Potential Effects of United States-Mexico Border Hardening on Ecological and Human Communities in the Malpai Borderlands

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Introduction

Between 17 October and 29 December 2008, contractors working for the U.S. Department of Homeland Security (DHS) constructed approximately 19 km of contiguous barrier along the United States-Mexico border in the Malpai Borderlands region of southeastern Arizona. The construction was part of the U.S. Secure Fence Act of 2006, which mandated installation of fences, barriers, roads, and surveillance technology on five segments of the United States-Mexican border, totaling approximately 1120 km (or 35% of the entire border) by December 2008. To expedite implementation of the act, Congress authorized the secretary of Homeland Security to waive all or parts of 37 federal statutes pertaining to the conservation of cultural and environmental resources, including the National Environmental Policy Act, the Endangered Species Act (ESA), the Clean Air and Clean Water acts, and the Antiquities Act. Secretary Michael Chertoff exercised this authority on 1 April 2008. According to the Associated Press (28 January 2009), 962 km of barriers had been completed as of January 2009; DHS maps indicate that nearly all of the new construction is located between San Diego, California, and El Paso, Texas.

The Malpai Borderlands region harbors significant cultural and ecological resources and has been the site of extraordinary conservation efforts in recent decades (Curtin 2002; Sayre 2006). Cultural sites and artifacts are ubiquitous, reflecting aboriginal human use from the Clovis period to the last days of the Apaches as well as historical Euro-American settlement. Judging from natural heritage data, there are more species of plants and animals in the borderlands than in any other place of comparable size

in the United States (Brown & Kodric-Brown 1996): the Malpai planning area harbors an estimated 4000 species of plants, 104 species of mammals, 327 species of birds, 136 species of reptiles and amphibians, and the greatest known richness of bee species in the world. Thirteen species are listed as threatened or endangered under the ESA, and dozens more are protected under state laws. Since 1994 the Malpai Borderlands Group (MBG), a nonprofit organization founded by area landowners, has led a community-based, collaborative effort to protect the area from exurban development, restore fire and grasslands, and conserve livestock ranching as a viable livelihood. The MBG's achievements have been heralded and supported by philanthropists, foundations, journalists, scholars, government agencies, and environmental groups across the United States (Curtin 2002). Even as the barriers were being constructed, the MBG and the U.S. Fish and Wildlife Service signed a habitat conservation plan (HCP), granting MBG and participating landowners a permit to take individuals of 19 listed species incidental to otherwise legal ranching- and conservation-related management practices (including prescribed fires). From start to finish, the HCP took 5 years to complete; without the waiver from Congress, the new barrier would have required a comparable planning effort.

The ecological value of the Malpai Borderlands is exceptionally high due to its location at the intersection of five continental biomes, but in other respects it has much in common with most of the rest of the United States-Mexico border: pronounced biogeographic variation, relatively intact natural communities of flora and fauna, and limited human development due to both natural conditions (weather, soils, rainfall, topography) and



Figure 1. Newly constructed barrier next to border monument 75, San Bernardino Valley, Arizona. The new roadbed is on the United States side of the border (source: Malpai Borderlands Group).

social circumstances (remoteness, low population densities, marginal economies). Indeed, it is precisely the relative lack of human impacts that has allowed the biological and cultural resources along the border to persist in situ, and it is for this reason that hardening the border may represent a threat of such great proportions. Previously, the international border had been delineated only by widely spaced monuments erected in the 1890s and a barbed-wire fence completed in the 1940s (Fig. 1). The topography is rugged and broken, defined by high mountains and drainage networks carved by floods through erodible valley soils. Few roads accessed the area, none of which were paved.

The potential effects of border hardening on biodiversity are of grave concern to conservation biologists but are uncertain at this time. The Malpai Borderlands case suggests that infrastructure installed to build border barriers poses a greater ecological threat than the barriers themselves and that the top-down manner in which construction occurred undermines the social relationships on which effective conservation in the region has been built and ultimately depends. These social effects of border hardening must be assessed in addition to ecological effects.

Effects on Ecological Communities

Assessing the effects of border hardening on ecological communities is an urgent but difficult task. The actions being taken are unprecedented; baseline data are limited; impacts are likely to be uneven across different types of organisms, communities, and processes; and causal interactions are complex and difficult to disentangle. Some impacts may take decades or longer to become discernible from existing or foreseeable data.



Figure 2. "Normandy" barrier (left) and post-and-beam barrier (right) (source: Malpai Borderlands Group).

Effects of the Barriers

Two types of barriers were built in the Malpai Borderlands: so-called Normandy barriers and post-and-rail barriers (Fig. 2). Both are designed to prevent vehicles from crossing the border while letting animals and pedestrians pass. Pedestrian fences, which more closely resemble walls, are being installed in more populated areas of the border.

Although monitoring and research are needed to test this, it appears unlikely that the new barriers by themselves will pose significant new threats or impediments to most wildlife. Birds can walk under or fly over the barriers; small mammals and all reptiles and amphibians can pass under. Experience with post-and-rail barriers installed previously on the San Bernardino National Wildlife Refuge suggests that most of the larger mammal species in the area-including mule deer (Odocoileus hemionus), pronghorn (Antilocapra americanus), javelina (Pecari tajacu), coyote (Canis latrans), and mountain lion (Felis concolor)-can and do pass under or over this type of barrier, albeit after a period of cautious familiarization or hesitation. The Normandy barriers (named after similar ones erected on France's Normandy Beach during World War II) are likewise intended to allow wildlife passage; whether they may prove too wide and high, posing a risk that deer may catch their rear legs while jumping over, is not known. Where barbed-wire fences were removed. the new barriers may actually inhibit some organisms less than the previous fences did.

Effects of Associated Infrastructure

Border hardening involved more than just the barriers, however. Building the barriers was accompanied by major new road construction in an 18-m-wide strip of land along the border and construction of several access roads from the border to the existing road network.

Roads have pronounced effects on wildlife and ecosystems (Havlick 2002; Forman et al. 2003). For some species, roads act as barriers due to behavioral conditionings. For example, prey species may be reluctant to traverse such wide areas that lack protective cover (Forman & Alexander 1998; Shepard et al. 2008). Road traffic results in increased wildlife mortality, even or especially—on minor roads (Frair et al. 2008; van Langevelde et al. 2009). Roadways also provide habitat for invasive or nonnative plant species and may act as corridors for invasions (Harrison et al. 2002; Christen and Matlack 2009).

The new roads provide vehicle access to large areas previously reachable only by foot or on horseback. As a result both legal hunting and illegal poaching of wildlife can be expected to increase (Cole et al. 1997). If areas just outside the Malpai region are any indication, the new roads are also likely to result in additional "wildcat" roads created by recreational off-road vehicle use. Although contractors used only native species of seeds in revegetating staging areas, the new roads may facilitate movement of nonnative plants such as Lehmann lovegrass (Eragrostis lebmanniana), yellow starthistle (Centaurea solstitialis), buffel grass (Cenchrus ciliaris), and Russian thistle (Salsola iberica) into previously uninvaded areas. Construction-related trucks and equipment, and subsequent general traffic, can be expected to transport seeds into previously inaccessible areas, and prevailing southwesterly winds may carry propagules from the border further into the Malpai Borderlands. Finally, many of the new roads include cattle guards built with enclosed concrete pits that are effectively lethal pit-fall traps for reptiles, amphibians, and many small mammals.

Roads also alter patterns of erosion and water movement, which affect infiltration, soil stability, sedimentation, and the quality of habitat for aquatic and riparian species. At numerous locations in the Malpai Borderlands, the border road was built across drainages subject to major flash flooding. Inadequate culverts and other engineering flaws ensure that the road will wash out, barriers will give way under the force of water and debris, and large quantities of sediment will wash into downstream areas such as the San Bernardino National Wildlife Refuge, which is a home to seven species of native fishes, including four listed as threatened or endangered under the ESA.

Effects on Human Communities

The new barriers are intended and designed to impede vehicular traffic engaged in smuggling of undocumented migrants and contraband. Nevertheless, in areas previously inaccessible to vehicles, new roads may in fact facilitate traffic across and along the border. For example, smugglers in the Malpai Borderlands area have used torches to remove segments of the Normandy barrier and then driven across the border, taking advantage of the new road system to access areas farther north. The new road along the border also facilitates over-the-fence smuggling, in which people cross or contraband is thrown over the border to waiting vehicles.

Moreover, effects of the barriers are not limited to smuggling. The increased traffic—for construction, enforcement, and general public use as well as smuggling poses risks to area residents. Vehicles travelling at high speeds, often driven by individuals inexperienced with gravel roads, result in increased risks of accidents. As traffic increases, public roads deteriorate faster and require greater maintenance, without which they become more dangerous for all drivers.

Finally, the manner in which the barriers were constructed has had negative effects on the social relations through which conservation must inevitably take place, especially given the intermixed private, state, and federal landownership in the region. Members of the MBG made early, sustained, good-faith efforts to contact public officials-including both elected representatives and agency personnel at all levels of DHS and its Border Patrol-and conducted tours and briefings to discuss how best to build the barriers. Ways to avoid new road construction were emphasized repeatedly. Concerns and suggestions voiced by locals were sometimes heeded, but often disregarded. Many suggestions were dismissed on the grounds that no deviations from "the contract" between DHS and the construction company were possible, yet the contract itself was merely a draft version (a final version is still not available) and construction deviated from it in numerous other ways. In several instances, commitments made by DHS or Border Patrol officials were reneged without notice or apology. For example, some staging areas were installed in areas where the landowner or leaseholder had been promised no clearing of vegetation would occur. Contractors also built 1219 m of post-and-rail fence along the southern border of the San Bernardino National Wildlife Refuge, even though an identical barrier, built there by the Fish and Wildlife Service, had already been in place since 2005.

Conclusion

In summary, border hardening may have myriad negative effects on wildlife, vegetation communities, and watershed functioning. Assessing these effects will require investments in monitoring and research. Given the extraordinary ecological importance of the borderlands, funding for such monitoring (and appropriate mitigation) should be included in the costs of border hardening. An adequate assessment of border hardening must also consider social effects, which mediate both the ecological impacts and any attempts to minimize and mitigate them. In a region where local residents have gone to great effort and expense to comply with the complex array of laws protecting the environment, waiver of those laws constitutes a blatant double standard. That the resulting barriers will likely not achieve their stated goals, but may instead make problems worse, further damages relations with the local community.

There is reason to believe that the MBG case may be typical of recent border hardening in general. Local opposition to the barriers has been widely reported, especially from Texas, and the Government Accountability Office has found a lack of oversight in DHS contracting and investment generally (GAO 2009a); cost overruns and performance shortfalls in border hardening in particular (GAO 2008a, 2009b); and a frantic rush to meet the 1072-km target for new barrier construction in the final months of 2008 (GAO 2008b). Although the Obama administration may pursue different immigration policies, it has not indicated any intention to halt barrier construction, let alone remove what has already been built. Unfortunately, the top-down manner in which border hardening occurred in 2008 has undermined the trust and respect between area residents and the federal government that had been painstakingly built over the past 15 years through the good will and hard work of MBG landowners and individuals in a range of public agencies. The MBGa decidedly bottom-up approach to conservation-has demonstrated that these social relations are critical to the region's human and ecological communities alike.

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