ECOLOGY

Globalization, Migration, and Latin American Ecosystems

T. Mitchell Aide and H. Ricardo Grau

The floods of 24 May 2004 and the tragic loss of thousands of lives in southeastern Haiti and Jimaní, Dominican Republic, provide important lessons for scientists, conservationists, and politicians. The same storm did not have such a devastating effect in neighboring Puerto Rico or in other regions of Dominican Republic, mainly because the highlands are forested. The mountains of southeastern Haiti, the major source of the flood, are quite a different story—they are virtually treeless. Sixty years ago, most of the mountains of Puerto Rico were also treeless, but forest recovered as the economy shifted from agricultural to industry and services (*1*). A similar process has occurred in Dominican Republic during the last 20 to 30 years; an increase in job opportunities in the cities associated with expanding tourism and textile industries stimulated rural-urban migration and forest recovery on the abandoned lands in the mountains. Other areas in Latin America are experiencing similar land-use dynamics as socioeconomic globalization extends its effects.

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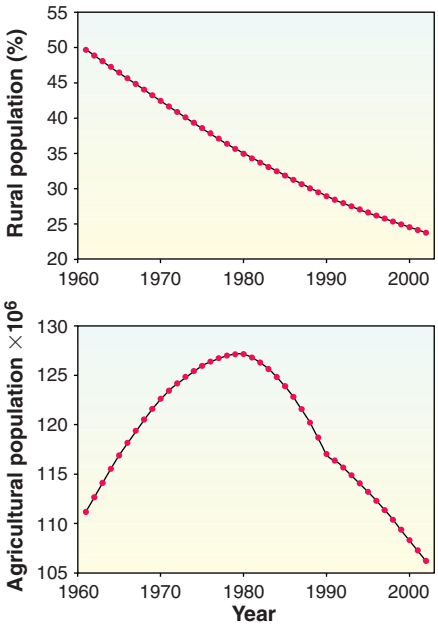
In Latin America, conservation efforts have focused on lowland deforestation for cattle grazing and slash-and-burn agriculture, but the relative importance of these drivers of deforestation is declining. Today, soybean production—the majority of which is shipped to China for animal consumption—is the major cause of deforestation of millions of hectares of seasonally dry forests in Brazil, Bolivia, Paraguay, and Argentina (*2*, *3*). At the same time, rural-urban migration is leaving marginal grazing and agricultural lands abandoned. In rural areas, an important conservation strategy has been to invest in community-based sustainable development projects. These projects have had limited success in improving socioeconomic conditions and may delay rural-urban migration and ecosystem recovery. Current economic and demographic trends suggest that social and conservation policies should focus on preparing rural migrants for an urban environment and should promote ecosystem recovery in the lands that are abandoned.



Changes in the rural and agricultural populations of Latin America and Caribbean (*14*). The agricultural population is defined as individuals whose livelihood directly depends on agriculture, hunting, fishing, or forestry.

During the last 40 years, the proportion of the population of Latin America and the Caribbean living in rural areas has dropped from about half to less than one-quarter (see figure above). More important, since 1980, the population whose livelihood directly depends on agriculture, hunting, fishing, or forestry has declined by about 20 million people (see figure above). Migration is particularly intense among those of economically active ages (*4*), who have the strongest impact on natural resources, and a growing proportion of the remaining "rural" inhabitants who depend on government subsidies, state employment, and money transfers from family members abroad.

What are the major factors driving rural-urban migration? In fertile lowlands and valleys, small farms have been bought and converted to large-scale modern agriculture, which frequently results in a decrease in the labor demand and rural-urban migration. In these areas, agriculture will continue to be the major use of land. The expansion of high-yield agriculture has decreased the prices of many crops and is indirectly influencing land-use practices in other regions. In Latin America, lower prices of corn, grain, coffee, potatoes, and beef have made it very difficult for small-scale farmers to compete, and this has contributed to the abandonment of marginal grazing and agricultural lands, particularly in the mountains. In other areas, rural migration has been stimulated by armed conflicts (Colombia), large-scale natural catastrophes such as hurricanes (Honduras), and international migration. Possibly, the most important factor influencing rural-urban migration, particularly for young people, is the cultural and economic attraction of urban life. Regardless of the motive for migrating, the abandonment of agricultural and grazing lands will facilitate ecosystem recovery. These recovering ecosystems will provide ecological services for the growing urban population and could support much of the biodiversity that has attracted widespread conservation interest to this region.

These economic, demographic, and land-use/land-cover dynamics or "forest transition" (*5*) are similar to what has occurred in Europe and North America; economies shift from agriculture to industry, cities grow, consumption increases, rural areas are abandoned, and forests recover. What is different is that Latin America has some of the highest levels of biodiversity in the world. Increasing forest in the mountains, and expanding cities and high-yield agriculture in the lowland and valleys present new opportunities and challenges for conservation; however, the consequences of this economic/demographic/ecological transition have received little attention. Most current tropical conservation research focuses on the drivers of deforestation (e.g., agriculture expansion, timber extraction, infrastructure development) (*6*), and its ecological consequences: carbon emissions (*7*), habitat destruction and fragmentation (*8*), and biodiversity loss (*9*). Although deforestation continues in many regions of Latin America, a decreasing rural population has tremendous implications for conservation as reduced human pressure often allows ecosystem and biodiversity recovery.

Many tropical ecosystems can recover fast with little or no intervention when previous land use has not severely degraded the

T. M. Aide is in the Department of Biology, University of Puerto Rico, San Juan, PR 00931–3360. E-mail: tmaide@yahoo.com. H. R. Grau is in the Laboratorio de Investigaciones Ecológicas de las Yungas, Universidad Nacional de Tucuman Casilla de Correo 34 (4107), Yerba Buena, Tucuman, Argentina. E-mail: chilograu@yahoo.com.ar

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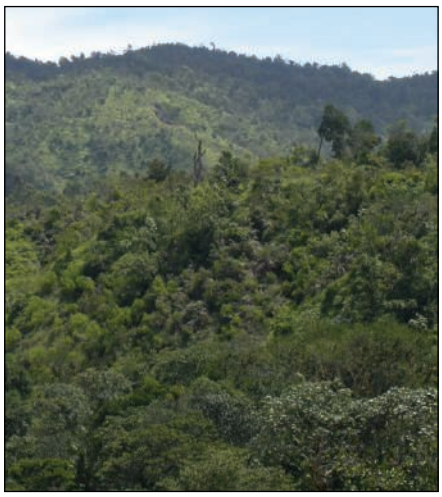

Recent transformation of subtropical dry forest (Chaco) in northwest Argentina into soybean fields contrasted with (right) forest regeneration in abandoned agricultural lands in a montane region of Dominican Republic.

soils. For example, in Puerto Rico, forest-cover increased from <10% to >40% in about 60 years, following the abandonment of agricultural and grazing lands (*1*). Virtually all the recovering forests are in the mountains, reducing erosion and floods, improving water quality, and providing habitat for many organisms. Rapid ecosystem recovery has also occurred in the 400-year-old pastures and fields formerly covered with dry forest in the Area de Conservación (ACG), northwestern Guanacaste, Costa Rica. In the 1980s, reductions in global trade tariffs reduced beef prices, and cattle production in Guanacaste declined by 90% facilitating the addition of 60,000 hectares to the ACG. By removing cattle and controlling anthropogenic fires, in 20 years, seed dispersal from forest fragments has converted a landscape previously dominated by cattle pasture on highly degraded soil into young forest (*10*). Furthermore, the fauna, including a stable population of jaguars, is recovering (*11*). Similar patterns of ecosystem recovery following rural-urban migration have been documented in forested (e.g., Patagonia, northwest Argentina, Ecuador, Mexico, Honduras, and Dominican Republic) and nonforested ecosystems (e.g., montane deserts and Andean tundra ecosystems of Bolivia, Argentina, and Peru). Although the potential for wide-scale recovery is encouraging, the land-use history of many areas has caused severe degradation, and recovery can be slow or arrested when invasive species, such as African grasses or ferns, dominate recently abandoned pastures or agricultural fields. Although other factors (e.g., global climate change) will influence the future of ecosystems in Latin America, the interactions we have described between natural and social systems suggest that research and management of ecological recovery/restoration should become better integrated into land-use policy and conservation agendas.

The global human population is expected to grow to about 9 billion people during the next 50 years, and resource consumption rates are increasing. Thus, we must efficiently use the world's resources to balance the growing human population and their food, health, and educational needs with the need to conserve the world's biodiversity and ecosystems services (*12*). Present strategies of opposing high-yield agriculture and discouraging rural-urban migration do not help to resolve these challenges. The globalization process, including high-yield agriculture, has neglected many environmental and social issues. These issues must be resolved, but at the same time, we must continue to invest in research and development to ensure the most efficient and long-term use of our agricultural lands. If agricultural activities are concentrated in the most productive soils, then other areas, particularly areas with marginal soils or steep slopes, can be dedicated to producing water and providing habitat for bioconservation and recreation. This balancing act will be difficult to achieve, but it will be much easier if we continue to improve agriculture efficiency and support population urbanization where social issues (e.g., health, education, and job opportunities) can be resolved more efficiently.

Effects of the 24 May 2004 flood on the border town of Jimaní, Dominican Republic.

The growing human population, biodiversity loss, and economic globalization are expected by many people to result in an ominous future for our planet. We do not have to accept this scenario, but we do have to understand how these and other important factors interact to create alternative scenarios, and to enact effective policies that ensure a more promising future. Technological improvements that have increased agricultural productivity and land-use efficiency and an increase in rural-urban migration are positive signs.

One week after the tragic floods in Haiti and Dominican Republic, we have read dozens of newspaper reports and only two have mentioned the extensive deforestation in Haiti and its relation to the floods. Clearly the emphasis has been on the human tragedy, and there are many immediate problems that must be resolved, but we should not allow this event to pass without learning from it. Twenty years ago, few people would have predicted a simultaneous increase in forest cover and Gross Domestic Product (GDP) in Dominican Republic and Puerto Rico (*13*). These examples challenge the conservation paradigm of a negative effect of economic growth on forest cover. To be effective, conservation action and land-use policy need to be more responsive to the dynamics of a changing world and to the opportunities that globalization provides. The social and ecological systems of Haiti, Latin America, and the developing world depend on these actions.

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