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Author: Luque, Sandra

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Ecosystem Services, Biodiversity and Environmental Change in a Tropical Mountain Ecosystem of South Ecuador

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The region of Latin America and the Caribbean is the repository of some of the world's richest biodiversity by any measure, containing 40% of Earth's plant and animal species. Ecuador, in particular, is one of the 9 most biodiverse countries worldwide. With its megadiverse flora comprising more than 25,000 plant species, it is considered a biodiversity hotspot as important as Brazil in terms of species richness per area. Despite Ecuador's significance as a biodiversity hotspot, information about this country is completely lacking in the 2005 Millennium Ecosystem Assessment (Millennium Ecosystem Assessment 2005). This report has the merit of putting in evidence the growing international awareness of how important it is to maintain healthy ecosystems if we want to preserve life as we know it today; but it does not include vital information at the local and regional levels, even for the world's key ecosystems. The book reviewed here fills this gap for one of the world's "hottest" biodiversity hotspots: it brings together and synthesizes scientific knowledge about the biotic, abiotic, and socioeconomic spheres in the southeastern tropical Andes of Ecuador, covering 15 years of research in the valley of the Rio San Francisco.

This book is rooted in interdisciplinary ecosystem research. It provides a plethora of information on the structure and functioning of ecosystems, based on comparative field surveys and ecological experiments in pasture and forest environments. The book became possible due to the knowledge, cooperation, and commitment of its 103 authors—including Ecuadorian researchers and local people—as well as Ecuadorian government support. Its 4 parts and 29 chapters take us from a detailed description of the study area that provides readers with an understanding of its significance (Chapter 1) all the way to conflicts over future provisioning services (Chapter 26).

Part I sets the scene, offering a detailed description not only of the study area but also of its resources and related conflicts, including challenges that lie ahead for the sustainable development of protected areas (Chapter 3). It also introduces the concept of ecosystem services as a useful approach for the region's management. The book uses the concept "as a tool to structure research at the interface of the natural and the social sciences" (p 47) that is oriented toward sustainable ecosystem management. Figure 4.1 (p 42) provides a comprehensive overview of the 4 groups of ecosystem services considered, according to their applicability to landscape management in the study area: (1) cultural, (2) preserving, (3) regulating/supporting, and (4) provisioning services. The figure also shows which book chapter deals with each particular service. The book thus focuses on 4 main categories of ecosystem services that reflect human activities that are affecting the environment—in particular, biodiversity—while altering the capacity of ecosystems to deliver this wide range of goods and services. Given the complexity of the system under study, the authors have focused on services that are of the greatest interest to the country as a whole.

Part II presents the current states of different ecosystem service categories and current understandings of the relation between biophysical parameters and ecosystem functioning and related monitoring results. The historical perspective is an important component of the book; in particular, Chapter 5 provides a comprehensive and very well-written geological and historical analysis of landscape changes that helps to increase our understanding of such a complex system's dynamics across space and time. The research area "presents a dichotomy of forest areas and adjacent pastures" (p 42) as a result of slash-and-burn practices that fragment and degrade the original landscape. The differences between these two ecosystems lead to conflicts and contrasting ecological and environmental impacts. Conversion of natural forests into agricultural land and pastures has affected about 50% of the lower part of the study area. An unintended consequence of this conversion is that pastures are unsustainable and are therefore abandoned after some time. One of the challenges will be to restore these degraded areas through reforestation or by reconverting them into pastures; but any alternative may come with negative consequences for the natural system and the local population. Thus, the research presented uses the ecosystem services approach to analyze the various options' economic, ecological, and social sustainability in terms of their future impacts on the study area's natural resources and local population.

Part III is concerned with prospective approaches that can provide the basis for scenario analysis. Field observations, measurements, and experiments, combined with numerical models and calibration, provide a robust foundation for deriving sustainable land use strategies based on a good understanding of the complexity of the ecological systems and the associated services in the study area. Despite the many ecological, economic, and social uncertainties, the book attempts to provide transferable methods to help understand complex ecosystems while searching for prac-

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tical solutions to support sustainable management.

The considerable amount of accumulated knowledge is synthesized in Part IV. In particular, these chapters assess the results of 15 years of comprehensive research and deal with the question of how knowledge can be transferred into practice. Chapter 29, which summarizes the outcomes of the collaborative research between Germany and Ecuador, is particularly relevant in this respect. An example of successful knowledge transfer can be found in Table 29, which lists capacity-building initiatives that enabled 1515 participants to share their knowledge and experience at 45 events between 2007 and 2012. Thus, the book is not just about science, facts, data, information, and expertise, but also about awareness, comprehension, shared experience, and shared access to research facilities, technology, and information.

Putting together an interdisciplinary book like this was certainly a major challenge. The volume reflects the editors' and authors' commitment to sharing their unique experience with a broader audience. It is a fine book, an extraordinary, well-written, and well-produced synthesis of interdisciplinary work—and it educates.

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AUTHOR

Sandra Luque
sl208@st-andrews.ac.uk
Irstea, Mountain Ecosystems Unit, Irstea, 2 rue de la Papeterie, BP 76, 38402 Saint-Martin-d'Hères, France, and Department of Geography and Sustainable Development, University of St. Andrews, St. Andrews KY16 9AL, Scotland, United Kingdom

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