

An integrated approach for monitoring the post-fire responses of *Pinus pinaster* Aiton

F. Niccoli¹, V. De Micco², S. Castaldi¹, R. Valentini³, G. Battipaglia¹

¹ Department of Environmental, Biological and Pharmaceutical Sciences and Technologies, University of Campania "L. Vanvitelli", Via Vivaldi 43, 81100, Caserta, Italy

² Department of Agricultural Sciences, PWA Lab, University of Naples Federico II, via Università 100, 80055, Portici, Italy

³ Department for Innovation in Biological, Agro-food and Forest systems, University of Tuscia, Via de Lellis, 01100, Viterbo, Italy

INTRODUCTION

In the Mediterranean Basin, fire incidence and severity have increased dramatically during the past decades due to climate change (IPCC, 2014). The effects of fires on forest ecosystems can last several years: the survival of fire-injured trees depend not only on the adaptive traits of individual species, but also on the ability of trees to tolerate post-fire environmental constraints.

STUDY AREA

The study area is the "Tirone Alto Vesuvio Nature Reserve" within the Vesuvio National Park (lat. 40°48'43.00" N, lon. 14°24'44.64" E.). The Park, is characterized by a large plantation forest: while the Northern slope is covered by tall deciduous trees, the Southern side presents a large plantation dominated by *Pinus pinaster* Aiton (Figure 1) and scattered patches of Mediterranean maquis vegetation. The area was damaged by a large wildfire in 2017 (Figure 2) (Battipaglia et al. 2017).



Fig. 1 Sampling site.



Fig. 2 Wildfire of 2017 in the Vesuvio National Park.

MATERIALS AND METHODS

15 dominant trees were selected at the burned site, for each tree two wood-cores were collected with a 5 mm incremental borer. The tree rings were measured using the LINTAB system. The chronologies were corrected by COFECHA software and standardized using the ARSTAN software.

To study the long-term effects of post-fire conditions on the ecophysiology and to quantify recovery times of this species, the analysis of xylogenesis is in progress on 8 trees which currently show a different percentage damage to the crown (Figure 3).

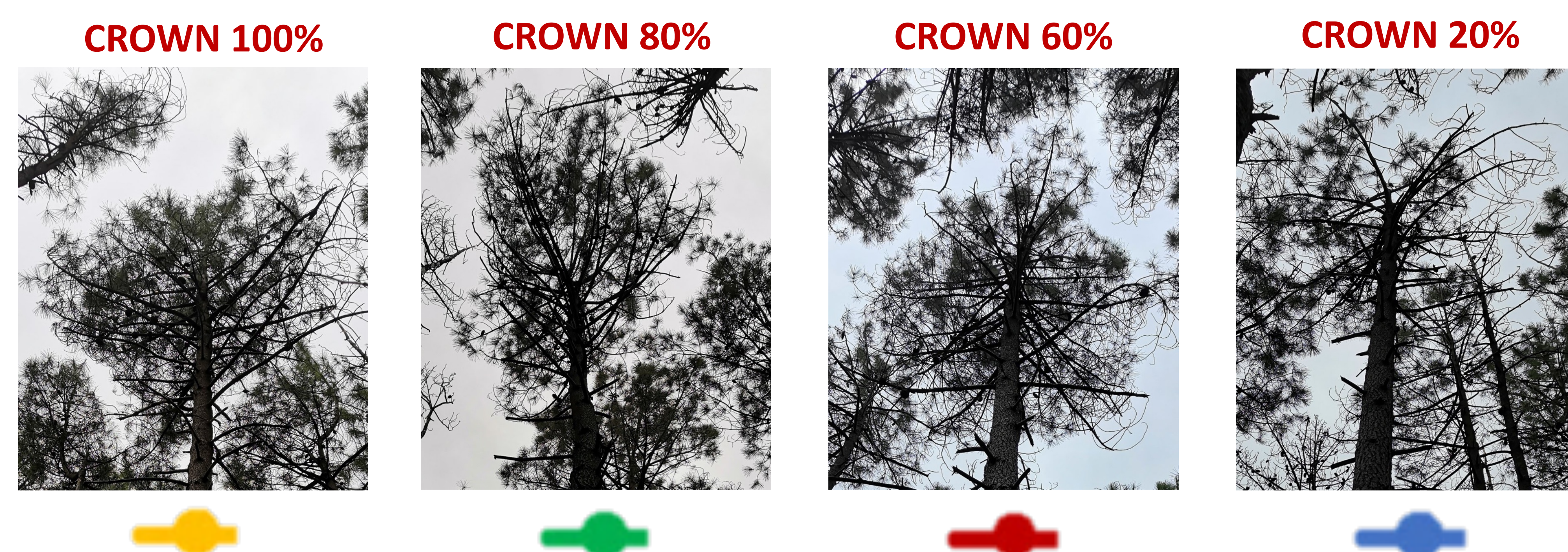


Fig. 3 *Pinus pinaster* plants with different crown reduction chosen for xylogenesis monitoring.

Since March 2019, every two weeks, wooden micro-cores are collected with the Trephor tool and chemically fixed. The samples are embedded in acrylic resin and cross sections are cut through a rotative microtome. Subsequently, slides are analysed through microscopy to detect and count the cells in the different phases of xylogenesis: cambium cells (CCs), post-cambial or enlarging cells (PCs), cells undergoing secondary thickening and lignification of the cell walls (SWs) and mature cells (MTs) (De Micco et al., 2016).

RESULTS AND DISCUSSION

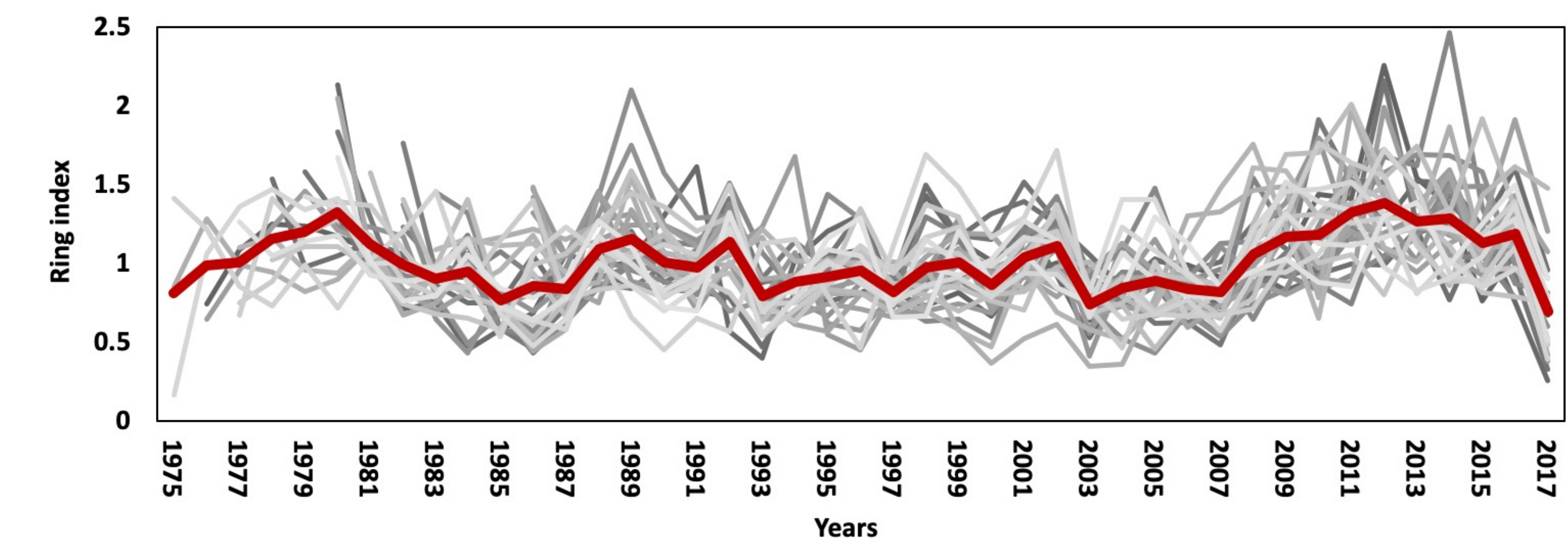


Fig. 4 Individual Tree-ring index in gray, in red the average value.

Tree-ring chronologies (Figure 4) showed a strong climatic signals and a reduced growth in relation to past fire events (1993, 2007, 2015). All the sampled trees in the burned site showed a decrease in tree growth in 2017. However, *Pinus pinaster* plants showed a very limited mortality rate in the short term: at the end of 2018, only 2-10% of individuals reduced their vigor (Niccoli et al., 2019).

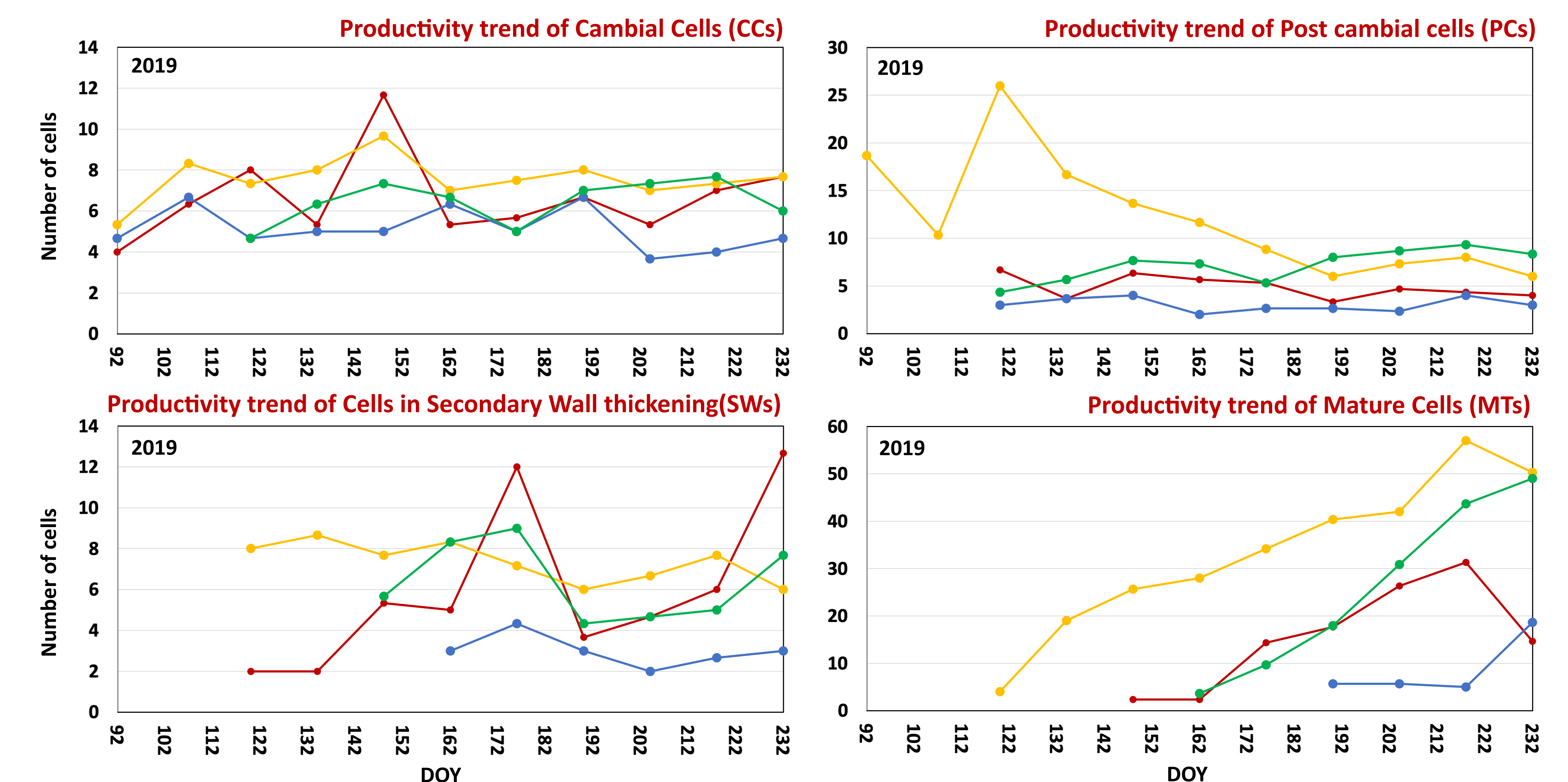


Fig. 5 Cambial cell productivity trend of the tree with crown 100% (in yellow), 80% (in green), 60% (in red), 20% (in blue).

KINETICS	CROWN 100%	CROWN 80%	CROWN 60%	CROWN 20%
CCs	02/04/2019	30/04/2019	02/04/2019	02/04/2019
PCs	02/04/2019	30/04/2019	30/04/2019	30/04/2019
SWs	30/04/2019	28/05/2019	30/04/2019	11/06/2019
MTs	30/04/2019	11/06/2019	28/05/2019	25/06/2019

Tab. 1 Cell differentiation kinetics of the plants studied.

FUTURE DEVELOPMENTS

The monitoring of the xylogenesis activity will continue for the next 2 growing seasons. In addition, after the COVID-19 emergency, the TreeTalker device will be installed on the studied plants. This device, capable of constantly measuring the climatic and physiological variations of plants, will allow us to identify and study trees ecophysiological responses and link such data with anatomical traits.

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