Chapter 7
Geographical Distribution of Cutaneous Leishmaniasis and Its Relationship With Climate Change in Southeastern Morocco

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ABSTRACT
The current chapter deals with one of the most neglected tropical diseases in Morocco, the cutaneous leishmaniasis. It is based on 10-year research (2010-2017) on the evolution of leishmaniasis taking climate change into account. Epidemiological and climatological data were collected from different administrations. The Geographic Information System (GIS) is chosen for interpolation, space-time analysis of climate data and map creation. The SPSS software was used for statistical analysis and to establish the relationship between Leishmaniasis and climatic conditions. Results show that the maximum number of cases is recorded in 2010 with 4,407 people affected while the low number is recorded in 2014 with 18 cases. Results also show a clear link between climatic factors and the incidence of the disease. The distribution of the disease in the province is influenced by maximum temperature, aridity, and vegetation cover. Additionally, anthropogenic factors play a significant role in explaining the emergence or re-emergence of leishmaniasis in the region.

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INTRODUCTION

Leishmaniasis is a widespread parasitic disease that is transmitted to humans by the female bite of a hematophagous dipteran insect called phlebotomus or sandfly. The parasite is a flagellated protozoan of the genus *Leishmania* that infects the mononucleated phagocytic system. Transmission occurs when the phlebotomus bites a sick man or animal and absorbs blood monocytes or parasitized dermal histiocytes. This vector stings another healthy man or animal and they will also be infected with the parasite, the latter will have as a reservoir of nomadic mammals including humans (Rguioui, 2006).

Leishmaniasis was ranked by the World Health Organization (WHO) among the main diseases to public health problems worldwide (Sadqi, 2013). In fact, leishmaniasis is endemic in 88 countries throughout Latin America, Africa, Asia and Southern Europe. 350 million people are at risk of infestation with a prevalence of 12 million people per year (Boussaa, 2008).

In Morocco, according to Ministerial Order 683-95- of March 31, 1995, leishmaniasis is a notifiable disease (MS, 2019). In this country, cutaneous leishmaniasis (CL) is endemic (Mahjour, Akalay, & Saddiki, 1992) and is widely distributed in three nosogeographic entities, zoonotic cutaneous leishmaniasis (ZCL; caused by *L. major*) located in the arid regions along the northern edge of the Sahara desert, anthroponotic cutaneous leishmaniasis (ACL; caused by *L. tropica*) in the semi-arid regions of central and south-western Morocco, and CL caused by *L. infantum* in the northern regions of the country (Rguioui, 2006). In the last thirty years, an increasing trend of geographic expansion was observed and new foci in several provinces of Morocco were recorded. A total of 24 804 cases of *L. major* and 16 852 cases of *L. tropica* were registered between 2004 and 2013 (Kahime et al., 2016).

The current study was carried out in the province of Errachidia that has a Mediterranean climate with dry summer according to the classification of Koppen-Geiger (Hufty, 2001). According to Regional Directorate of Health Draa-Tafilalet (SIAP), this area is affected by major cutaneous leishmaniasis (MCL) and more than 1900 cases have been diagnosed in 2017. These patients received free treatment in the various medical centers and facilities.

In this chapter, a retrospective analysis of the CL in Morocco was conducted based on epidemiological data of the period 2010-2017. The main objective was to highlight the relationship between climatic and environmental conditions and the distribution of CL by *L. major*. 
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