Present and future role of forest resources in the socio-economic development of rural areas

Rome, 23rd June 2011
Parallel Session

Parallel Session 2

Forests, agroforestry and bioenergy.

Conifer afforestations in Italy: an opportunity for wood energy and forest restoration

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INTRODUCTION

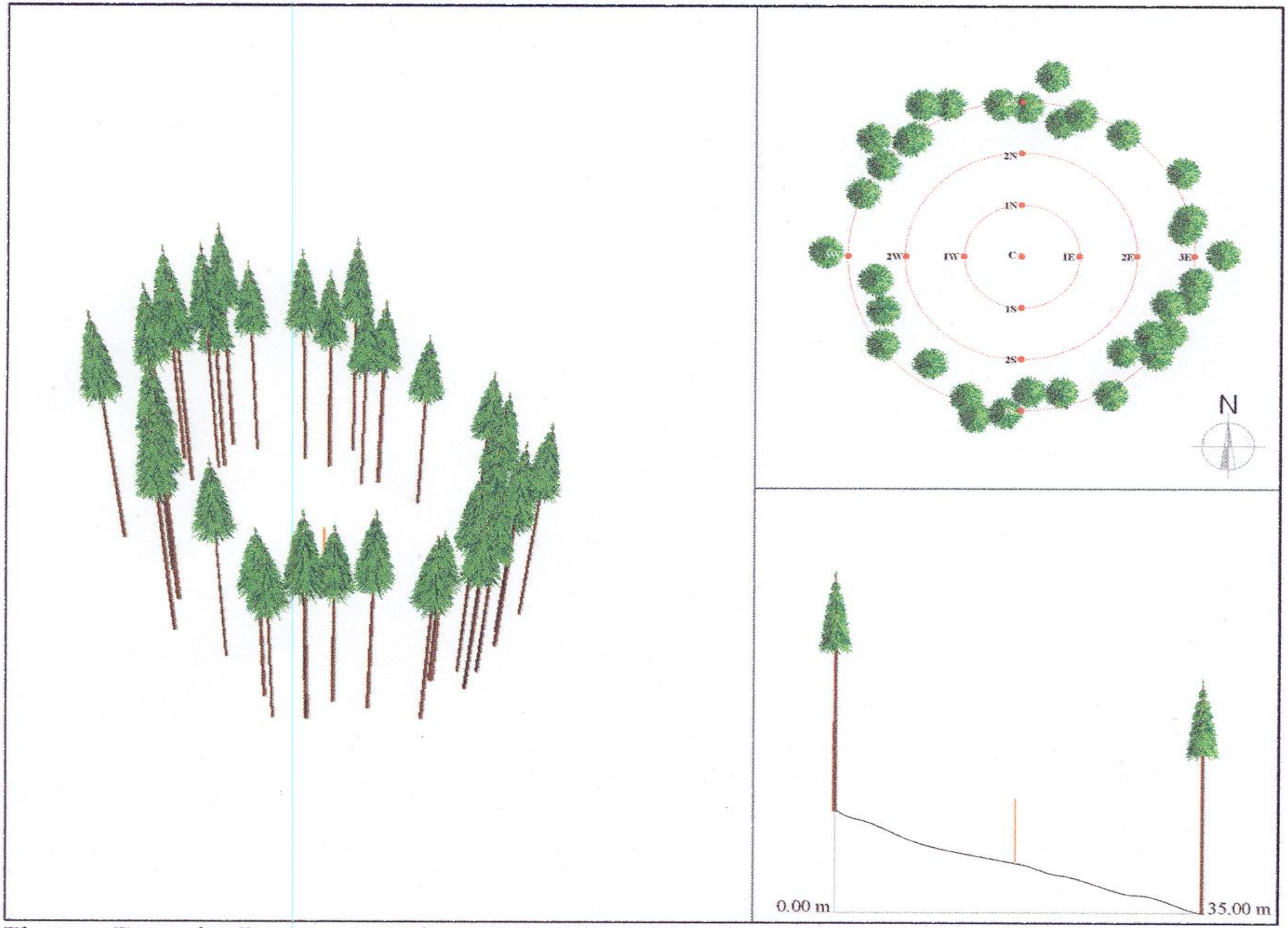


Fig 1a – Esempio di rappresentazione di un taglio a buca.

Methodologies


Capistrano (VV)

Mean annual precipitations are 1848 mm, summer precipitations are 102 mm, mean annual air temperature is 10.8 °C, mean temperature of the coldest month is 3.1 °C

Mean temperature of the warmest month is 21.5 °C.

Soils developed from compact gneiss and biotitic scysts (Paleozoic) were depth with a loamy-sand texture and were classified as Humic Dystrudept (Soil Survey Staff, 1999).

Natural vegetation was beechwoods with Silver fir (*Anemono apenninae-Fagetum* Brullo 1984 = *Aquifolio- Fagetum* Gentile 1969) (Mercurio and Spampinato, 2006) then converted in agricultural lands and afforested in the '50s with Calabrian pine.

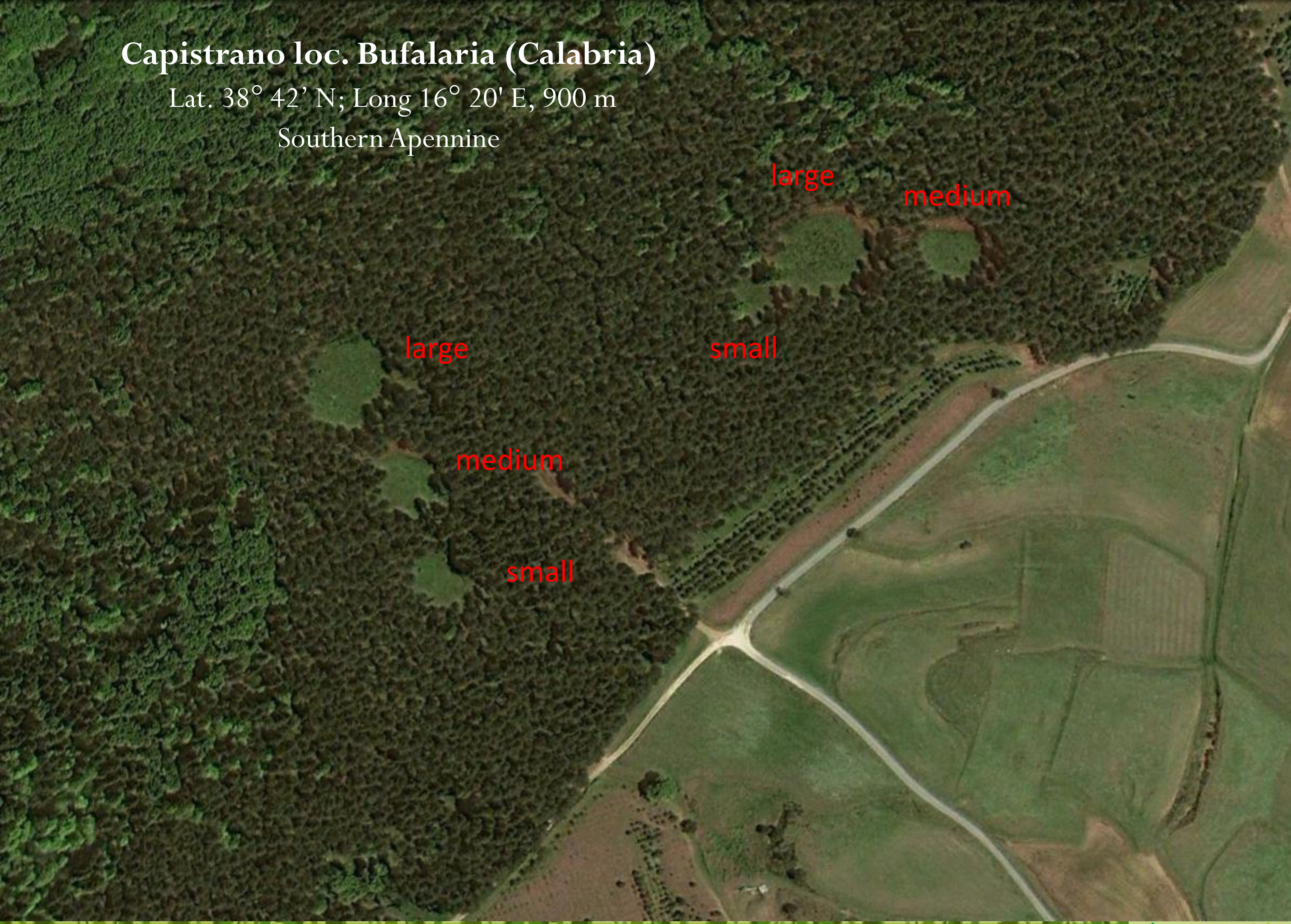
Stand and experimental design

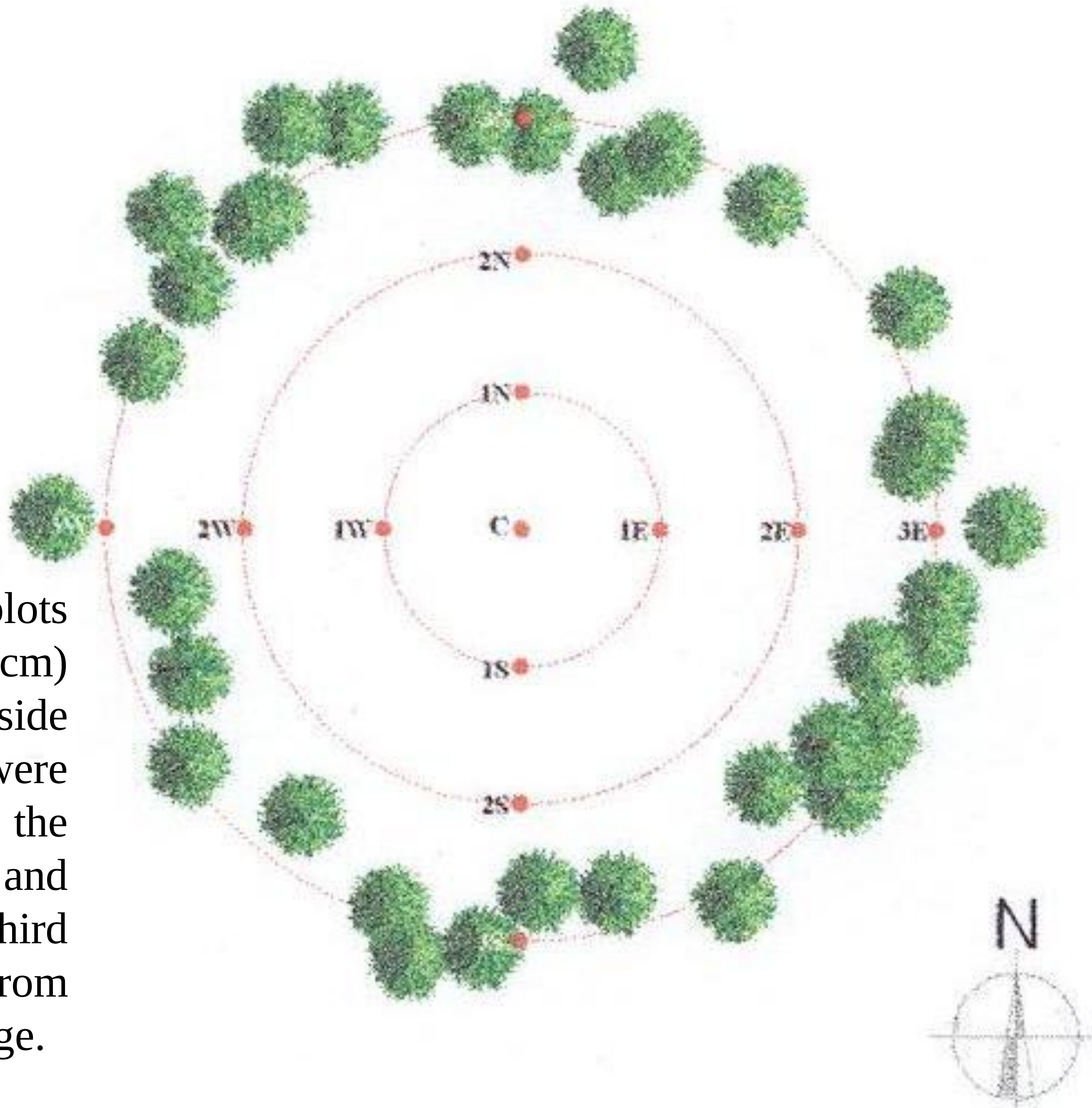
During the spring season 2003 a randomized complete block of six circular gaps: two small (380 m^2), two medium (855 m^2) and two large (1520 m^2) was carried out. Each gap was paired with an adjacent under canopy cover site located 25-30 m from the edge of the gap. The gap diameter to the tree height ratios (D/H) were respectively 1.0, 1.5 and 2.0 (stand height 22 m).

Capistrano loc. Bufalaria (Calabria)

Lat. 38° 42’ N; Long 16° 20' E, 900 m

Southern Apennine

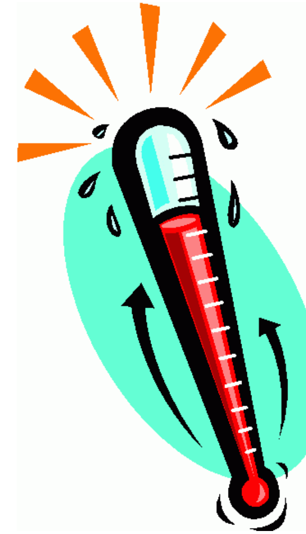




Thirteen circular sub-plots of 3.14 m^2 (radius 100 cm) were established inside each gap. Sub-plots were positioned one in the central part of the gap and the other three at one third of the radius starting from the centre of the gap edge.

soil moisture content $$\theta = \frac{ww - dw}{dw} \cdot 100$$

Soil temperature



seedlings were distinguished by species and measured

$$PAR\,transmittance = \left(\frac{PARsubplot}{PARopen} \right) \cdot 100$$

Data were grouped for analysis according to the position of the subplot inside the gap and the cardinal directions: 1) central subplot CENTRE (C, 1N, 1E, 1S, 1W); 2) edge subplots EDGE (2N, 2E, 2S, 2W, 3N, 3E, 3S, 3W) the four nearest subplots.

Data were subjected to a two-way ANOVA (α=0.05) considering as factors soil moisture and temperature, PAR and seedling density in the different gap sizes and the adjacent under canopy cover site. Treatments were compared using the Student Newman-Keul post hoc test.

RESULTS AND DISCUSSION

Soil moisture and temperature

Soil moisture was significantly different among the gaps of different size showing the highest value in the small gaps.
Small gaps were generally wetter than the medium and large ones and the surrounding forest.
Soil temperature was significantly higher in the large gaps in comparison to small and medium gaps. Under canopy cover sites soil temperature was similar to that detected in small gaps.

Soil temperature and soil moisture values average ± SE (n=40).

Location	Year	Soil temperature (°C)	Soil moisture (%)
A (small gap)	2003	10.1±0.1	31.0±0.7
	2007	10.8± 0.1	33±0.7
B	2003	11.4±0.1	28±0.3
	2007	11.2±0.1	28± 0.3
C (medium gap)	2003	12.7±0.2	26±1.2
	2007	12.9±0.2	27± 1.2
D	2003	11.6±0.1	28±0.3
	2007	11.1±0.1	28± 0.3
E (large gap)	2003	13.0±0.2	25±1.1
	2007	13.9± .2	26± 1.1
F	2003	11.2±0.1	29±0.9
	2007	11.4±0.1	28± 0.9

A = small gap; B = under canopy cover near small gap; C = medium gap; D = under canopy cover near medium gap; E = large gap; F= under canopy cover near large gap.

Par transmittance

PAR transmittance was higher in large and medium gaps than in small ones with significant difference between gap sizes. These findings confirm that the amount of solar radiation received on the ground increased with the size of gap opening. Consequently the micro-environment in large gaps is lighter and warmer than that in smaller gaps which may be favourable for Calabrian pine germination and establishment.

PAR transmittance varied significantly within-gap position. High values were recorded in the centre and northern positions in both gap sizes and tended to decline from north to centre to south for all gap sizes (data not reported).

PAR values average ± SE (n=40).

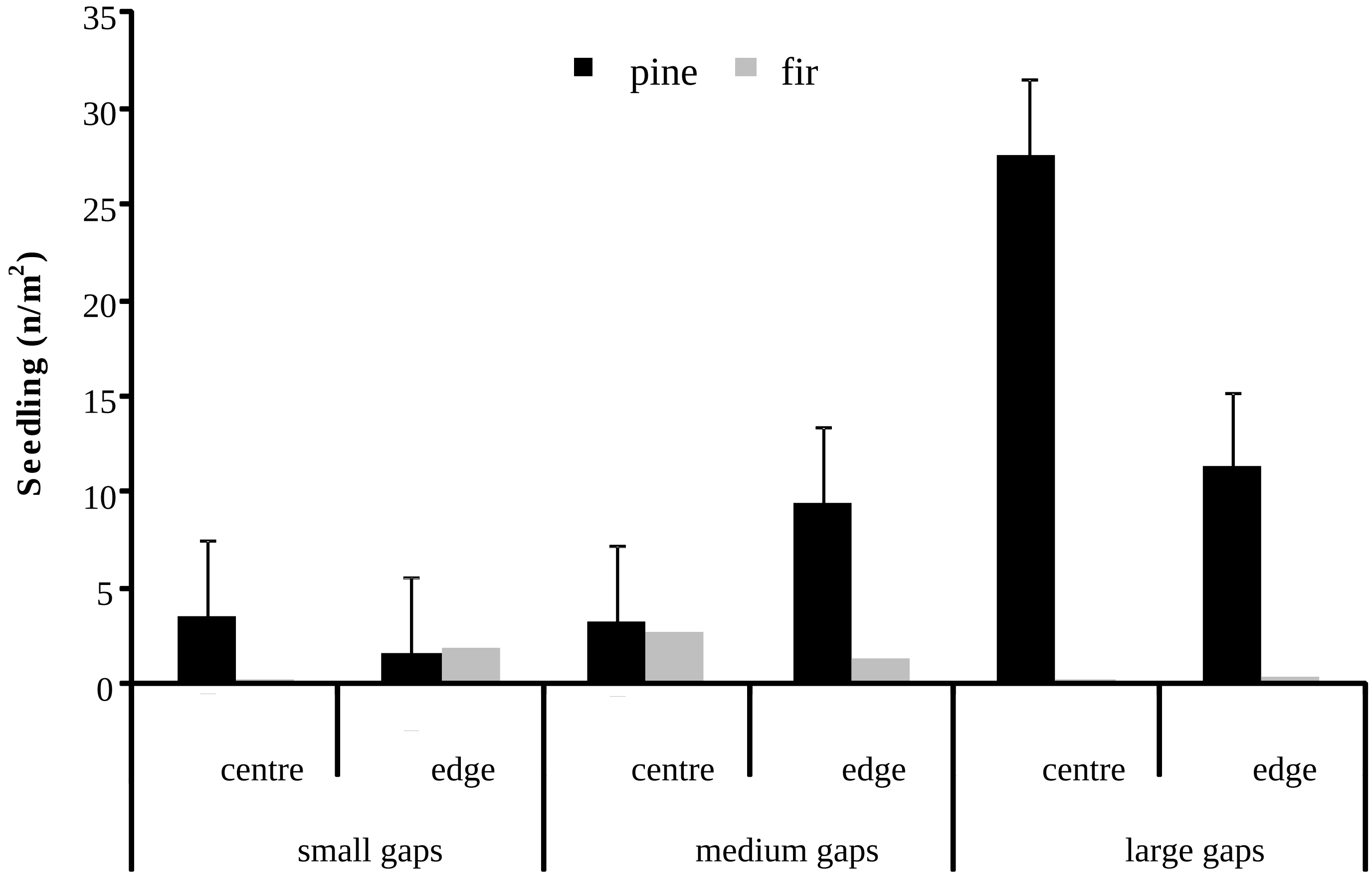
Location	Year	PAR (%)
A (small gap)	2003	13
	2007	15
B	2003	6
	2007	5
C (medium gap)	2003	36
	2007	38
D	2003	6
	2007	5
E (large gap)	2003	61
	2007	65
F	2003	6
	2007	5

A = small gap; B = under canopy cover near small gap; C = medium gap; D = under canopy cover near medium gap; E = large gap; F= under canopy cover near large gap.

Seedling density

Seedling density of Calabrian pine was higher in large gaps than in medium and small ones, evenly distributed, with a prevalence in the central part of the gap, since the first years after the gap opening. In fact in Calabrian pine stands the age at which abundant coning can be expected is generally close to 30-40 years. The mast years occurred at intervals of once every 2 years. Silver fir density was lower and scattered because of the scarcity of seed bearing of the nearby trees and of the abundance of cone production which occurs every three-four years and was more abundant at the gap edge. Sometimes beech regeneration can occur in the gaps (not recorded inside the sub plots).

Figure 1. Distribution of seedlings density (2007) according to gap sizes and within-gap position

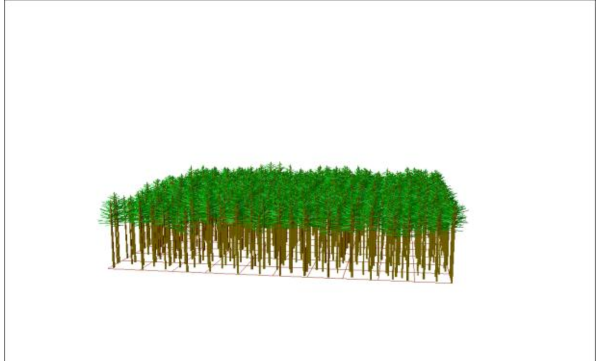


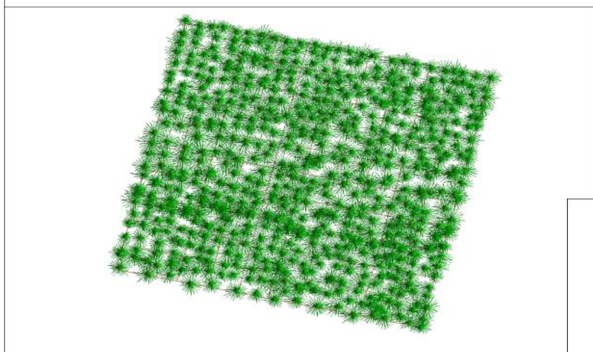
Preliminary results after 7 years

The main results after 7 years of gap opening confirm what Gugliotta et al., (2006) and Muscolo et al., (2007) previously reported and show that the most appropriate gap sizes for regeneration of Calabrian pine (shade-intolerant tree species) are those of 1500 m^2 according to the statements of Malcolm et al., (2001) with a D/H of 2.

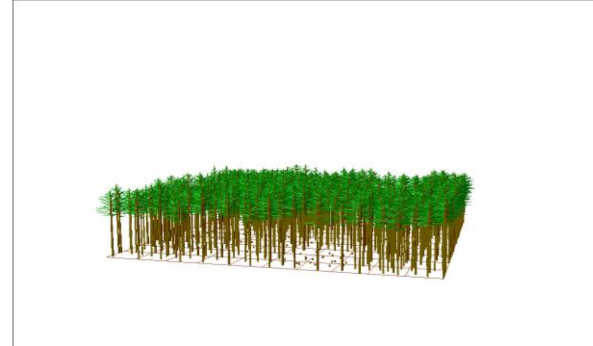
Preliminary results after 7 years

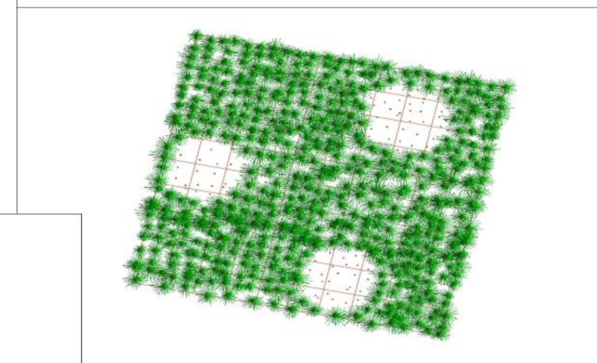
While for late-successional species (silver fir and beech) gap of 380 m^2 with a D/H of 1 or slightly larger are recommended.

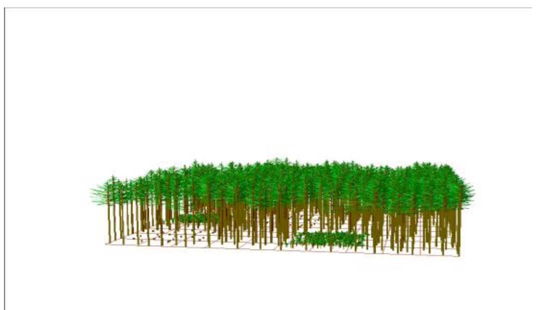


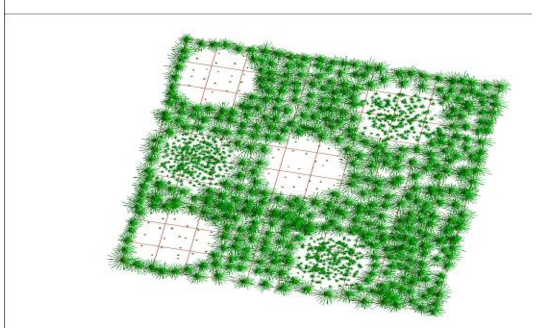


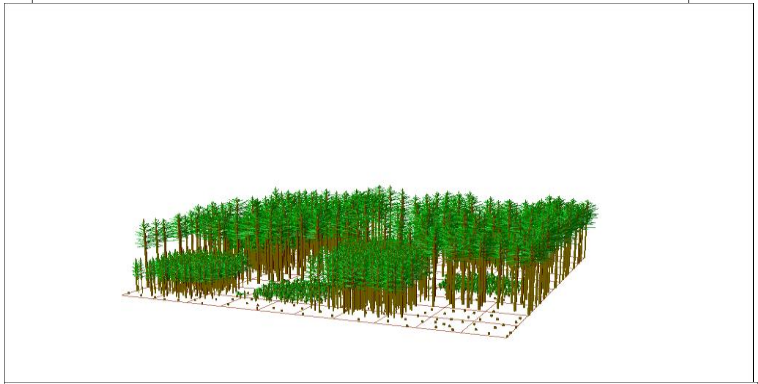
The interval between cuttings is 7 years. Whereas any intervention removes the 30% of the stand, the cycle is complete in about 20 years. At the time of the first cutting from 15 up to 70 m^3 per gap, or 140 m^3 per hectare can be obtained.

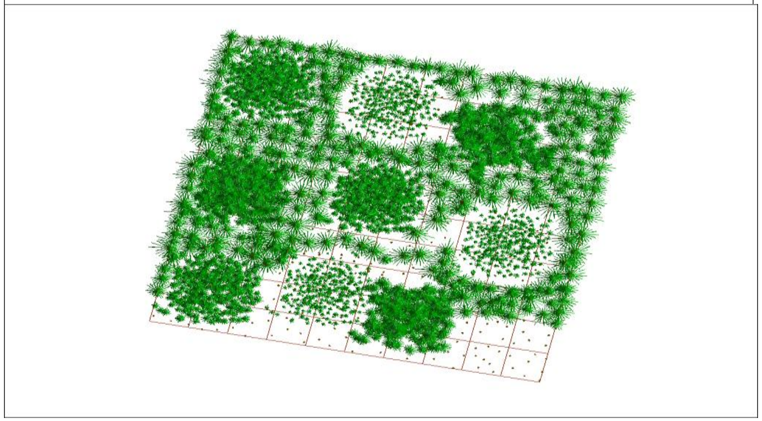


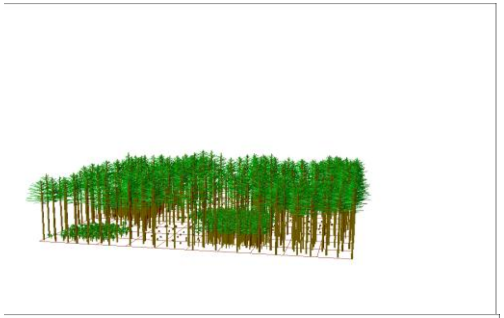


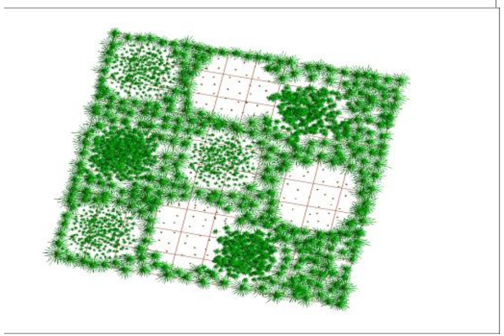












Conclusion

In consequence of this experience you can get interesting implications for sustainable forest management. Under the Italian Code of Cultural Heritage and Landscape (2004), a gap cutting system configures as a sustainable silvicultural treatment because of its low environmental and aesthetic impact, which derives from the possibility of diluting the cuttings over space and time. Therefore, a gap cutting system is particularly suited to the restoration of conifer afforestations growing inside protected areas. For instance, the Management Plans of some Italian protected areas (National Park of the Foreste Casentinesi, 2002; Regional Natural Park of the Serre, 2008) introduce gap cutting for the forest restoration purposes.


Thanks for your
attention