

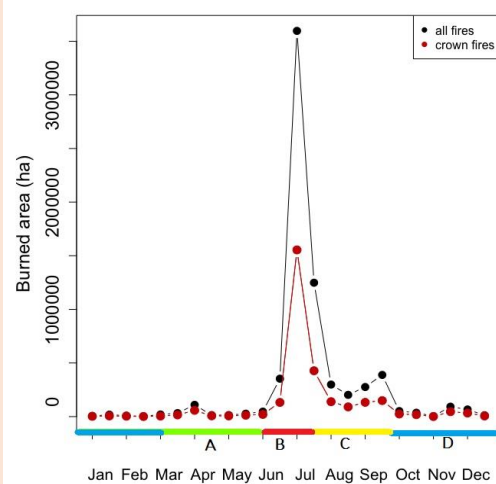
# Needle Senescence Affects Fire Behavior in Aleppo Pine (*Pinus halepensis* Mill.) Stands: A Simulation Study

Rodrigo Balaguer-Romano <sup>1,\*</sup>, Rubén Díaz-Sierra <sup>1</sup>, Javier Madrigal <sup>2</sup>, Jordi Voltas <sup>3</sup> and Víctor Resco de Dios <sup>3,4</sup>

<sup>1</sup>Mathematical and Fluid Physics Department, Faculty of Sciences, UNED. <sup>2</sup>Department of Forest Dynamics and Management, INIA-CIFOR. <sup>3</sup>Department of Crop and Forest Sciences, Universitat Lleida. <sup>4</sup>School of Life Science and Engineering, Southwest University of Science and Technology. \* Correspondence: rodrigo.balaguer.romano@gmail.com

## INTRODUCTION

The brunt of the fire season in the Western Mediterranean Basin occurs at the beginning of July, when live fuel moisture content is near its maximum. We have tested whether a potential



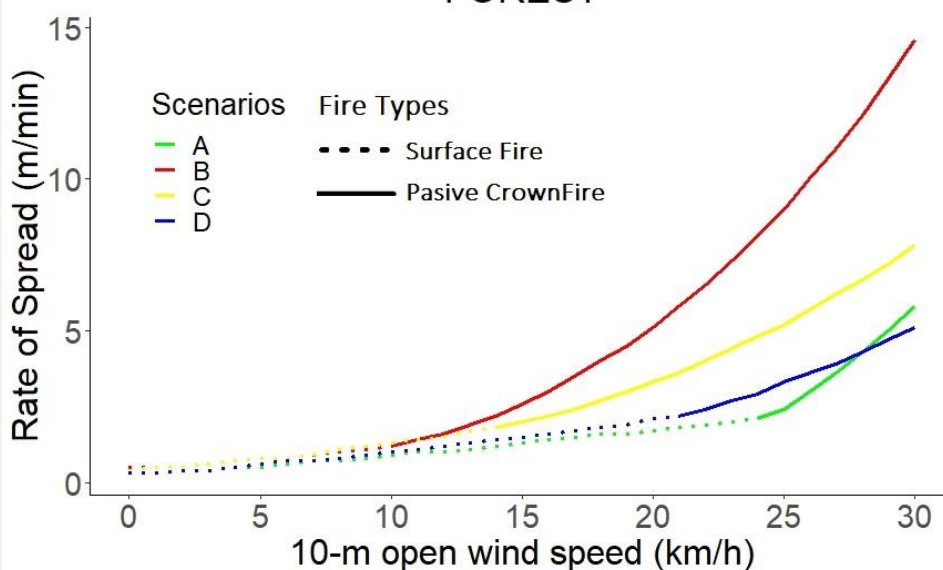
explanation to this conundrum lies in Aleppo pine needle senescence, which typically occurs in July. Our objective was to simulate the effects of needle senescence on fire behavior.

## METHODS

We simulated in *BehavePlus6*. four scenarios that recreated the major annual physiological and structural changes in relation to needle senescence. That is; A: representing spring leaf sprout; B: representing the time of needle senescence; C: after dry leaves shed and D: later in the year after the onset of litter decomposition in the autumn. Simulations were carried out in two contrasting stands types: Forest and Shrubs.

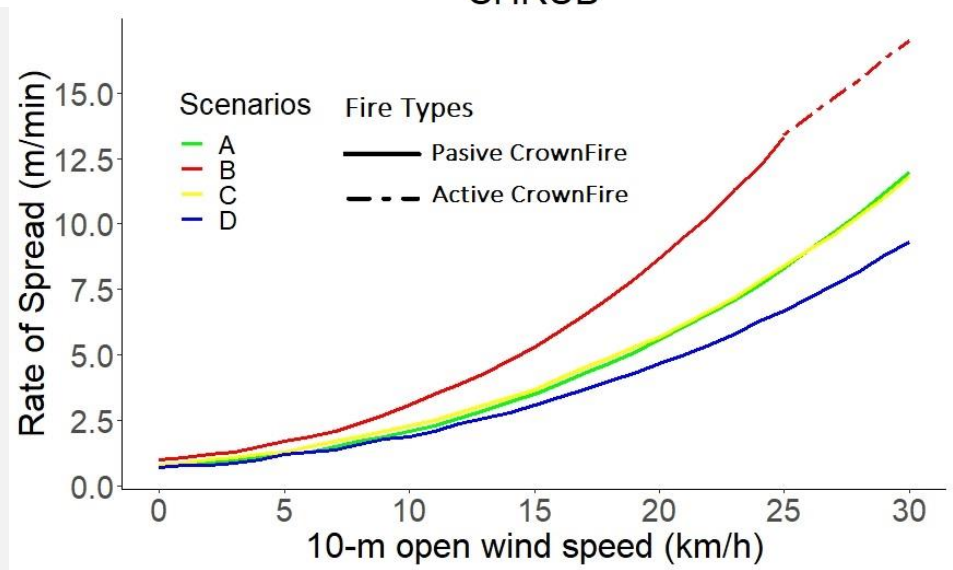
Forest	A	B	C	D
Canopy Cover (%)	35	35	35	35
Canopy Height (m)	8	8	8	8
Canopy Base Height (m)	1.5	1.5	1.5	1.5
Canopy Bulk Density (kg/m <sup>3</sup> )	0.15	0.15	0.1	0.1
Fine Fuel Load (t/ha)	2.5	2.5	3	2.5
1-h Dead Surface Fuel Moisture (%)	6	5	5	9
Foliar Moisture Content (%)	105	74	100	100
Shrub	A	B	C	D
Canopy Cover (%)	100	100	100	100
Canopy Height (m)	5	5	5	5
Canopy Base Height (m)	1	1	1	1
Canopy Bulk Density (kg/m <sup>3</sup> )	0.22	0.22	0.15	0.15
Fine Fuel Load (t/ha)	10	10	10.7	10
1-h Dead Surface Fuel Moisture (%)	6	5	5	9
Foliar Moisture Content (%)	105	74	100	100

## FOREST



## RESULTS

## SHRUB



## CONCLUSION

Changes in physiological and structural conditions following senescence enhance the probability of more intense and severe crown fires development and concentrate extreme tree mortality rates in senescence periods.