

Foreword

By Matthew C. Larsen

Humans face a future limited by the increasing effects of environmental problems and resource scarcity. The world's population is now consuming water and energy, and using agricultural and other land resources, at per capita rates that will be challenging to sustain. Environmental degradation is intensifying conflict over resources. Local consequences are exacerbated by climate change, manifested as changes in the timing and distribution of rainfall and runoff. As our influence on Earth's lands and waters grows more substantial, we need to understand and quantify these effects to preserve our well-being. Earth sciences are central to meeting this need because they guide the monitoring, assessment, and modeling of natural processes that help us to understand our interaction with the environment. The U.S. Geological Survey has a long history of providing authoritative earth science to inform local and national decision makers as they confront difficult choices in a changing world.

The low-latitude regions of Earth, in particular, are undergoing profound, rapid landscape change. Humid-tropical watersheds of eastern Puerto Rico, at 18° North latitude, provide a natural laboratory that allows researchers to quantify and better understand this change and how it impinges on the human world. In recognition of this opportunity, the National Science Foundation's Long-Term Ecological Research program and the U.S. Geological Survey's Water, Energy, and Biogeochemical Budgets (WEBB) program have operated in eastern Puerto Rico for several decades. WEBB program scientists have studied hydrologic, geologic, geomorphic, and anthropogenic processes in eastern Puerto Rico in an effort to generalize their results to the broader tropical world. Long time-series of streamflow, water-quality, suspended-sediment, meteorological, and land-use data, collected by Federal and by Commonwealth of Puerto Rico agencies, record the effects of landscape changes that are characteristic of environmental challenges that we all face. This publication summarizes research based on these data, and it provides insights into how landscape change may increase soil erosion, reservoir sedimentation, and landslide hazards while decreasing soil-nutrient content and surface-water quality.

In the 1990s the Puerto Rico Tourism Company invited travelers to "discover the continent of Puerto Rico." In a very different sense, Puerto Rico's landscape and the results of our studies there provide a microcosm of the challenges faced by societies on islands and continental land-masses. What choices will we make as we confront future limitations of land and resources? What scientific information will we need to guide these choices? The science presented in this volume improves our understanding of the ramifications of landscape changes by using analysis of watershed-scale geologic, hydrologic, and geomorphic processes, and it can help guide policymakers and resource managers as they confront difficult choices.