The forest of San Rossore (Tuscany, Italy): a call for its conservation through a multidisciplinary approach

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The forest of San Rossore, extending for approximately 3,500 ha along the coast of Tuscany (central Italy), is the heart of the “Selve costiere di Toscana”, included in the World Network of Biosphere Reserves (UNESCO). This forest is a mosaic of patches of mixed hygrophilous broadleaves, Mediterranean sclerophyllous and conifers, and old stone pine plantations. With its more than 600 plant species this forest system is a recognized reservoir of high landscape and biological value, nevertheless it is highly vulnerable to antrophogenic disturbance and climate change. The primary reason is that it grows on a succession of old sand dunes alternated with wet hollows and, therefore, the soil is characterized by a very thin organic layer which is prone to erosion and mineralization once the integrity of the vegetation cover is disturbed. Secondly, the forest is surrounded by a highly urbanized area and undergoes touristic pressure, both facilitating the introduction of alien species into the natural vegetation. Investigations demonstrated that the soil seed bank is generally poor and contains an appreciable proportion of alien species. Forest clearings are often invaded by alien trees, first by Ailanthus altissima (Mill.) Swingle, whereas Amorpha fruticosa L. diffuses along channels and ditches.

In the foregone decades the forest of San Rossore underwent several threats: i) the progressive dieback of the forest front nearest to the seashore caused by both the massive coastal erosion and the foliar deposition of marine aerosol-borne pollutants, and ii) the attack of Leptoglossus occidentalis Heidemann and Matsucoccus feytaudi Ducasse, two insect pests that caused a diffuse decay of Pinus pinea L. and Pinus pinaster Aiton stands, respectively. In addition to the above damages on the standing plants, a high density of ungulates impairs the regeneration of forest trees, primarily that of broadleaves.

In recent years, an increased crash down of isolated trees belonging to both the hygrophilous and the Mediterranean forest associations, and the dieback of entire Fraxinus angustifolia Auct. patches were observed. While the former events can be attributed to windstorms, which increased frequency and strength is associated with climate change, the latter are still unexplained, but multiple, interacting factors can be hypothesized. Among these, the infiltration of saline rich seawater in consequence of coastal erosion, the accumulation of pollutants in the soil, the attack of a specific pathogen, but also changes in the seasonal fluctuations of soil humidity, due to either changes in the amount and distribution of rainfall or to changes in forest management. The forest of San Rossore is, indeed, crossed by a system of artificial channels which provided to drain the...
soil of stone pine plantations in the past, but are no more maintained today. This could have reduced the water flux in the subsurface water table causing soil hypoxia, which weakens the root systems and reduces tree vigor, thus increasing their susceptibility to diseases and crash down.

The forest of San Rossore is a model for complex forest systems subjected to several pressures, which health conservation urgently needs the joint effort of multidisciplinary knowledge.