

# INTRODUCTION

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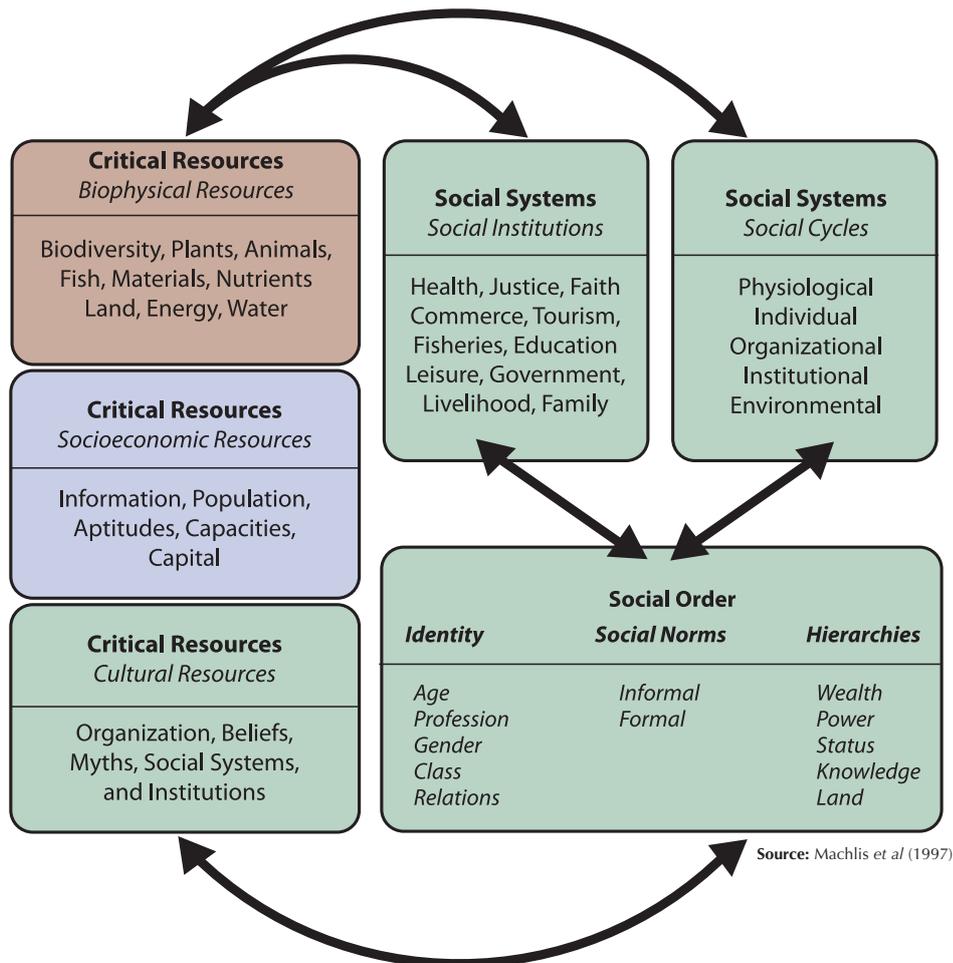
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## THE MODEL: GALAPAGOS AS A HUMAN ECOSYSTEM

Galapagos can be viewed as a complex system comprised of critical resources (biophysical, socioeconomic, and cultural) and social systems. The intersections between resources and social systems determine the course of development and the state of conservation in the archipelago.

The organizing framework for the 2006-2007 Galapagos Report is a **human ecosystem model**, which examines the complex and occasionally unexpected interactions of these different elements (Fig. 1).

**Figure 1.** Theoretical model of a human ecosystem showing flow patterns among systems and critical resources



The first section of the 2006-2007 Galapagos Report presents a series of articles that address important socioeconomic issues in the archipelago. They consider the flow of resources, such as investment capital, human resources, and energy, as well as issues such as waste management. Studies examine community perceptions of regulations and the Galapagos legal system as well as the key institutions in the islands.

The social systems and the socioeconomic and cultural resources of Galapagos have a profound impact on the archipelago's natural resources and biodiversity. The Report's second section examines the conservation status of the endemic biodiversity of Galapagos and its greatest threat - introduced species. The Report also includes an initial review of the status of the fresh water of the islands. This is one of the most critical natural resources and requires urgent attention.

The interactions between critical resources and the social systems are ongoing and nonlinear, with all of the various elements influencing or interrelating with each other, directly or indirectly. For instance, the limited natural and socioeconomic resources of Galapagos lead to a dependence on outside resources – one of the most important characteristics of the Galapagos human ecosystem. Another example is the relationship between population growth and the growth in tourism, and the resulting impact on Galapagos social systems, the increased risk of introduction of exotic species, and increasing negative impacts on endemic and native species. These unique species and the environment

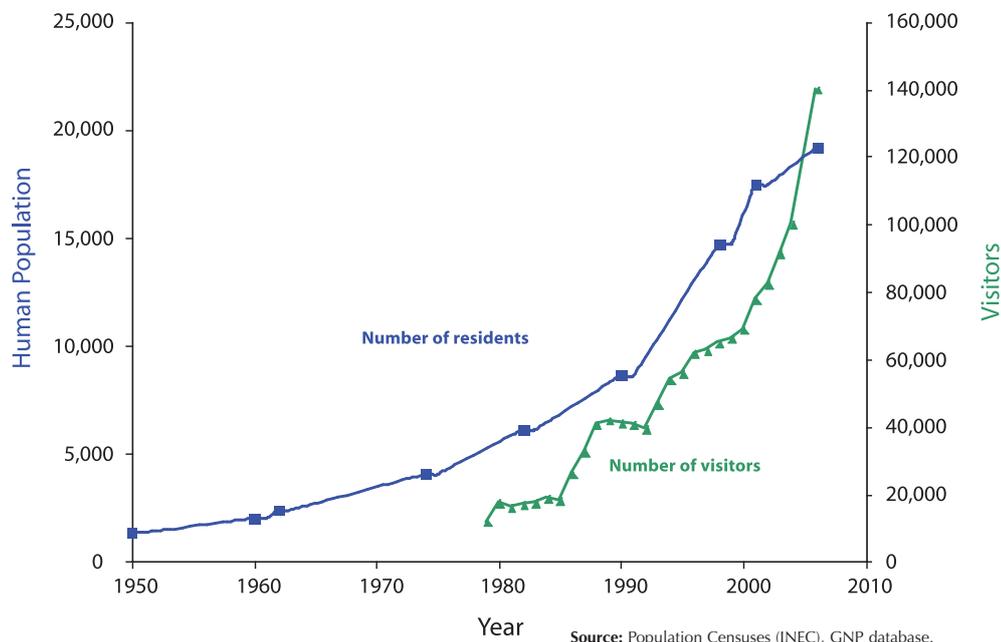
that sustains them are the basis for the local economy and the main attraction for tourism – the primary economic driver in the Galapagos human ecosystem.

**KEY STATISTICS AND TRENDS**

Galapagos is undergoing a process of change and growth that began nearly two decades ago. Tourism is increasing at a staggering rate. The number of visitors has increased at a yearly average of 9% over the last 25 years, while tourism, in economic terms, has grown at an annual rate of 14% over the last 15 years. This growth has occurred despite the fact that the number of boats has remained relatively constant during the last decade (Fig. 2). The growth from 1991 to 2006 resulted from increased installed capacity, changes in certain aspects of tourism operations, and conditions in external markets. During this period, the passenger capacity of boats rose by 72%, the number of hotels by 97%, the number of hotel beds by 90%, and the number of cruise days by 45%.

Tourism is the primary economic driver in Galapagos and is fueling the current cycle of growth. The requirements, opportunities, and higher standard of living associated with a growing economy attract an ever-increasing number of immigrants to the islands. Official data from the National Institute of Statistics and Censuses (INEC) indicate that the regular resident population in Galapagos has increased from 8,611 in 1990 to 19,184 in 2006, which represents a 123% increase in population over the last 16 years (Fig. 2). Population growth generates an increase in economic activities (primarily in tourism

**Figure 2.** Population growth (regular residents) and visitors in Galapagos, 1950-2006



and fisheries), which in turn exerts pressure on the natural resources and increases the demand for improved public services. A clear example of this relationship is the continued pressure to extract coastal fishery resources (lobster and sea cucumber) despite the fact that their populations have been decimated by overfishing. From 2002 to 2005, the sea cucumber and lobster catches dropped by 83% and 43%, respectively. This had a direct impact on the profits of the fishing sector, with the gross income from both species dropping approximately 60%, from about US\$ 8,000 per fisher in 2002, to only US\$ 3,400 in 2006.

The use of and dependence on other natural resources has also increased along with the population. Over the last five years, the consumption of diesel and gasoline (fossil fuels) increased by 64% and 63%, respectively. The demand for electricity (number of clients) increased 35% in Santa Cruz alone, between 2001 and 2006. Another critical resource analyzed in this Report is fresh water. Inhabited areas in the Galapagos were developed and have grown significantly without thought to the integrated management of water supplies and quality. Each island has its own water needs and priorities, but the most serious problems are the same for all – pollution, waste, and scarcity of fresh water.

The relationship between energy resources in Galapagos is demonstrated by the dependence on fossil fuel for electricity. The greater the demand for electricity, the greater the demand for fossil fuels shipped from continental Ecuador, which poses a significant risk of environmental accidents. Historically, energy consumption in Galapagos has been subsidized by the national government. Over the last few years, efforts have focused on analyzing renewable energy options to reduce this dependence and the overall consumption of fossil fuels. In 2005, Floreana shifted to a hybrid system for power generation. The ERGAL Renewable Energy Project, carried out by the United Nations Development Program, the Galapagos Electric Company, and the Ministry of Energy and Mining, is now promoting such systems on the other inhabited islands. However, there is still no effort to reduce fossil fuel consumption on boats, which account for 61% of the total fuel demand in the archipelago. It was to serve this market that the Jessica oil tanker ventured into Galapagos waters in 2001 and caused the most significant human-caused environmental disaster in the archipelago.

The higher standard of living and overall growth of the Galapagos economy has led to increased consumption and greater buying power for goods and services. A related indicator examined in the Report is the number of motor vehicles in Galapagos. During the last eight years (1999-2006), 1211 motor vehicles were imported into Galapagos, representing 59% of the total number of vehicles in the archipelago. Regulations implemented in 2004 to curb the importation of vehicles resulted in an initial

decrease in the number of vehicles per year (2005-06) and demonstrated that it is essential to improve these types of measures and ensure their implementation.

The growth in both tourism and the resident population has also resulted in an increase in the movement of air passengers and cargo to the islands. From 2001 to 2006, the number of commercial flights nearly doubled. Over that same period, total air traffic continued to increase, with the number of flights increasing by 59.2%, the number of passengers by 58.5%, and the amount of air freight by 94%. If effective control and inspection mechanisms are not in place, increased air traffic and the opening of new commercial routes and direct flights to Isabela will result in an increased risk of introduction of exotic species. In this context, it is critical to ensure the response capacity of the Quarantine Inspection System for Galapagos (SICGAL). One study in the Report assesses the capacity of SICGAL after its first seven years of operation. It finds that SICGAL lacks the resources to respond to the increasing demand for its services. For instance, from 2001 to 2006, the number of inspectors was reduced by 20% while the number of inspection units doubled.

The consequences of economic and population growth on the ecological integrity and biodiversity of Galapagos are well documented. Marine resources, including lobster, sea cucumber, and cod, have declined precipitously over the years. The disappearance of these overfished species could result in major ecological changes in the marine ecosystems. Preliminary findings of sub-tidal ecological monitoring studies indicate that some changes are already visible in Extractive Use Zones. Of the 383 endemic and native terrestrial species of Galapagos fauna that have been classified on IUCN's Red List, 52% of them are categorized as Critically Endangered, Endangered, or Vulnerable. Of the 180 species of endemic plants, 60% are categorized as "threatened" by the IUCN.

To date, 748 species of introduced plants have been recorded in Galapagos, compared to only 500 species of native plants. At least 490 species of insects and 53 other invertebrate species have been introduced into Galapagos, with 55 of them having the potential to cause serious damage to the native flora and fauna. As of May 2007, 36 species of introduced vertebrates have been recorded in Galapagos; 30 of them have become established while the other 6 were intercepted upon arrival. Of the 30 species of established introduced vertebrates, 13 are considered invasive and cause serious impacts in the island ecosystems. As of 2007, the number of introduced species recorded in Galapagos totaled 1321, versus 112 introduced species recorded in 1900 (Fig. 3). The growing number of introduced species recorded in recent years is, in part, a reflection of the greater interest and increased effort in locating and identifying them.

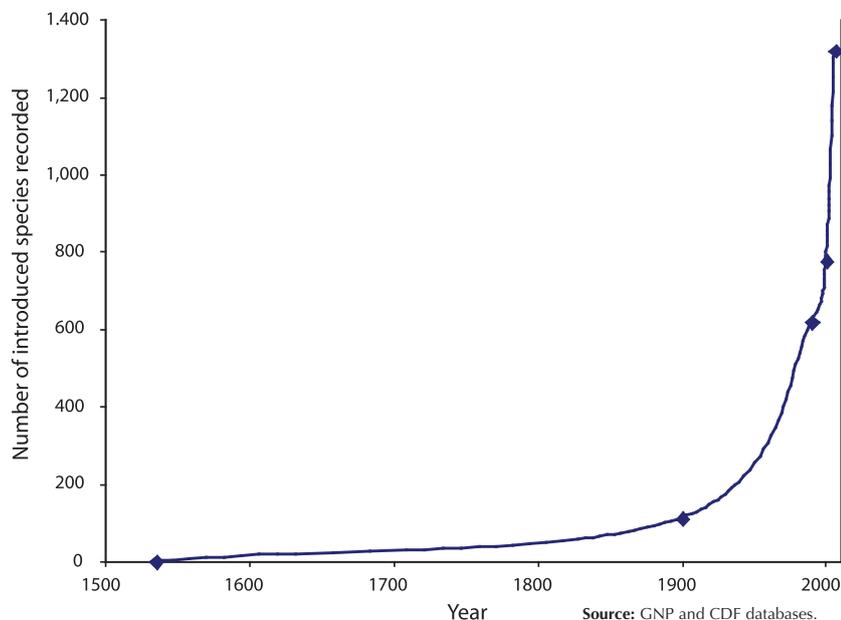
Management and conservation institutions have carried out major control and eradication projects over the last several years. Since 1999, Project Isabela, funded by the United Nations Foundation (UNF) and the Global Environment Facility (GEF), achieved the extraordinary result of eradicating goats from northern Isabela and Santiago. It represents the world's largest successful eradication project in terms of the land area cleared, and has attracted considerable international attention.

As of 2007, several islands and islets in the archipelago are now free of cats, goats, pigeons, donkeys, and pigs. A number of control methods for introduced land invertebrates have been developed, including the biological control of the cottony cushion scale. Current research on the distribution of two highly invasive fire ants will form the basis for future management actions. If current eradication of the little fire ant from Marchena is confirmed in the next few years, it will represent another major conservation success for the region and the world. Introduced species are more abundant and have a greater incidence on the inhabited islands, all of which are considered high priority for control and eradication efforts in the coming years.

**THE CHALLENGE FOR THE FUTURE**

Despite the challenges and problems identified in this Report, Galapagos is the only oceanic archipelago that still has 95% of its original biodiversity intact. Much of this success is due to far-reaching public policy, which, although erratically implemented, still creates a strong legal framework for conservation. Additionally, there are strong conservation institutions in Galapagos with an enviable record of significant achievements. Regulations have been established at the regional and island level to limit and control certain activities related to the growth and demands of the human population. Initiatives to help build institutional capacity at the local level, financed by multi-lateral and bilateral cooperation agencies and non-profit conservation and sustainable development organizations, are helping to prevent entry of exotic species and to control those that have been introduced. They are also promoting the use of renewable energy alternatives to decrease the dependence on fossil fuels and the associated risk of fuel spills.

**Figure 3.** Cumulative number of introduced species recorded in the Galapagos, 1535-2007. (Species are added in the year they are identified, which may be several years to a few decades after their arrival)



Sustainable businesses are being promoted, such as *Pescado Azul*, a company owned and managed by women from Isabela, which produces added-value sea food products. A number of recycling initiatives are underway, run by the municipal governments on the different islands. Unprecedented eradication efforts, such as Project Isabela, are resulting in the ecological recovery of large areas damaged by invasive species. These are just a few examples of projects and initiatives developed in Galapagos that should be further promoted and replicated.

Nevertheless, sustaining the human ecosystem of Galapagos and an acceptable level of conservation requires considerable additional commitment. Positive change will only be achieved through effective leadership that builds consensus, collaboration, and a shared vision among all Galapagos stakeholders. There are several socio-

cultural issues (such as health, justice, and governance) that have yet to be examined and for which suitable monitoring indicators must still be defined. Future Galapagos Reports will seek to gain a deeper understanding of all aspects of the human ecosystem.

UNESCO and the World Conservation Union (IUCN) have expressed concern about the conservation status of Galapagos and its future. The President of Ecuador has declared Galapagos to be at risk (Executive Decree N° 270) and a top national conservation priority. The President's Decree provides a crucial opportunity to change the present development model in Galapagos. A new vision of a sustainable, equitable society living in balance with the unique natural resources of Galapagos could be a model for the world.