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TO: Interested Parties
FROM: Andy Kerr
RE: Livestock Grazing Exacerbates Rather Than Reduces the Invasion of Alien Cheatgrass
DATE: 17 January 2020

Most ranchers believe that the invasion of alien cheatgrass into native ecosystems not only harms the ability of their livestock to graze what are or where native bunchgrass-dominated sites, but that the solution to halt and reverse the spread of the nonnative species is more livestock grazing.

It is very difficult to get someone to understand something when their wages, profits, lifestyle, sex life and/or election depend upon them not understanding that something.

There is belief and then there is science. What follow immediately below is a review of the scientific literature in re the spread of cheatgrass and in particular the role of domestic livestock in causing and aiding that spread. It is in a different font to reflect the fact that I did not write it. It was written by a highly qualified expert who must, for anonymous reasons, remain anonymous.

After the scientific review, I (again back in this font) examine how impractical it would be to use domestic livestock as a management tool in the form of early spring flash grazing to address the cheatgrass invasion.

Cheatgrass and other exotic annual grasses are rapidly spreading across the West.

Biological invasions, especially invasion by exotic annual grasses, is consistently cited as among the most important challenges to maintenance of healthy sagebrush communities (Miller et al. 2011; Wisdom et al. 2005; Suring et al. 2005). At least 46 exotic plants occur in sagebrush steppe (Pyke 2000). Estimates of the rapid spread of weeds in the West include 2,300 acres per day on BLM lands and 4,600 acres per day on all western public lands (65 Fed. Reg. 54544).

Cheatgrass (*Bromus tectorum*), an invasive annual grass, is now the dominant species on 100 million acres (158,000 square miles) in the Intermountain West (Rosentreter 1994: 170, *citing* Mack 1981). It was estimated in 1999 that 25 percent of the original sagebrush ecosystem has been converted to cheatgrass/medusa-head rye (*Taeniatherum caput-medusae)* annual grassland, and an additional 25 percent of sagebrush steppe has only cheatgrass as understory vegetation (West 2000). Cheatgrass is estimated to spread at a rate of 14 percent annually in the United States (Duncan et al. 2004: 1412, Table 1). The conversion

of sagebrush steppe to exotic annual grassland has been described as “massive” (Allen 2003) and is expected to continue (Miller et al. 2011; Hemstrom et al. 2002).

Current research indicates domestic livestock grazing contributes to the spread of invasive annual grasses in sagebrush steppe.

Reisner et al. (2013) found that, even after controlling for other factors that may contribute to the spread of cheatgrass, there is a strong correlation between grazing effects and cheatgrass incursion (*see also* Reisner 2015). Cattle grazing increases cheatgrass dominance in sagebrush steppe by decreasing bunchgrass abundance, altering and limiting bunchgrass composition, increasing gaps between perennial plants, and trampling biological soil crusts (Reisner et al. 2013; Knick et al. 2003; *see* Chambers et al. 2016). “These annual grasses tended to fill vacant spaces among native perennial plants creating a continuous fuel for wildfires to burn and spread (Brooks and others, 2004), especially in areas where perennial herbs had been depleted by inappropriate livestock grazing (Reisner and others, 2013)” (Pyke et al. 2015: 4).
Bock et al. (2007) similarly found that “livestock grazing facilitated the invasion [of exotic grasses] into native grasslands, such that the proportion of total grass cover consisting of exotics was 2.5-fold greater on grazed than on ungrazed areas 22 years after we began this study.” Their results demonstrated that livestock grazing served as an exogenous disturbance on the landscape in a manner that was more favorable to exotics than to most native southwestern grasses (Milchunas et al. 1988; Milchunas 2006; Bock et al. 2007). The latest research by Williamson et al. (2019: 12) further support these findings: “[o]ur results suggest a strong positive relation between the probability of presence and prevalence of cheatgrass and livestock grazing, particularly in unburned locations, where resistance to cheatgrass is greater than in burned locations.”

Domestic livestock can degrade biological soil crust, facilitating the spread of invasive annual grasses in sagebrush steppe.

Livestock trampling can reduce and fragment biological soil crust in sagebrush steppe (Warren and Eldridge 2001; Reisner et al. 2013), reducing the susceptibility of the landscape to invasion by *Bromus* and other weedy species in arid ecosystems (Chambers et al. 2016). “Cheatgrass, however, may be less effective at invading areas with an intact biological soil crust (Kaltenecker et al. 1999). This notion is supported by field observations and growth chamber experiments that indicate that the presence of certain types of biological soil crusts decreases cheatgrass germination compared to bare soil (Larsen 1995; Serpe et al. 2006)” (Deines et al. 2007: 2). Damage to the soil crust by livestock hooves can lead to an increase in the number of safe sites in which annual grasses can emerge and establish (Pyke et al. 2016).

The degradation and loss of biological soil crust (a natural barrier to invasive plant species, Reisner et al. 2013) can accelerate cheatgrass invasion in sagebrush steppe. As summarized by Chambers et al. (2017: 37), “biological soil crusts, which are an important component of plant communities in warmer and drier sagebrush ecosystems, can reduce germination or establishment of cheatgrass (Eckert et al. 1986; Kaltenecker et al. 1999). Disturbances or management treatments that reduce abundance of native perennial grasses and biological soil crusts and increase the distances between these perennial grasses often are associated with higher resource availability and increased competitive ability of cheatgrass (Chambers et al. 2007; Reisner et al. 2013, 2015; Roundy et al. 2014).”

Excessive use of grazing may eventually lead to reductions in perennial plants, increases in *B. tectorum* dominance, and ultimately result in the conversion of sagebrush steppe habitats into (annual) grasslands (Pyke et al. 2016). Loeser et al. (2007: 87) found that high-intensity grazing had “strong directional effects that led to a decline in perennial forb cover and an increase in annual plants, particularly *B. tectorum”* in grasslands near Flagstaff, Arizona. In managing for “fire fuels” (including native plants), Chambers et al. (2016: 264) cautioned that “any potential

gains resulting from fine fuel removal by livestock may be counterbalanced by decreased resistance to *B. tectorum* due to herbivory of native plants that compete with *B. tectorum*, increased soil disturbance, and damage to biocrusts (Reisner et al. 2013)."

Cheatgrass evolved with herbivory, rendering persistent and targeted domestic livestock grazing ineffective at controlling continued incursion in sagebrush steppe.

Many annual grasses, including cheatgrass, have evolved grazing tolerance through adaptations over time, often selected through evolution with grazing animals (Strauss and Agrawal 1999). Even targeted grazing management might only impede the spread of cheatgrass temporarily. "As populations of *B. tectorum* decrease in one generation, and in the absence of competition from native perennial plants, the remaining individuals tend to produce more seeds for the next generation compensating for temporary population reductions (Mack and Pyke 1983; Hempy-Mayer and Pyke 2008)" (Pyke et al. 2016: 318-319). Moreover, "[s]eed banks in soil may not be impacted directly by grazing intensities (Clements et al. 2007); therefore, once *Bromus* becomes abundant within plant communities, their seed densities tend to dominate seed banks (Chambers et al. 2015)" (Pyke et al. 2016: 319).

In a study conducted to mimic the impact of frequent grazing, plants were clipped to 2.5 cm in height and then re-clipped two weeks later. Results from the study showed that cheatgrass seeds still dominated the landscape, "calling into question the potential for using livestock grazing as a biocontrol in *B. tectorum*-dominated areas (Hempy-Mayer and Pyke 2008). Grazing tolerance in *B. tectorum* may result from continued growth of its root system despite defoliation (Arredondo and Johnson 2009)" (Chambers et al. 2016: 293).

There is no scientific evidence that domestic livestock grazing can shift site dominance from invasive annual grasses to native perennial plants.

Grazing system designs such as the Green-Brown grazing method (Smith et al. 2012), in which livestock graze when invasive annual grasses are green and native species are brown, is proposed as a biocontrol for annual grasses to help shift dominance to native sagebrush steppe. The U.S. Department of Agriculture (USDA) has investigated this method and determined that "there are no published papers demonstrating success of this method for sagebrush steppe. In addition, if locations for targeted grazing are sage-grouse nesting or brood rearing habitat, then adequate perennial grass height for maintaining habitat guidelines may be required." (Pyke et al. 2017: 27).

The USDA's recent review of best management strategies for preventing unnatural fire in the sagebrush steppe also noted that "[i]n general, improper livestock use, such as heavy grazing during the critical growth period, can decrease perennial grasses and forbs, increase woody biomass (fuel loads), and elevate susceptibility to invasive annual grasses" (Chambers et al. 2017: 83). Williamson et al. (2019: 2) concluded from 14 years of field research that "grazing corresponds with increased cheatgrass occurrence and prevalence regardless of variation in climate, topography, or community composition, and provide no support for the notion that contemporary grazing regimes or grazing in conjunction with fire can suppress cheatgrass."

Science-based prescriptions are available for managing livestock grazing to avoid contributing to the spread of invasive annual grasses.

Research conducted on invasive grasses found that cheatgrass and clasping pepperweed (*Lepidium perfoliatum*, a non-native mustard) out-compete native grasses where vegetative communities are stressed by higher surface temperatures, limited moisture and grazing pressure (i.e., on south facing slopes) (Reisner et al. 2015). Managing grazing to maintain soil and hydrologic functioning and capacity of native perennial herbaceous species, especially perennial grasses, should help native plants to compete effectively with invasive plant species

(Chambers et al. 2017). The U.S. Geological Survey recommends adjusting and even suspending livestock grazing as part of a passive restoration program to maintain and reestablish resilient sagebrush steppe (Pyke et al. 2015).

Reisner et al (2013) provided clear, science-based prescriptions for managing grazing to avoid contributing to the spread of invasive annual grasses such as cheatgrass:

> "If the goal is to conserve and restore resistance of [big sagebrush] systems, managers should consider maintaining or restoring:
>
> (i) high bunchgrass cover and structure characterized by spatially dispersed bunchgrasses and small gaps between them;
>
> (ii) a diverse assemblage of bunchgrass species to maximize competitive interactions with *B. tectorum* in time and space; and
>
> (iii) biological soil crusts to limit *B. tectorum* establishment. Passive restoration by reducing cumulative cattle grazing may be one of the most effective means of achieving these three goals" (Reisner et al. 2013: 1).

Early Spring Flash Grazing = Fat-Free Hot-Fudge Sundae

If only there was such a thing as a delicious fat-free hot-fudge sundae, but alas there is not.

The life history of annual cheatgrass is that is "greens up" early in the spring and then soon dries out (cures) and goes to seed. When invasive cheatgrass are green and palatable, the native bunchgrasses on the site are still comparably unpalatable (and less nutritious) as they have greened up yet.

After cheatgrass dries out it is unpalatable to domestic livestock, especially when adjacent to very palatable native bunchgrasses. In many places cheatgrass greens up is before the usual turnout time for livestock grazing on federal public lands, which is timed for the consumption of palatable perennial bunchgrasses.

The rancher solution is to turn livestock out early just when cheatgrass is greening up some that livestock heavily graze it, thereby knocking back the cheatgrass. There are several problems with this approach.

1. *Timing is everything.* If domestic livestock grazing is to be useful in knocking back the cheatgrass, it must occur promptly upon cheatgrass green-up. Highly dependent upon spring temperatures and moistures, the cheatgrass green-up can vary by several weeks and cannot be predicted far in advance. A rancher would have to have livestock at the ready to be trucked as soon as called by a qualified expert monitoring the vegetation.

2. *The time is short.* Cheatgrass green-up lasts but few weeks. If the livestock remain they soon turn to the palatable native bunchgrass, which is not good for allowing native bunchgrasses to resist the alien cheatgrass.

3. *Hammering the alien grasses is one thing, while hammering the native grasses is quite another*. The best way for the native bunchgrasses to resist the alien cheatgrass is to be healthy and with a large root system that allows it to dominate the site against cheatgrass and outlast the cheatgrass in drought. Grazing native bunchgrasses may cause the above-ground portion of the

plant to respond with more growth, but it is at the overall expense of a smaller below-ground reservoir of biomass and nutrients.

Grazing public lands for just a few very carefully timed weeks may perhaps be somewhat helpful to knocking back the cheatgrass, but it knocks an even bigger hole in the business plan of a public lands rancher. That's why they are proposing not just early spring flash grazing, but early spring, all summer, and late fall grazing.

And, in the end, such grazing simply will not work to reduce cheatgrass. As the BLM has acknowledged,

> *"[i]ntensive livestock grazing is often suggested for controlling cheatgrass competition. Although targeted grazing may have some applications for fuels management, it is not effective in reducing cheatgrass competition…. During the short time when cheatgrass is highly palatable in the spring, a sufficient number of livestock cannot be concentrated on a small enough area to reduce the cheatgrass seed significantly or reduce cheatgrass seed lying on the soil surface. In addition, this type of grazing can be detrimental to remaining perennial grasses, opening the site up for further cheatgrass expansion in the future."* (Idaho/Southwest Montana Greater Sage-Grouse DEIS, 2014: 3-64 – 3-65).

As long as the native bunchgrasses (and wildflowers) continue to be hammered by livestock, they will not recover.

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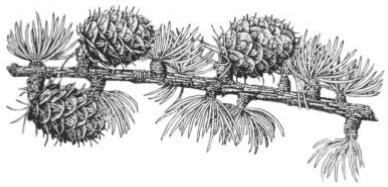

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