

EarthTrends: Featured Topic

Title: Grasslands in Pieces: Modification and Conversion Take a Toll
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For many people, the word “grasslands” conjures an image of seemingly endless grassy landscapes, sometimes dotted with small trees or shrubs—the prairies of Canada, the savannas of Brazil and Kenya, or the steppes of Mongolia, for example. But while grassland ecosystems still exist on every continent and cover approximately 41 percent of Earth’s land area, many grasslands are better characterized as “fragments” than as “vast expanses” (White et al. 2000:14). Increasingly, roads interrupt grasslands, breaking large tracts into pieces, and invasive species and human-induced fires change grassland composition and extent. Most notably, many of the world’s original grasslands have been completely transformed—converted to farmland or urban areas.

These human influences jeopardize the many goods and services grasslands provide, including their ability to supply food for livestock herds, maintain biodiversity, store carbon, and provide choice

Box 1 Grasslands Goods and Services

Grassland ecosystems supply goods and services to support flora, fauna, and human populations worldwide. Grasslands:

- provide many of our food grains—wheat, corn, rice, rye, millet, and sorghum;
- remain the primary source of genetic resources for improving our crops and for increasing the number of pharmaceuticals;
- supply forage for domestic livestock; support human livelihoods with meat, milk, wool, and leather products; and
- provide habitat for breeding, migrating, and wintering birds; ideal conditions for many soil fauna, and rangelands for wild herbivores.

Grasslands also cycle water and nutrients; build and maintain stabilization mechanisms for soil; serve as large storehouses for carbon, helping to limit global warming; supply energy from fuelwood and wind generated from windfarms; support recreational activities such as hunting, wildlife observation, and tourism; and offer aesthetic and spiritual gratification through natural beauty.

areas for recreational use and wildlife viewing. (See Box 1: Grassland Goods and Services.)

Pressures on Grasslands

Agriculture

Conversion to agricultural areas has caused the greatest loss of the world’s grasslands. The effects of this conversion can be dramatic:

- native vegetation is removed and replaced with farm crops;
- soil is exposed and becomes vulnerable to wind and water erosion;
- fertilizers and pesticides may be added, changing soil composition; and
- water-holding capacity may be lessened, reducing the moisture available for plants and animals.

Some native grassland flora and fauna are able to survive when grasslands become farmland or grazing land, and continue to reproduce in the agricultural environment. However, many species fail to reproduce successfully, and some of the more mobile fauna may attempt to migrate to more suitable habitat.

Enormous percentages of original tracts of grasslands in North and South America already have been transformed into agricultural areas. For example, 71 percent of the North American Tallgrass Prairie and the Cerrado Woodland and Savanna in Brazil, Paraguay, and Bolivia have been converted to croplands (White et al. 2000:21). (See Figure 1.) Globally, other predominantly grassland areas have not experienced

More Croplands, Fewer Grasslands

Figure 1: Estimated Remaining and Converted Grassland (percent)

Continent and Region	Remaining in Grasslands	Converted to Croplands	Converted to Urban Areas	Total Converted
N. America Tallgrass Prairie in the United States	9.4	71.2	18.7	89.9
S. America Cerrado Woodland and Savanna in Brazil, Brazil, Paraguay and Bolivia	21.0	71.0	5.0	76.0
Asia Daurian Steppe in Mongolia, Russia and China	71.7	19.9	1.5	21.4
Africa Central and eastern Mopane and Miombo in Tanzania, Rwanda, Burundi, Dem. Rep. Congo, Zambia, Botswana, Zimbabwe and Mozambique	73.3	19.1	0.4	19.5
Oceania Southwest Australian shrublands and woodlands	56.7	37.2	1.8	39.0

Source: White et al. [PAGE] 2000

complete conversion but are identified as areas of mixed grassland and agricultural land (White et al 2000:24). These grassland mosaics are most extensive in Sub-Saharan Africa, with substantial areas also found in South America (especially in northeastern Brazil and in Asia, particularly in Kazakhstan and nearby countries).

Urbanization

Human settlements and urbanization have greatly modified grassland ecosystems, often in the same areas where grasslands were converted to agricultural land. For example, the prairies of North America attracted many early European settlers. There were no trees to be cleared from these large, open expanses, and the thick prairie sod provided building material for homes. Fuel was readily available from animal dung.

Today, grassland ecosystems support large numbers of people—nearly 800 million—all over the world and provide homes for more people than forests do. (White et al. 2000:13). This vast population subjects grasslands to alterations from urbanization and human settlement including removal of vegetation, soil erosion, displacement of native plants and animals, and introduction of exotic species.

Fragmentation

Grasslands are fragmented naturally by geographic features like rivers and shorelines, but humans contribute to fragmentation, too—most notably through agriculture (as discussed above) and road building.

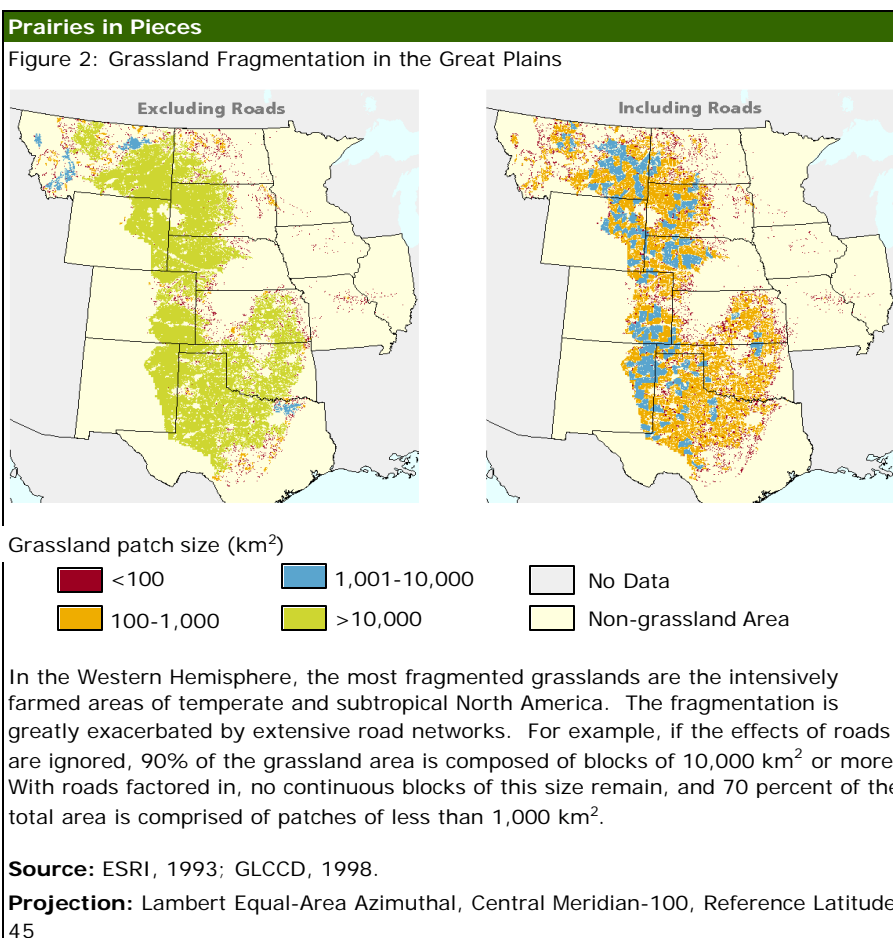
One way to evaluate fragmentation is visually—by analyzing habitat maps to gauge the degree of fragmentation in an area. Using this approach, an analysis of 90 grassland regions in North America and Latin America showed that the most heavily fragmented grasslands were in temperate and subtropical zones of North America, where there has been extensive agricultural development. Nearly 37 percent of the grassland regions studied were

characterized as fragmented: small with few patches of grassland in a linear shape (rather than circular and providing more protective core habitat) (Ricketts et al. 1997:33, 147-150; Dinerstein et al. 1995:78-83). Another analysis measured the degree to which road networks have contributed to the breakup of large blocks of grasslands in the Great Plains of the United States. Road fragmentation was found to be pervasive, breaking 70 percent of the prairie into patches of less than 10,00km². (See Figure 2.)

Fire

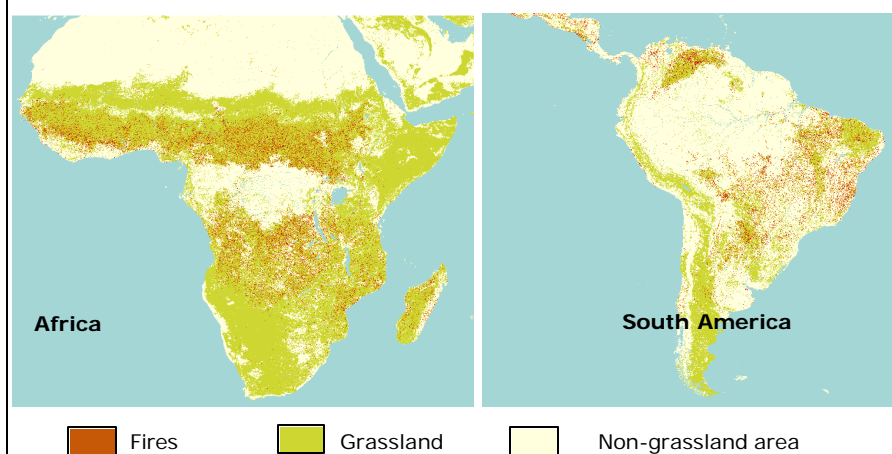
Lightning routinely causes fires in grasslands, and those fires help maintain productive grassland ecosystems. Fire prevents bush encroachment, removes dead herbaceous material, and recycles nutrients. Without fire, much of the world's grassland would eventually become forested.

Humans start fires in grasslands to maintain good grazing conditions for livestock, to clear away dead debris, and to control pests, for example. But fires also can be harmful, and humans cause a far larger number than would occur naturally. Intense and frequent fires can destroy vegetation and increase soil erosion. Fire also releases atmospheric pollutants. According to a recent UNEP report, uncontrolled or misused fires can cause “tremendous adverse impacts on the environment and human society” (Levine et al. 1999:1). Biomass burning is the source of nearly 40 percent of gross carbon dioxide and tropospheric ozone (Levine et al. 1999:2.) Much of those emissions come from Africa, recognized as the ‘burn center’ of the planet (Levine et al. 1999:2) because of the extensive burning of biomass in its savannas. (See Figure 3.)



Burning Biomass

Figure 3: Grassland Fires Detected by Remote Sensing in Africa and South America, 1993



This map shows that majority of fires on the African continent occur in the grassland area confined by the Sahara Desert to the north, by the Horn of Africa to the east, and by the Kalahari Desert to the south. A similar pattern is found in South America, where the least number of fires occur in the Amazon Basin and southern Patagonia, and the greatest number occur in the grasslands of eastern Brazil and Venezuela.

Source: Arino and Melinotte, 1997; GLCCD, 1998.

Projection: Interrupted Goode's Homolosine

Future Prospects for the World's Grasslands

There are signs of an emerging, greater appreciation for grassland ecosystems, including a Prairie Conservation Action Plan (PCAP) for North America and other new initiatives to preserve the prairies of the United States and wildlife on the Canadian prairies (Dyson 1996:175; Anderson et al. 1996; Clark 1996; Kresl et al. 1996). The increasing number of tourists and the revenues received from tourism in most countries with extensive grassland suggest a growing public awareness of the value of grassland ecosystems (White et al. 2000:56). International conventions such as the United Nations' Convention on Biological Diversity, and the Convention to Combat Desertification, plus international assessments such as the Millennium Ecosystem Assessment, hold additional promise of promoting a greater understanding of the importance of grasslands—ideally, in time to ensure that the world's grasslands are maintained.

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