Chapter 4
Decision Support Systems for Forest Management in Mexico: Their Characteristics and Context for their Creation and Evolution

Rafael Moreno-Sánchez
University of Colorado Denver, USA
Juan Manuel Torres-Rojo
Centre for Research and Teaching of Economics (CIDE), Mexico.

ABSTRACT
In the last 25 years there have been several efforts to create Decision Support Systems (DSS) for management of the forests in Mexico. Few references exist that document these experiences and that can assist in understanding their genesis, evolution, successes, shortcomings, or failures, as well as the factors that have led to these outcomes. This chapter fills this gap by presenting an overview of the DSS that have been created since the mid 1980’s. The characteristics of the Mexican forest ecosystems and the complex web of interactions and co-evolution of the contexts that frame the forestry activities in Mexico have influenced the characteristics, evolution, and current state of the art of the DSS for the management of the forest in the country. Similar characteristics and contexts are commonly found in developing countries around the world. Hence, the experiences, lessons, and recommendations for future developments presented in this chapter can be of value beyond the specific conditions of the Mexican forestry sector.

INTRODUCTION
The conservation and management of natural resources in general, and forest ecosystems in particular, involve problems and decision-making processes that are semi-structured or unstructured. These problems have no definitely correct formulation, encompass a large number of alternatives, have no stopping rule to identify when they are “solved”, involve multiple stakeholders with conflicting agendas, and require a negotiation process to determine the best alternative. Under these conditions Decision Support Systems (DSS), if properly designed, developed, and used, can have a major impact on improving the effectiveness and efficiency of decision-making processes.
Since the mid 1980’s there have been several efforts to create DSS for the management of the forests in Mexico. Their genesis, evolution, and current state of development are the result of the emergence of new forest management paradigms, the professional background of their developers, and the characteristics of the environmental, socio-cultural, economic, land tenure, legislative, and institutional contexts that frame the forestry activities in the country. Much can be learned from the successes, shortcomings, and failures of the DSS that have been developed in the last 25 years. Unfortunately, there is little or no literature that can assist in understanding their evolution and the factors that have led to these outcomes. The purpose of this chapter is to fill this gap by documenting the most important DSS’s for the management of the forest in Mexico and the critical factors that have influenced their characteristics and evolution.

There are few sophisticated DSS currently in use in the country. From the outside, the number and state of evolution of several DSS in Mexico might seem not at par with equivalent systems in other parts of the world. This is not because of a lack of highly qualified Information Technology and forestry professionals in the country, but due to the characteristics of the forest ecosystems and the complex web of interactions and co-evolution of the contexts that frame the forestry activities in Mexico. Similar characteristics and contexts are commonly found in developing countries around the world. Hence, the experiences, lessons, and recommendations for future developments presented in this chapter can be of value beyond the specific conditions of the Mexican forestry sector.

The rest of the chapter is organized as follows. The next section presents the environmental, socio-cultural, economic, land tenure, legislative, and institutional contexts for the management of the forests in Mexico, and how they have influenced the features and evolution of the most important forest management DSS’s in Mexico. The third section provides the necessary background on the principles and methods used for the management of forests to be able to understand the computations and processes that are supported by the DSS reviewed in this chapter. The fourth section describes the genesis, characteristics, and current state of the art of the most important DSS that been created in the last 25 years in Mexico. The last section summarizes the most important lessons that can be drawn from these experiences and provides recommendations that would enhance future developments.

**CONTEXTS FOR THE MANAGEMENT OF THE FORESTS IN MEXICO**

In each of the following subsections, we first present the characteristics of a specific context followed by the direct or indirect impacts it has had on the evolution, current state of the art, and contributions for the development of DSS for the management of the forests in Mexico.

**Environmental Context**

The physical (topography, geology, climates, and soils) and biotic (flora and fauna) environments in Mexico are highly diverse and complex. The country has one of the highest flora and fauna biodiversity and endemic species in the world (Conservation International, 2009; Viva Natura, 2009). This rich diversity is due to several factors (CONABIO, 2000): a) the size, latitudinal location, and long north-south shape of the country; b) a complicated topography composed of numerous high and long mountain ranges; c) a large diversity of climates and microclimates; and d) the fact that Mexico is at the confluence of two biogeographic zones (neartic and neutropical).

Mexico has close to 65 million hectares of forests (Velázquez et al., 2005). Temperate forests cover 51% of this area. These forests are dominated by pine forests and pine-oak mixes. The pine forests are composed of complex mixes
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