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Commercial Livestock Production on Federal Public Lands: Environmental Destruction at Taxpayer Expense

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Western Turf Wars: The Politics of Public Lands Ranching

I. Overview of Federal Public Lands Grazed By Livestock

Approximately 98% of all livestock grazing on federal public lands in the US occurs in the eleven western states. The remaining 2% is mostly in the Midwest, where about 325,000 acres of Bureau of Land Management (BLM) lands and several million acres of Forest Service lands (including National Grasslands) are open to ranching. Approximately 100,000 acres of National Forest in the East and some other non-western federal lands are commercially grazed. (Jacobs 1991: 21)

The US Forest Service and BLM administer 85% of western public ranchland—about 260 million acres, or an area the size of the 14 eastern seaboard states plus Missouri. Of this 85%, the BLM administers 63% (163 million acres) and the Forest Service administers 37% (97 million acres). Roughly 90% of western BLM and 70% of western Forest Service land is managed for ranching [outside of Alaska]. (Jacobs 1991: 21)

National wildlife refuges (NWRs), administered by the US Fish & Wildlife Service, are the only federal lands in the US where wildlife has officially been given higher priority than recreational and commercial activities. Federal law states that no recreational or commercial use shall be permitted on these lands unless the secretary of the Interior determines that these activities are compatible with the primary purposes for which refuges are established. As of 1991, according to Jacobs (1991: 470), 156 of the 368 NWRs in the seventeen western states and Pacific Islands allowed commercial livestock grazing and/or haying.

In the eleven western states, the National Park Service (NPS) currently administers twenty-three national parks, forty-seven national monuments, eleven national recreation areas, and seventeen national memorials, historic sites, historic parks, battlefield parks, seashores and such. These ninety-eight NPS units cover about 17 million acres, or 2.3% of the West. Somewhat less than 3 million acres of this land is open to commercial ranching, including seven national parks, seven national monuments, five national recreation areas, and seven national memorials (Jacobs 1991: 473)

II. Economics of Public Lands Grazing

The federal grazing program, which benefits a relatively small number of individuals, is heavily dependent on taxpayer subsidies.

A. Direct and indirect annual subsidies may reach $500 million (Hess and Wald 1995), which include $180 million for the BLM grazing program (Nelson 1996: 4) and $13.9 million for Wildlife Services' pest and predator control (Predator Project 1997: 4).

B. Although the US Department of Agriculture's Farm Service Agency is mandated to give emergency livestock feed relief to ranchers only in periods of extreme drought, in practice it hands out $100 million to $500 million annually during both dry and wet years. (Holechek 1995) "In effect, emergency feed relief creates artificial drought by subsidizing overgrazing. It allows ranchers to run a grass deficit. Each year that they overstock and overgraze—irrespective of rainfall—their rangelands produce less grass, and with less grass their need for drought relief mounts." (Hess and Holechek 1995)

C. Federal subsidies benefit approximately 22,350 livestock operators (2.3% of the operators in the contiguous 48 states) (US Department of Interior 1994: 3-65), who collectively produce only about 2% of the US beef supply (Committee on Government Operations 1986). The approximately 4,600 sheep producers with federal permits (US Department of Interior 1994: 3-65) represent about 4% of US producers (Vegetarian Voice 1991: 13).

D. Control of the majority of federal forage is concentrated in the hands of a relatively small percentage of permittees. For example, the largest 24.4% of permittees on US Forest Service lands control 79% of the forage (General Accounting Office 1993), while an even greater concentration of power exists among BLM permittees, the largest 9.1% of whom control 74% of the forage (General Accounting Office 1992). Hence, it is these large private and corporate ranchers to whom most of the federal subsidies accrue.

E. In the eleven western states livestock grazing on federal public lands provides only 0.06% of the jobs (<18,000) and 0.04% of the income (Power 1996: Table 8-2).

F. Recent research shows that most rural counties have little economic dependence on federal grazing. of 102 counties in the seven state region encompassing the Columbia River Basin, only eleven counties were found to have more than 1% of total income or employment associated with public land grazing. (Power 1999) (federal forage in this region represents about a third of the total federal grazing supply in the eleven western states.) of the eleven counties exceeding the 1% threshold only Clark (Id) had an income dependency exceeding 2%, and a job dependency exceeding 3.5%. (Power 1999)

III. Environmental Impacts of Livestock Production

Managing our public lands for livestock production has resulted in a domestication of our ecosystems. Numerous unfavorable consequences for the environment ensue from the devices installed and actions taken on behalf of livestock.

A. Fencing

1. "Fences … can obstruct wildlife (particularly pronghorn antelope) movements, even to the point of fragmenting habitat and causing reduced vigor and mortality. Barbed wire fences cause injuries or mortalities when animals such as deer attempting to jump or pass through the fence get entangled in the strands. The cleared rights-of-way along fences and roads facilitate the invasion of weedy species." (Donahue 1999: 127)

2. "Although most North American ungulates can move through or over traditional three-wire barbed-wire fences, some problems exist. First, not all fences are as loosely constructed, and tighter fences such as woven wire can severely impede movement of native wildlife. Pronghorn antelope are particularly limited in their ability to cross fences, and woven wire fences can effectively fragment their habitat and ultimately cause population decreases or extirpation … Second, even though species such as mule deer can and do easily jump fences, a certain number (especially juveniles) get tangled in them and die every year. In times and areas where these animals abound, these losses may not limit population densities. However, as populations decline, such losses become more significant." (Noss and Cooperrider 1994: 241)

3. Fencing of riparian areas can entangle wildlife, and can trap and concentrate cattle along streams. (Ohmart 1996: 271)

B. Water Developments

1. Data obtained by Burkett and Thompson (1994) implied that definitive effects of artificial water sources on native wildlife species were not detectable.

2. Most stock tanks are dirt. Ranging from bathroom-sized to acres in area, they are scraped into the earth with bulldozers, backhoes, and graders. This often involves bringing heavy equipment across land never even driven on before. (Jacobs 1991: 211) "Wildlife tends to shun these stock tanks, which are usually little more than nearly sterile, viscous mudholes frequented by hordes of bellowing cattle. Many large wild animals actively avoid cattle and/or sheep (and their smell), and thus tanks. Most small animals have been killed off or forced away from sacrifice areas, and many of those in surrounding areas may refuse to cross the wide 'zones of nothing' around tanks, especially with livestock present." (Jacobs 1991: 216–17) "In sum, stock watering developments are ugly sores upon the land. They harm ecosystems by bringing ranching degradations to areas that had little or no ranching

previously." (Jacobs 1991: 219) See Jacobs (1991: 211–20) for a more thorough description of water developments and their impacts.

3. "[D]eveloping water sources for livestock often involves taking water from streams, springs, or seeps, where it was used by native plants and animals, and moving it somewhere else for livestock. In other cases, springs have been drilled, resulting in overuse of aquifers and eventual drying up of water sources historically used by native species. Areas around natural water or water developments tend to become sacrifice areas when livestock are present. Livestock typically denude these areas of vegetation and compact the ground. Of little value to any native species, sacrifice areas do provide nodes for establishment of exotic plants and diseases." (Noss and Cooperrider 1994: 242, 244)

C. Pest and Predator Control

1. In fiscal year 1996 Wildlife Services killed nearly 100,000 predators in the West. Livestock protection accounts for 69% of its western state office expenditures of federally appropriated funds. Aerial gunning and spring-loaded sodium cyanide traps are the most common methods of lethal predator control used by Wildlife Services in the West, and neither of these methods are able to only target depredating individuals. (Predator Project 1997: 2)

2. See Jacobs (1991: 252–314) for a thorough presentation of the types of animals killed on behalf of the livestock industry: grizzly bear, black bear, wolf, coyote, fox, mountain lion, jaguar, ocelot, jaguarundi, golden eagle, bald eagle, California condor, raven, deer, pronghorn, bighorn, buffalo, elk, horse, burro, prairie dog, jackrabbit, kangaroo rat, pocket mouse, pocket gopher, grasshopper, rattlesnake, etc., and the methods used to kill them: guns, poisons, traps, denning, dogs.

3. "Most controlled species, such as wolves, coyotes, and mountain lions, are at or near the top of the food chain and may often influence the structure and function of the entire ecosystem. For example, predators may not only limit abundance of prey at times, but they may strongly influence their distribution and movement patterns, thereby influencing impacts of herbivores on vegetation. One can make a good case that all large predators are likely keystone species. Thus, where wholesale predator control (i.e. attempts to extirpate or drastically reduce densities of predators over a large area) is a component of livestock management, then livestock grazing must be considered a serious treat to biodiversity even if direct effects on vegetation are minimal." (Noss and Cooperrider 1994: 242–43)

4. As of 1919 prairie dog colonies covered some 40 million hectares, more than 20% of the short-grass prairie landscape in the US. "Today 98% of those populations have been eradicated in an ongoing control effort by range managers who view prairie dogs as pests that reduce the amount of grass available to cattle. … The short-grass areas [Prairie dogs] help

create provide food or shelter for many other animals, from pronghorn antelope and bison to mice and burrowing owls. In addition, the defensive encampments they build attract a plethora of predators from hawks, coyotes, snakes, badgers and bobcats to black-footed ferrets." (Baskin 1997: 165–66)

5. "Approximately 170 vertebrate species rely at some level on prairie dog activity for survival (Reading 1993), and the presence of prairie dogs favors plant diversity and increases grasses and forbs grazed by livestock and big game (Bonham and Lerwick 1976)." (Miller et al. 1994: 678) "[E]radication of prairie dogs from large areas has led to near extinction of black-footed ferrets (*Mustela nigripes*). Recently, mountain plovers (*Charadrius montanus*), ferruginous hawks (*Buteo regalis*), and swift foxes (*Vulpes velox*) have been proposed as candidate species under the US Endangered Species Act, and their listing proposals cited prairie dog poisoning as a factor in their decline." (Miller et al. 1994: 678–79)

D. Fire Control

1. "On the overgrazed lands of the Southwest, fire suppression has allowed woody species such as big sagebrush, pinyon pine, and juniper to invade millions of acres of what were previously grasslands or mixed grassland/shrublands, profoundly changing their ecological characteristics." (Cooperrider, Wilcove et al. 1995: 69–70)

2. Negative effects of prescribed burning:

a. reduction or elimination of natural fires causing reduction or elimination of native fire-dependent species;

b. destruction of brushland and dependent wildlife;

c. in forests, a reduction of foliage height diversity, creating a 2-layered instead of multi-layered forest, with attendant reduction in wildlife diversity;

d. in grass/shrublands, diminishment of native species along with target shrubs;

e. because organic litter doesn't have time to rebuild and all of each target area is burned, there is more frequent and more complete loss of energy stored in ground litter than with natural fires;

f. more frequent and more complete elimination of wildlife cover at ground level than with natural fires;

g. recurrent short-term elimination of ground level food supplies needed by wildlife;

h. because prescribed fire is managed to burn all of a target area evenly … there is increased danger of pest and disease outbreaks;

i. because prescribed burns provide much less diversity of impact than natural fires, there is a reduction in biome diversity;

j. most natural fires burn near the end of or following growing seasons, after most animal inhabitants have finished breeding. Prescribed burning often is done preceding or early in growing seasons, when it may hamper breeding, destroy nests, and kill small animals. (Jacobs 1991: 243–44)

E. Roads

1. "Each linear mile of dirt road ruins an average of approximately 4 acres of ecosystem. Accordingly, western public land's minimum of 500,000 miles of official and de facto ranching roads represents a bare area of about 2 million acres—about the size of Delaware and Rhode Island combined." (Jacobs 1991: 223)

2. Roads block waterways and drainages, hamper interrelationships, fragment habitat and create edge effects. They act as barriers to the normal movement and activity of native animals and they serve as corridors for the spread of opportunistic plants and associated pests and pathogens. (Jacobs 1991: 224)

F. Vegetation Management

1. "Livestock grazing is frequently accompanied by the massive manipulation of vegetation to increase forage production. This includes such practices as herbicide spraying, plowing and seeding, mechanical control such as chaining (the practice of removing brush by dragging a heavy anchor chain between two Caterpillar tractors), and controlled fire." (Cooperrider et al. 1995: 78)

2. "Major herbicides used on public ranges include 2,4-D, Picloram, Dicamba, Atrazine, Dalapon, Tebuthiuron, Glyphosate, and Hexazinone. Of these, 2,4-D accounts for a large percentage of acreage treated." (Jacobs 1991: 237) "Herbicide is used to kill sagebrush, snakeweed, mesquite, acacia, shadscale, greasewood, creosote, scrub oak, manzanita, rabbitbrush, other brush and shrubs, juniper, pinyon, tamarisk, cacti, yucca, and a great variety of 'weedy' plants and livestock-unpalatable grasses." (Jacobs 1991: 238)

3. "Unfortunately, few if any vegetation manipulation projects have been carried out to restore biodiversity or even species diversity. Rather, these projects have been conducted with the single-minded purpose of increasing livestock forage, and they have been evaluated by their success in achieving that limited objective over a short time period.

Vegetation manipulation to restore or increase livestock forage can severely affect biodiversity and should not be confused with the more difficult task of restoring biodiversity on rangelands." (Noss and Cooperrider 1994: 243)

G. Fragmentation and Degradation of Aquatic Ecosystems

The major consumer of water in the West isn't golf courses or suburban lawns. It is agriculture. And the primarily use of agricultural water diversion and irrigation in the West is production of forage for livestock. The dams and reservoirs on our rivers have severely altered natural waterways in numerous ways with detrimental consequences for native species. The removal of water from streams or by groundwater pumping and subsequent dewatering of aquifers has been one of the major factors that has led to the decline in native fish throughout the West. Dewatering can eliminate spawning habitat, or change water quality to favor non-native exotics. In either case, native species have suffered greatly from livestock production.

1. "Nearly 90% of the water taken out of streams in the Colorado River basin is used for irrigation to grow hay and other crops for livestock, according to a 1982 Living Wilderness article." (Wuerthner 1990)

IV. Livestock as Agents Destructive of Native Biodiversity

Cattle and domestic sheep, as animals exotic to all the ecosystems encompassed by our public lands, are themselves agents for degradation and destruction of native biodiversity, native bioproductivity, soil quality and water quality. Here are the principle ways in which these impacts occur.

A. Truncated Nutrient Flows

Under natural conditions forage goes into native species that subsequently die and provide food for scavengers and decomposers. When we put forage into a cow, we remove them and their biomass from the landscape. Furthermore, since cattle consume forage that would otherwise support native herbivores, even a "predator friendly" rancher is negatively affecting native predators like wolves by effectively reducing the prey base. (Jacobs 1991: 111–21; Public Employees for Environmental Responsibility 1993: 10–13) "The climax species—Bison, Bighorn Sheep, and Pronghorn Antelope have declined the most, perhaps existing today at less than 5 percent of their primeval numbers." (Wagner 1978: 139)

B. Exotic Weeds

Almost nothing has contributed more to the spread of exotic weeds than livestock. Not only do livestock degrade soils, trample soil crusts (that can prevent the germination of weedy species), but they selectively remove desirable species, giving weedy species an advantage in the race for water and nutrients. Plus cows help to spread the seeds of exotics. This is not to suggest that other factors aren't also contributing to the spread of weeds, but cows are undeniably one of the chief factors in their spread. Consider these findings:

1. Alien annual grasses such as cheatgrass and medusahead and forbs such as the starthistles and knapweeds and leafy spurge have invaded over 40 million hectares of western grasslands, shrublands, and woodlands. (Mack 1989; Whisenant 1990; Billings 1990; Pellant and Hall 1994)

2. Invasion by nonindigenous species are suspected of being the second main cause, following loss of habitat, for the listing of all threatened and endangered species in the United States (Flather et al. 1994; Wilcove et al. 1998)

3. "[W]ater tanks and ponds developed for livestock, and the roads constructed to access them, act as loci for weed spread. These disturbed sites are highly invasible (Rickard 1985; Tolsma et al. 1987), and act as conduits for invasion into surrounding communities." (Gelbard and Belsky 2000: "Livestock As Vectors Of Nonindigenous Plants")

4. Nonindigenous plant species are most likely to invade sites that experience disturbances that differ in type or frequency from their natural disturbance regimes. Native wildlife species do not appear to be major causes of weed invasions. (Schiffman 1997)

5. "[R]eports of serious weed infestations in ungrazed [by livestock], undisturbed grasslands and shrublands appear to be limited." (Gelbard and Belsky 2000: "Can Ungrazed Communities Resist Invasions of Nonindigenous Species?")

6. "This review suggests that nonindigenous plants will continue to spread through arid and semi-arid grasslands, shrublands, and woodlands in the western United States unless selective grazing, nutrient redistribution, and soil disturbances by livestock are greatly reduced." (Gelbard and Belsky 2000: "Abstract")

C. Social Displacement of Native Wildlife

Some wildlife species such as elk and antelope avoid areas that are actively being grazed by domestic livestock and are thus socially displaced into other habitat. Whether this habitat is less desirable or exposes the animals to greater predation or other impacts is seldom considered.

1. In a study of female mule deer in the Sierra Nevada, Loft et al. (1991: 24) suggest that high quality forage may be limiting on summer ranges grazed by cattle, thus contributing to suboptimal nutrition for female deer and their offspring.

2. In central Arizona with moderate stocking of cattle, significantly ($P<0.05$) fewer elk and mule deer were seen on pastures grazed by cattle than on pastures not grazed by cattle. "Use of habitats by elk shifted from open mesic and silviculturally disturbed areas to more closed forest after cattle were introduced." (Wallace and Krausman 1987: 80)

D. Water Quality

Livestock production is the greatest source of non-point water pollution in the West. (Royte 1990) Nearly all surface waters in the West are fouled with livestock-related contaminants. (Suk 1986) Since cows like to linger near streams and other water sources, they deposit a disproportionate amount of manure and urine in waterways. Pollution not only affects water for human consumption, but can change the chemical properties and clarity of waterways contributing to the decline of native aquatic life. Examples:

1. Overgrazing by livestock destroyed microhabitats frequented by California golden trout. (Matthews 1996)

2. Chronic, moderate siltation, such as that experienced downstream from cattle crossings (Armour et al. 1991), can reduce the quality of food resources for insects that feed on algae and other microorganisms that cover exposed substrates (Davies-Colley et al. 1992).

3. Stream channel fenced from livestock afforded the opportunity to compare sediment loads above (in livestock-grazed area) and below the fenced area. Sampling done at three run-off periods showed reduction in sediment loads of 79%, 48% and 69% respectively after flowing through 3.5 miles of protected channel. (Winegar 1977: 12)

4. Cattle have been shown to produce 5.4 billion fecal coliform and 31 billion fecal streptococcus bacteria in their feces per day. Since cattle spend a significant portion of their time in or near streams, lakes and wetland areas and average twelve defecations per day, they can contribute significant numbers of these organisms to surface waters. (Howard et al. 1983)

5. "Livestock excrement deposited along stream banks and directly to channels elevates stream water concentrations of inorganic phosphorus and nitrogen (Lemly 1982; Mosely et al. 1993). This fertilization of stream water can result in an increased production by heterotrophic and autotrophic microbes that, when current velocities are low, can drastically reduce dissolved oxygen concentrations (Harris et al. 1994; Fleischner 1994)." (Strand and Merritt 1999: 17)

E. Trampling of Microbiotic Crusts

Microbiotic crusts (also referred to as biological, cryptobiotic, cryptogamic, or microphytic crusts) typically grow on the interspaces between grasses and shrubs throughout the Great Basin Desert, the semideserts of the Colorado Plateau and in many pinyon-juniper communities of Utah, Nevada, Arizona, Colorado, New Mexico and Wyoming. These soil crusts reduce soil erosion, act as a mulch trapping moisture in the soil, capture atmospheric nitrogen and make it available to soil and plants, and prevent the germination of seeds—particularly annuals that are typically "weeds" (Gelbard and Belsky 2000). (Anderson et al. 1986) Trampling by livestock can and does destroy these crusts, particularly in ecosystems

where large herds of native herbivores have been restricted or absent for thousands of years. Example studies:

1. "Both total cryptogamic cover and number of cryptogamic species decreased under grazing pressure." (Anderson, Harper and Holmgren 1982: 180) "Grazed areas supported only one-tenth as much moss cover, one-third as much lichen cover and about one-half as much algal cover as did the areas within exclosures. The number of lichen and moss species per 0.25 square meter was reduced by about 50% on the grazed transects." (Anderson, Harper and Rushforth 1982: 357)

2. "In the most arid communities of the Agropyron Province (caespitose grasses), cryptogams cover all undisturbed soil surfaces not occupied by vascular plants; such cryptogam cover may exceed 50% on a unit area basis." (Mack and Thompson 1982: 764)

"Presence of large ungulates even at low density in the Agropyron Province results in rapid, permanent loss of cryptogams through trampling. In turn the broken cryptogam crust is a major source of microsites for alien grass establishment. Prior to domestic livestock introduction common ungulates were small (e.g., pronghorn antelope versus cow/bison, 70 vs. 500 kg) and/or present in low numbers; their localized trampling damage could be tolerated even by communities ill-equipped to cope with such disturbance. It appears that herbivorous mammals are incompatible with maintenance of steppe where cryptogams (particularly crustose lichens) occupy a significant fraction of the soil surface." (Mack and Thompson 1982: 764)

3. "Observations of recovery of cryptobiotic crusts from trampling by livestock at three sites in Utah yielded estimates for full recovery of 45–85 years. … Moss recovery was much slower than that of the lichens. At two of the three sites where mosses were found, no moss recovery at all was seen. … At the third site, where some recovery was seen, full recovery of moss cover would take over 250 years at the observed rate of recovery." (Belnap 1993: 94)

F. Destruction of Riparian Areas

Riparian areas, though limited in overall acreage, are among the most biologically important areas. "[I]n the Great Basin of southeastern Oregon, more than 75% of terrestrial wildlife species are dependent upon or use riparian habitats. In southeastern Wyoming more than 75% of all wildlife species depend on riparian habitats. In Arizona and New Mexico 80% of all vertebrates depend on riparian areas for at least half their life cycles: more than half of these are totally dependent on riparian areas. Riparian areas provide habitat for more species of birds than all other western rangeland vegetation types combined. More than half of all bird species in the southwestern US are completely dependent upon riparian areas." (Chaney et al. 1990: 2)

1. Cows love water. They concentrate most of their daily activity in and near streams. As a consequence they have damaged approximately 80% of the streams and riparian ecosystems in the arid regions of the western United States. (US Department of Interior 1994)

2. "[E]xtensive field observations in the late 1980s suggest riparian areas throughout much of the West were in the worst condition in history." (Chaney et al. 1990: 5)

3. "Livestock grazing was found to negatively affect water quality and seasonal quantity, stream channel morphology, hydrology, riparian zone soils, instream and streambank vegetation, and aquatic and riparian wildlife. No positive environmental impacts were found. Livestock also were found to cause negative impacts at the landscape and regional levels." (Belsky et al. 1999: 419)

4. Yes, one can fence cows out of riparian areas, but this is both expensive, and often merely transfers use to uplands that also have other no less important ecological values. Consider a rough estimate of the financial cost of riparian fencing just on western BLM lands. Fencing costs per mile have been estimated at $8,000 to $12,000. (Oppenheimer 1996) There are reportedly 36,631 linear miles of riparian zones on BLM lands in the 10 western states (Washington not reported). (Bureau of Land Management 1998: Table2-2) Assuming that the number of riparian miles grazed by livestock is directly proportional to the percentage of western BLM lands that are grazed by livestock, i.e. 94% (Fleischner 1994: 630), gives 34,433 riparian miles subject to livestock impacts. Fencing these areas would cost between $275 million and $413 million. BLM lands provide approximately 13,303,068 animal unit months (AUMs) of livestock forage annually (US Department of Interior 1994: Fig. 2-5), at $1.35/AUM (as of FY 2000). Only half of this money is allocated for range development by the BLM. This amounts to less than $9.0 million annually available for all range improvements of which fencing is just one consideration.

G. Destabilization of Fire Regimes

In much of the West, fire was the major recycling agent and an important factor in structuring ecological communities. By repeatedly removing the fine litter on grasslands and in forested communities, livestock have substantially changed the role of fire in many ecosystems with disastrous consequences for natural communities. Examples:

1. Permanent invasion of North American grasslands by woody plants: "Field observations and experiments indicate that mesquite trees initiate these invasions, as individual trees appear in the grassland and become foci for clusters of other shrubs that develop in their vicinity. Livestock apparently play a dual role in mesquite invasion. First, they eat mesquite beans and disperse the seeds in their dung. Second, they graze away grass cover that otherwise can (1) outcompete mesquite seedlings and (2) carry fires that kill the young woody plants." (Bock and Bock 1995: 200)

2. Alteration of dynamics of upland forests of the interior West: By reducing the abundance of fine fuels which formerly carried frequent, low-intensity fires through forests, livestock contribute to the formation of shade-tolerant, but fire-sensitive dense stands highly susceptible to damage by insects and pathogens. This further contributes to the likelihood of stand-replacing fires. An example of the difference in forest density that can result from livestock grazing was provided by Rummell (1951) and summarized by Belsky and Blumenthal (1997). Two areas, distinguished only by the grazing of livestock, differed markedly in the density of small-diameter trees: 85 per acre in the ungrazed region compared to 3,291 per acre in the grazed.

H. Disease Transmission

Many native wildlife species are vulnerable to diseases transferred to them from domestic livestock. Whether that is bighorn sheep which suffer from diseases they contract from domestic sheep or a disease like brucellosis that is causing bison to be shot in Yellowstone to please the livestock industry, the presence of domestic livestock often poses a real threat to native wildlife populations. Examples:

1. "Blue tongue is probably the most serious disease of pronghorn, and cattle are a primary reservoir for this disease. Cattle do not develop clinical or acute symptoms, but are chronic carriers (Thorne et al. 1983)." (Yoakum et al. 1996: 219)

2. "Bever (1957) reported 30–40% losses of pronghorn fawn crops on rangelands heavily grazed by domestic sheep in South Dakota. Bever (1957) also reported that pronghorn had higher parasite loads on rangelands grazed by domestic sheep than rangelands grazed by cattle. In Wyoming, illness and deaths of pronghorn fawns have been attributed to parasitic infections that were prevalent on rangelands grazed heavily by sheep." (Yoakum et al. 1996: 221)

3. "Co-use of ranges by domestic and bighorn sheep has been consistently linked with declines, die offs, and extinctions of bighorn populations from historical to recent times." (Goodson 1982)

I. Forage, Water and Space Competition

If we are devoting the majority or even a significant minority of our public lands forage, water, and space to privately owned livestock this only comes at the expense of native species. There is only so much forage. A blade of grass going into a cow is that much less grass for grasshoppers or voles to eat. Fewer grasshoppers or voles means less food for foxes, hawks and trout. Water developments for livestock often results in less water for streams and springs—and less water for native species from trout to otter. Even the mere presence of cows can effectively displace native species. While wolves and grizzlies may not avoid cattle, landscape dominated by cattle are effectively off-limits to these predators. And the

reason bison have not been restored to much of the public lands that are suitable for them is the political opposition from ranchers and use of public lands by their domestic livestock.

V. Conclusion

The environmental damage inflicted by livestock production on federal public lands is not justified by social nor economic benefits. The federal grazing program should be fazed out and terminated.

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