2.5 TREE SPECIES RICHNESS MODULATES THE EFFECT OF DROUGHT AND HEAT STRESS ON TREE MORTALITY AND UNDERSTORY DIVERSITY IN THERMOPHILOUS DECIDUOUS FORESTS.

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114° Congresso SBI

INTRODUCTION

Future temperature rise is expected to be one of the main drivers of plant community changes. The last years offer an opportunity to study the effects of this kind of events on forest ecosystems. The extensive coring campaign of two international studies in the Tuscan thermophilous deciduous forest allowed us to explore the aftermath of a temperature rise occurring since 1998 (Fig.1).

The sampling design is focused on isolating the effect of tree species richness over multiple ecosystem's characteristics.

MATERIAL & METHODS

the study was carrie out on the Italian sites of the FunDivEUROPE and SoilForEUROPE projects (Colline Metallifere area of Tuscany - Fig.2) with the following setup:

36 squared plots (30x30 m) - tree layer (DBH, height, defoliation, Kraft) over a gradient of tree diversity:

9 monospecific, 10 2-species, 9 3-species, 7 4-species, and one with all the 5 focal species (*Castanea sativa* Mill., *Ostrya carpinifolia* Scop., *Quercus cerris* L., *Quercus ilex* L., and *Quercus petraea* (Mattuschka) Liebl.), selected to maximize evenness

108 squared subplots (3x3 m): each plot has 3 subplots for the herb layer sampling (Braun-Blanquet), cover from the 3 subplots were averaged

3205 measured trees of 23 species

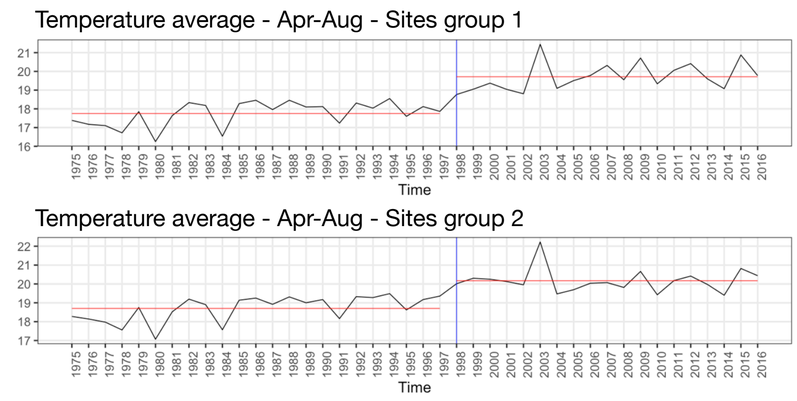
659 cored trees (to the pith) of the 5 focal species

Everything was measured twice: in 2012 and in 2018

Chronologies were derived from the Basal Area Increment, used here as growth proxy.

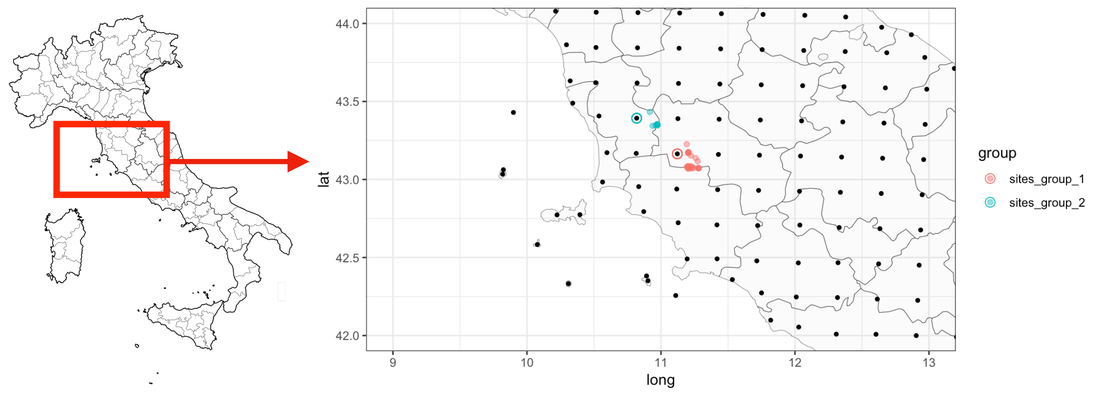
Tree loss was estimated as fraction of tree biomass loss.

1. SUMMER AVERAGE TEMPERATURE INCREASE



≈ +2°C

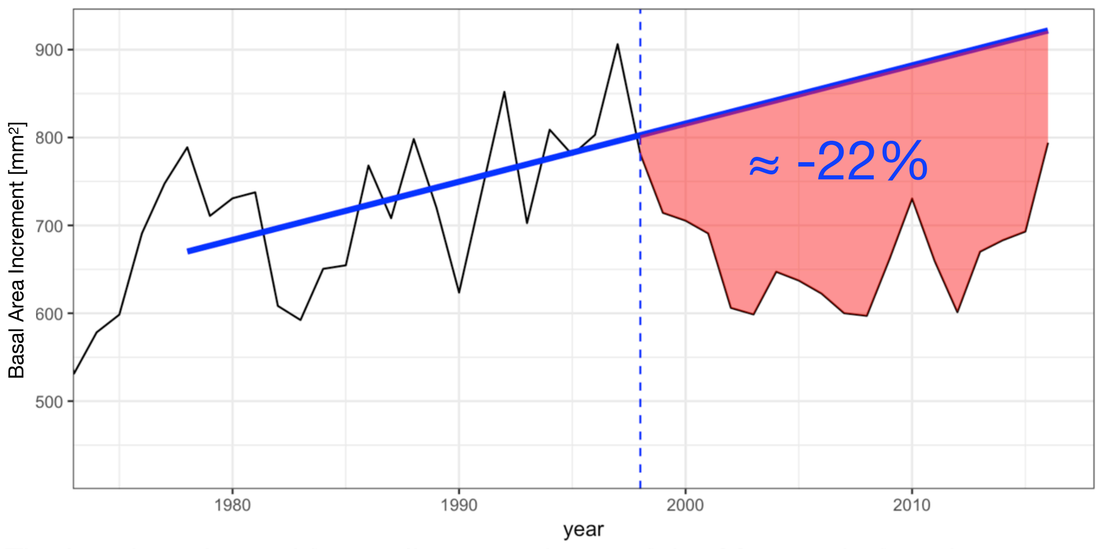
2. STUDY AREA AND AGRI4CAST GRID ASSOCIATION



CONCLUSIONS

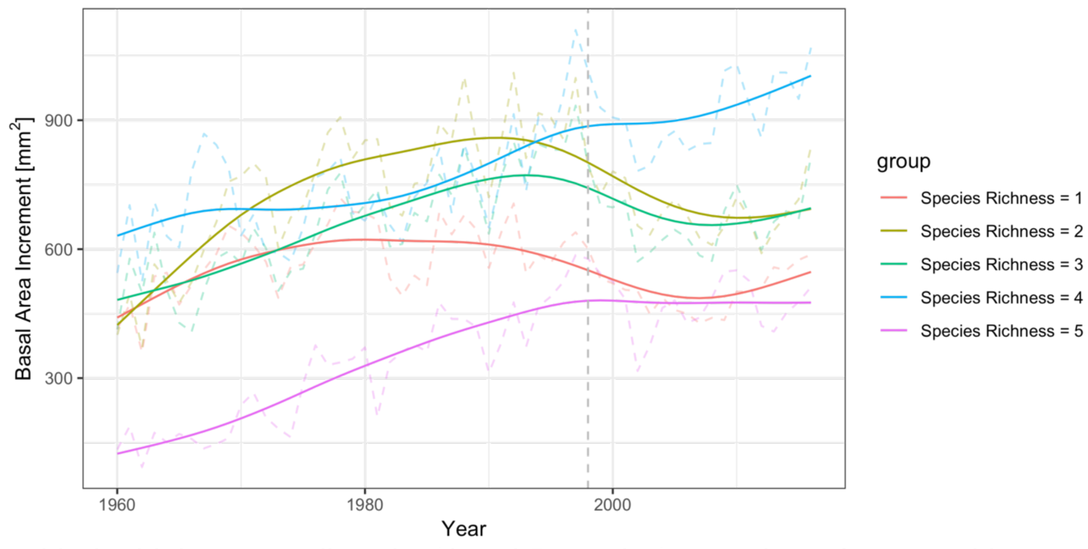
- After a rise in temperature of almost 2°C the forest takes more than 20 years to acclimatize itself and regain the same growth rate
- High tree diversity levels can moderate the impact of rising temperatures on the forest growth (Fig. 3 and 4)
- Under similar disturbance condition tree diversity can reduce the turnover of understory species, with a negative effect on herb diversity but a stabilizing effect against a transformation of the herb community (Fig. 5 and 6)
- The role of ecosystem complexity and fastest gap recovery, in more diverse forest, should be examined as a possible cause of reduced herb species turnover

3. TOTAL GROWTH LOSS ESTIMATION BETWEEN 1998 AND 2016



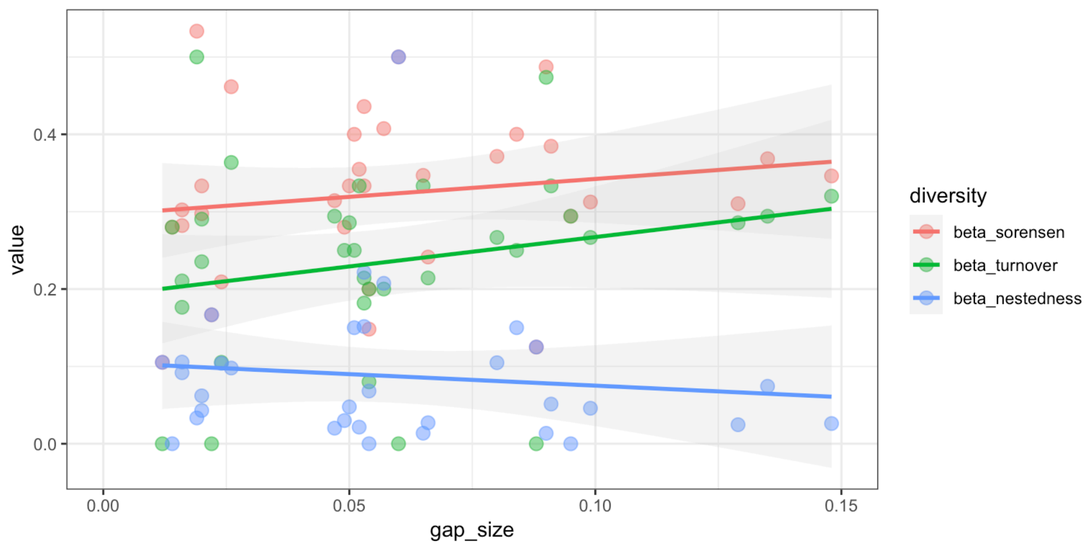
The loss is estimated from a linear tendency of the 20 years before the temperature rise (the most conservative estimation is about 16%) - BAI chronologies

4. BASAL AREA INCREMENT BY SITE TREE SPECIES RICHNESS



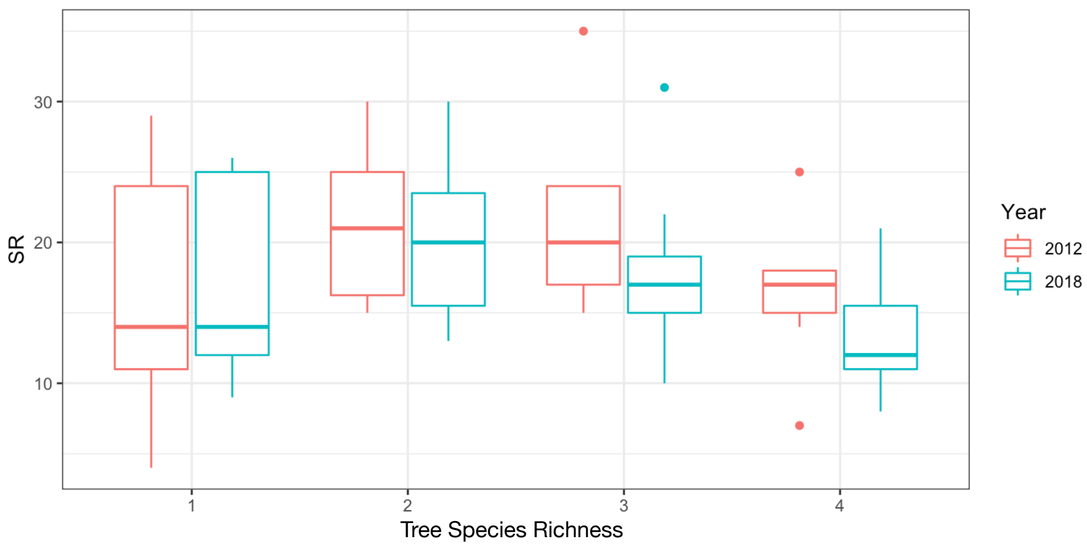
Sites with the highest tree diversity (4 and 5 species) were the only ones without a significant growth loss - BAI chronologies

5. TREE LOSS INCREASES SPECIES TURNOVER



Herb species turnover increased by tree loss, the shift toward a more light demanding herb community mitigate the species loss de facto increasing the SR

6. TREE DIVERSITY INCREASES HERB SPECIES LOSS



Herb species loss increased by tree Species Richness, mainly by turnover reduction