



Post-wildfire vegetation regeneration in *Quercus pyrenaica* Willd. forests

Juliana Polido Monteiro

Centre for Ecology, Evolution and Environmental Changes (cE3c)

Authors: Juliana Monteiro, Inês Domingues, Miguel Brilhantes, João Serafim & Cristina Branquinho

13 a 15 de outubro de 2021
CIMO, Instituto Politécnico de Bragança



RISCOS
ASSOCIAÇÃO PORTUGUESA
DE RISCOS, PREVENÇÃO
E SEGURANÇA

Increasing trends in wildfire **frequency** and **severity** have been reported worldwide

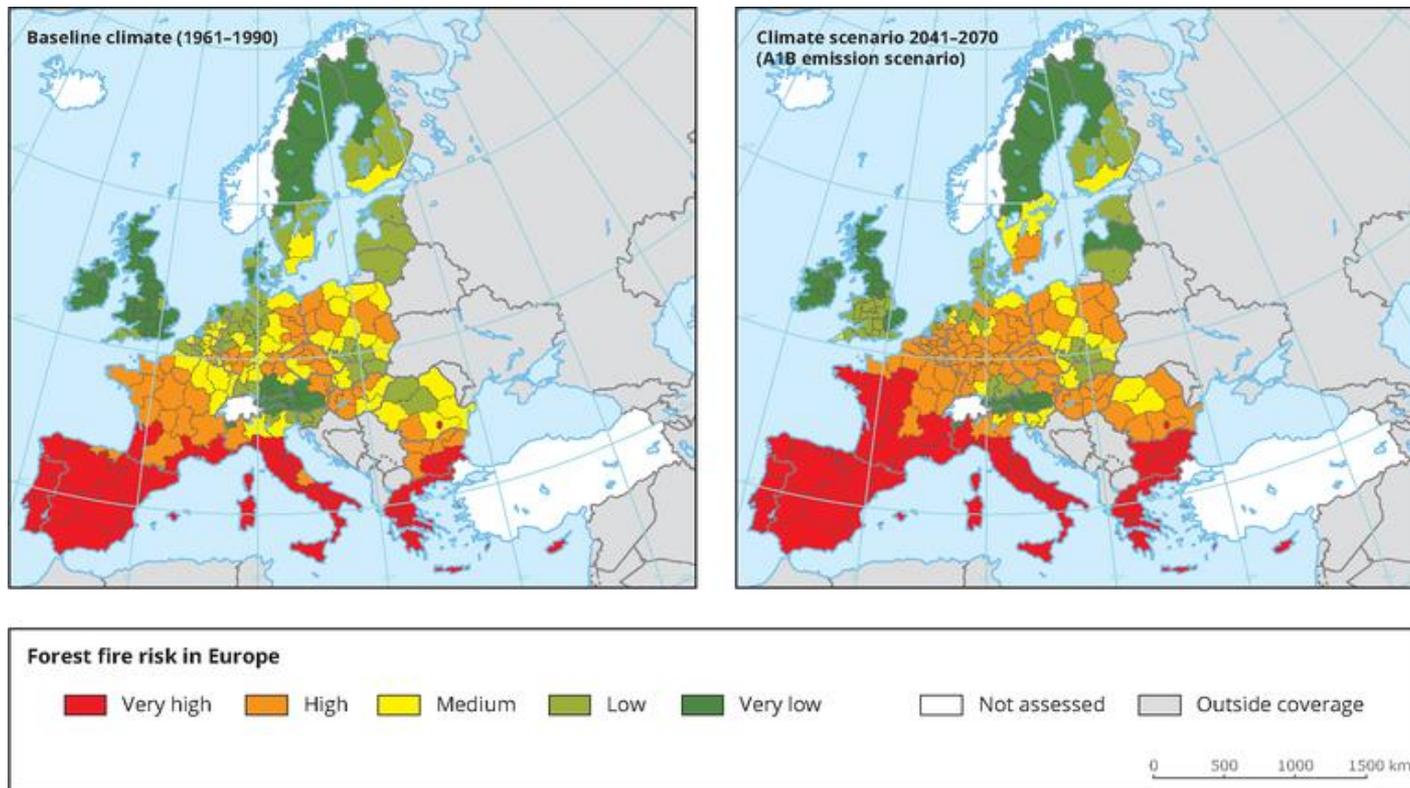


Fig 1. Forest fire risk calculated for baseline period (1961-1990) and 2041-2070 (A1B emission scenario). Source: European Environment Agency.

Fire has played a major role in shaping the structure and floristic composition of plant communities in Mediterranean ecosystems

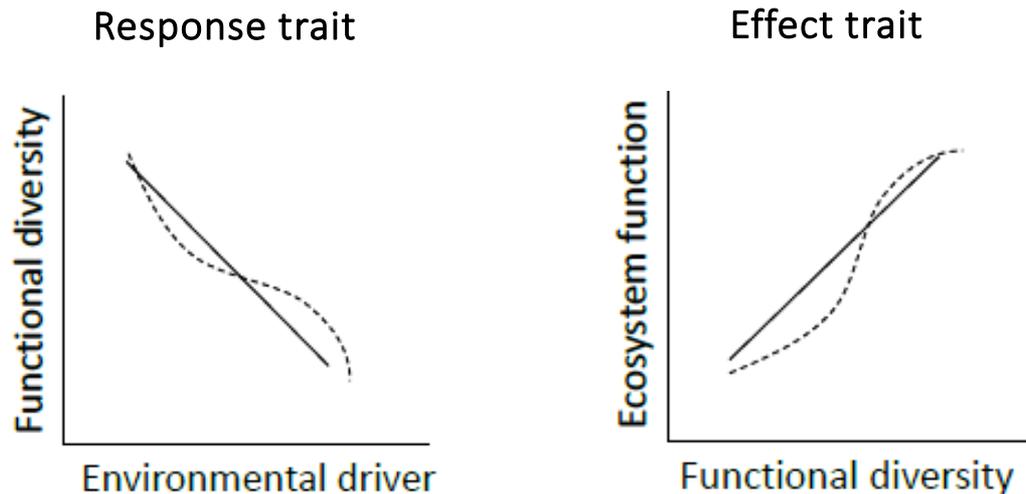
→ Few studies have dealt with the succession of bryophyte communities in burned forests



Fig 2. Moss colonization after fire (left), micro-plot detail in October 2015 (centre) and March 2016 (right). Silva *et al* 2019.

Bryophytes present functional traits that allow them to enhance ecosystem recovery

Species attributes that influence their responses to environmental conditions – *response traits*, or determine their influence on ecosystem properties – *effect traits*



Traits may provide a mechanistic understanding of species-environment relationships, as they reflect the organism's adaptation to its habitat

Effects of wildfires on the functional composition of *Quercus pyrenaica* Willd. forests



1

Assess changes in the functional composition of *Quercus pyrenaica* forests along a fire chronosequence

2

Identify relevant functional traits along the post-fire gradient

How bryophyte functional composition varied along the fire chronosequence

Vegetation sampling

Post-wildfire chronosequence (2009 - 2019) in deciduous *Quercus pyrenaica* forests

Cover was measured in 33 sampling plots (800 m²), using the point-intercept method

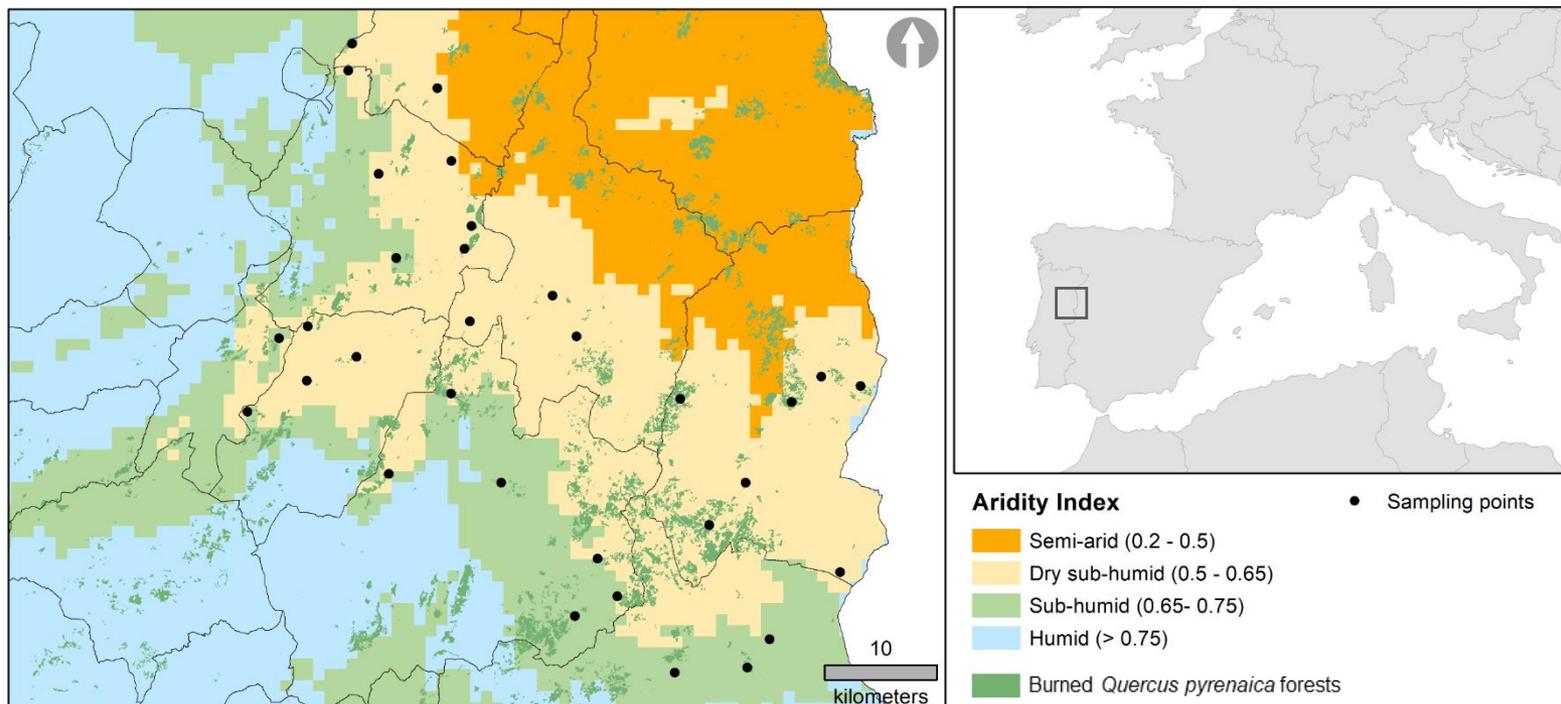
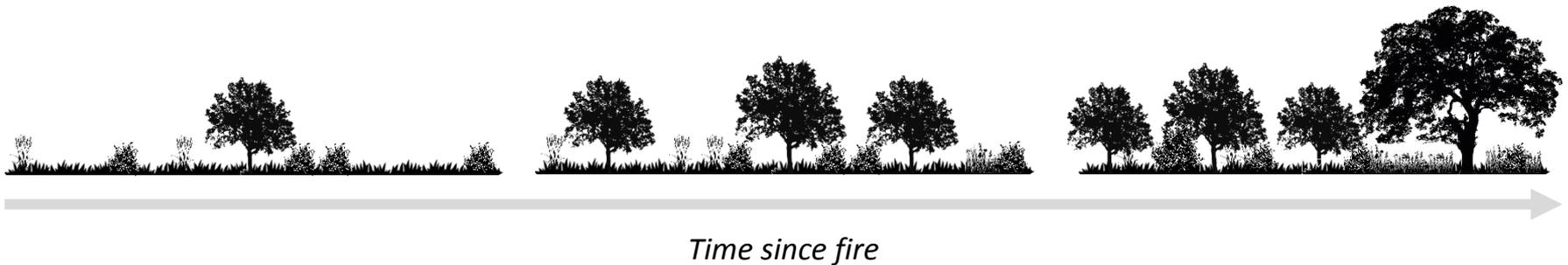


Fig 2. Map of the study area showing sampling sites located in burned *Quercus pyrenaica* forests in Northeastern Portugal. Sites are located within the dry sub-humid and sub-humid aridity classes.

Vegetation sampling

Post-wildfire chronosequence (2009 - 2019) in deciduous *Quercus pyrenaica* forests

Cover was measured in 33 sampling plots (800 m²), using the point-intercept method



Growth-form
(GF)

Morphological term, expressing the structural architecture of the individual moss plant

Life-form
(LF)

Encompass the overall organization of growth-form, branching pattern, the general assemblage of individuals, and modification of a population by the environment

Life-strategy
(LS)

Consists of several components: life span, breeding system, main reproductive effort, spore size, and dispersal strategy

Polytrichum commune



Growth form
acrocarpous

Life form
turf

Life strategy
perennial

Community Weighted Mean (CWM)

$$CWM_j = \sum_{i=1}^S p_i x_{ij}$$

Dominant traits in a community

152 vascular plant *taxa*

81.6% cover

*Quercus pyrenaica* | Cristina Estima Ramalho***Quercus pyrenaica****Cytisus multiflorus* | Carlos Aguiar (CIMO)***Cytisus multiflorus****Arrhenatherum elatius* | Miguel Porto***Arrhenatherum elatius****Jasione montana* | Pedro Pinho***Jasione montana***Climatophilous and secondary forests of *Quercus pyrenaica*

40 bryophyte *taxa*

18.4% cover

Pleurocarpous mosses



Rhynchostegium megapolitanum



Isothecium myosuroides



Homalothecium sericeum

Acrocarpous mosses



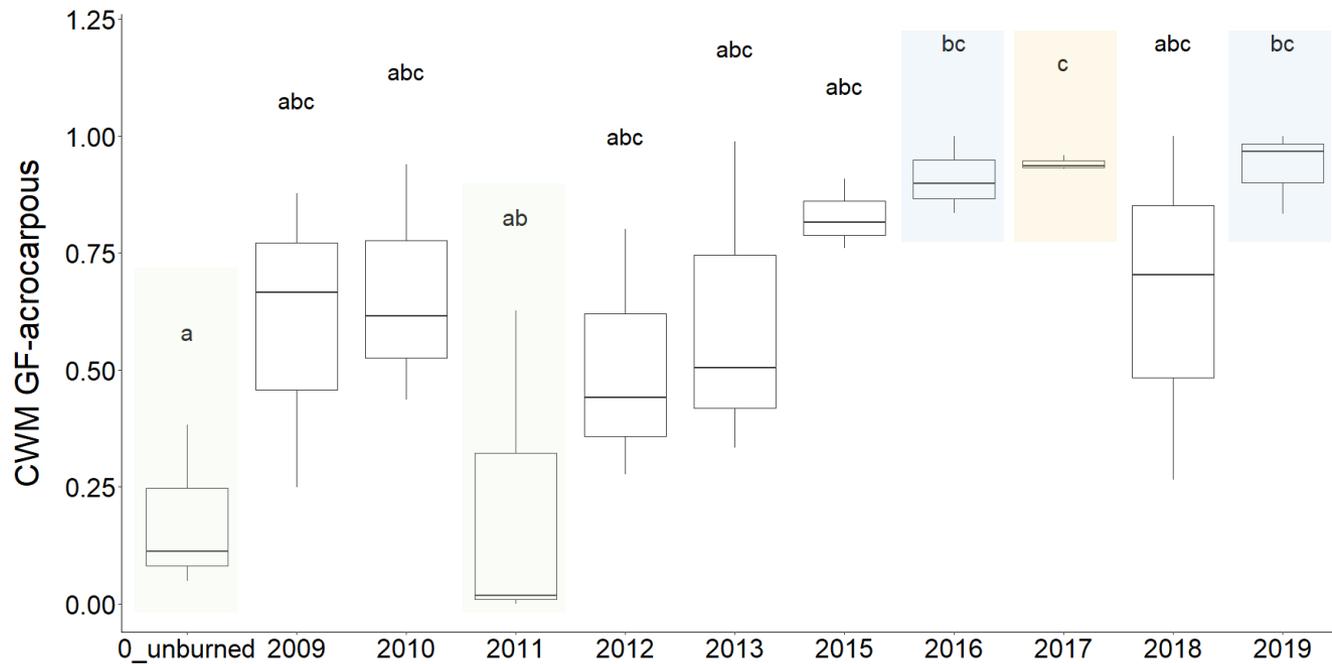
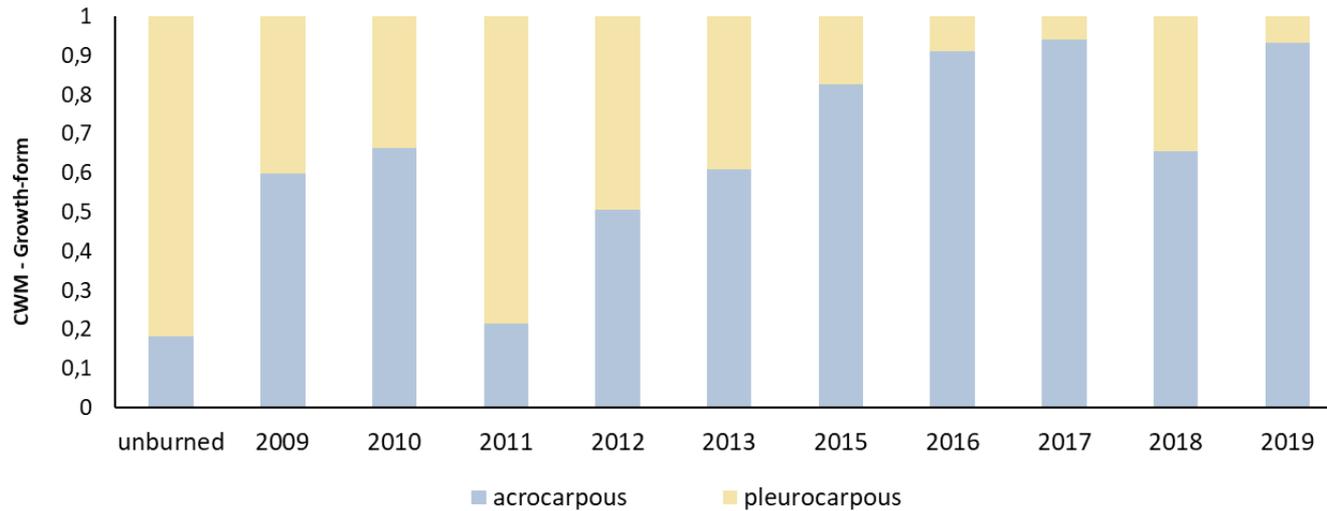
Ceratodon purpureus



Bryum capillare

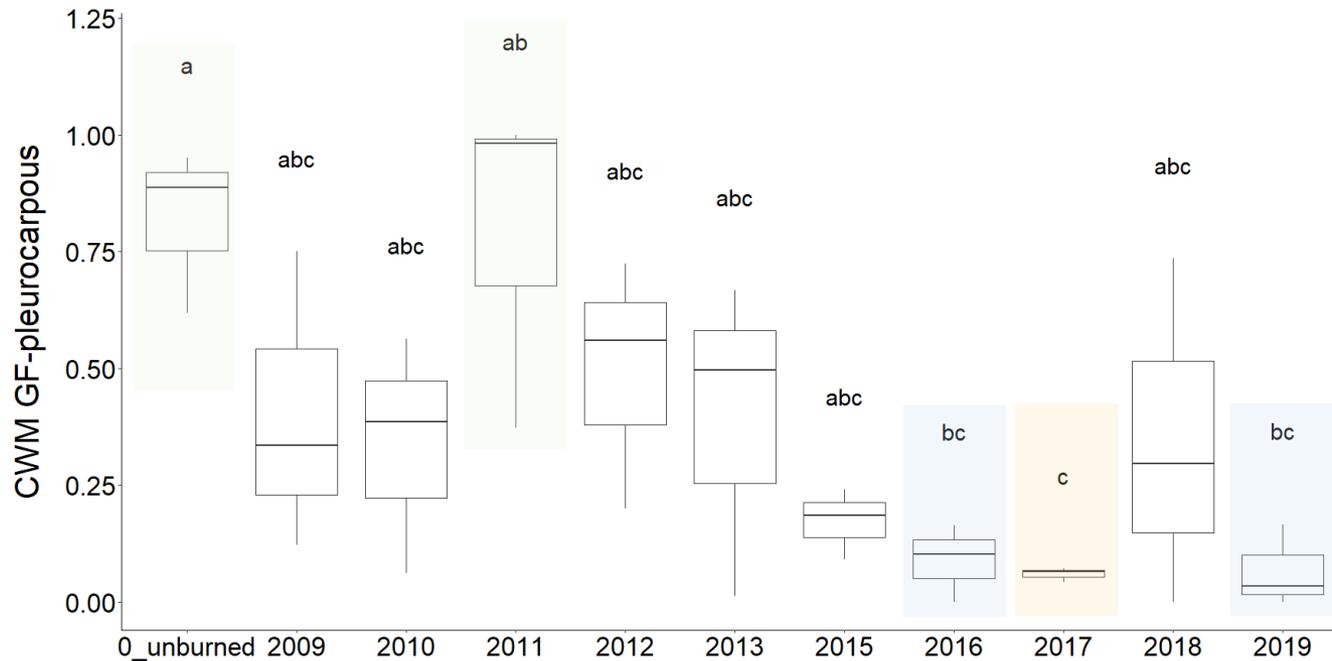
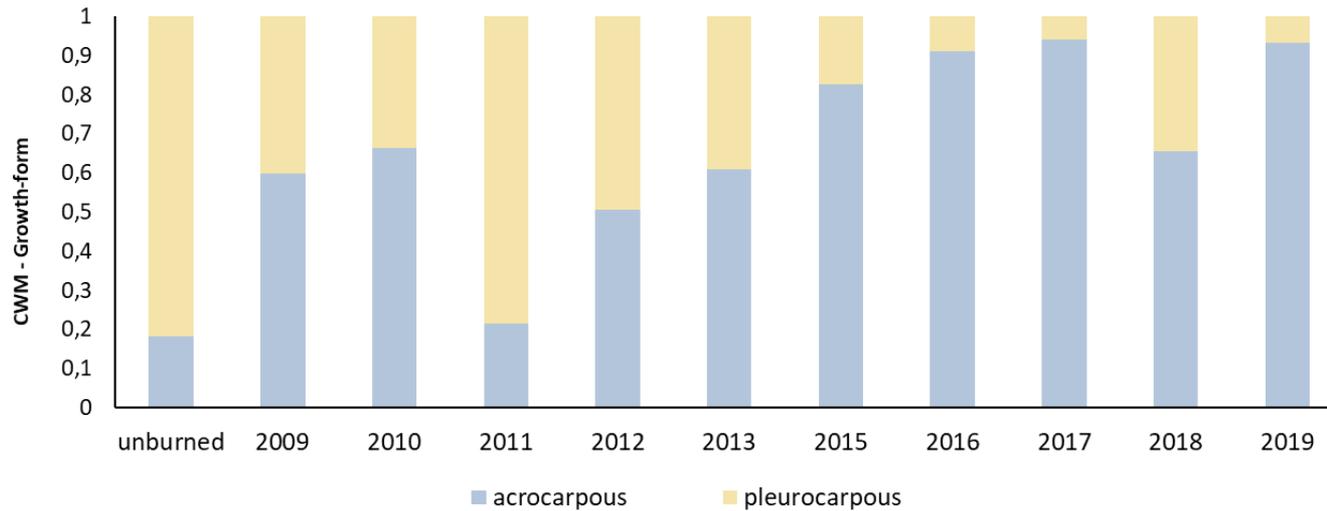


Polytrichum commune



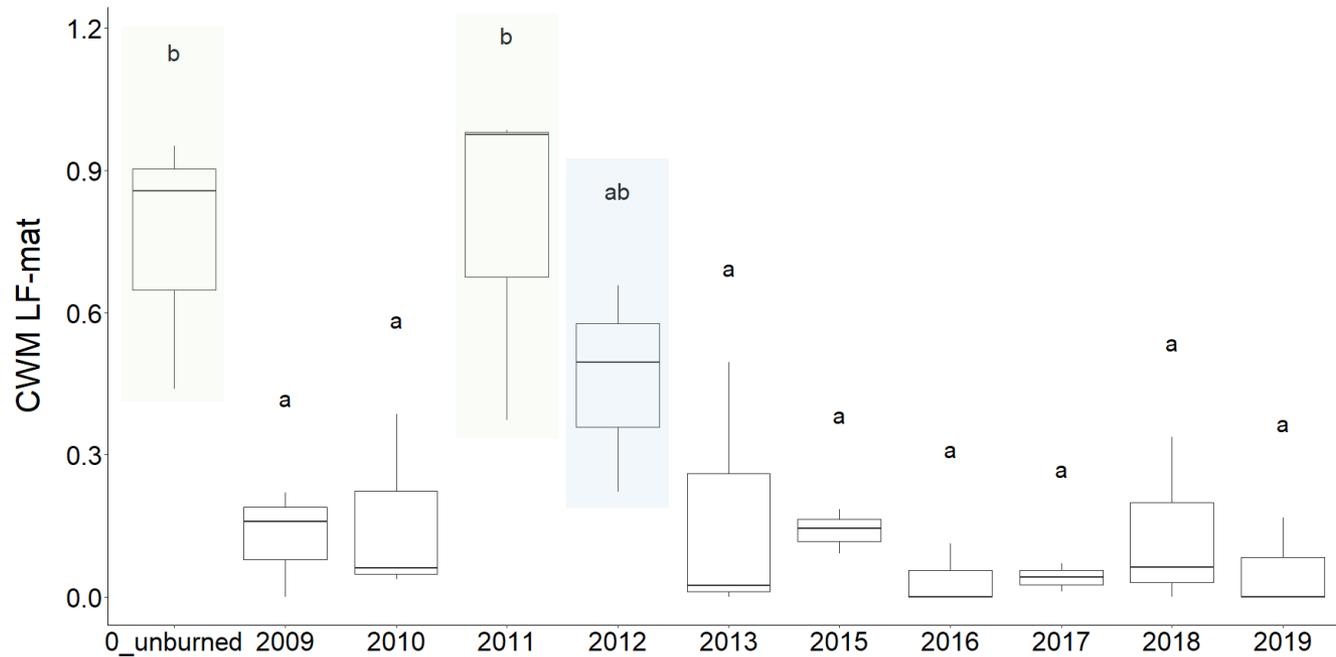
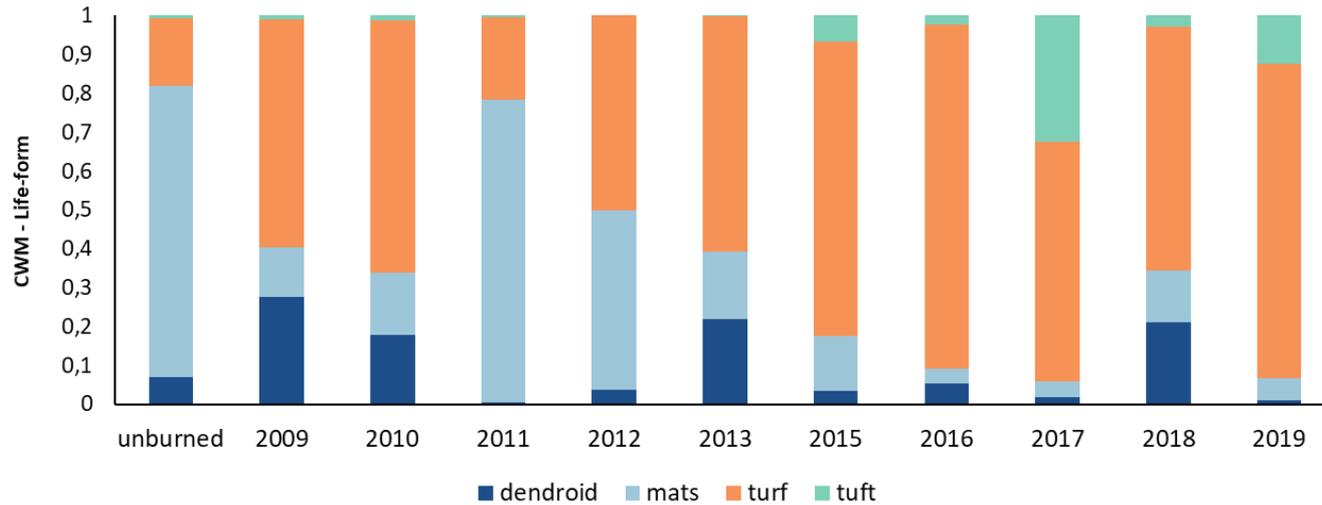
Acrocarpous

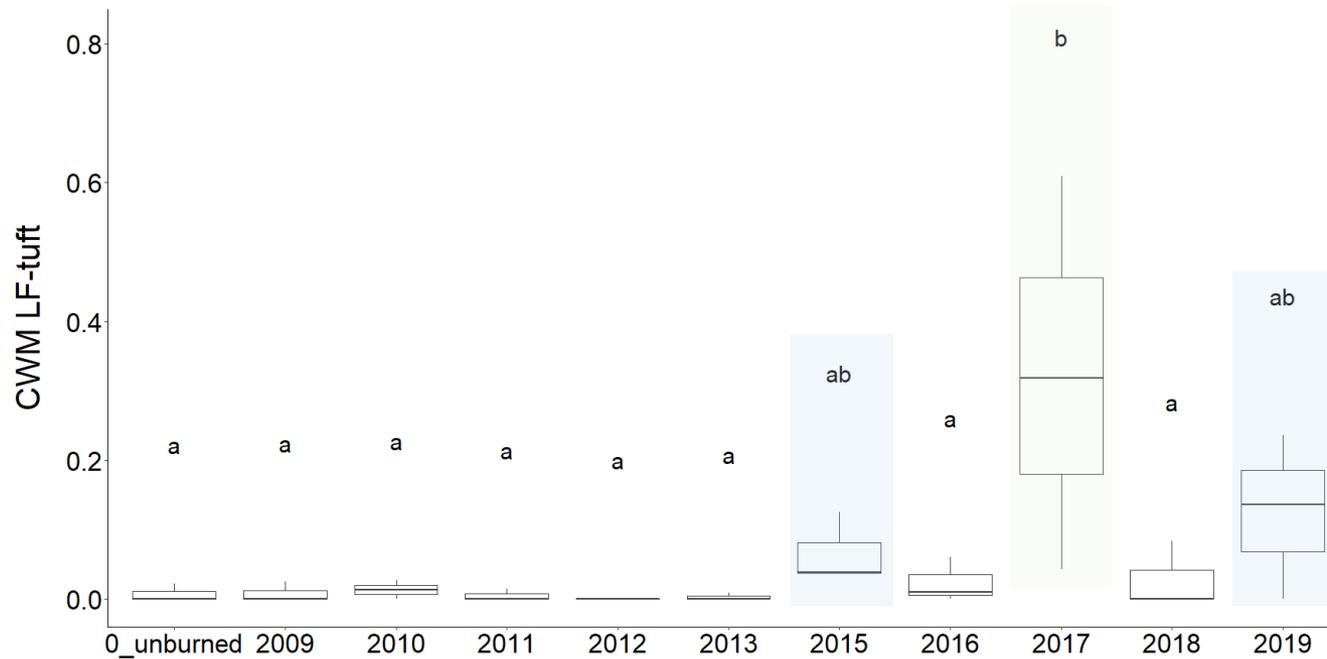
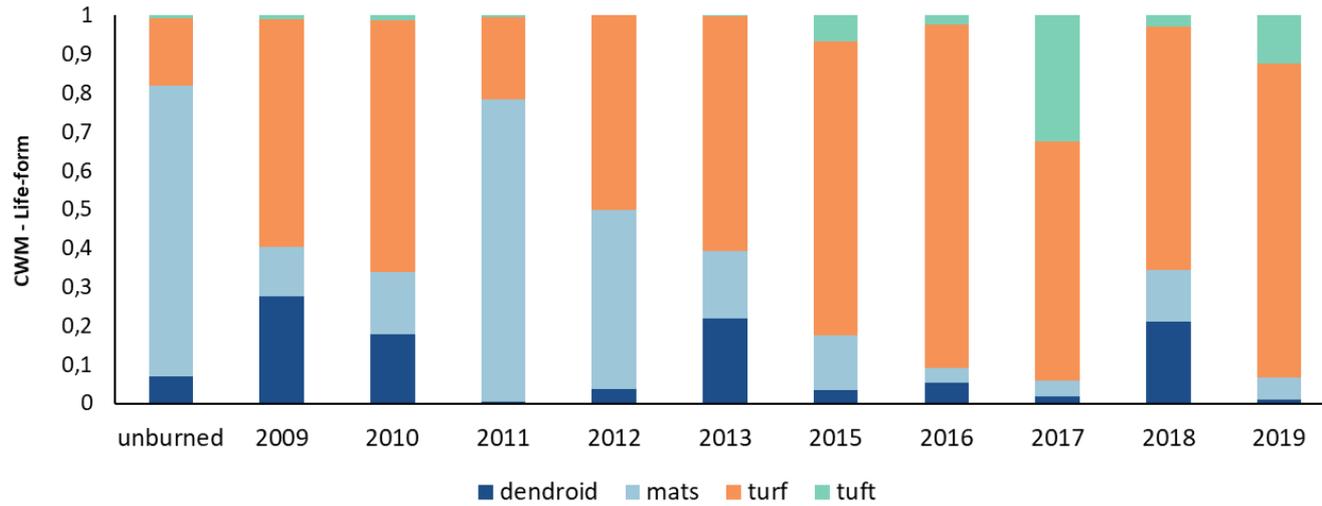




Pleurocarpous







Tufts



Life-forms are constructed to minimize evaporative loss while maximizing photosynthetic light capture

Mat life-form



Hypnum cupressiforme

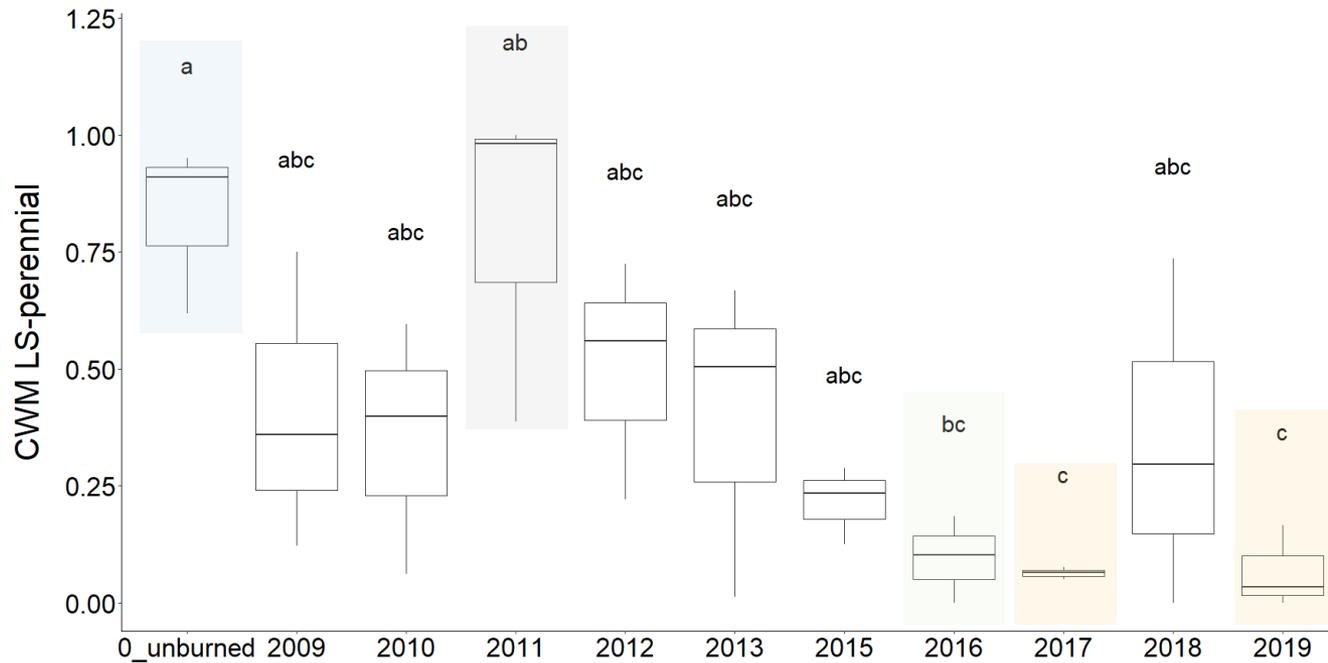
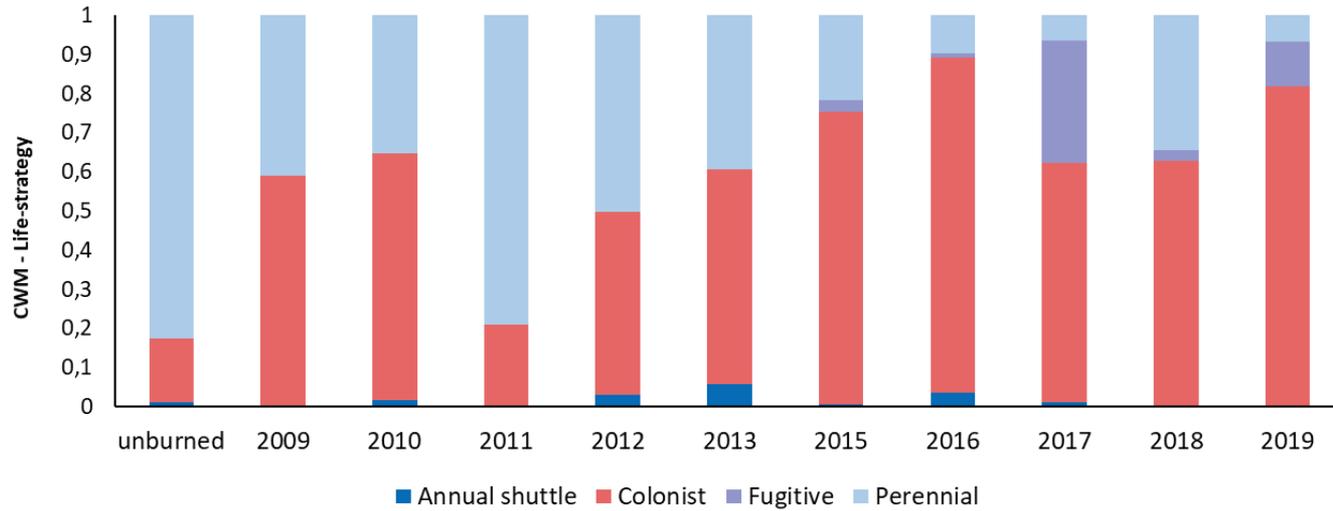
More common in moist, shaded habitats (open forms are more prone to water loss)

Tuft life-form

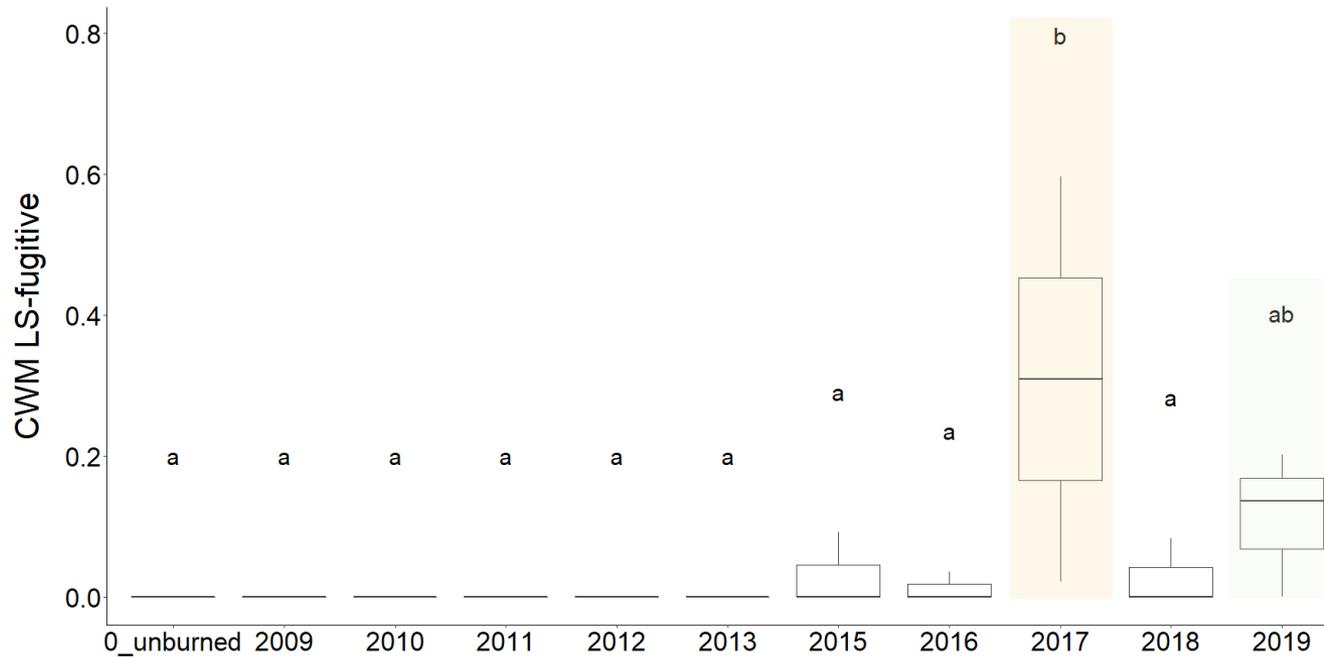
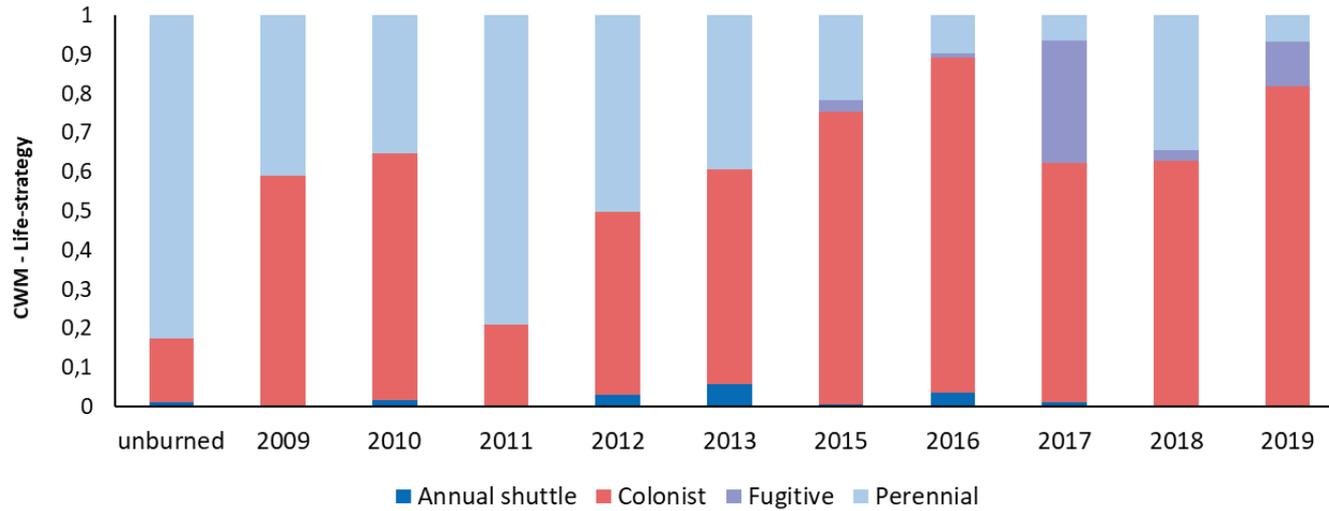


Funaria hygrometrica

Improves water uptake and moisture retention and reduces air movement close to the upper leaves in the canopy



Perennial

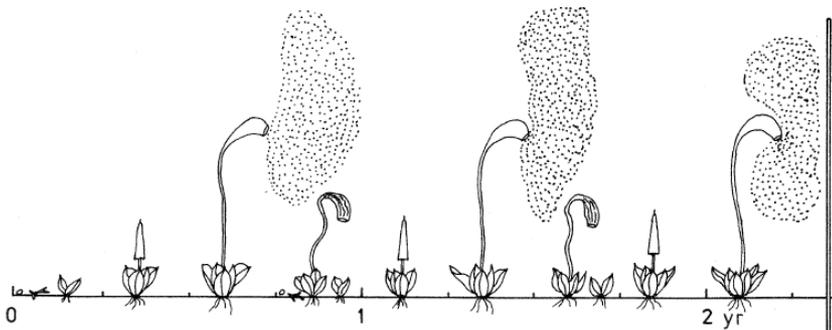


Fugitive

The environment provides the major selection pressure on the life cycle strategies

Fugitive life-strategy

Pioneers of successional stages



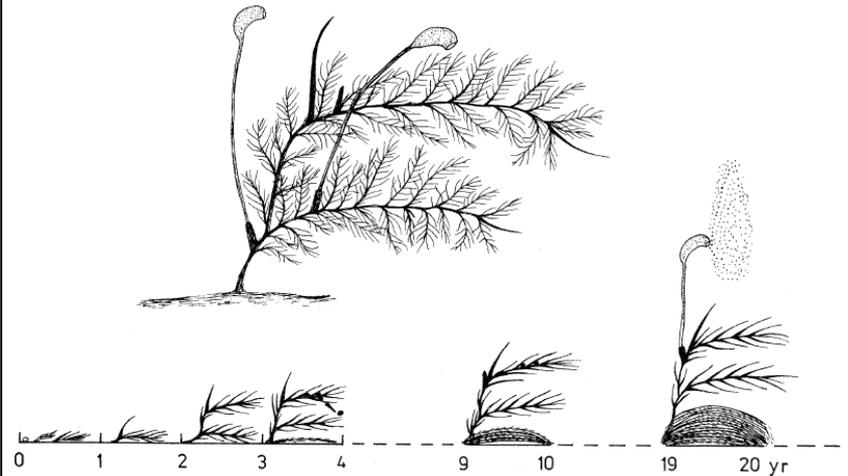
Short life span; ephemeral-annual

High sexual reproductive effort

Small, widely dispersed spores

Perennial life-strategy

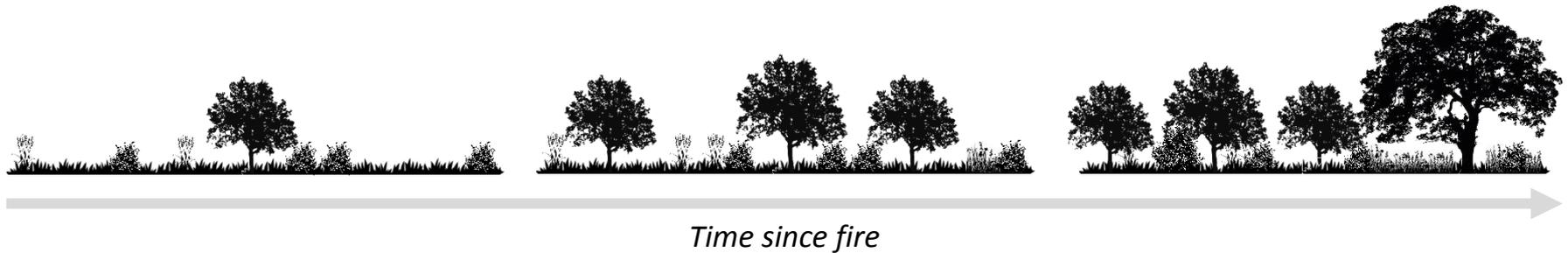
More frequent in late successional stages



Long life span

Sexual and asexual reproductive effort low to nearly absent; spores small, less than 20 μm

Bryophyte functional composition along the fire chronosequence



+ Acrocarpous

- Mats

+ Tufts

- Perennials

+ Fugitives

+ Pleurocarpous

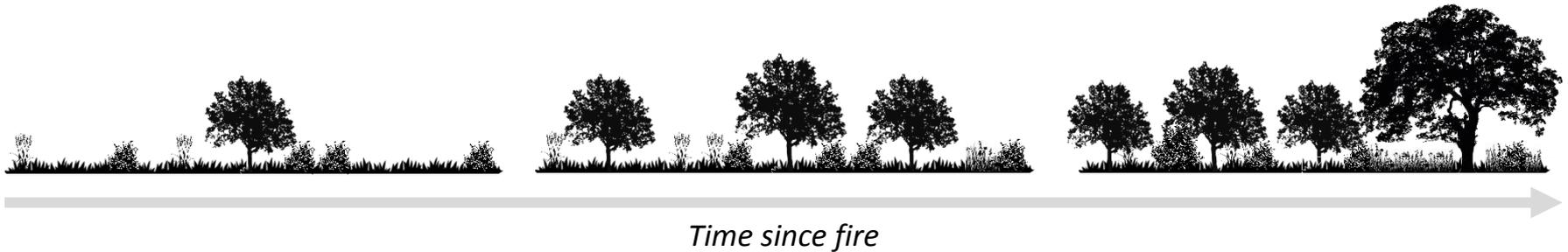
+ Mats

- Tufts

+ Perennials

- Fugitives

Bryophyte functional composition along the fire chronosequence



Highly unpredictable environments, that exist for only a short time



Constant environmental conditions or regularly fluctuating environments

- Changes in bryophyte functional composition along the fire chronosequence;
- Different bryophyte functional groups were associated with different stages of post-wildfire succession.



Future analysis

- Structure and composition of vascular plant communities along the fire chronosequence;
- Analyze the influence of soil properties (OM, pH, total carbon, total nitrogen, available cations and trace metals) on plant communities;
- Quantify how burn severity affects vegetation recovery.

THANK YOU FOR YOUR ATTENTION!



FCT
Fundação para a Ciência e a Tecnologia
MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E ENSINO SUPERIOR

 **eCE3C**
centre for ecology, evolution
and environmental changes

 **Ciências
ULisboa**

PhD grant (SFRH/BD/131924/2017)