

## **Appendix C: Disturbance Factors and Ecological Processes**

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### Disturbance Factors and Ecological Processes

Historical natural disturbances and ecological processes such as fire, drought, flooding, and native herbivory, in conjunction with human-caused disturbances such as cattle grazing and altered hydrology have notable effects on the Grasslands vegetation including composition and structure. These historical natural disturbances influence the composition and structure of the Grassland PNVTs. In addition, invasive species and motorized and off-road travel are now recognized as having disturbance-like effects on the Grasslands vegetation.

The following is a list of current and historical disturbances that occur on the Grasslands affecting all identified soil resource characteristics including: soil condition, soil loss, soil productivity and organic matter.

**Fire:** Historically, lightning-caused fires and fires set by humans burned across extensive areas of the plains grasslands and ecosystems adapted to the periodic fires. The plains grasslands had a historical fire regime of 3 to 10-years. This was disrupted by Euro-American settlements in the late 1800s, mainly by over-grazing and fire suppression. Contemporary residential development and growth led to widespread fire suppression, with roads often serving as fuel breaks. Fire suppression allowed trees and other woody vegetation to increase their dominance over the landscape while reducing the abundance of fire-adapted native grasses. With the exclusion of wildfire throughout most PNVTs in the last 70 years, fuel loading has increased in woodland and forest PNVTs resulting in high risk of accelerated erosion, loss of soil and vegetative productivity, and sediment transport to connected streams following wildfires in areas with moderate and high erosion hazard on the Grassland. High levels of sediment can reduce fishery and aquatic habitat and those species that rely on it for their survival.

Grasslands managers have increasingly used prescribed burns to eliminate the excess of woody trees and shrubs, including invasive trees like black locust and Eastern red cedar, improve the diversity of structural stages, and restore fire-adapted ecosystems. Over the past 10-12 years, approximately 80% of the Black Kettle and McClellan Creek National Grasslands have been burned, with some units burned two to four times, and about 2% of the Kiowa and Rita Blanca National Grasslands units have been burned, mostly in the piñon-juniper ecosystem. In addition, approximately 7,300 acres burned in wildfires on all four Grasslands in the ten years from 1995 to 2005. The 2006 wildfire season was especially unique due to prolonged drought and burned over 3,700 acres of Black Kettle, 1,500 acres of McClellan Creek and 850 acres of the Kiowa and Rita Blanca National Grasslands.

**Grazing/herbivory:** Grazing by herbivores such as bison played a very important role in the development of the current grazing-adapted grasslands. For millennia, unconfined herds of bison moved over extensive grasslands year-round, reducing grass cover and changing the dominance of certain plant species. Prairie dogs once inhabited millions of acres of the Great Plains and played an important role in modifying grasslands and providing habitat for numerous species.

Herbivory can directly reduce vegetative cover by affecting a change in vegetation species and as a consequence, may inadvertently select for plants that have roots less capable of holding soil and soil trampling by large ungulate trail creation, all of which can lead to accelerated erosion rates. High levels of livestock, pronghorn and prairie dog grazing has been observed to reduce effective vegetative ground cover in drier PNVTs and potentially contribute to accelerated erosion, soil compaction and declined soil productivity exacerbated during periods of drought.

The Forest Service has adopted an adaptive management approach and completed an environmental analyses and Allotment Management Plans on every active grazing allotment on the Grasslands. The adaptive management approach now in place allows for adjustments in numbers of livestock and seasons of use through the annual operating permit system in order to respond to changing conditions and achieve

management objectives. The intensity of livestock grazing is substantially lower on the Grassland units than on adjacent private lands, averaging half the stocking rate found on private land. Current livestock management trends indicate that grazing on the Grasslands is currently sustainable.

**Invasive Species:** Pre-European settlement, there were no invasive species found on the Grasslands; however that is no longer the case. Invasive species disrupt natural ecosystem functions and negatively affect both ecological and socio-economic conditions. Invasive species can displace desirable native species, reduce the quality of wildlife habitat, damage sensitive riparian and watershed areas, increase wildfire risk, and increase erosion. Invasive species cause major modifications in ecological processes and soil microflora, affecting nutrient cycling and decomposition rates. Changes to grassland habitat by non-native species introduction can be beneficial to some game species such as whitetail deer and Rio Grande turkey and tree dependant bird species that can utilize the altered habitat.

Grasslands managers have greatly increased the emphasis on preventing and controlling invasive plants by developing cooperative agreements with adjacent landowners to actively control invasive plants on “both sides of the fence”; engaging in cooperative interagency programs such as the salt-cedar control project along the Canadian River; conducting some small-scale control treatment for invasive species; and developing environmental analyses needed to implement more invasive plant control projects.

**Climate/Drought:** The Grasslands evolved with severe droughts and other extreme climatic events. Native grasslands are extremely well-adapted to tolerate and resist the impacts from drought and regularly experience extreme fluctuations in climate conditions and extreme weather events such as prolonged droughts, flooding, hail, blizzards, tornadoes, and dust storms. Precipitation has a significant influence on ecological conditions and processes in the Great Plains. Evaporation typically exceeds precipitation and water is the primary factor limiting vegetative growth and the type of vegetation a site will support.

The Grasslands have recently experienced several years of drought since about 1999, with occasional normal levels of seasonal moisture. Reduced precipitation results in reduced vegetative growth, reduced surface organic matter and productivity and ineffective vegetative ground cover putting the soil at risk of accelerated erosion and compaction during storm events and subsequent loss of soil productivity. As vegetation dries out, there is increased risk of wildfire spread and subsequent accelerated erosion and watershed degradation.

It is projected that the Southwest will be warmer/wetter with climate change and as a consequence may include the invasion of woody species as a function of increased carbon dioxide concentration and a change in seasonal precipitation patterns. Both these factors favor the establishment of vegetation such as woody shrubs at the expense of warm season perennial species of grasses.

**Flooding:** Frequent flooding is a natural process and disturbance within the Grasslands and affects the riparian PNVTs, as well as unmapped stream courses throughout all the PNVTs. Flooding may cause localized soil loss in the stream channel, stream banks and floodplains if not well protected with deep rooted vegetative ground cover. Flash flooding can occur in perennial, intermittent and ephemeral streams in all PNVTs, especially in large watersheds where short duration, high intensity storms occur. Flooding processes produce scouring and sedimentation and the entire range of flood magnitudes contribute to ecological processes such as nutrient cycling, recruitment and species composition. Two to ten-year events primarily impact herbaceous vegetation and 7-50 year events result in patchy removal of shrubs and saplings. 50+-year events will remove stands of larger trees. Cottonwoods return to pole size within 10 years of disturbance and is considered mature around 60 years. Maintaining native vegetation described in the Potential Plant Community of the TEUI provides channel stability, functional riparian areas and good water quality for wildlife and aquatic species.

**Motorized Travel and User-Created Roads:** On the Kiowa and Rita Blanca National Grasslands, off-road driving is not prohibited and is particularly prevalent in the popular hunting areas. Most of the Kiowa and Rita Blanca National Grasslands are not highly desired by off-road driving enthusiasts because

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of the mixed ownership pattern, abundance of fences, and relatively even and homogenous terrain. However, where the off-road driving and user-created roads are prevalent, such as in the Mills Canyon and Uplands, use has resulted in a loss of vegetative productivity and species diversity, long-term soil compaction and erosion, water quality degradation, and impacts to scenery, historical resources and other social values.

The Black Kettle and McClellan Creek National Grasslands prohibit driving off designated roads or trails so effects of off-road motorized travel on ecological sustainability are not an issue on that District.