

Chapter 7

Climate Change Impacts on Biodiversity in Arid and Semi-Arid Areas: Biodiversity Under Climate Change

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ABSTRACT

Considerable attention has been paid to climate change and its impacts on biodiversity. The climate change has caused several problems such as continuous ecosystem degradation and a resultant biodiversity decline. In addition, climate warming has a range of indirect effects through changes in vegetation type level and sea that affect physical and biological systems. This has also led to changes in the distribution of species, as well as reductions in the size of populations, or even local extinctions of these populations. Moreover, many species are disappearing with time due to climate change combined with the emergence of disease that develops and increases with time. These problems affect different biodiversity components that are close to collapse. This chapter explored the richness of biodiversity in arid and semi-arid zones. It is also illuminates the effects of climate change on distribution of biodiversity. The authors highlight the responses of biodiversity under climate change, in terms of species extinction, biodiversity loss, and the impacts of climate change to ecological tourism. Finally, the authors show how biodiversity can overcome the effect of climate change, by developing some systems that allow to them to survive and conservation of species and ecosystems.

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INTRODUCTION

Biodiversity is essential to the function and structure of ecosystems and underpins the broad scale of goods and services, which humans procure from natural ecosystems (Walther et al., 2002). It is an intrinsically complex variable composed of processes and numerous biological entities (Naeem, 2009; Mace et al., 2012), interacting individually and collectively at multiple levels of organisation, with biotic propagule dispersal over space and time, and abiotic exchange, flow of materials and energy (Hartvigsen et al., 1998; Noss, 1990). Climate change impacts is considered as the most important global environmental challenges, affecting biodiversity and natural ecosystems because natural ecosystems and biodiversity are closely interconnected on each other (Bharali and Khan, 2011) not just through changes in biodiversity that affect climate change, but also through climate change effects on biodiversity (Secretariat, 2010). Moreover, biodiversity are projected to increase in pervasiveness and magnitude as CO₂ levels and temperatures continue to rise, which could increase photosynthesis and water use efficiency (Solomon et al., 2007). The biodiversity in different ways are affected by multiple components of climate change, from individual to biome levels (Figure 1). They primarily interest various forms of physical decrease that are expressed at different degrees, and have impacts on species, ecological networks and ecosystems. Negative effect on some susceptible life forms could be due to the quickly increasing of average temperature and increasing rainfall. It might have even more severe repercussions for biodiversity than the temperature elevation itself. At the most basic level of biodiversity, the rapid migration and directional selection could have an effect on decrease of genetic diversity of populations, which is caused by climate change and might affect in turn the ecosystem resilience and functioning (Botkin et al., 2007; Meyers and Bull, 2002). When one life form is affected, that in turn will affect other life forms. Even in cases where one life form is affected in a positive way, it can in the next step have negative effects on others. Access to the right quantity of water at the right time of year is essential for all life forms, especially for species in arid and semi-arid environments changing precipitation, which can be lethal. Several studies are interested on impacts of genetic effects and at higher organisational levels of climate change, which have been explored just for a very small number of species. Climate change is considered now as a major driver of biodiversity change, extinction and loss due to these pressures and ecosystem responses, which could affect strongly the Mediterranean over the course of this century. Hooper et al., (2005) reported that decrease or loss of any aspect of biodiversity could have direct and indirect effects persistence, ecosystem function and services. Foundation species or keystone have a major role in ecosystems by either providing structure, moderating the availability of different resources to other species, or through trophic processes. Many such species also provide beneficial services to humans in the form of storm and flood protection (e.g. mangroves), food (e.g. fisheries), and maintenance of water quality (Leadley, 2010). The extension of species geographic range limit either towards the poles or to higher elevations; increasing invasion by opportunistic, competitively mobile species; the extinction of local populations along range boundaries at lower elevations or lower latitudes; increasing decoupling of species interactions owing to mismatched phenology. Richardson and Poloczanska (2008) reported that twenty-eight thousand five hundred eighty-six significant biological changes were observed from terrestrial ecosystems associated with climate change, the most important of it is species extinctions. Some species are important for other species as for example food, pollinators, etc. If they disappear, other species will be affected negatively. Different species, which depend on each other can be also affected differently by climate change. However, in many cases there is limited understanding of the functional or interactive role a species or group plays in a system, which in turn limits our ability to predict how

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