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Fuels management in the Great Plains

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INTRODUCTION

Fuels management typically involves changing fuel structure or amount. Fuels management in woodlands conjures up visions of burning, tree felling, and mastication among other techniques, but grassland fuels management requires very different approaches. The mass of potentially combustible material in an area, referred to as *fuel load* in fire-related terms, is one component used in determining the appropriate fuel model to use. Fuel load and fuel models assist with defining expectations for fire behavior and intensity of a fire. In grasslands, fuel load is primarily composed of fine fuels (plant material < 1 inch diameter) which includes both standing live and dead plants (standing fuels) and litter and duff (surface fuels). In grasslands, fuels accumulate rapidly after a fire. Changes in conditions, such as fire suppression, have resulted in the expansion of shrubs and trees at the expense of grasses and forbs. This shift has changed both fuel load and composition which in turn, alters fire behavior.

WHY MANAGE GRASSLAND FUELS?

Whether dominated by native or introduced grasses, grassland fuel loads may be managed to meet a variety of goals including those focusing on ecosystem restoration, conservation, or risk mitigation. For example, burning and cutting may be used to maintain low levels of woody plant cover important for light penetration to understory plants and to the soil. Fuels are also managed for other purposes. For example, grazing by large herbivores, which are integral to grassland management, may need to be altered to provide adequate fuel for a planned prescribed burn.

Fuel load reduction for risk management can be applied to improve safety during prescribed burns or reduce the probability of a wildfire by altering fuel continuity or by creating fire breaks. Fire breaks may be particularly important in grasslands adjacent to urban areas or structures which may present high wildfire risk. Fuel reduction in high risk areas may help protect property as well as firefighters and others in fire's way.

MONITORING FUEL LOADS

Monitoring fuel loads over time provides information that helps land managers understand the potential fire behavior and associated risk in an area. In grassland dominated ecosystems (e.g. grasslands or savannas), fuel loads are measured by assessing the amount of plant matter present on the ground. There are a variety of ways to estimate fuel load in grasslands with units of measure usually expressed as weight per area (e.g. tons/acre or kg/ha). The monitoring technique used will vary depending on considerations such as land management or research goals or the resources available. Relative changes in fuel load may be measured using grazing sticks or photo monitoring . Rising plate meters provide a way to measure fuel load more quantitatively, particularly where fuels are primarily herbaceous and are homogenous in height and composition.

Clipping vegetation in a plot. Photo by C. Blocksome.

Clipping vegetation within a defined space, however, provides the most accurate method of quantifying fuel load particularly where fuels are heterogeneous. Clipping involves cutting and collecting , usually in paper bags, both standing and surface fuels. Collections are completely dried before recording a final weight. Clipping can be time consuming since it requires many samples and is tedious. In grasslands that have transitioned to woodland, Brown's method (Brown et al. 1982) may provide a better estimate since fuels in these areas may include woody stems and branches. This technique for fuel load monitoring includes counting dead and down woody fuels, by size class. Regardless of the method used, collecting fuel load measurements both prior to a burn and at intervals after the-burn provides infor-

mation on the effect of fire on fuel load reductions and rate of fuel accumulation after a burn.

GRASSLAND FUEL MANAGEMENT TECHNIQUES

There are several techniques available for managing grassland fuels. Choosing from among these techniques will depend on management objectives as affected by site condition, fuel load and type, and landscape context. Combining techniques can even increase the effectiveness of managing fuel load. In addition, effectiveness of fuel management can result either from timing treatments so that reduced fuel loads coincide with high fire risk or from applying treatments either uniformly or in a heterogeneous fashion.

Mowing/haying: While mowing (cutting without removal) reduces plant stature, standing fuels are still present but as surface fuels. Mowed residue is often compact which may reduce flammability. In contrast, haying (cutting and removing) removes the fuel from the site which reduces both total fuel load and fire intensity. The seasonal timing of mowing would also affect the type and amount of residual fuels.

Mowing at George Washington Carver National Monument aimed at managing the restored prairie. Park photo.

Grazing: Stocking rates are the key to using livestock grazing to alter fuel load. Forage consumption calculations can assist producers in determining how much standing herbaceous material (forage) will be removed as well as the uniformity of the fuel across a pasture. With respect to litter, while the trampling effect of large grazers can compact litter and incorporate some into soil, grazing typically will not reduce litter fuels except at high rates. As with mowing and haying, timing of livestock grazing and forage regeneration can play a role in fire risk reduction.

Burning: Prescribed fire can be a cost effective way to reduce grassland fuel loadings. When developing fire prescriptions, consider the level of fuel reduction needed to accomplish objectives. For example, if a 100% reduction in fuel load is desired, fuel should be fully cured and continuously distributed across the burn unit with higher temperatures and lower relative humidity (RH) conditions during the burn. Alternatively, if a patchy fire is desired so as to leave some standing and surface fuels , a fire prescription might call for lower temperature and higher RH. Prescribed burning, however, may not be effective in cases where fuel amount and continuity is reduced by trees and shrubs or heavy grazing. Although fire has the ability to topkill many woody species, with the exception of conifers (such as eastern redcedar) most will regenerate quickly from below ground roots and rhizomes. Importantly, fuel reduction using fire in urban settings requires careful planning and preparation with smoke production being a principal concern.

Prescribed fire designed to reduce woody plant encroachment and fuel loads at Wilson's Creek National Battlefield. HTLN photo.

Patch burn grazing: The synergistic effect of fire and grazing allows for a sustained, heterogeneous fuel across a pasture. The year following burning, grazers focus foraging activities on the burned patches which reduces fuel in the patches and effectively maintains firebreaks. The following year or two, when different patches in the unit are burned, grazers focus on the new patches allowing vegetation (i.e., fuels) in the previously burned areas to begin to recover. Stocking rate is a key feature in determining the rate and amount of fuel accumulation.

Woody plant removal (tree cutting): Woody plants contribute disproportionately to fuel load because of the mass of large-cross-section fuels (branches). Some woody plants also produce volatile compounds that increase flammability. Most importantly, trees intercept light needed for herbaceous species (e.g. grasses) to grow. Removing trees through mechanical means, such as cutting , will quickly reduce fuel loads and canopy light interception. Although for deciduous trees, these effects will only be temporary unless stumps of cut trees and shrubs are treated quickly with herbicides. Increased light for the understory plants is likely to increase productivity and germination which will affect both the amount and type of fuel and subsequent fire behavior. Me-

chanical removal of trees can be expensive. In addition, it is important to consider whether trees will be dropped in place, removed from the site, or masticated on site. Tree cutting is often combined with prescribed fire for more effective fuel reduction and ecosystem restoration.

GETTING HELP

The Great Plains Fire Science Exchange has resources on fire, fire effects, monitoring, and more at http://GPFireScience.org. We can also locate experts to address your fuels questions.

Your county extension specialists from universities, conservation organizations, and the Natural Resource Conservation Service have publications and personnel that can help you develop a plan. Fire experts can also answer your questions online at: http://www.extension.org/prescribed_fire.

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