

Fire experiments for *Calluna* heathland conservation in NW Italy

Ascoli D., Bovio G.
e-mail: d.ascoli@unito.it

www.agroselviter.unito.it/pianificazione/index.htm



Dip. agr. selviter

University of Torino



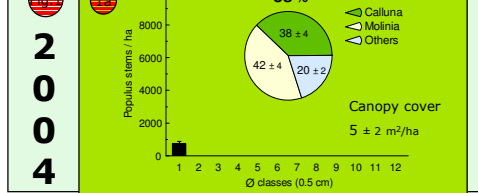
Introduction

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Populus stand structure and canopy cover (Cc) and *Calluna*, *Molinia* specific contribution (CS%), were monitored before and after fire treatments.

A microplot scale analysis² of fuel and fire behaviour descriptors enabled to design fire spread diagrams and correlate fire descriptors to effects on vegetation with spatial detail.



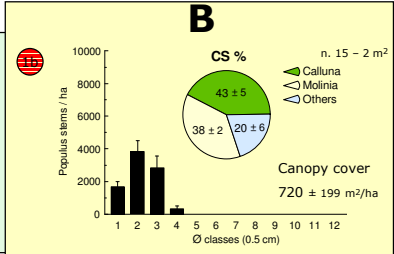
Methods

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1 sensu Watt (1955). 2 sensu Smith et al. (1993).



Results

Before fire (2004), *Calluna* CS% was inversely related to increasing *Molinia* and was lowest in site C, where tree competition was higher up to 2558 m²/ha in Cc (fig. 1a,b,c).

Calluna fuel load ranged from 5 to 8 t/ha while moisture content was ~40% in all dates of burn (fig. 2a,b,c).

Fires in winter 2005 were wind driven in sites A and B, back fire in site C. Ignition pattern and weather determined a decreasing ROS¹, I² and increasing Tr³ from site A to C (fig. 2a,b,c).

1 Rate of spread 2 Fireline intensity 3 Residence time

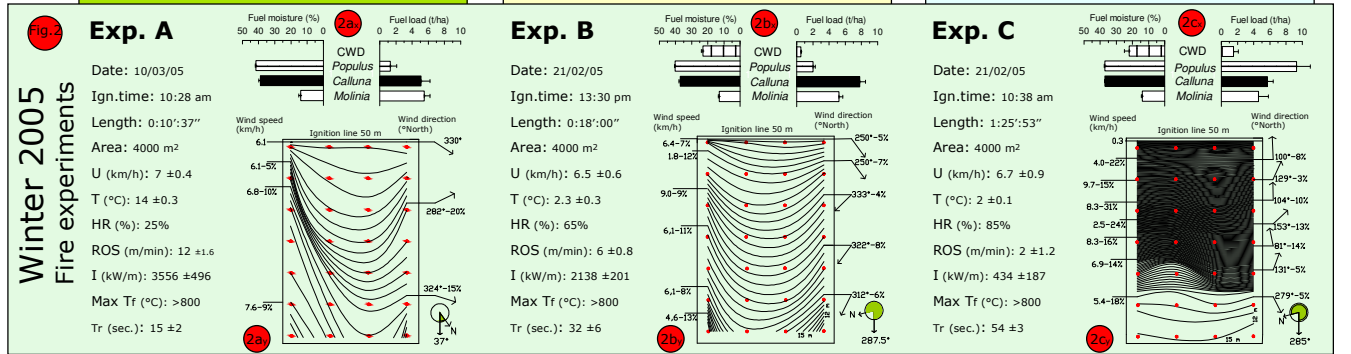
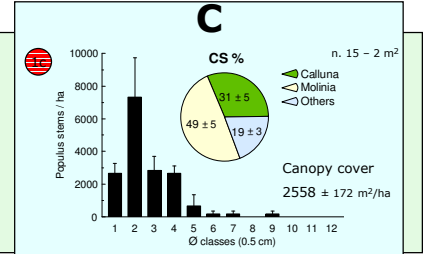
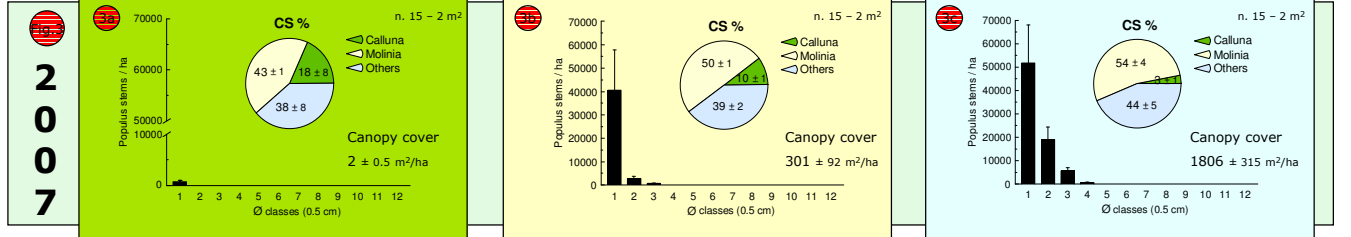


Fig. 2 Exp. A, B, C: Date of burn; Ignition time; Experiment length; Area burnt; U (km/h): average wind speed (± SE); T (°C): aver. air temperature (± SE); HR%: aver. air humidity (± SE); ROS (m/min): aver. rate of spread (± SE); I (kW/m): aver. Fireline intensity (± SE); Max Tr (°C): fire pick temperatures; Tr (sec.): residence time measure at central part of fire front.
Fig. 2x Fuel characteristics: fuel load (t/ha) and moisture (%) for dead fine fuel (*Molinia*), live fine fuel (*Calluna*), live fuel $\varnothing > 0.6$ cm (*Populus*) and coarse woody debris (CWD).
Fig. 2y Fire Behaviour Maps: lines represent the fire front position at 30 sec. intervals from the ignition line. The average value and CV% of wind direction (degree from North) and speed (km / hr) each 3 minutes (Exp.A-B) and 12 minutes (Exp.C) are reported on the right and left sides of each map.



After fire (2007), *Calluna* dominated heathland changed to *Molinia* grassland. Top kill of *Populus* (~100%) was followed by a dramatic increase in stem density due to root resprouting (Fig. 3a,b,c).

Nevertheless, in 3 growing seasons, *Calluna* was able to recover respectively 48% of pre-fire CS% in site A, 24% in B and 9% in C (Fig. 4).

Variability between sites could be explained by 2 main factors:
- Differences in *Populus* Cc competition up to 1806 m²/ha in C;
- Residence time of flames (i.e. temperatures) in Exp. C, 3.6 times higher comparing to Exp. A;
As Cc & Tr are correlated their main effect is not evident.

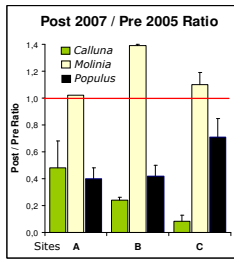


Fig. 4: Post/Pre Ratio of *Calluna*, *Molinia* CS% and *Populus* Cc. Values close to 1 means specie recovered Pre-fire conditions.

Conclusion

- ✓ Winter headfire is an effective tool to regenerate *Calluna* stands and top-kill juvenile trees;
- ✓ Prescriptions:
 - dead fine fuel moisture: 15%–25%;
 - U: 1–10 km/h; T: 0–15 °C; HR: 30%–60%;
 - Ignition technique: "Strip head fire" 30x20 m wide;
 - Return interval: 10–20 yr according to regeneration success;
- ✓ *Populus tremula* is resilient to fire-disturbance and shows a dramatic resprouting capacity; selective grazing after fire (results not presented) for limiting trees abundance is a necessary consequence.