

Climate Change and Forest Natural Regeneration in Mediterranean Mountain Areas

Manuel Esteban Lucas Borja*

Department of Agroforestry Technology and Science and Genetics, School of Advanced Agricultural Engineering Castilla La Mancha University, Spain

Introduction

Forests supply essential harvestable products (e.g. wood, food, medicines, oils, gums, resins and tannins); ornamental landscapes; regulation of climate, hydrology, mineral cycling, and soil erosion; create wildlife habits; etc. Over the last few decades crucial changes have taken place in the views and demands on forests by society at large. This includes the increased environmental awareness and recreational interests of society. Unfortunately, a wide range of abiotic and biotic stresses threatens the goods and services that forests can supply. For example, disturbances of forest by excessive harvesting, insects, diseases, drought, flooding, pollution, fire, and soil compaction often result in catastrophic losses of both forest products and services.

A detailed understanding of the laws and processes that determine the ecosystem dynamics is essential if well-adjusted forestry management plans are to be developed in light of climate change. This includes a good understanding of natural regeneration processes so natural regeneration can become an important component of stand resilience. Moreover, climatic changes may reduce the success of natural regeneration and hence require adjustments to silvicultural practices. Management strategies should focus on ecosystem persistence and an adequate degree of ecosystem stability. To meet this challenge, sustainable forest management should be promoted, and forest persistence needs to be a fundamental aim. Further studies are necessary to better understand the specific influences across sites and under changing climatic conditions.

Natural Regeneration Processes in Mediterranean Mountain Areas

In many forests, natural tree regeneration is a key process in ensuring forest sustainability and a relatively slow process, with the initial stages of the plant life cycle being critical for natural regeneration dynamics. Natural regeneration takes place in a very complex scenario but seedlings are particularly suitable for exploring species responses to changing resource levels. The natural regeneration is a multidimensional space where many abiotic and biotic factors act simultaneously and interactively, and these interactions could be sometimes even more important than the main effects. Thereby, regeneration, growth and mortality are the main processes driving plant community dynamics. Seedling recruitment is one of the mechanisms of forest regeneration which plays an important role for numerous tree species. Nevertheless, recruitment patterns vary widely, and it is frequently difficult to appraise the role of seedlings in forest dynamics. Although the natural forest regeneration success depends on events occurring during the whole tree lifespan, some stages such as seedling establishment, survival and early growth are critical [1], due to the vulnerability to environmental constraints during early plant life-stages. Thus, numerous studies have focused on early tree development and underlined factors that are detrimental to tree seedlings [2,3], but studies that explore seedling performance through environmental gradients (altitude, latitude, light, etc.) under field conditions are necessary to discern the ranking and interactions among factors determining spatio-temporal patterns of tree recruitment.

Climate Change and Natural Regeneration in Mediterranean Mountain Areas

In the context of global change, changes in temperature, rainfall patterns, biogeochemical cycles and land use have already been recorded worldwide and are predicted to intensify in the future [4]. Thus, the alteration of environmental conditions may affect structure and dynamics of plant communities and these changes entail the simultaneous alteration in the average levels and spatio-temporal variability of the basic resources for plant regeneration, mainly light, water and nutrients. Therefore, understanding the species-specific responses is essential to manage and conserve plant communities in current and future environmental scenarios.

During the summer season, Mediterranean forests experience a recurrent drought, when temperature and radiation are at their maximums. This summer drought is a major cause of mortality of Mediterranean woody species during early life stages and would be expected to increase in severity. Mediterranean ecosystems are predicted to be among the most vulnerable to climate change due to an intensification of their already limiting conditions for plant regeneration. Therefore, current decreasing precipitation and increasing temperatures, together with the growing likelihood of extreme drought events, may heighten the vulnerability of several tree populations in the Mediterranean basin [5]. Accordingly, the predicted increase in temperatures caused by global warming is expected to have large effects on mountain ecosystems, where the elevational ranges of trees are mainly controlled by temperature. The differential ability of species to cope with light and water limitations, particularly during the establishment stage, is considered a key trait governing community structure and dynamics. Identification of seedling functional responses along resource gradients and implied trade-offs is critical to achieve a mechanistic understanding of vegetation dynamics in this region and to assess potential responses of Mediterranean plant communities to expected global change scenarios.

Conclusion

Understanding the dynamics, patterns, and interactions involved at the plant level provide foresters with the fundamental knowledge for decision-making for forest management. The drought-

*Corresponding author: Dr. Manuel Esteban Lucas-Borja, Professor, Department of Agroforestry Technology and Science and Genetics, School of Advanced Agricultural Engineering Castilla La Mancha University, Spain, Tel: 967599200 ext. 2818; E-mail: ManuelEsteban.Lucas@uclm.es

Received March 22, 2014; Accepted March 24, 2014; Published March 26, 2014

Citation: Borja MEL (2014) Climate Change and Forest Natural Regeneration in Mediterranean Mountain Areas. Forest Res 3: e108. doi:10.4172/2168-9776.1000e108

Copyright: © 2014 Borja MEL. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

prone Mediterranean eco-region forests are naturally prone to socioeconomic hardships, with a long history of over-exploitation. Climate changes may reduce the success of natural regeneration and hence require adjustments to silvicultural practices. Seed germination and emergence represent important phenological events that influence the success of the initial seedling recruitment. Soil temperature, soil water availability, air relative humidity and the amount of light are some of the main environmental factors affecting seedling emergence, and some microhabitats or certain periods of the year may provide better conditions than others with respect to seed germination. The Mediterranean forests have a rich biodiversity, are attractive for tourism and recreation, and have a great potential for high value forest products. In this context, sustainable forest management must encompass the maintenance of the ecosystem's integrity to support multiple users. In spite of the hot and dry season in the Mediterranean region, and water deficits during the growing seasons, natural forest regeneration problems can be overcome by selecting silvicultural

characteristics of trees which are best adapted to the specific ecological conditions of the Mediterranean eco-regions.

References

1. Kozłowski TT (2002) Physiological ecology of natural regeneration of harvested and disturbed forest stands: implications for forest management. *Forest Ecology and Management* 158: 195-221.
2. Coll L, Balandier P, Picon-Cochard C (2004) Morphological and physiological responses of beech (*Fagus sylvatica* L.) seedlings to grass-induced belowground competition. *Tree Physiology* 24: 45-54.
3. Prevosto B, Balandier P (2007) Influence of nurse birch and Scots pine seedlings on early aerial development of European beech seedlings in an open-field plantation of Central France. *Forestry* 80: 253-264.
4. Canadell JG, Pataki DE, Pitelka LF (2007) Terrestrial Ecosystems in a Changing World. *Global Change. The IGBP Series*, Springer (Edn.)
5. Candel Pérez D, Linares JC, Viñebla B, Lucas-Borja ME (2012) Assessing climate-growth relationships under contrasting stands of co-occurring Iberian pines along an altitudinal gradient. *Forest Ecology and Management* 274: 48-57.