



30 years of bringing green ideas to LIFE

Technical Seminar
LIFE MycoRestore
Vallombrosa (Reggello)
16/6/2022



“Use of native mycological resources
as Biocontrol Agent of Forest
Pathogens and Resilience of Forests to
Climate Change”

The “Seca de la encina”

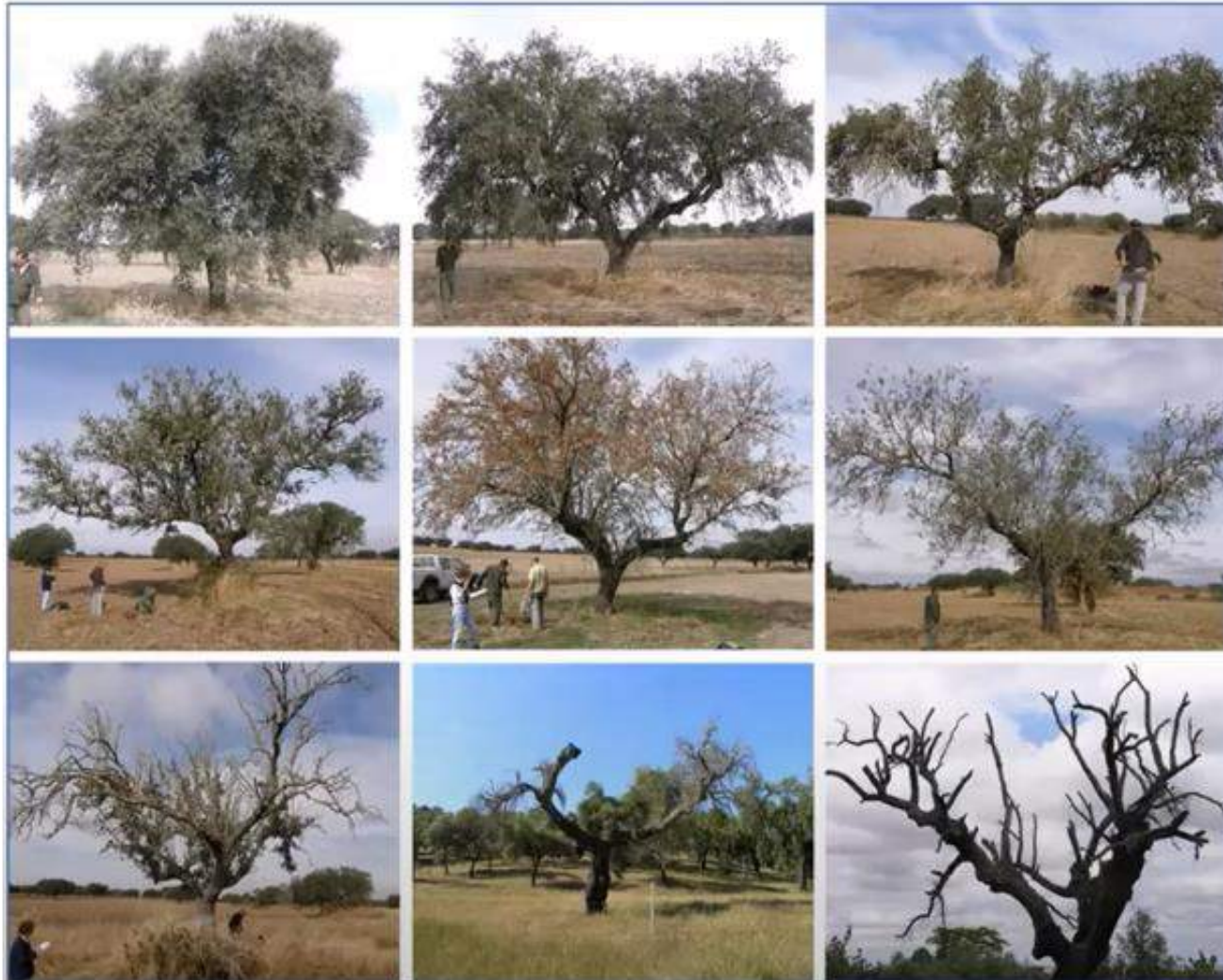


The “Seca de la encina”

Infection

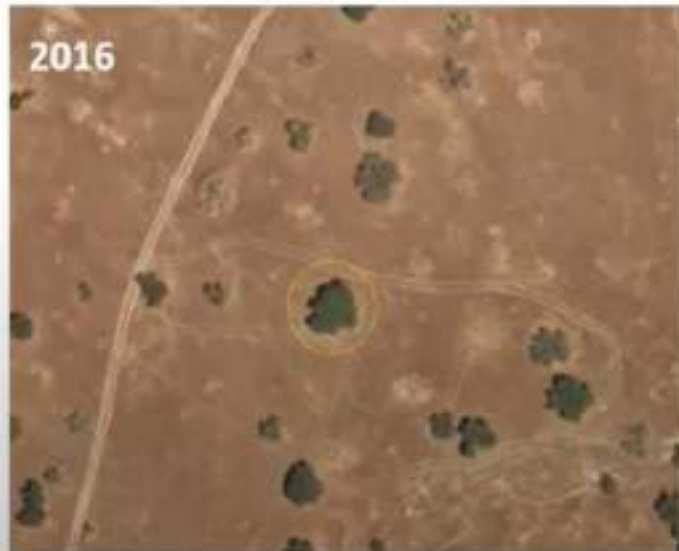


Tree
death
4-6 years



Source: Enrique Cardillo Amo (CICYTEX)

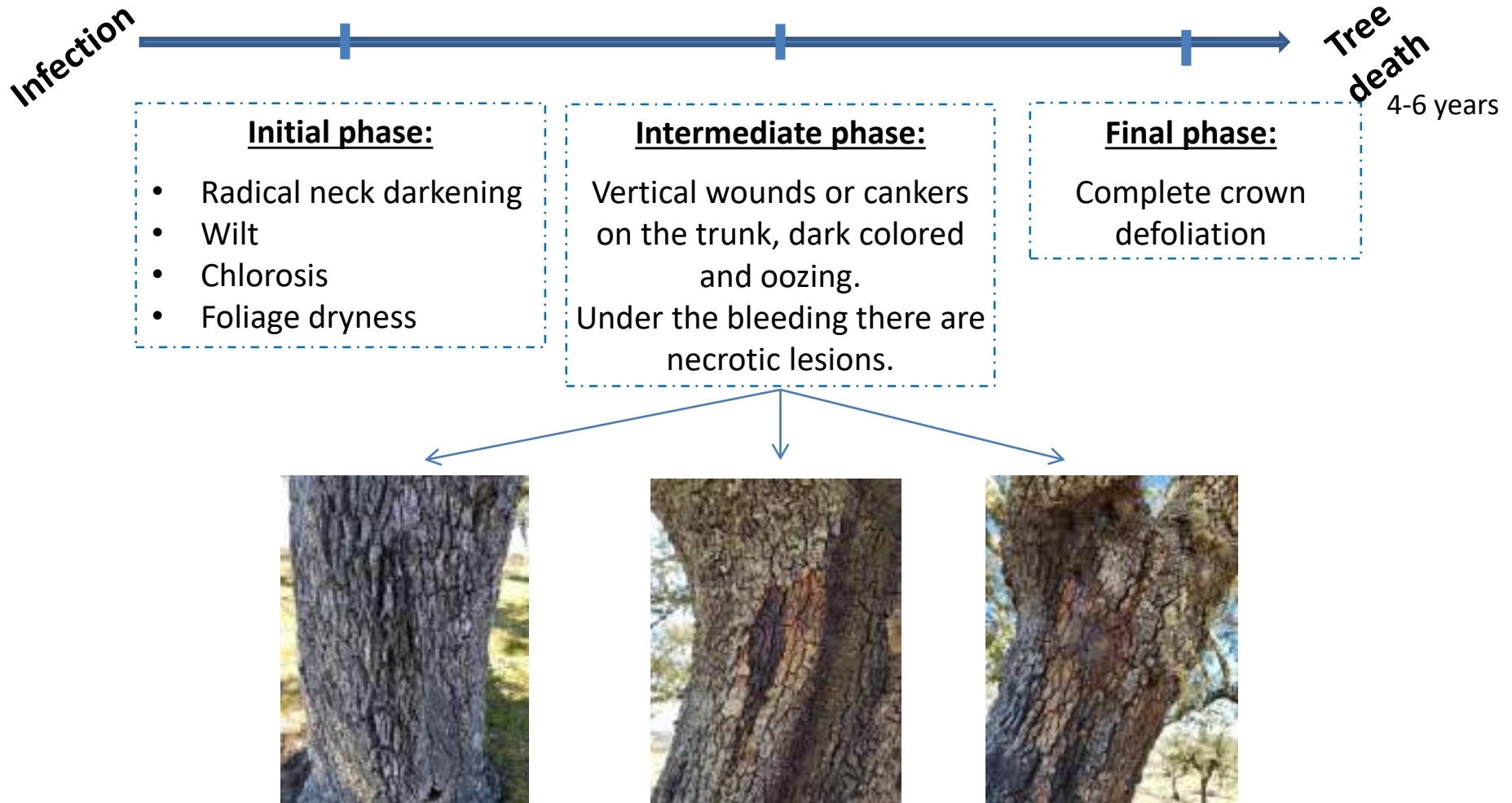
The “Seca de la encina”



Source: Enrique Cardillo Amo (CICYTEX)

The “Seca de la encina”

Symptoms: Causes destruction of the root structure of the tree.



The “Seca de la encina”

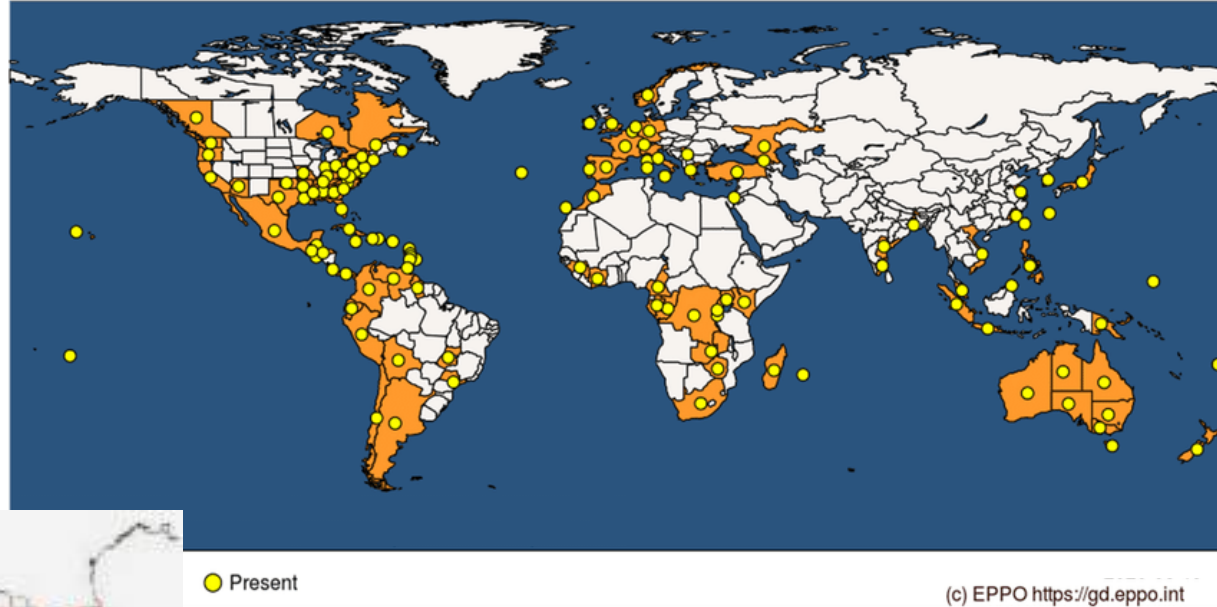
Multifactorial. The main pathogen responsible is the oomycete *Phytophthora cinnamomi*:



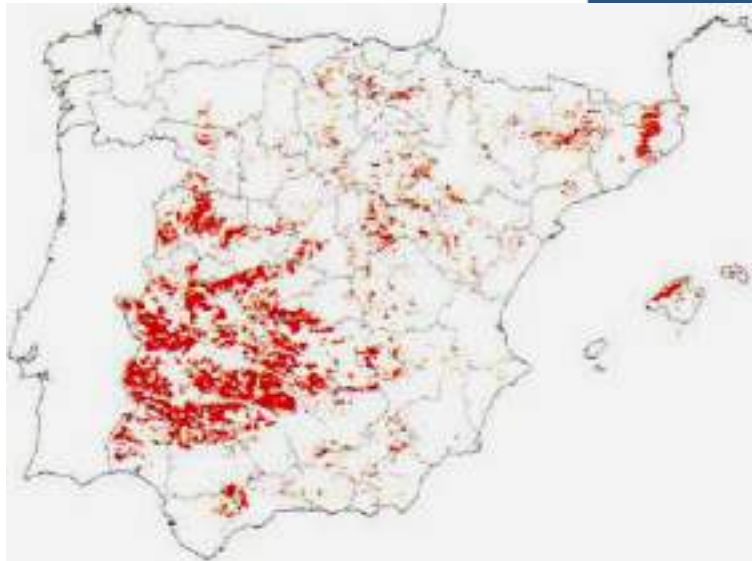
- It affects numerous species of the **Quercus** spp.
- It **attacks** the **roots** of the tree, causing its desiccation. Causes **death** in **4-6 years**. In acute episodes 18 months.
- It especially affects **mature oaks and holm oaks** already weakened by environmental factors, although it has also been recorded in juvenile stages.
- **Progressive loss of leaves** similar to episodes of extreme drought.

The “Seca de la encina”

Distribution of *Phytophthora cinnamomi*



Map of distribution of *Phytophthora cinnamomi* worldwide.
European and Mediterranean Plant Protection Organization (EPPO) (2020)

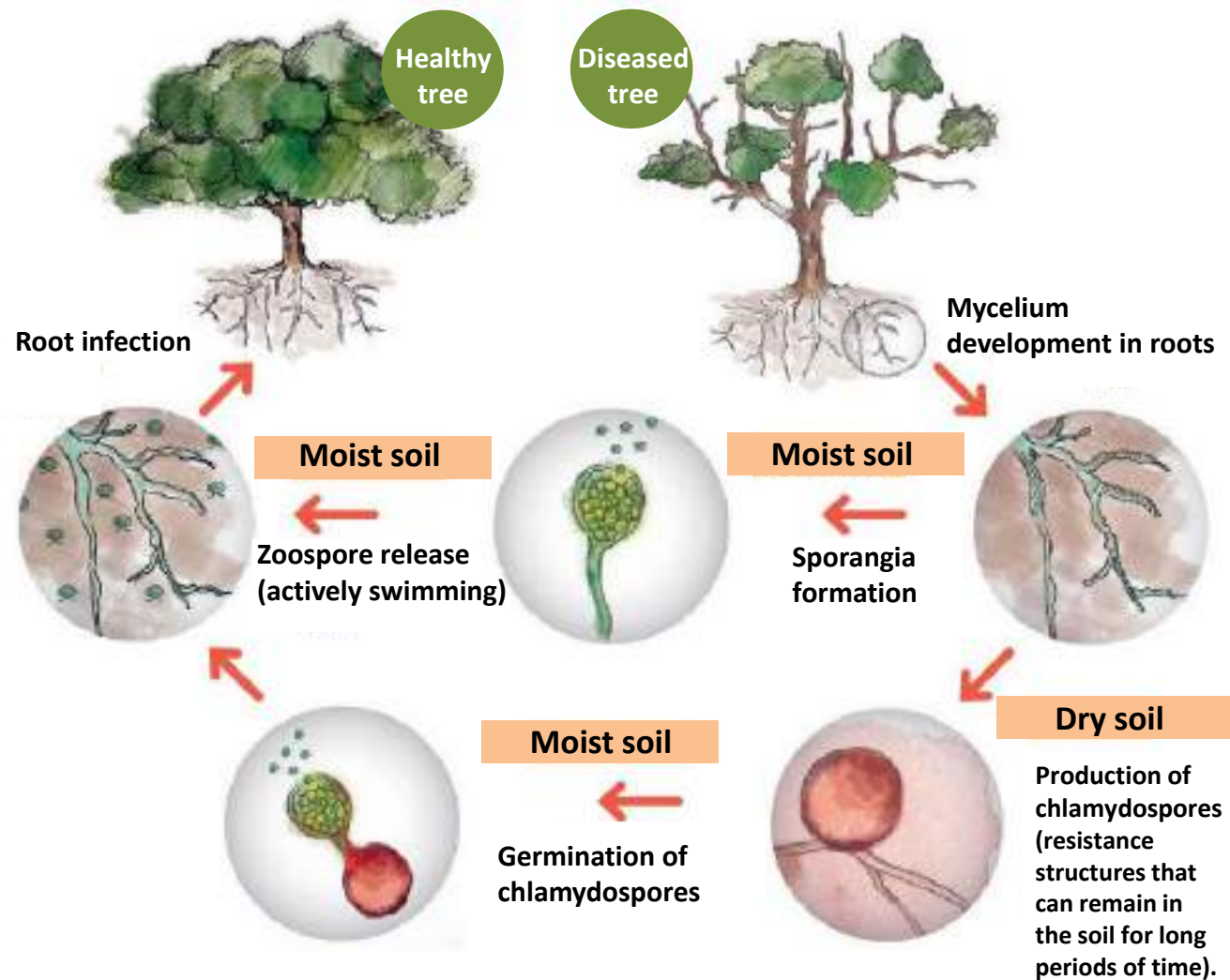


Map of distribution of *Phytophthora cinnamomi* in Spain
(Soriano Martín et al., 2004)

The “Seca de la encina”

Dissemination:

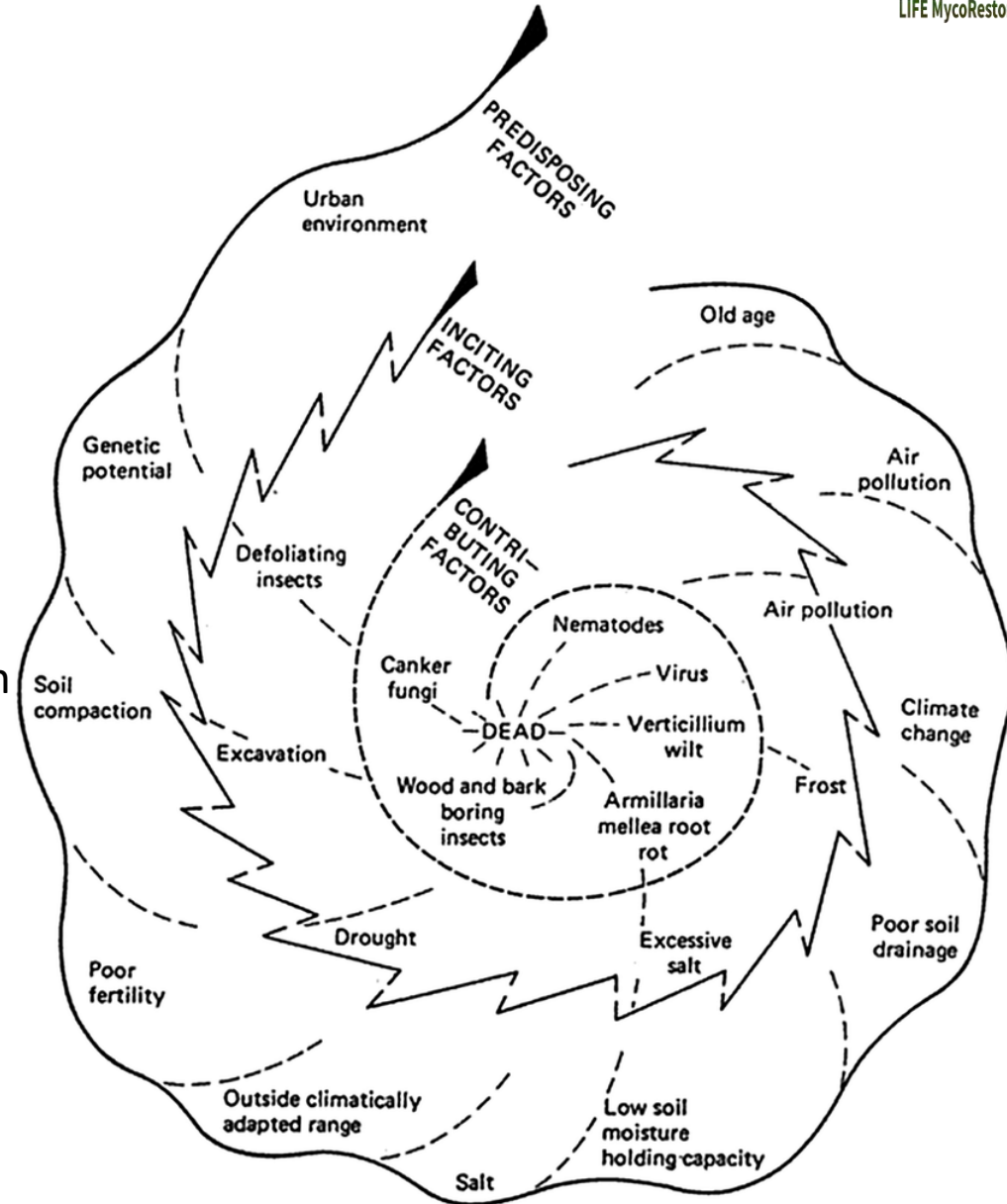
- **Aquatic dissemination:** Zoospores are able to swim through water contained in the interstitial spaces of the soil. Spread by watercourses and through **trade** of infected plants.
- Favored in conditions of mild temperature and high soil moisture. Preference for acid-neutral soils and clayey texture.



The “Seca de la encina”

Causal agent:

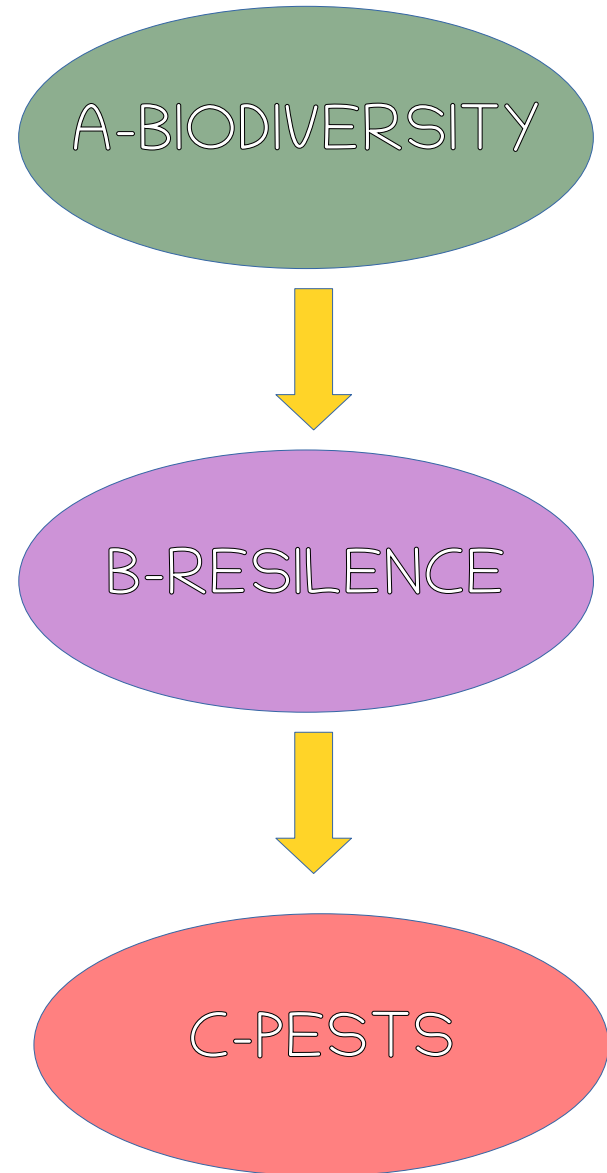
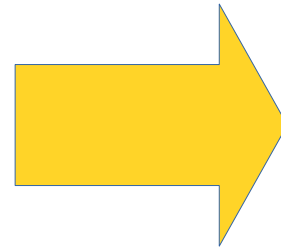
- The main pathogen responsible is the oomycete *Phytophthora cinnamomi*.
- It is considered a **multifactorial disease**, where biotic factors such as those mentioned above and abiotic factors such as drought, high temperatures, etc. are involved.
- **Complex networks** of biological interactions are involved, such as polymicrobial infections.



Biological Equilibrium Concepts

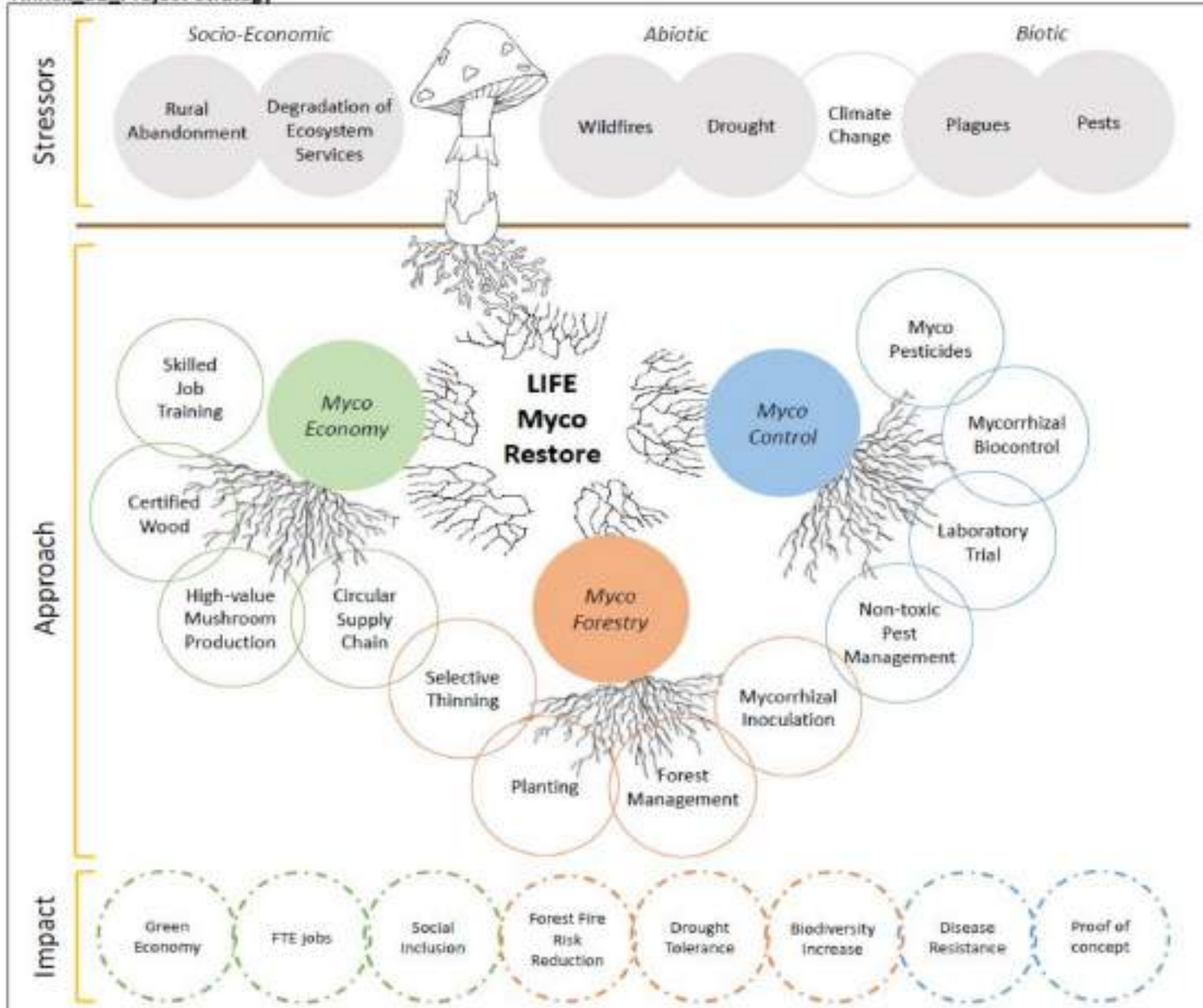
- 1-GLOBALIZATION
- a. Invasive Species
 - b. Possibility of Success
 - c. Equilibrium breakage

- 2-CLIMATE CHANGE
- a. Change of the conditions
 - b. Climatic adaptation of forest species: movement/extinction
 - c. Equilibrium breakage



Biological Equilibrium Concepts

Annex B2 Project Strategy



Biological Equilibrium Concepts

Cerambyx welensii

Family: *Cerambycidae*

Host plants: Oak trees (*Quercus sp.*), and less common found in other deciduous species such as chestnuts, birch, willow, ash, elm, walnut, hazel, carob, beech, hornbeam etc.

Description: The *Welensii* lays its eggs on the sun-exposed trunks of large trees (>30 cm trunk diameter) of living and weakened trees. The larvae live under the bark for 3-4 years during which they create tunnels in the wood, weakening and eventually kill the tree. Dehesas are particularly vulnerable since trees are not densely planted and thus many trunks are exposed to the sun. Besides this most trees in the Dehesa are veteran trees, targeted by the *Welensii*. The *Cerambyx welensii* is found across the northern Mediterranean basin. Once a tree is infected, there is no cure [15].



Figure 1: Tunnels created by the *Welensii* larvae in a *Quercus pyrenaica* tree in the Cubo de Don Sancho project area.



Figure 3: *Cerambyx* Larvae



Figure 2: Specimen of a male *Cerambyx Welensii*

Biological Equilibrium Concepts

Coraebus undatus

Family: Buprestidae

Common name: Jewel beetles or Metallic wood-boring beetle

Host plants: Cork oak (*Quercus suber L.*)

Description: Eggs of the *C. Undatus* are laid in deep bark crevices. The larvae then dig into the bark, leaving long tunnels through the thickness of the bark between the sapwood and the outer layer. Larvae appear both on the trunk and on branches. The tunnels reduce the value of the cork, as well as making the removal process more difficult. On top of this, wood peckers cause further damage by making holes in the bark while feeding on the larvae. Development to adult takes 2-3 years depending on the temperature. Adults live and reproduce in the canopy of the tree where they feed on leaves.¹ Neither active nor preventative chemical control have proven to be effective.



Figure 6: *Coraebus Undatus* larvae on cork bark, leaving tunnels depreciating the value of the cork.



Figure 5: Specimen of *Coraebus Undatus*.

Biological Equilibrium Concepts

Phytophthora cinnamomi

Family: *Peronosporaceae*

Common name: Oak Decline "La Seca"

Host plants: Broad range of host plants of hundreds of trees. In Europe mainly *Quercus* spp.

Description: *Phytophthora cinnamomi* is a soil-borne fungi which can spread through water. The pathogen favours warm and moist conditions, but can survive periods of drought by becoming dormant chlamydospores. When the conditions are favourable the chlamydospores germinate, producing mycelia and sporangia. These in turn release zoospores which infect plant roots. Infection of the roots is most likely in moist soils as the zoospores need water to 'swim' through the soil. The fungi destroys the structure of the root by absorbing the carbohydrates and nutrients, which it uses to grow. Early symptoms of infection include; wilting, yellowing and retention of dried foliage and darkening of root color. Infection often leads to death of the plant, especially in dry summer conditions when plants may be water stressed. In the Mediterranean the pathogen spreads and infects trees during the wet seasons. During the dry summers trees are water stressed and often weakened by other biotic stresses such as the *Cerambyx*, in combination with root rot the tree often dies.

In Spain Oak Decline has been reported to be induced by multifactorial causes including pathogens such as *P. cinnamomi*, other fungi, pests like *cerambyx*, drought and other abiotic factors. Recent studies from 2018 have shown that Oak decline in Great Britain forests is caused by complex biotic interactions such as polymicrobial infections involving at least 3 pathogenic bacteria.



Figure 15: Oak trees affected by La Seca in the La Alamedilla project area. La Seca is associated with *Phytophthora cinnamomi*.

Conclusions

1-The Seca de la Encina is a complex disease.

2-Environmental factors as climate, soil and management are involved in the disease.

3-Global Change (Globalization and Climate Change) are related with the disease.

4-*Phytophthora cinnamomi* is a contributing factor of the Seca.

5-A multifactorial disease (decline) needs of multifactorial approach (Integrated Management).



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