Chapter 11


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Chapter 11

An Opportunity and an Imperative

By Randall G. Updike and William R. Page

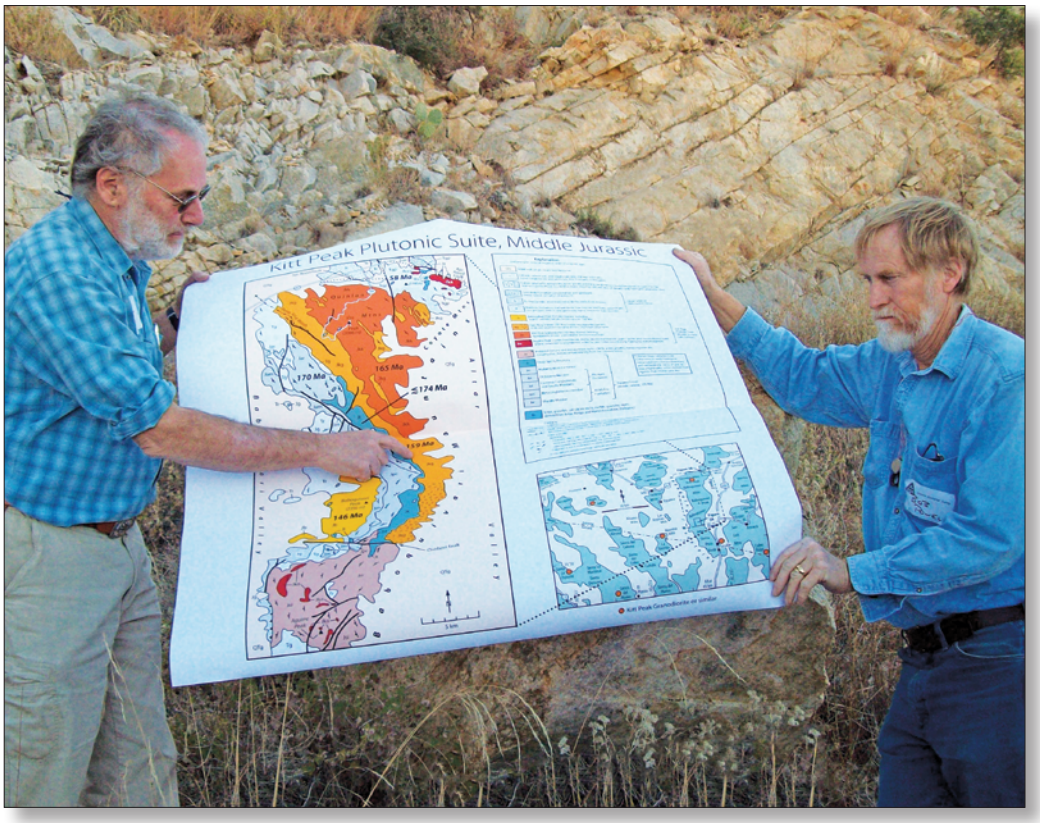
Along the nearly 3,200 kilometers (almost 2,000 miles) of the United States–Mexican border, we are witnessing the expression of the challenges of the 21st century. The Borderlands have become a microcosm for the entire United States and Mexico; the issues faced in that region are felt throughout both nations—water availability and quality, ecosystem health, natural resource needs, safety from natural hazards, and human socioeconomic well-being. If these issues were not challenging enough, we now recognize that the difficulties of addressing them are exacerbated by the onset of climate change, and as we come to better understand the complexities of the components of these challenge themes, we discover that each part is inextricably intertwined with other overarching issues. Further, because we are a creative and progressive society, we all seek to understand and appreciate the natural environments associated with the Borderlands while at the same time benefitting from the region's many social and economic values. It is little wonder that we as a society find it increasingly difficult to ask the right questions, much less find suitable answers to the questions we do ask. For the many scientists who have worked in the Borderlands and contributed to the preceding chapters, this circular is a way to describe to the two nations of the region the capabilities the U.S. Geological Survey can provide to assist in that quest for knowledge and understanding in preparation for the future.

Though the mission of the U.S. Geological Survey (USGS) is not to serve as land manager, law enforcer, or code regulator, its innovation and creativity and the scientific and technical depth of its capabilities can be directly applied to monitoring the conditions of the landscape. The ability of USGS scientists to critically analyze the monitored data in search of signals and trends, whether they lead to negative or positive results, allows us to reach significant conclusions—from providing factual conclusions to decisionmakers, to estimating how much of a natural resource exists in a particular locale, to predicting how a natural hazard phenomenon will unfold, to forecasting on a scale from hours to millennia how ecosystems will behave.

Fortunately, both Mexico and the United States are beginning to recognize the urgency needed in responding to the challenges described in these chapters. Land management agencies, natural resource entities, political and social leaders, and private citizens are facing tomorrow's challenges by taking the initiative to search for solutions. The USGS offers a wealth of capabilities in support of that goal, and though some of our partners in our applied science efforts are other Federal agencies, we also seek to collaborate with State and local partners, associations, State and county governments, nongovernmental organizations, and our counterparts in Mexico at both the Federal and State levels.

U.S. Geological Survey scientist collecting a water-quality sample from Loma Verde Wash in Saguaro National Park, Arizona, as part of the multidisciplinary USGS Amphibian Research and Monitoring Initiative

One outcome of the discussions offered in this circular would be to encourage the development of strategic and multidisciplinary solutions to problems with local to far-reaching scopes. To this end, the USGS approaches collaboration with our present and future partners in the Borderlands with three goals: (1) develop a basic understanding of the specific issues and concerns facing Federal, State, and local governments and private entities; (2) recommend ways to address these issues and concerns; and (3) carry out investigations that help to address each specific border issue.



U.S. Geological Survey emeritus Gordon Haxel (Flagstaff) (with Bob Powell, Tucson, right) explaining the geology of the Baboquivari Mountains, Arizona

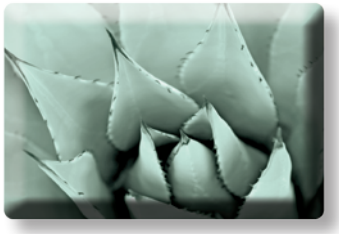
U.S. Geological Survey scientist preparing a sample within a glove box to test the effect of antibiotics on denitrifying bacteria

(Above) Boreholes being drilled at Cinder Lake in Coconino National Forest, Arizona, as part of a U.S. Geological Survey study to determine the lake's floodwater storage capacity. The lake has been used to store runoff from nearby areas affected by wildfire.

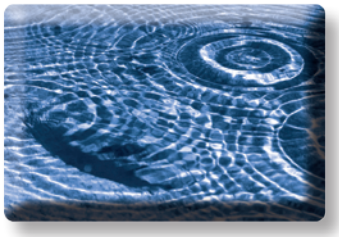
Dr. Janet Ruth of the Fort Collins Science Center, U.S. Geological Survey, studying wintering grassland birds in southeastern Arizona with the help of local student volunteers. Dr. Ruth conducted research over several years in cooperation with the Bureau of Land Management, U.S. Forest Service, U.S. Fish and Wildlife Service, National Audubon Society, and private landowners. For more information on this project, see *http://www.fort.usgs.gov/HerdingSparrows/*.

Grasshopper Sparrow (*Ammodramus savannarum*)

This circular identifies several challenge themes associated with the United States–Mexican border region—ecological resources, water availability and quality, environmental and human health, people in the Borderlands, energy and mineral resources, natural hazards, and border security and environmental protection. Climate change is also discussed, as it influences the course of all of these issues. The discussion for each theme has focused on how the USGS can work with cooperating agencies to improve understanding of the issues, which can then lead to action and hopefully to collaborative solutions. The table on the following pages reviews the eight issues covered in this circular and summarizes what we, the USGS, consider to be our essential core responsibilities in addressing each of these challenges. Below are some brief highlights of just a few of the ways the USGS uses our multidisciplinary science to meet these core responsibilities.



The Borderlands region boasts the highest diversity of desert plants and one of the largest number of bird species in the world. Increases in human populations and associated changes in land use, however, threaten this diversity by contributing to the fragmentation and loss of ecosystem habitats. The USGS uses state-of-the-art research to address habitat loss and fragmentation; projects include developing ecological indicators, conducting baseline biologic inventories, and determining the effects of climate change on ecosystems by mapping and monitoring vegetation and habitats across the United States–Mexican border region.



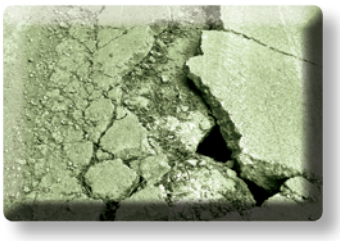
Water availability is one of the most important issues in the Borderlands because it is intertwined with the socioeconomic well-being of communities, with ecosystem diversity, and with the survival of unique species. Hydrologic capabilities of the USGS address the water issues of these complex systems through monitoring, characterization, and modeling activities.

Protecting the environment, safeguarding human health, and understanding and mitigating the effects of human activity in the Borderlands are challenged by stressors such as overpopulation, inadequate infrastructure, water shortages, elevated rates of communicable disease, and contaminants in air, soil, and water. In addition to water quality monitoring, the USGS leads in the development of environmental indicators and human health geospatial analyses.

Issues related to energy and mineral resources include supply and demand, competing land uses, and the environmental consequences of resource management. The USGS addresses these issues through resource predictive modeling, monitoring, and assessment activities.

borderlands challenge themes

Natural hazard risks such as earthquakes, landslides, wildfires, hurricanes, and flash floods threaten communities and infrastructure along the border. The USGS possesses advanced capabilities to monitor natural hazards, analyze levels of risk and vulnerability, and provide risk assessment data to emergency response officials, resource managers, and the public to help reduce property damage, injury, and loss of life.



Rapid population and economic growth and the problem of undocumented border crossings present challenges for the management of border security and environmental protection among the unique natural resources of the Borderlands. To help protect these resources, the USGS has developed binational, integrated science datasets to support the border and environmental security and management activities of Federal, State, and local agencies.

Perhaps the most perplexing issue facing the Borderlands is climate change and how it could affect the region. Because it is a far-reaching and long-term concern, climate change will continue to have an increasing influence on all of the Borderlands challenge themes. The USGS is vigorously developing its climate change science program to assess the overall effects on society and ecosystems, not only in the Borderlands, but throughout the world as well. Forecasting environmental change on decadal scales—such as precipitation, water availability, changes in seasonality, and the response of living organisms—will be critical to successfully addressing each of the Borderlands challenge themes.

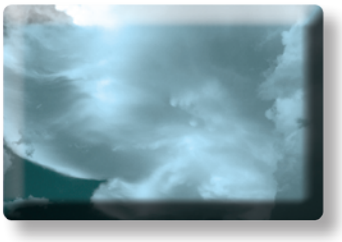


Table 11–1. Summary of the issues faced in the United States–Mexican border region within each of the challenge themes used in this report and the strategic goals adopted by the U.S. Geological Survey to address those issues.

issues goals

Issues	Strategic Goals
 ***Ecological Resources***	
The Borderlands have the highest diversity of desert plants in the world and host critical migration routes for the largest number of bird species in North America. Because many of these species reside at their northernmost extents, they are at particular risk of habitat loss due to stressors such as climate change and human activities, including population growth, industry, mining, and agriculture.	Conduct research through monitoring and mapping activities that would assist resource managers prevent species loss, help recover and protect habitat, predict the effects of invasive species, and provide resource management expertise through biological, social, and economic analyses of conservation policy and management practices.
 ***Water Availability and Quality***	
Much of the water resources of the Borderlands are extremely limited because of its low precipitation and semiarid to arid environments, the over-allocation of water rights from past international treaties, and water budget deficits where withdrawls exceed limited aquifer recharge. Many populated parts of the Borderlands also have dire water quality problems, including significant microbial and chemical contamination from sewage and agricultural runoff.	Assist land and water resource managers at all levels of government in assuring transboundary water availability and quality by conducting research through monitoring, characterization, predictive modeling, and water quality analyses and by developing new methods and techniques to understand and solve water resource problems, in this way supporting population growth and economic prosperity while protecting the natural environment.
 ***Environment and Human Health***	
Water shortages and pollution, poor air quality, increased soil salinities, and pesticides and heavy-metal contaminants are some of the many stressors that contribute to degradation of the quality of life in the Borderlands. Lack of water treatment infrastructure along many parts of the border has led to elevated rates of chronic and communicable disease.	Conduct long-term water quality and biota monitoring and modeling, perform land use and land cover analyses, develop environmental indicators, and provide database development and geospatial analyses in both environmental and human health fields to help ensure quality of life in the Borderlands.
 ***People in the Borderlands***	
Rapid population growth has contributed to increased environmental stressors in the Borderlands and has led to unplanned development, which has negatively affected ecosystems, natural resources, and quality of life. Native American cultural sites and resources are rapidly being lost to vandalism and trafficking of artifacts.	Develop and maintain binational geographic information systems and natural resource databases, and establish baseline datasets for monitoring and conducting landscape change analyses to assist researchers, government officials, planners, and concerned citizens in mitigating human activities that adversely affect the environment and human and wildlife health in the Borderlands.

Issues	Strategic Goals
 ***Energy and Mineral Resources***	
With global and domestic demand for energy and mineral (precious metal and rare earth) resources increasing, the abundance of these resources in the Borderlands will make it an important area for development well into the future. There are approximately 11,000 abandoned mine sites in the Borderlands. Legacy heavy metal contamination and other toxic materials have resulted in water, soil, and air pollution; habitat destruction; and adverse effects on human and wildlife health.	Conduct energy and mineral resource modeling, monitoring, and environmental assessment, and provide unbiased resource data to help guide policy decisions concerning sustainable and responsible resource development and to assess and evaluate abandoned mines and waste dumps in order to understand potential effects on human and wildlife health.
 ***Natural Hazards***	
Earthquakes, landslides, wildfires, hurricanes, and intense flash floods occur frequently in the Borderlands and have resulted in millions of dollars in property and infrastructure damage, the destruction of ecosystem habitats, and significant injury and loss of life.	Collaborate with Federal, State, and local agencies to minimize the effects of natural hazards by providing timely, unbiased science information to emergency response officials, resource managers, and the public to help reduce the loss of life, injuries, and property damage from natural hazards. Improve hazard predictions, analyze risk and vulnerability for disaster prone areas, develop a national risk monitoring program, and mobilize response efforts during and after a natural disaster event to provide technical counsel on recovery and response.
 ***Border Security and Environmental Protection***	
Illegal crossings and human and drug smuggling activities occur daily at numerous locations along the United States–Mexican border. These activities have created significant security challenges to both nations and have adverse effects on natural resources and fragile wildlife habitat.	Develop a collaborative effort between United States and Mexican officials at all levels of government to collect information and provide a binational geographic information system containing environmental and socioeconomic datasets to assist in improving border protection and security and developing state-of-the-art techniques to assure greater overall security along the United States–Mexican border while protecting the environment.
 ***Climate Change***	
Climate change projections have shown that parts of the Borderlands may be particularly vulnerable to climate change because of low precipitation and extreme temperatures, which may lead to adverse effects on humans and ecosystems by increasing the potential for more droughts, heat waves, water shortages, wildfires, poor air quality, disease, and flooding.	Meet the needs of policy makers, resource managers, communities, and ecosystems by conducting research and monitoring and modeling activities to evaluate and assess the effects of climate change and by developing predictive and adaptive tools and strategies to reduce the risk of hazards and increase the potential for communities and ecosystems to be self-sustaining and resilient to the adverse effects of climate change.

For more than one hundred years the Borderlands environment was able to exist somewhat unaffected by the scattered occupation of humans who demanded little from the land and exerted little influence in return. The marks of man's activities were only fine scratches on an expansive, wild panorama, but with the recognition that natural resources abounded in the Borderlands, that water, though apparently scarce, could be obtained, and that the land could support extensive agriculture and burgeoning cities, the fine marks became bold strokes. The most powerful change, however, has been the converging and blending of the Mexican and American populations in the Borderlands, coalescing into a unique Borderlands society. Inexpensive labor has fueled expansive urban sprawl, and supply and demand for products and people, both legal and illicit, have overrun the natural environment along many segments of the border, inhibiting the environment's ability to recover from human activity.

The USGS has a long history of providing reliable science information to work toward the resolution of important environmental and societal issues. The interdisciplinary science programs of the USGS and the breadth and depth of expertise of our researchers yield unique and unbiased perspectives on how such issues can be addressed throughout the Borderlands.

Dancers with the Baile Espanol de Santa Fe perform a folklórico, a traditional Latin American dance, at a Hispanic Heritage Month celebration in New Mexico. Events such as this held throughout the Borderlands help to bring the region's people together and highlight the culture, and the home, that they share.