



alberi. L'analisi di questi fattori ambientali permette la creazione di mappe del rischio e vulnerabilità delle foreste agli eventi climatici estremi. Questo è il presupposto per lo sviluppo e l'applicazione di nuove strategie gestionali mirate alla riduzione del rischio legato all'impatto dei cambiamenti climatici sulle foreste.

### ***Forest dieback and tree mortality related to extreme drought and heat waves in summer 2017 in Tuscany***

**Keywords:** drought; defoliation; tree mortality; forest dieback; resilience.

The reports of forest die-off events triggered by dry spells have increased significantly in the last decades. During summer 2017, central Italy was hit by intense drought and heat waves, with temperature peaks over 40°C. Starting from mid July, impacts on forest trees were observed such as leaf discoloration, desiccation and, in August, early foliar shedding in deciduous broadleaf tree species and diffuse desiccation of leaves and branches in evergreen broadleaf species.

This study describes the results of preliminary analyses of these impacts in Tuscany (central Italy), based on field observations and remote sensing surveys. To this purpose we adopted three different approaches:

- (i) mapping of drought-induced forest damage, by means of the analysis of reflectance canopy properties. The Normalized Difference Vegetation index (NDVI) and Sentinel 2 spectral bands (NIR, RedEdge 3, RedEdge 4) were evaluated for drought-affected and unaffected forest stands for each forest type studied;
- (ii) analysis of non-structural carbohydrates content in woody tissues (small branches and twigs) in drought-damaged and non-damaged trees for the main species examined;
- (iii) evaluation of the resilience of evergreen sclerophyllous species, by analyzing their capacity to produce new shoots and leaves from the damaged crown.

Beech (*Fagus sylvatica* L.), downy oak (*Quercus pubescens* Willd.), Turkey oak (*Quercus cerris* L.) and holm oak (*Quercus ilex* L.) forest stands, located respectively in the Apennines, hilly and Mediterranean areas of the region, were the forest ecosystems that suffered the major impacts. The strongest impacts were observed in the sites at the higher altitudes, south exposed and/or on poor soils, especially calcareous and serpentine soils. Remarkably, deciduous trees were affected by strong crown defoliation but, apparently, no mortality, whereas evergreen species showed foliar desiccation and large crown dieback. Crown defoliation, desiccation and tree mortality affected also drought-tolerant sclerophyllous shrubs, like *Arbutus unedo* L., *Phillyrea latifolia* L., *Erica arborea* L., and perennials herbs of the Mediterranean macchia.

The tree species that mostly suffered of the severe dry spell in 2017, and their distribution in Tuscany, suggest a relevant role of the site conditions (slope aspect, bedrock, soil properties as depth and capacity of water retention) in the occurrence and diffusion of forest dieback. The analysis of these factors allows to map the sensitivity and vulnerability of forests to extreme climate events. This is the premise for the development and application of new management strategies aimed at decreasing climate-induced risk and promoting forest resistance.

\*\*\*

### **5.1.19 Le carte della potenzialità alla produzione del tartufo in Piemonte: strumenti di conoscenza nell'ambito della pianificazione territoriale per la salvaguardia e il recupero del patrimonio tartufigeno regionale**

Flavia Righi, Igor Boni, Fabio Giannetti, Matteo Giovannozzi, Federico Mensio

**Parole chiave:** tartufo; attitudine; cartografia; pianificazione; suolo.

Tra i prodotti forestali non legnosi uno dei più famosi e apprezzati nel mondo è sicuramente il tartufo. Per approfondire le conoscenze su questo prezioso fungo ipogeo (con valore di mercato elevatissimo) la Regione Piemonte ha intrapreso una serie di attività di studio, ricerca e sperimentazione applicata.

Un punto fondamentale di queste ricerche e sperimentazioni è la mappatura delle aree territoriali più adatte alla tartufigicoltura.

Per questo è stato realizzato un primo strumento cartografico a livello di inquadramento regionale a scala 1:250.000 ovvero, la Carta di attitudine alla produzione tartufigicola per ognuna delle tre specie di tartufo: bianco pregiato, nero dolce e nero scorzone.