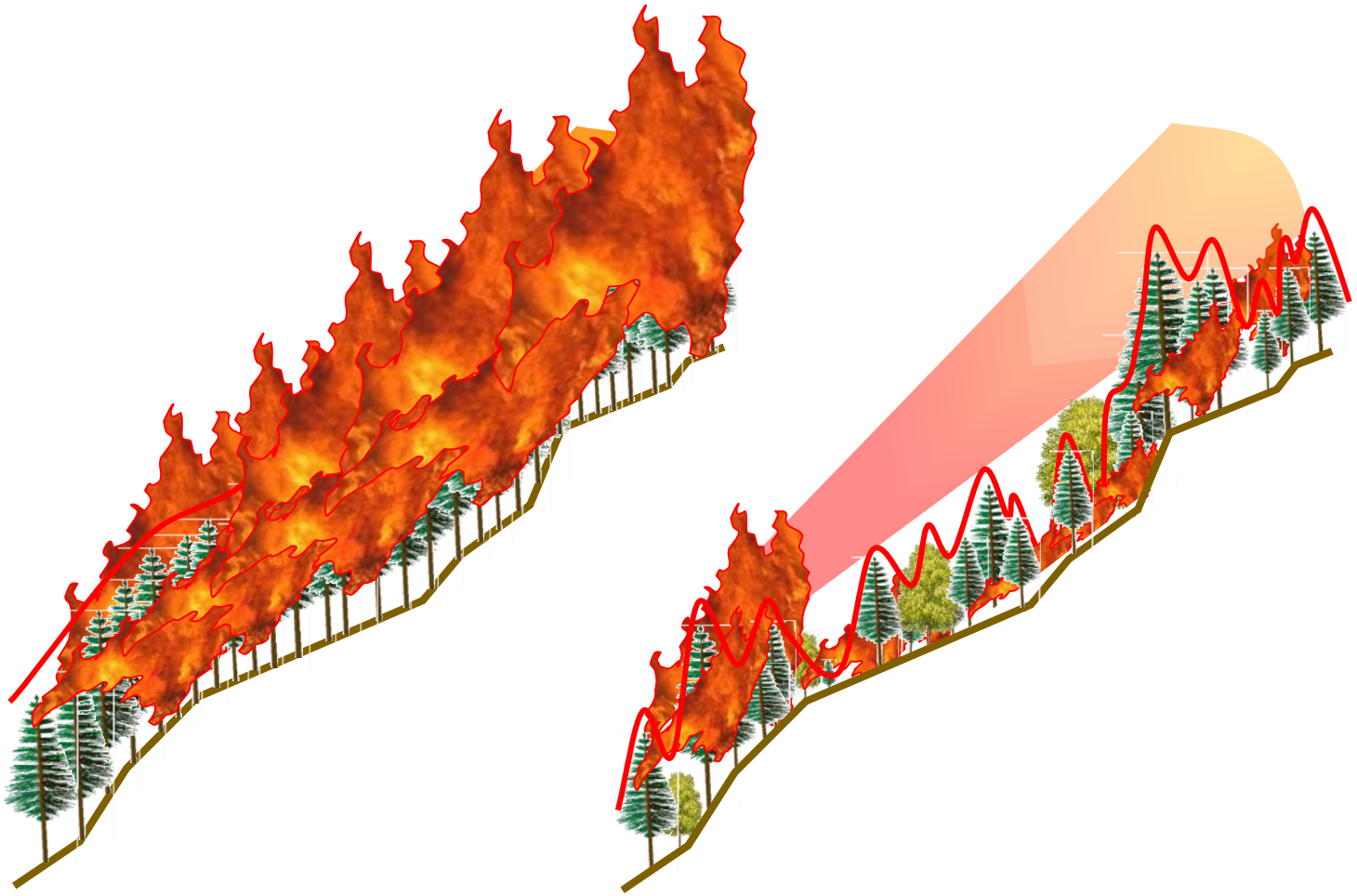
Pyrosilviculture in protected areas

Photo: Motta

Closer-to-nature sylviculture

Observation of the structure of **fire-prone stands** to understand the elements that **confer resistance** and resilience to fires and development of **pyro-silvicoltural** modules that **mimic** fire resistance stand **characteristics**

Pyrosilviculture in protected areas



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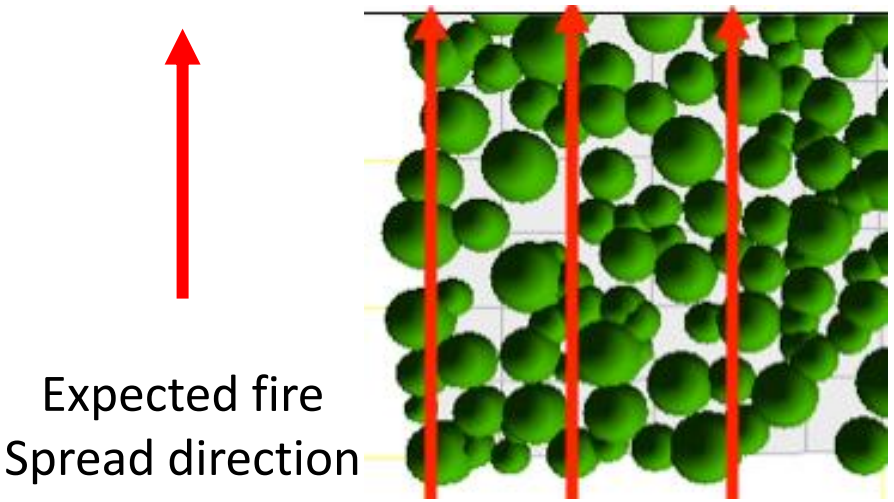
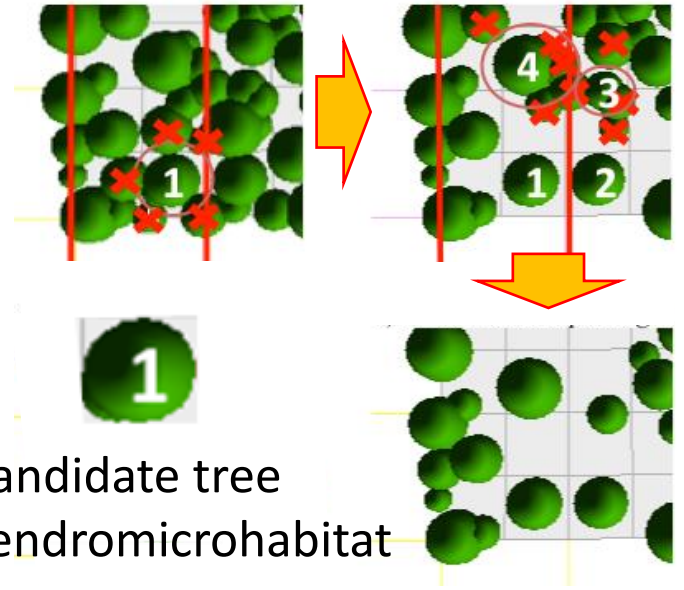
Pyrosilviculture in protected areas

Evaluate the **ecological value** of trees and their **flammability** in relation to **neighboring trees** and expected fire **spread direction**, especially with species that support **crown fires**

Retaining **flammable trees** with DMH (e.g., resin, cavities), requires **selecting** individual **trees** or **groups** around **candidate plants** to avoid the spread of **crown fire** or **lethal thermal doses** to candidates



Modified from Cantiani P.



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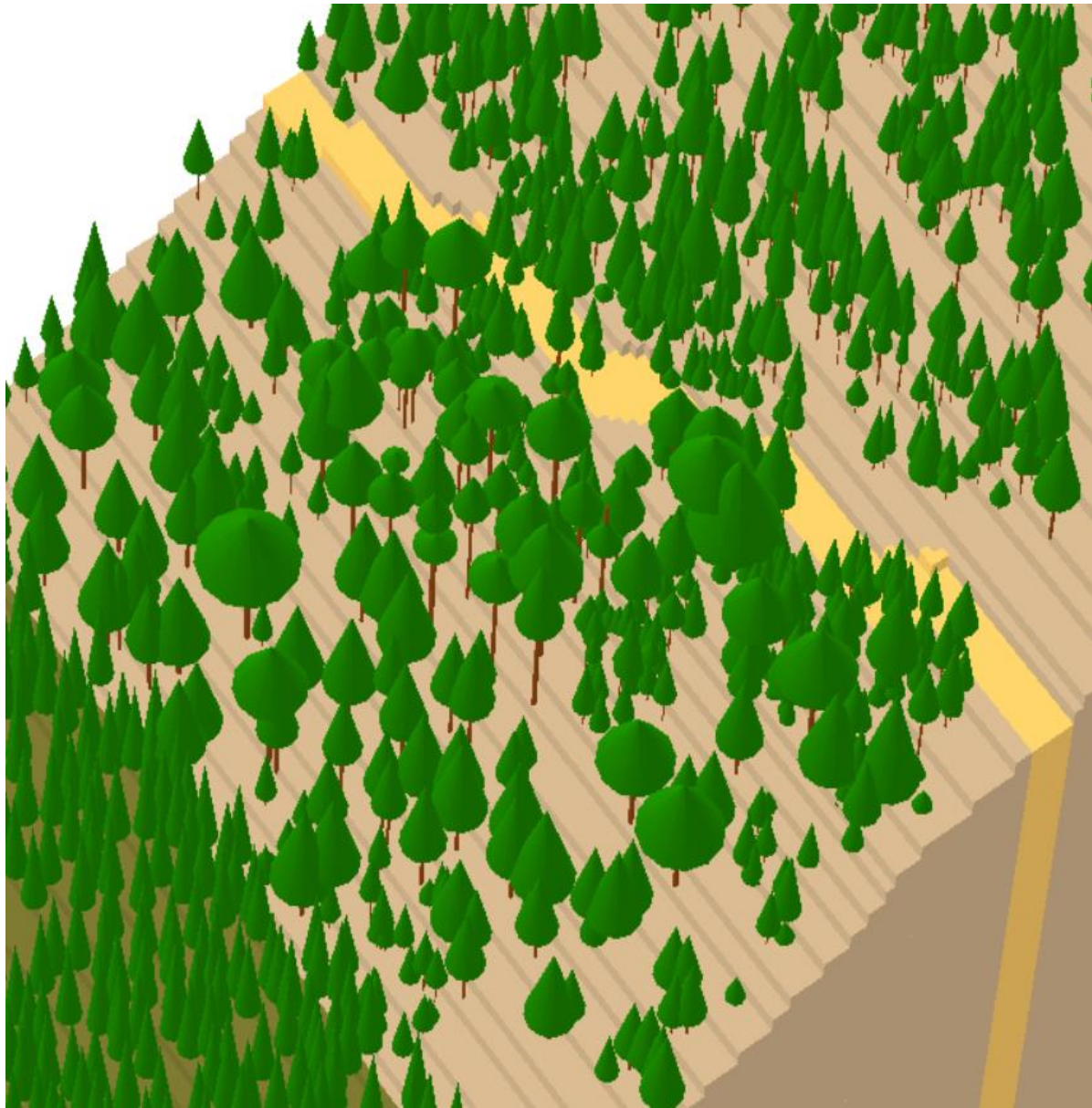

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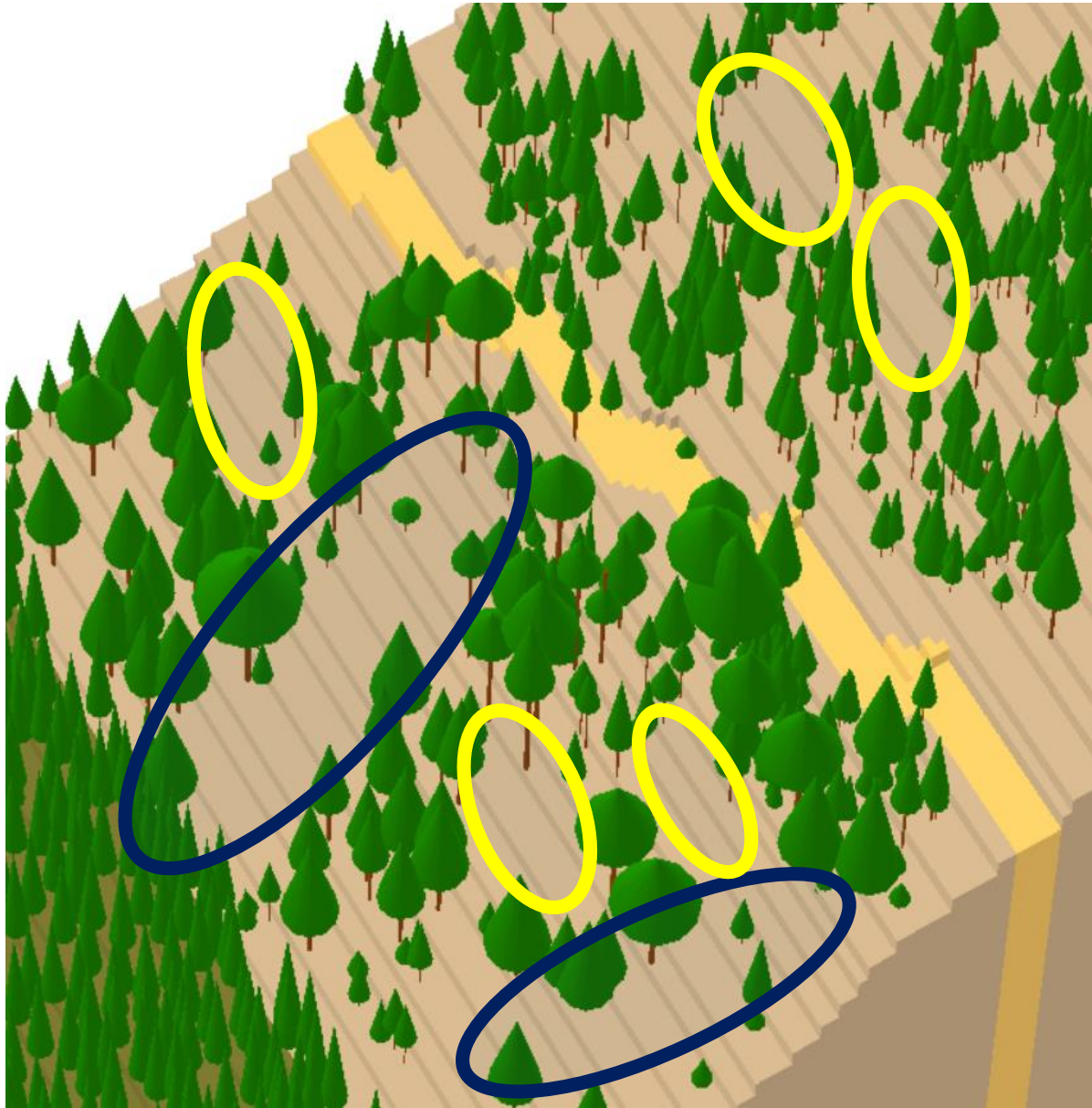

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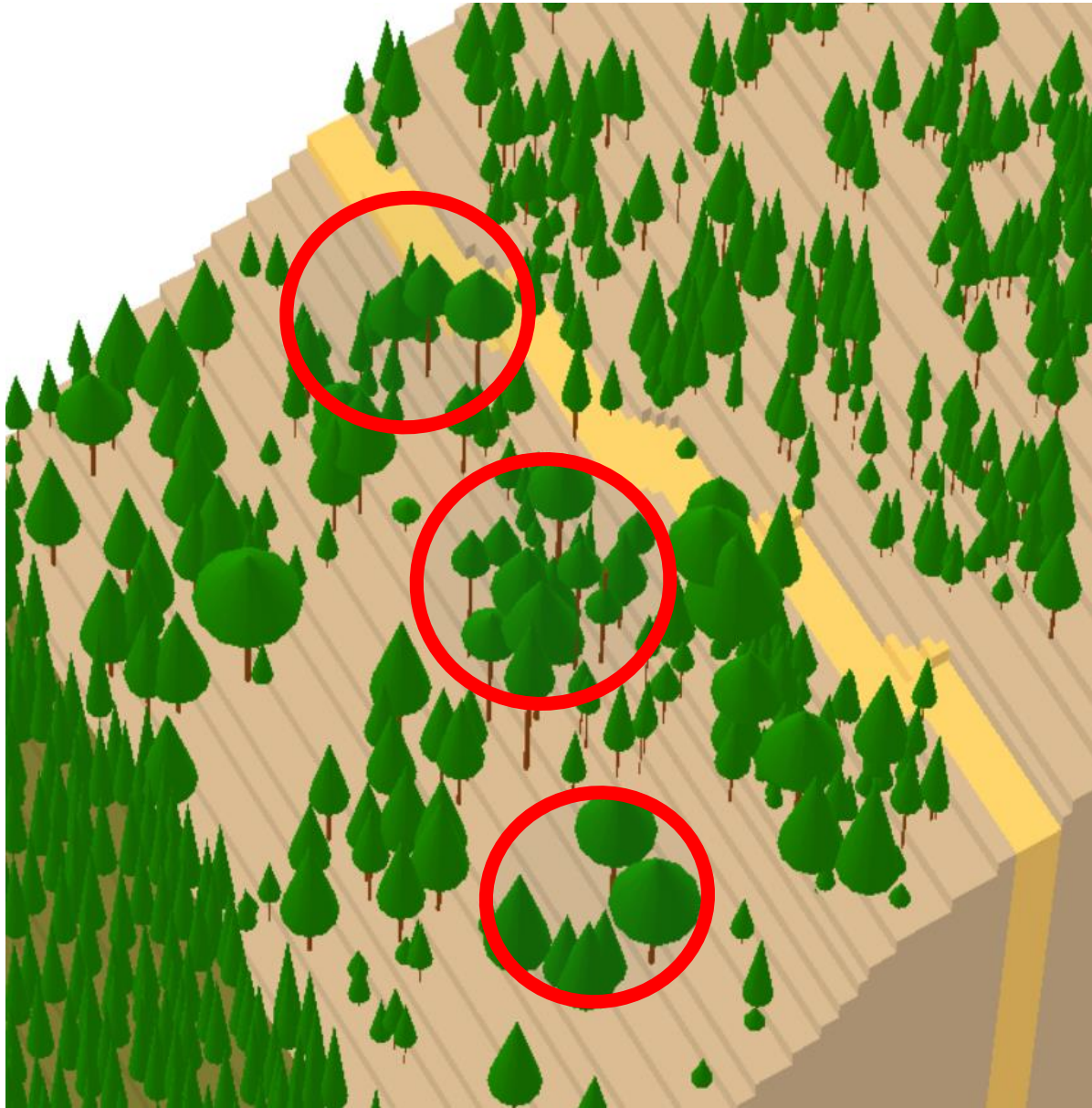


Pyrosilviculture in protected areas

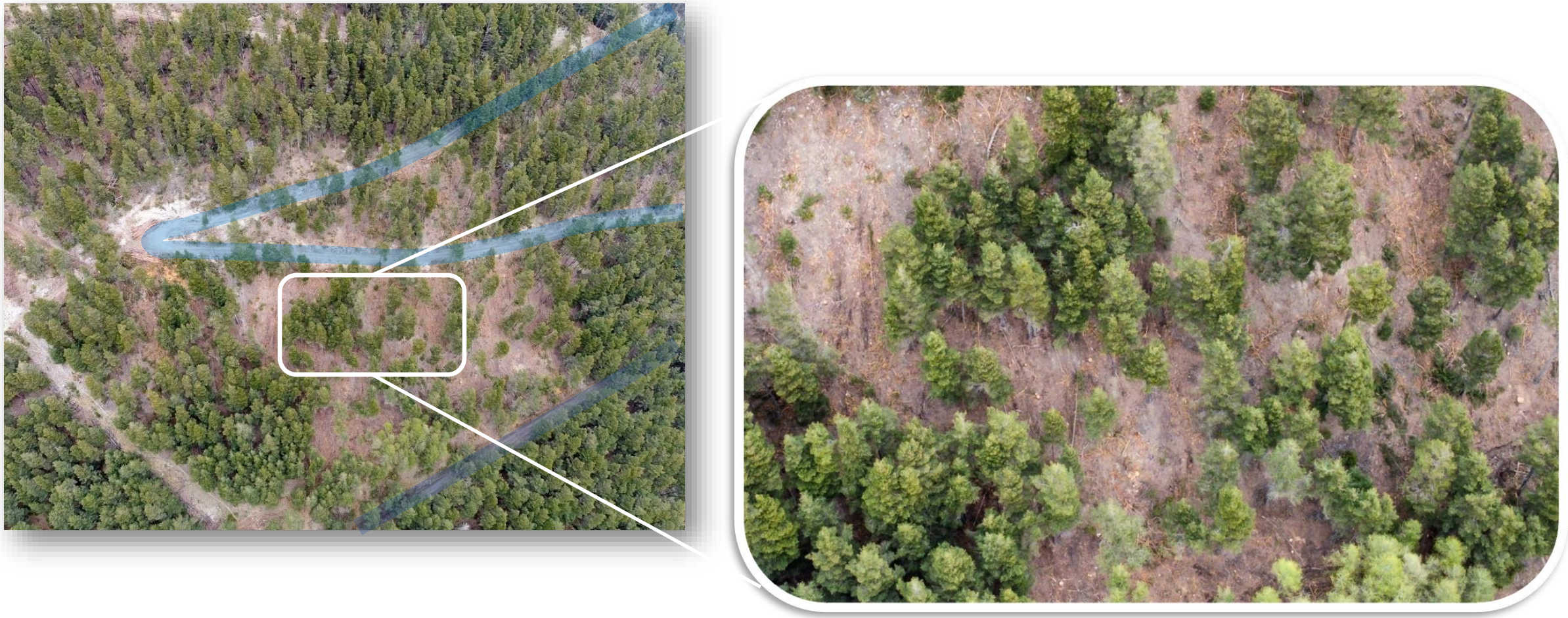
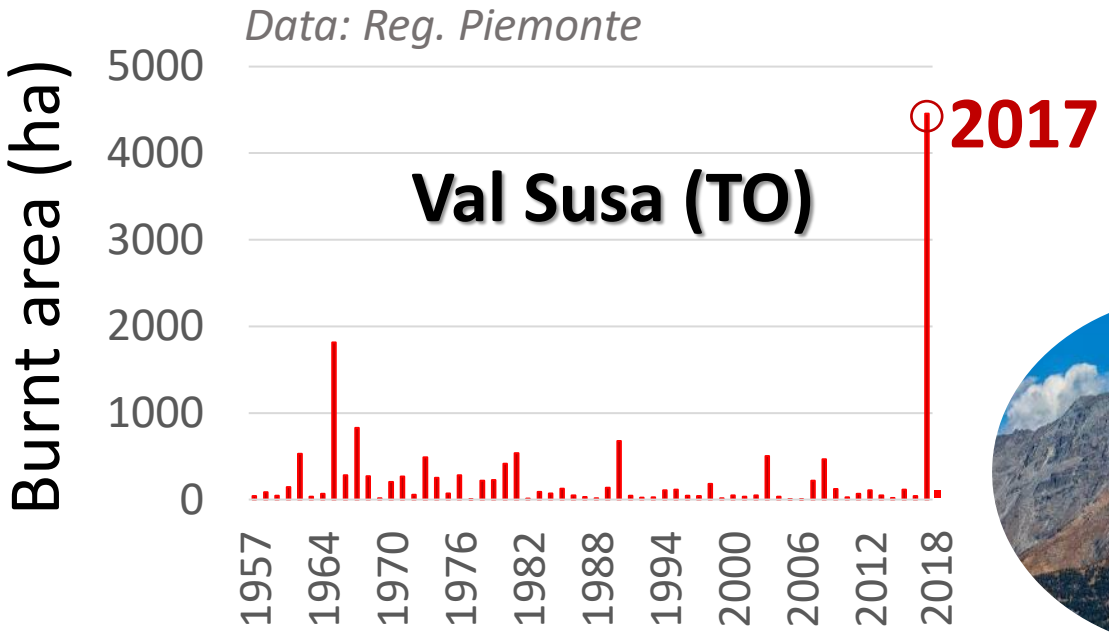


Foto: *Renzo Motta, UNITO*

Pyrosilviculture in protected areas

To protect **individual** or **groups** of **habitat trees**, we have to **reduce surface flammable** biomass, including **deadwood**, one of the most flammable components (dead wood loading can generate **high intensity** and **severity**)

Pyrosilviculture in protected areas: deadwood management

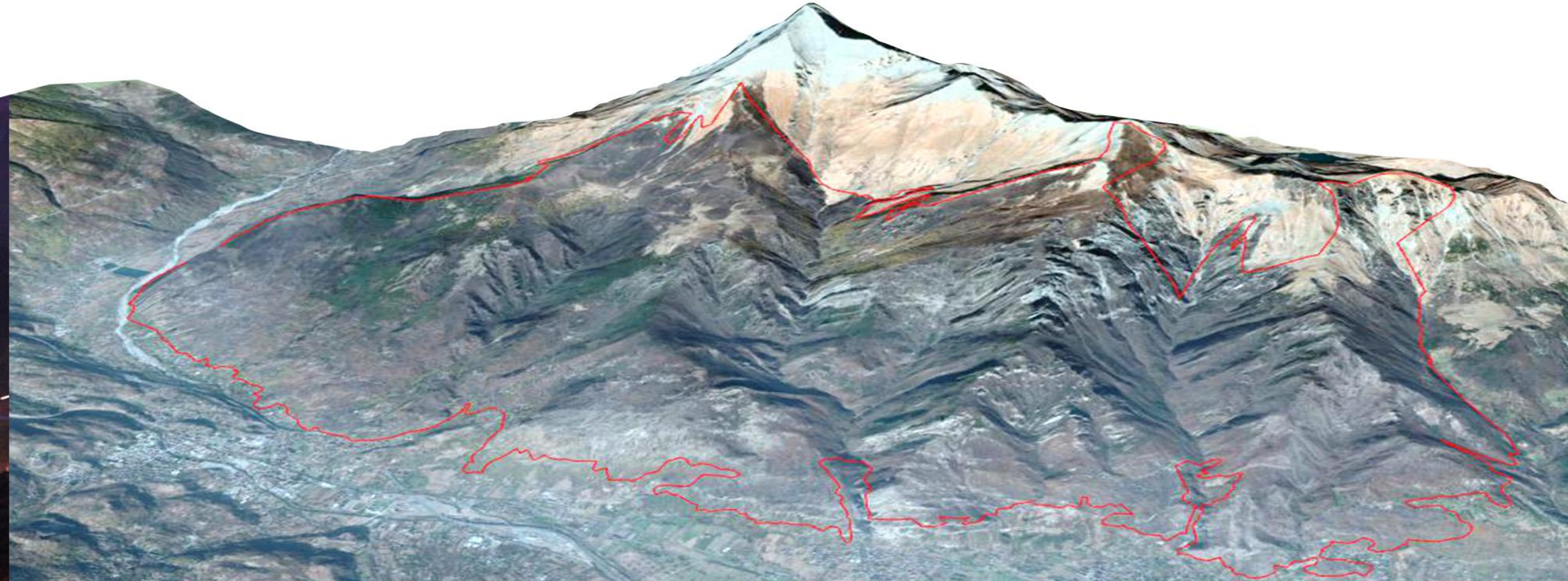


Extreme wildfire in **Val Susa 2017**
…more than **3974 ettari** (65% forest)
…above **fire suppression capacity**

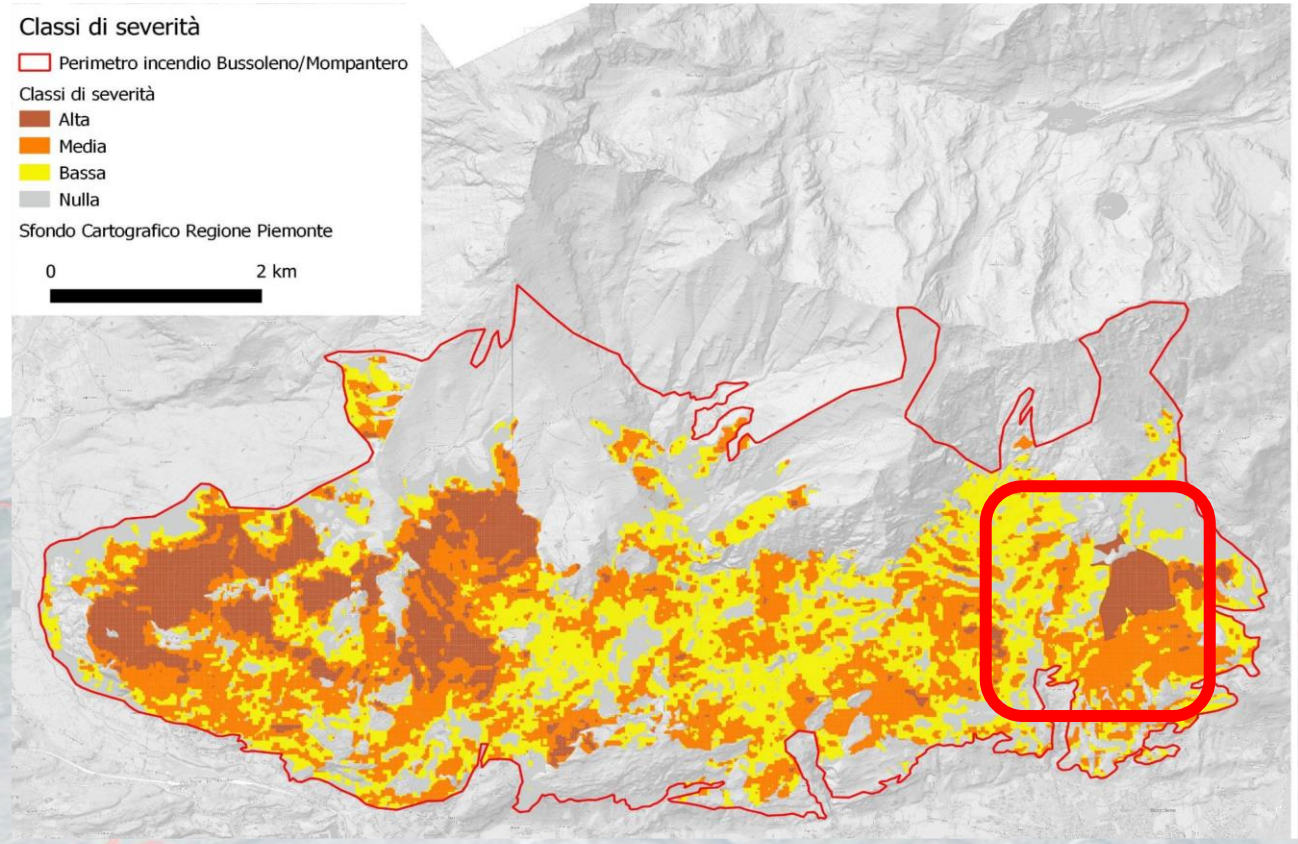
Pyrosilviculture in protected areas: deadwood management

Period: 22 October – 6 November 2017

Burnt area: 3974 ha



Pyrosilviculture in protected areas: deadwood management



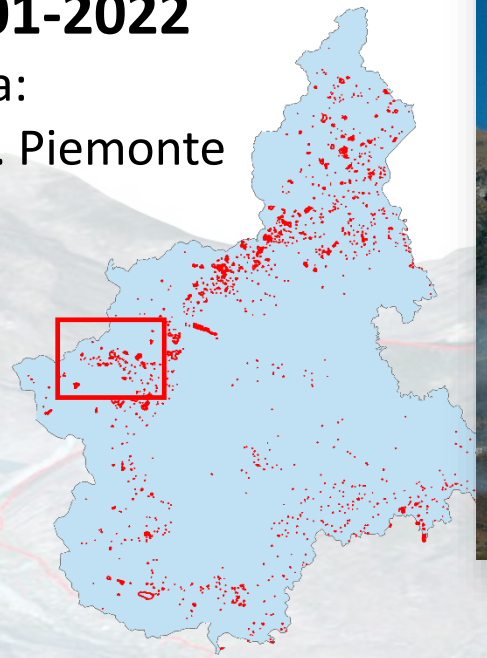
Fire severity

Piano straordinario

interventi di ripristino del territorio percorso dagli incendi boschivi dell'autunno 2017

Pyrosilviculture in protected areas: deadwood management

Wildfires
2001-2022
Data:
Reg. Piemonte

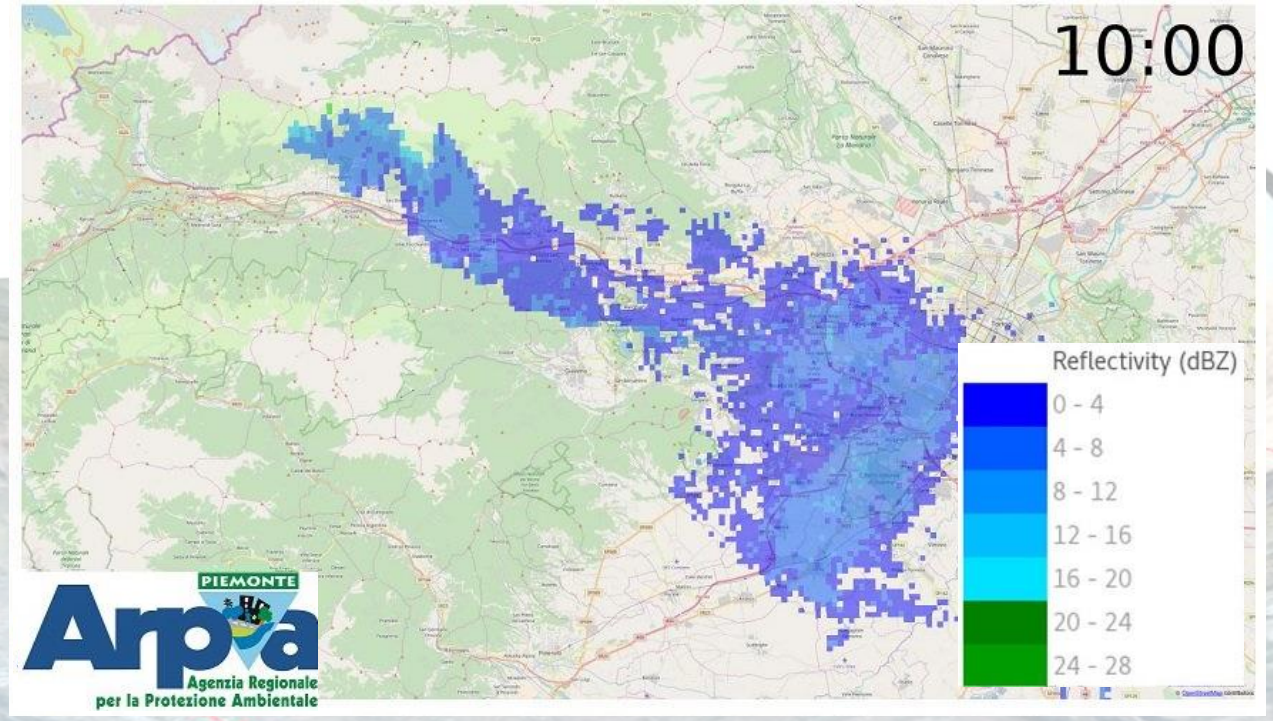


Pyrosilviculture in protected areas: deadwood management

Costs of debris flow

6 evacu ts
ed
sts
32

Pyrosilviculture in protected areas: deadwood management



Green house emissions (ton.)

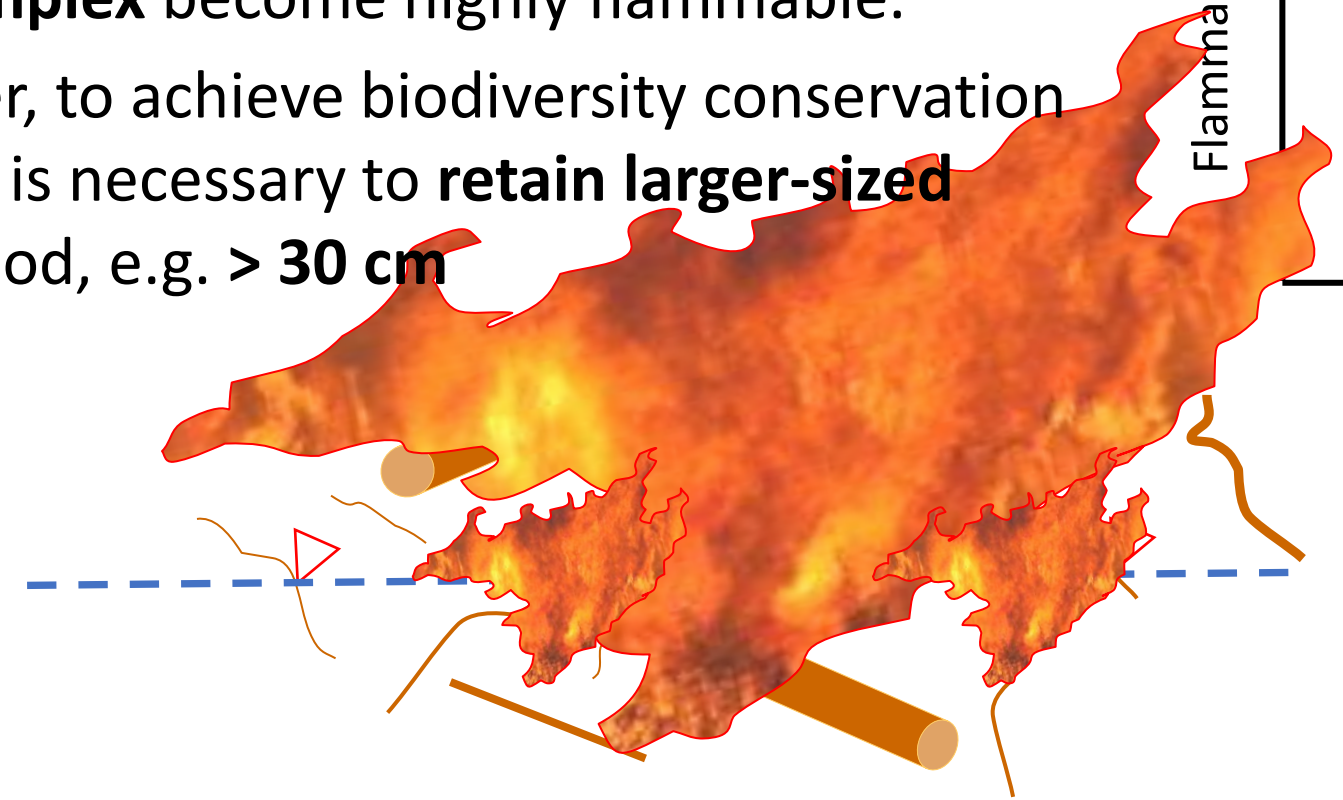
CO_2	CO	NOx	CH_4	PM_{10}
51728	9402	25	433	851

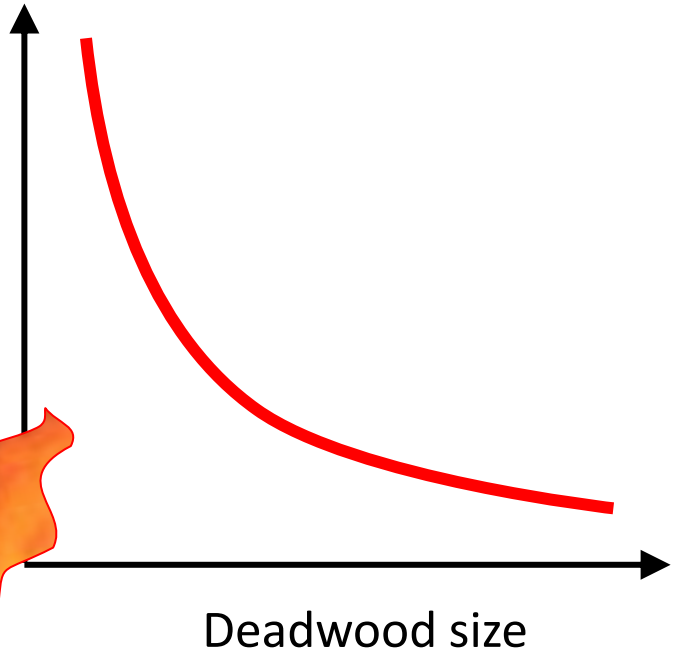
Source: Bacciu, CMCC; Scarpa, UNISS

Pyrosilviculture in protected areas

The **flammability** of deadwood is **inversely proportional** to its **size**. When all size classes of dead wood are **abundant** (>15 ton/ha) the **fuel complex** become highly flammable.

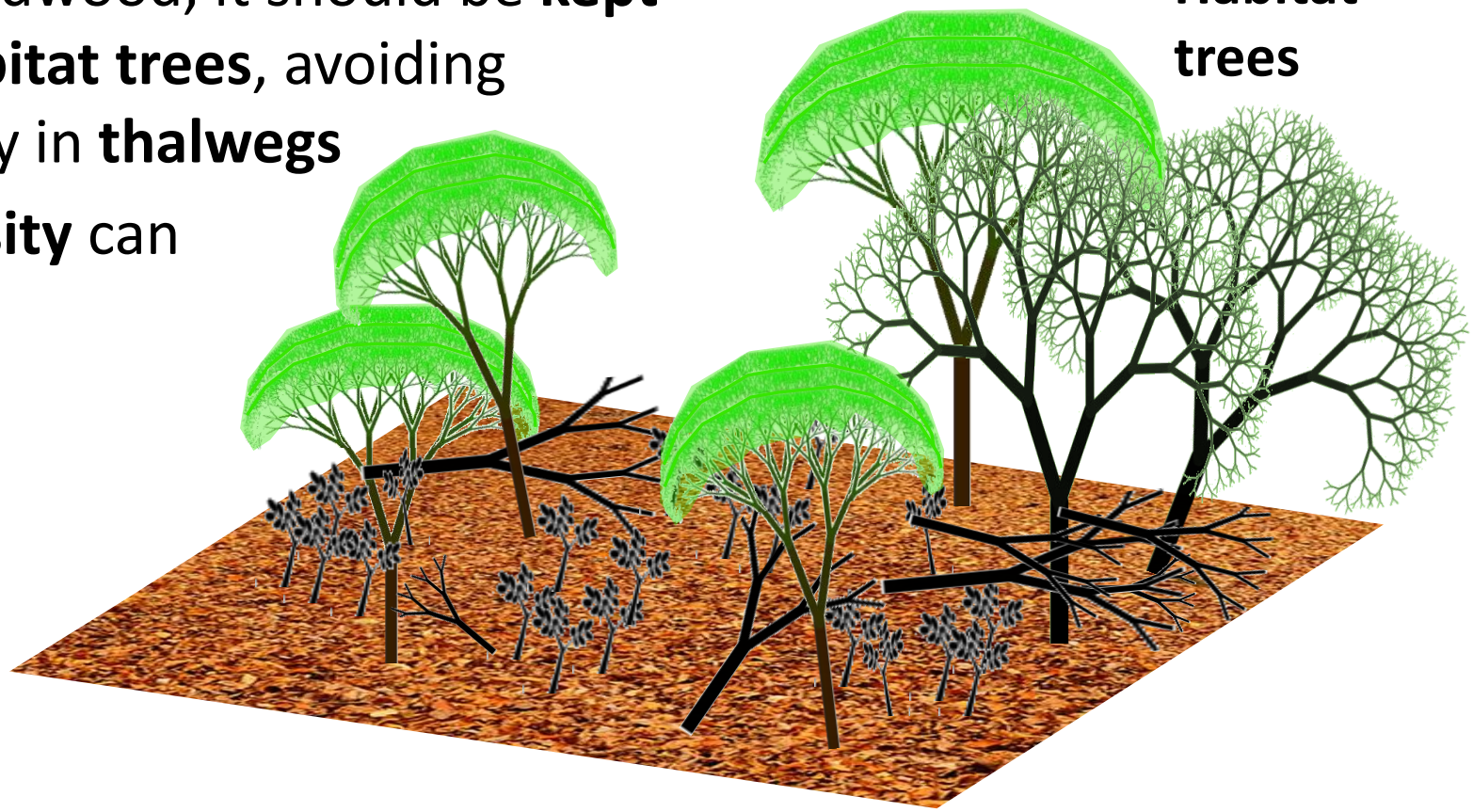
However, to achieve biodiversity conservation goals, it is necessary to **retain larger-sized** deadwood, e.g. **> 30 cm**





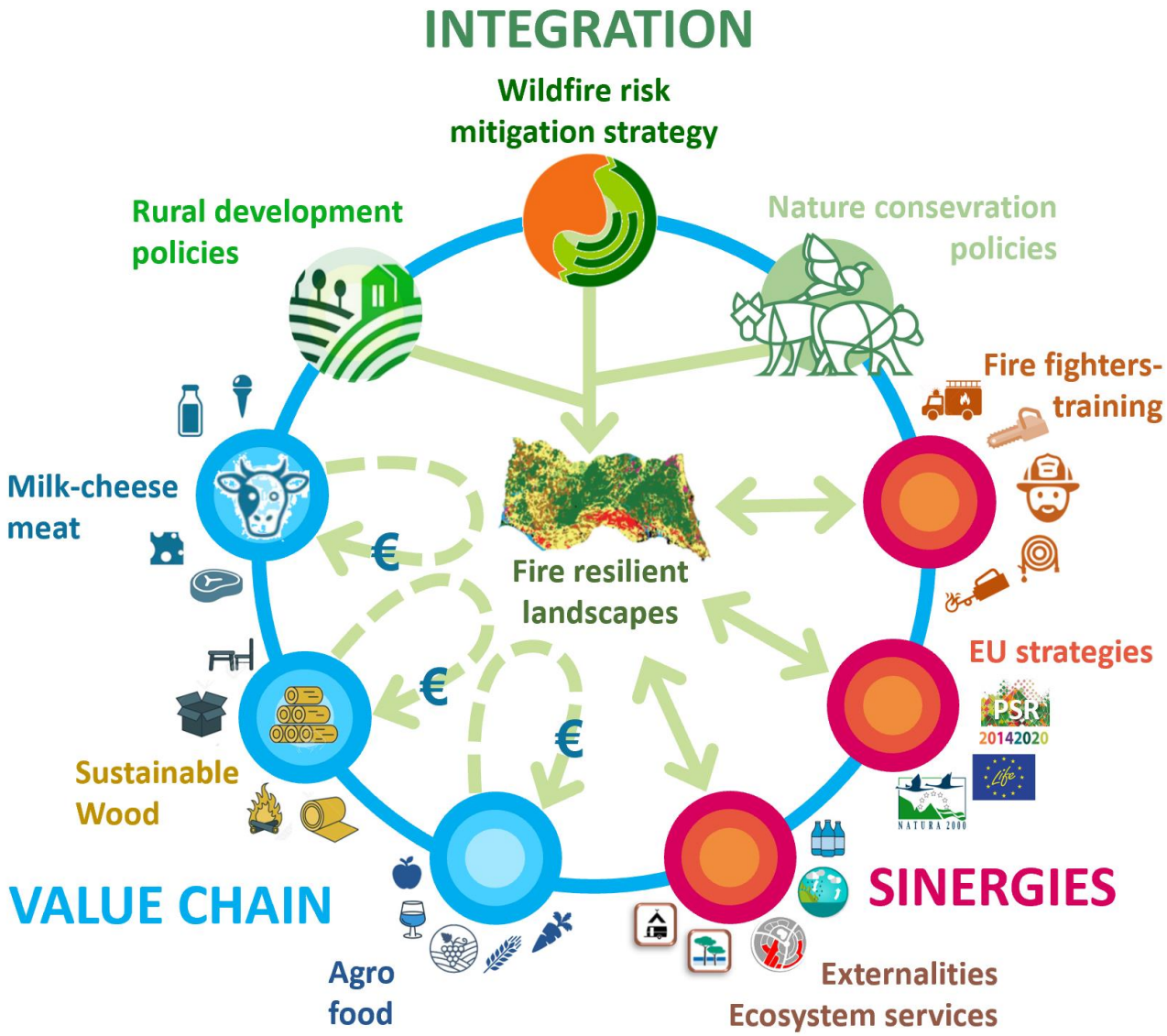
Pyrosilviculture in protected areas

The **spatial distribution** of deadwood can contribute to increasing the **stand resistance** to fire. While retaining an **adequate level** of deadwood, it should be **kept away** from **groups** of **habitat trees**, avoiding **accumulations**, especially in **thalwegs** where flame front **intensity** can increase, and ensuring **discontinuity**, i.e. portions **with** and **without** deadwood



General model for fire-resilient landscapes

Sustainable territorial processes that **adapt governance strategies** to **changing** fire regimes by improving the **cost-efficiency** of prevention by activating **multiple** interests, **synergies**, **value chains** and the recognition of the positive **externalities** of wildfire prevention (PES)



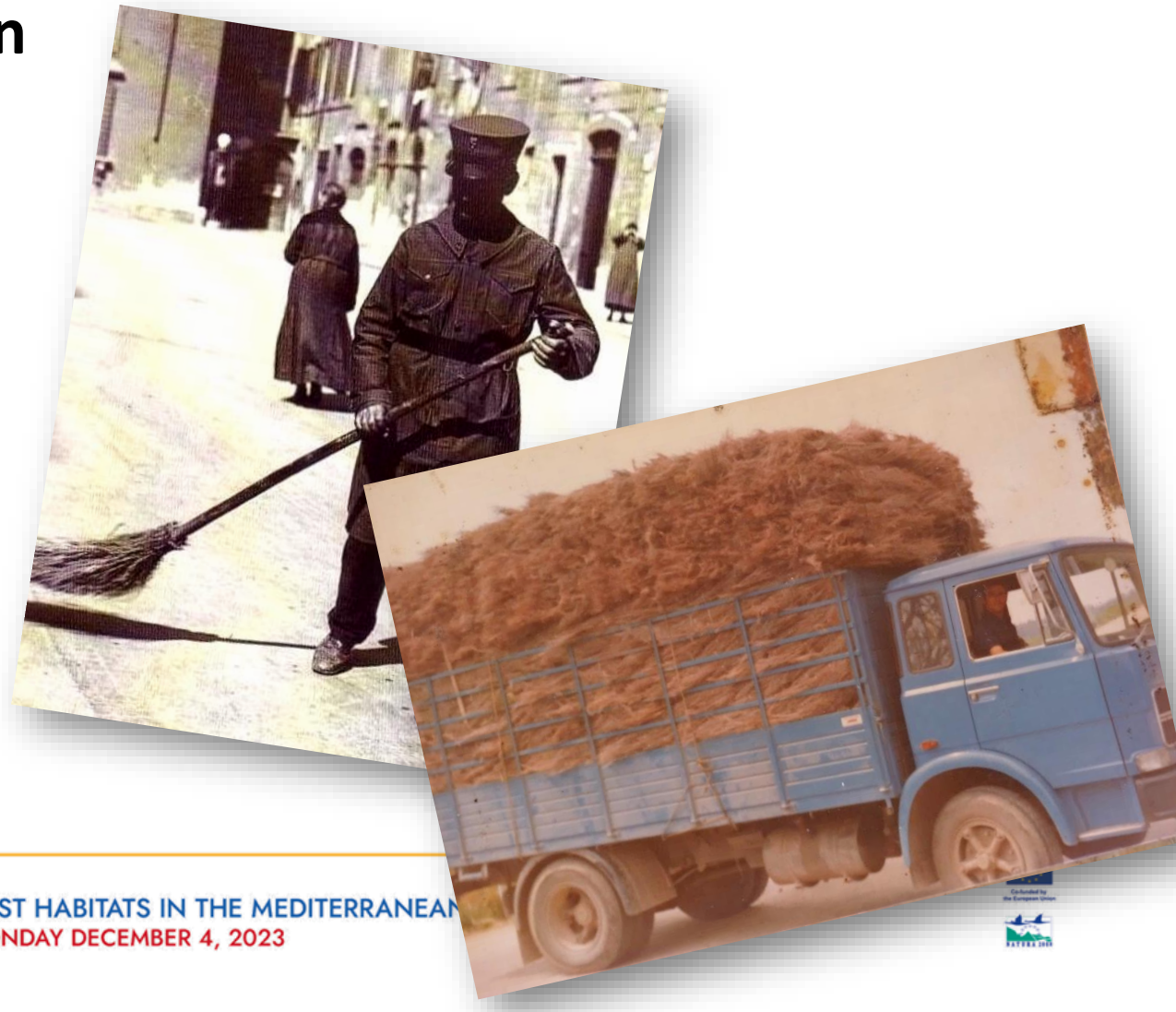
Life Granatha: the Pratomagno landscape

Life Granatha: mosaic landscape maintained by local economies

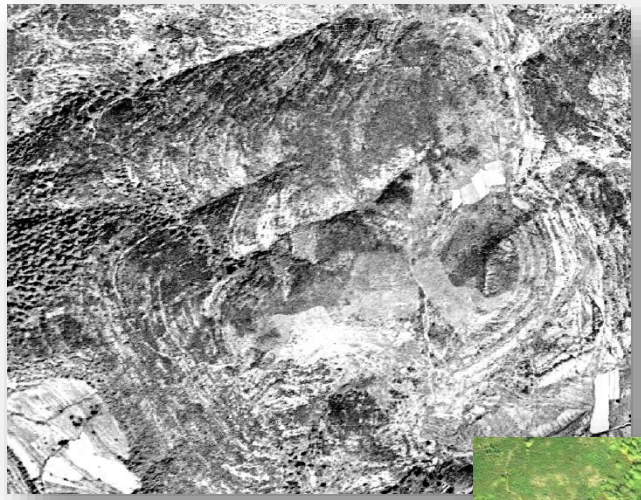
In the early XXth. ***Erica*** **broom production** was an important source of **income** for mountain **inland areas** of Tuscany

Heather brooms were sent throughout **Italy** and abroad (e.g. **Germany**. Swiss)

In 1970 a small town used about 3-5.000 heather brooms in one year, a city like Milan **150.000 brooms/yr**



Life Granatha: increased hazard by land use abandonment



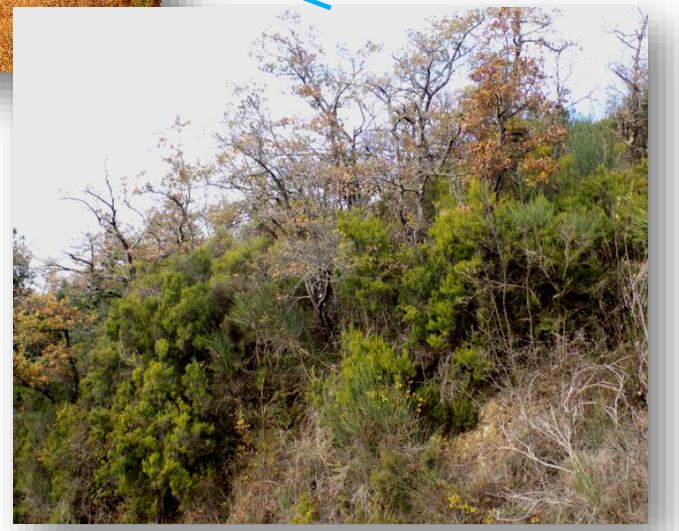
1945

2013

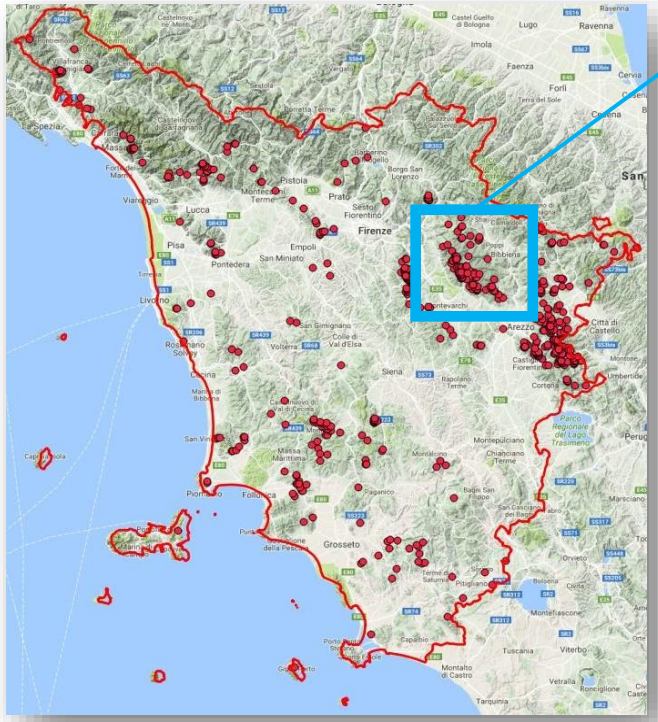
Fuel **build-up**

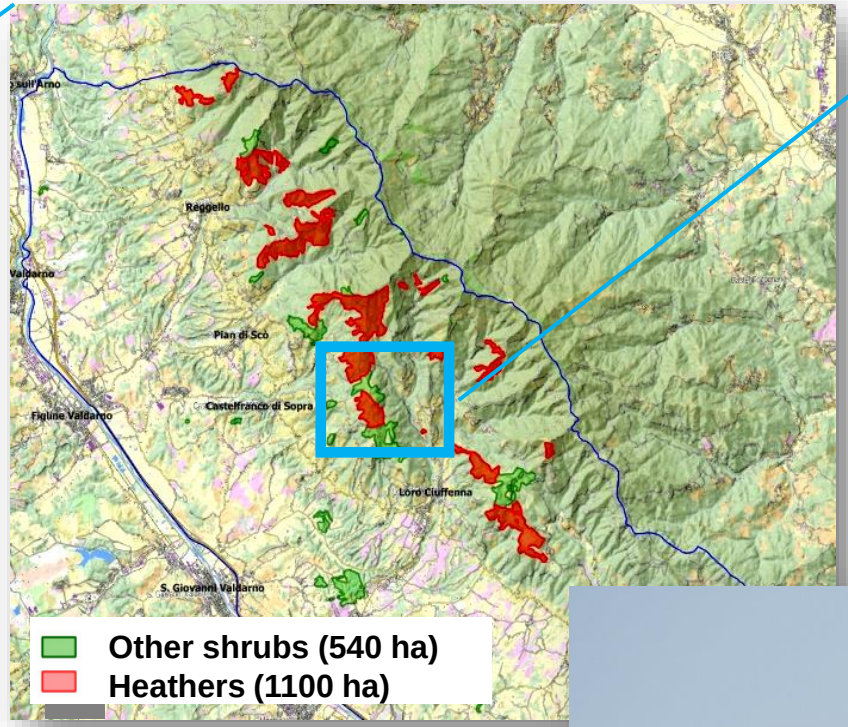
Tree **encroachment**

Habitat **loss**



Life Granatha: heathland (Habitat 4030) conservation problems





Dartfor warbler

Remnants
heathlands
8.688 ha

Habitat 4030
for many
protected birds

Montagu's harrier

Life Granatha: heathland (Habitat 4030) conservation solution

Planned treatments: fire risk mitigation x nature conservation x production

Actions	Private [ha]	Public [ha]	Tot [ha]
Heathlands management (*brooms production*)	30.9	38.2	69.1
Heathlands conservation mechanical	11.7	63.9	75.6
Heathlands restoration prescribed fire	9.5	17.9	27.4
Total [ha]	52.1	120	172.1

Intervention sites

Planned treatments: fire risk mitigation x nature conservation x production

Mechanical and hand cutting

Development of a **business plan for financially viable management** of heaths (feasible for most easily reachable heaths).

The heathlands are managed based on a **cultivation plan** on both private and public lands

Life Granatha: prevention + brooms production + habitat conservation

Prescribed burning plan

Prescribed burning
01/03/2021

Life Granatha: prevention + brooms production + habitat conservation

Prescribed burning plan

Life Granatha: training fire fighters, fire analysts and fire use

REGIONE TOSCANA

Life Granatha: *Erica* value chain and products

Canopy and tiles

Fascine/ bundles

Honey

Brooms

Mats

Life Granatha: market player selection

During 2020, as **result** of the project,

a **cooperative born** and since the 2021 it started to produce brooms using Pratomagno heather

Stipulation of **commercial agreements** for the supply of at least 40,000 pieces per year

Life Granatha: wildfire prevention raised to the cube^3

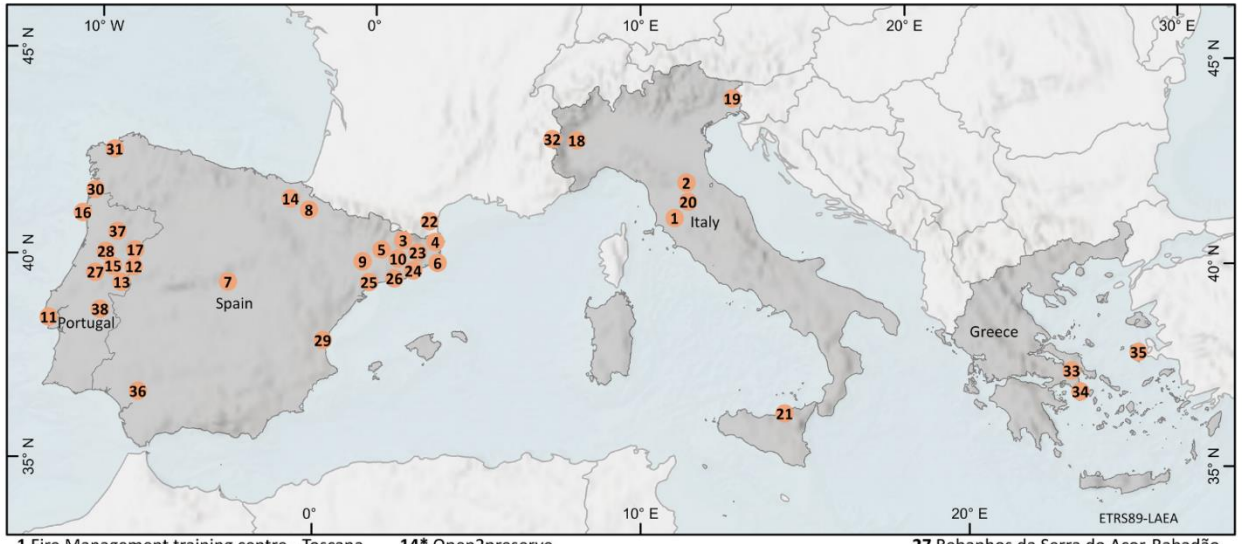
Fire **prevention** by fuel management at the **landscape scale** is **integrated** with **multiple goals**

habitat conservation

fire-fighters **training** programs

broom production bioeconomy chain

Fire-SMART stories… the documentary



1 Fire Management training centre - Toscana
2* Life Granatha
3 Life+ DEMORGEST
4* Ramats de foc (Fire flocks)
5 Life Monserrat
6 Assessment of biomass availability in Calonge
7 GEPRIF Project
8 PROBIOMASSE Project
9 Life PINASSA
10* Boscos del Vallès (Valles Forest)
11 Life Elia-Art
12 Cabra serrana nos Baldios da Malcata
13 Escola de Pastores - Shepherds' Schools
14* Open2preserve
15* SILVPAST Project
16 Forest Management - ACHLI
17 Reserva Faia Brava - Grazing fire brigades
18* Fire fighting training center of the Piemonte Region
19* Grazing program for fire hazard abatement (Landa Carsica)
20 Biomass production and fire hazard reduction in Pratomagno
21* New Business Models for the cork oak sector
22 Alberapastur Project
23 Quality-Suber
24 ORGEST Project
25* Fire prevention plan of Matadepera
26 Priority Protection Perimeters (PPP)
27 Rebanhos da Serra do Açor-Rabadão
28* Landscape Fire Project
29 Resilient Forest Project
30 LIFETEC Project
31 REFOREST Project
32* PreFeu initiative - Upper Val Susa
33 Wildfire prevention in Athens outskirts
34 Wildfire prevention in southern Attica
35* OMIKRON Project
36* RAPCA Program
37* Resin extraction - RaízesIn
38* Forest Management - REN

Fonte:
Ascoli et al. 2023

GR-AN -A-T-H
GRowing AviaN in Apennine's Tuscany HeathlAnds

prevail

agritech
Plan. Plant. Planet.

Thanks for the attention