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PART II

Scientific Bases for Restoration and Management

In the first two chapters of Part I of this book, we presented the ecology, biology, and genetic geography of the cork oak tree. Next, Chapters 3 and 4 described the various formations in which cork oak is prominent, with emphasis on the development of the open woodlands or anthropogenic savannas commonly known as *dehesas* or *montados*. Finally, Chapter 5 provided a historical overview of cork and its uses, up to the present day. We now know that a general decline in cork oak woodlands is taking place. They are aging and subjected to new threats, driven by diseases and changes in land use and climate. This leads to unsustainable intensification in many areas (i.e., overgrazing, bark overexploitation, and deep plowing of soils) and to a sudden abandonment after long use in other areas.

Nevertheless, cork oak and the cultural systems formed around it are an integral part of the Mediterranean biophysical environment and many of its historical cultures. In order to preserve them in a dynamic state, we will have to actively reverse the current trends of degradation. Otherwise, there will be no socioeconomic impetus to maintain them. In other words, we need to achieve a dynamic, healthy state for these socioecological systems and cultural landscapes that is also consistent with current needs of people and constraints of market and climate.

In Part II we provide an up-to-date scientific basis for restoration and management of cork oak woodlands. We start with a description of how cork oak copes with drought (Chapter 6), a phenomenon of increasing importance in our changing world. Next come two chapters related to cork oak mineral nutrition, specifically with regard to the role of mycorrhizal relationships (Chapter 7) and soil properties as they affect nutrient uptake (Chapter 8). These chapters are relevant in the context of how and where to introduce

new cork oak trees in order to reinforce declining populations. Then, we present a review of the diversity of pests and diseases affecting the different life cycle phases and physical components of the tree (e.g., acorns, seedlings, leaves, wood) (Chapter 9). Finally, we end this part by presenting the complete natural regeneration cycle of the cork oak system (i.e., from seed to seed), showing the different bottlenecks that may lead to failure in natural regeneration (Chapter 10). Understanding the points at which the regeneration process can fail will help us address restoration and management actions.

Together, these five chapters provide an integrated body of knowledge and state of the art for forest managers to learn how to address their specific problems in cork oak woodlands, including the lack of natural regeneration. In Part III we will discuss some specific seeding and planting techniques for enhancing the success of afforestation and the active restoration of cork oak woodlands.

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