

A DYNAMIC SIMULATION STUDY OF TOURISM AND ENVIRONMENT IN THE YUCATÁN PENINSULA IN MEXICO

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1. Introduction

This chapter presents results generated by an integrated dynamic model used to study the interactions between population, environment, and economy. The model is based on the Population-Development-Environment (PDE) approach developed by Lutz (1994). Recent PDE models have dealt with the small islands of Mauritius (Lutz, 1994) and Cape Verde (Wils, 1996). After studying islands the next step is to develop a more elaborate PDE model for a peninsula. For the present study, the Yucatán peninsula in Mexico was chosen for several reasons. First, it is a region that mostly borders the sea, which poses constraints to trade and human migration. Only recently, the peninsula has been connected by land infrastructure to the rest of Mexico. Second, it has a specific historical culture – the Mayan civilisation whose population suddenly decreased – of which many archaeological sites remain (Lutz *et al.*, 1996). Third, drastic economic and demographic changes have taken place in the last twenty years, such as a large population increase, resulting mostly from the growth of the tourism industry. Fourth, conflicts exist between the goals of economic growth, the population and the environment which are, to a large extent, due to tourism growth. In the PDE modelling of the peninsula special attention is given to the tourism sector for three reasons: (i) it is the most important economic sector in the peninsula; (ii) the tourism sector has developed rapidly in the last decades and is expected to

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continue growing in the coming years; and (iii) there are many interesting interactions between tourism, other economic sectors, population and environment worth analysing.

The purpose of the following application of the model is to represent the dynamics of the PDE interactions and to explain the observed relationships and the behaviour of the system. It does not intend to forecast future developments, but to show how interesting questions may be answered with the use of dynamic modelling and simulation. It should be emphasised that the model is not a black box in which the reader or user has no insight. It is an interactive model in which variables, relationships, and even modules may be changed or added. This allows the model to be updated easily. The model may provide also a basis for researchers or firms to forecast future development. The model, as presented in this chapter, may be useful for teaching and policy analysis. However, it cannot offer guidelines for policy recommendations, because it does not include all relevant relationships needed for this purpose. The equations of the model in its present form are not calibrated on historical data and, also, for many variables and interactions the correct data are missing. The model is meant to give indications on how dynamic modelling may be applied in a transparent way as it is user-friendly and the graphical interface allows one to see the interactions in the system. Thus, the model with its graphical and mathematical interface may serve as a basis for further exploration of PDE and tourism interactions.

The remainder of this chapter is structured as follows. Section 2 describes the tourism industry and the environment in the Yucatán peninsula. The modelling method is presented in Section 3. Section 4 describes the dynamic model comprehensively. Section 5 contains the model's results of testing alternative scenarios and Section 6 the model's results of the sensitivity analysis. Conclusions are drawn in the last section and suggestions for future research are offered.

2. The Yucatán peninsula, tourism and the environment

A short description of the peninsula is given first, followed by a presentation of tourism and the environment in the peninsula. The Yucatán peninsula (Figure 1) is a region in the Southeast of Mexico, surrounded by the Gulf of Mexico, the Caribbean Sea (Atlantic Ocean), Guatemala and Belize.