

Invited Feature

Land-Use Change in Rural America: Rates, Drivers, and Consequences¹

Ecologists, perhaps more than most Americans, are aware of the changes occurring on the landscapes around us. As we travel to our field sites, many of them on public lands, we notice that what were hay fields or wood lots on private lands are now rural home sites, exurban developments, or suburbs. In many parts of the country, our rural private lands have been undergoing significant land-use changes in recent decades. Though a variety of transitions can be observed, the major trajectory of change is from wildlands and agriculture to rural residential, suburban, and urban development. These changes are occurring both on the fringes of cities and in rural areas long distances from population centers. This land-use intensification is likely having important effects on ecosystems, like reducing availability of natural habitats, altering disturbance processes such as fire, and favoring weedy or exotic species. Though land-use intensification is occurring, sometimes more dramatically, in other regions of the world, the U.S. experience is instructive as an example of how land-use patterns evolve in the context of a diverse, wealthy, aging, and information-oriented society. Furthermore, working in the context of “our own backyard” provides ecologists with an opportunity to put our knowledge and experience into practice in support of the ecosystems we study.

While we can observe the pace and consequences of land-use changes around us, good information about rates of change, driving factors, and ecological consequences is sparse. For example, how widespread is rural residential development across the country? Can theory be developed to predict trajectories of land-use change as it has for vegetation succession? What are the influences of individual rural homes and increasing densities of homes on native wildlife species? To what extent are public lands influenced by development on nearby private lands? How can we effectively manage landscapes that are a mosaic of public and private lands and land uses? Though these are pressing questions indeed, their answers are not easily obtained.

Fortunately, increasing recognition of the importance of these issues, multi-disciplinary research efforts, and advances in technologies are encouraging the emergence of a land-change science. Ecologists, economists, sociologists, geographers, and others are increasingly willing to join forces to undertake integrated studies of land use and its impacts. National research programs have emerged to focus on the issues, including the National Aeronautics and Space Administration (NASA) Land-Cover Land-Use Change Program, the National Science Foundation (NSF) Urban Long-Term Ecological Research (LTER) Program, and the NSF Biocomplexity emphasis on coupled human–natural systems. These efforts take advantage of advances in satellite-based remote sensing and geographic data sets for quantifying and analyzing land-use change at multiple spatial scales. Consequently, a great deal is currently being learned about land use.

This Invited Feature attempts to synthesize current knowledge about changing land-use patterns in rural America. We consider rates of change, theory on the drivers of land use, consequences of land-use change for ecological processes and biodiversity, and emerging approaches for managing rural landscapes. These papers result from two workshops on these topics. The first, sponsored by the NASA Land-Cover Land-Use Change Program was held in Yellowstone National Park in fall 2000. The second was a symposium at the annual Ecological Society of America meeting in summer 2002.

The opening paper by Brown et al. draws on the U.S. Census and other data to compare, for the first time, patterns of change in agricultural and developed land uses from 1950 to 2000.

¹ Reprints of this 66-page Invited Feature are available for \$10.00 each, either as PDF files or as hard copy. Prepayment is required. Order reprints from the Ecological Society of America, Attention: Reprint Department, 1707 H Street, N.W., Suite 400, Washington, DC 20006.

They found that exurban development (low density housing) was growing rapidly during this period and now covers some 25% of the 48 contiguous states, significantly more in the Eastern Temperate Forest region. In the second paper, Huston offers a new paradigm for explaining land-use change in the United States. Drawing on ecological theory, he identifies three phases of human settlement (natural resource based, transportation based, and natural amenities based) and considers the ecological consequences of each. Dale et al. review the variety of ways that rural land use can alter ecological processes such as natural disturbance, vegetation succession, carbon sequestration, and air pollution. Hansen et al. consider impacts of exurban development on biodiversity. The studies they synthesize conclude that species and communities respond to gradients of land-use intensity in predictable, but sometimes nonlinear, ways. They also find that exurban development on private lands can have large effects on biodiversity in public lands many kilometers away. Finally, Theobald et al. summarize the variety of innovative land management approaches that are emerging from rural planners, non-governmental organizations, and public agencies.

Rather than offering a comprehensive review of land-change science, our goal is to illustrate the importance of the issue in the U.S. context, summarize current knowledge on key topics, and demonstrate the relevance to ecologists. Our hope is that this collection will help stimulate more research, development of decision support tools, integrated landscape management, and the formulation of networks of scientists focusing on land-use science and management.

—ANDREW J. HANSEN
Guest Editor
Montana State University
—DANIEL G. BROWN
Guest Editor
University of Michigan

Key words: biodiversity; ecological processes; exurban; landscape planning; landscape management; land cover; land use; land-use theory; nature reserves; rural residential; suburban; sustainability.

© 2005 by the Ecological Society of America