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**IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF OREGON**

OREGON NATURAL DESERT ASS’N et al.,

Plaintiffs,

v.

BUREAU OF LAND MANAGEMENT et al.,

Defendants.

Case No. 03-CV-1017-JE

**DECLARATION OF
JONATHAN L. GELBARD, Ph.D.**

I, JONATHAN L. GELBARD, Ph.D., declare and state as follows:

1. I am a professional biologist with a B.S. in Natural Resources from Cornell University (1995), a MEM (Master’s degree in Environmental Management) from Duke University’s Nicholas School of the Environment (1999), and a Ph.D. in ecology from the University of California at Davis. Between undergraduate work at Cornell and graduate work at

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Duke, I explored how different stakeholders approach environmental issues from different points of view. This work included the following: I was a vegetation and geographic positioning systems (GPS) technician for The Nature Conservancy's New Mexico Natural Heritage Program, during which time I worked with ranchers and state and federal agency officials as part of the Malpais Borderlands Group (1995); a research assistant with the U.S. Forest Service coauthoring proposals to study potential biological impacts of air pollution on Colorado's Mt. Zirkel Wilderness (1996); a weed survey technician in for the A.G. Crook Company on U.S. Bureau of Land Management (BLM) forest lands of the Western Cascade mountains (1996); and an intern for the Oregon Natural Desert Association, where I reviewed literature concerning relationships between public land management, the spread of exotic plant species, and the status of rare strains of desert trout (1996–1997). During my training as a biologist, I have explored questions in community, ecosystem, and landscape ecology in desert, grassland, oak and juniper savanna, and forest ecosystems in Oregon, Nevada, Utah, New Mexico, Arizona, California, North Carolina, New York, and New Hampshire. I have published 2 peer-reviewed scientific journal articles on arid-land ecosystems examining how human disturbances such as roads, off-road vehicles (ORVs), and livestock grazing can influence the distribution of native vs. non-native plant species differently depending on the soil type, topography, and geographic region of a site. I will soon submit 3 additional peer-reviewed papers to scientific journals; two that report my findings concerning relationships among distance from roads, grazing, climate, and the spread of invasive non-native plant species, and one that proposes means of improving translation of environmental science into management and policy decisions, including by elucidating relationships between environmental quality, economy, and quality of life. My curriculum vita is attached as Attachment A.

2. My interest in the biology, management, and restoration of desert and grassland ecosystems comes from my research on the invasions of pristine and disturbed semi-arid desert, grassland, savannah, and woodland habitats by non-native plant species (referred to as “weeds” in this document) in western North America. Most recently, I published scientific journal articles concerning relationships among roads, livestock grazing, and site characteristics on patterns of native plant persistence and non-native plant invasions in the scientific journals, *Conservation Biology* (co-authored with U.S. Geological Survey biologist, Dr. Jayne Belnap) and *Ecological Applications* (co-authored with Professor Susan Harrison, Director, UC Davis Natural Reserve System). In addition, I co-authored a scientific review paper on invasions of weeds into western rangelands, entitled “Livestock Grazing and Weed Invasions in the Arid West,” published by the Oregon Natural Desert Association (Attachment B). The paper is currently being revised for publication in a peer-reviewed scientific journal. I also have currently in review with the journal *Landscape Ecology* a paper titled, “Effects of landscape structure on native and exotic plant diversity in California grasslands.” Just recently, I also helped to co-organize a workshop on improving translation of environmental science into management and policy decisions (specifically related to the spread of invasive non-native species). Participants included officials from State of California land management and commerce agencies, The Nature Conservancy, the Ecological Society of America, and university ecologists, economists, and political scientists.

3. The problems of the spread of invasive non-native plant species and the destruction of biological soil crusts (living crusts composed of lichens, mosses, algae, and cyanobacteria that cover the soil surface between individual grasses, shrubs, and trees) are recognized, virtually by scientific consensus, as two of the greatest threats to desert ecosystems of the Intermountain West, including southeastern Oregon. Species-rich ecosystems are being

converted into monotonous weedlands as aggressive weeds replace native grasses and flowering plants, alter nutrient cycles and fire frequency, and degrade habitat for native wildlife, at the same time decreasing real estate values and the land's capacity to provide livestock forage. Intertwined with the spread of weeds is the ongoing destruction of biological soil crusts. Recent scientific reports, including some authored by the BLM's own scientists, have warned that continued large-scale destruction of these crusts will result in region-wide decreases in the levels of soil fertility required to support healthy native plant communities and the animals that depend on them. Two of the major causes of these problems are livestock grazing and ORV use, and thus scientifically-informed, well-planned management of these activities is required to prevent them from causing and exacerbating weed invasions and destroying biological soil crusts.

4. I have reviewed the final and proposed Southeastern Oregon Resource Management Plan and Final Environmental Impact Statement (hereby referred to as "SEORMP"). As part of my review, I evaluated whether the SEORMP is supported by scientifically sound conclusions based on its methods and the best available scientific information. I will divide this statement into four sections that relate my knowledge to the scientific basis of the land management measures analyzed by the Final Environmental Impact Statement for the proposed RMP. The areas that I will address pertain to (1) threats to the ecological structure (i.e., plant community composition) and function (e.g., nutrient cycles) of these southeastern Oregon ecosystems that I am best versed to address based on my experience, including (a) the spread of invasive weeds, and (b) the destruction of biological soil crusts; and (2) the SEORMP's proposed management of the land uses that are the major causes of these threats, including (a) livestock grazing, and (b) roads and ORV use.

I. THREATS TO SOUTHEASTERN OREGON ECOSYSTEMS

The biology and management of invasive weeds

5. Invasions by non-native (also referred to as “alien,” “non-indigenous” and “exotic”) weeds, are possibly the greatest threat currently facing grasslands, shrublands, and low-density (or open) forests of southeastern Oregon. The problem of invasive non-native species is so severe that the President signed an executive order in 1999 to combat their spread.

6. There are numerous reasons for the current rapid spread of weeds throughout southeastern Oregon. The process starts with the increasingly widespread transportation of weed seeds from infested areas into uninfested areas by cars, trucks, horses, hikers, ORVs, domestic livestock, wind, and native wildlife. Since healthy, densely vegetated plant communities with intact biological soil crusts provide few opportunities for the germination and growth of weed species, the next steps for rapid invasions are disturbances that prepare soils for seed germination by reducing the density of native plants and the cover by biological soil crusts. Causes of these disturbances can include anything on the land, including hikers, road construction and maintenance equipment, ORVs, native animals, livestock, or fire. Since native ungulate grazers tend to be sparse in southeastern Oregon, and the majority of disturbances associated with outdoor recreation tend to occur relatively near roads and trails, the major agent of disturbance on lands covered by the SEORMP is probably domestic livestock. For example, in a study conducted in and around Canyonlands National Park, Grand Staircase-Escalante National Monument, and Great Basin National Park, 64% of 674 total plots 50m (165 feet) from roads contained disturbances by livestock (e.g., hoof prints, dung, animals themselves), compared to 25% by wildlife and 12% by outdoor recreationalists (Gelbard 1999). Similarly, during 3 consecutive years of surveying vegetation, site characteristics, and disturbances at sites

in northern California grasslands, 65% of 1,380 total quadrats contained disturbances by livestock, compared to 25% by gophers and 15% by deer. Disturbances caused by livestock are clearly more widespread than those caused by wildlife or outdoor recreationalists in grazed lands of the arid and semiarid western U.S. On the lands covered by the SEORMP, the thousands of cattle and sheep that utilize the 420,584 AUMs (animal unit months) authorized by the BLM are undoubtedly the most widespread causes of the disturbances that prepare soils for weed seed germination and establishment, with localized exceptions occurring, for example, in areas frequented by outdoor recreationalists.

7. Most of the weed species of concern in southeastern Oregon are stimulated by the types of disturbances created by cattle, roads, and ORVs. In a 1999 book by weed experts Sheley and Petroff on the biology and management of noxious weeds, the authors noted that many weed species of concern in southeastern Oregon (e.g., knapweeds), are normally found in disturbed rangelands and are unpalatable to livestock. This suggests that the growth and reproduction of these species are enhanced by disturbances to the soil surface caused by cattle, and are less palatable than native species. As a consequence, native grasses and forbs (flowering plants) are preferentially consumed by the cattle while weeds species have the advantage of no longer having to compete with native species for water, soil nutrients, and other resources. The weeds grow vigorously, and produce large numbers of seeds.

8. Take for example the following quotes from weed experts on the spread of spotted knapweed (Sheley and Petroff, p. 350):

- a. **“Spotted knapweed does not compete with vigorously growing grass in moist areas.”**
- b. **“Spotted knapweed densities correlate with the degree of soil disturbance: the greater the disturbance, the higher the density. . . . Disturbance allows rapid**

establishment and spread; however, spotted knapweed is also capable of invading well-managed rangelands.”

- c. **Spotted knapweed may be prevented by “not grazing livestock in weed-invested areas during flowering and seeding.”**
- d. **“Knapweed spread can be limited** by detecting and eradicating weed introductions early, **by minimizing soil disturbance,** and by containing infestations.”
- e. **“Cattle appear to prefer grasses over spotted knapweed.”**
- f. **Where “grasses remain strong and vigorous, knapweed encroachment is minimized.”**
- g. **Most of the spotted knapweed grew on disturbed lands such as rangeland,** urban areas, industrial sites, and roadsides (Roche and Roche, 1988).
- h. **“Even moderate defoliation (30%) [by cattle] may allow greater spotted knapweed growth on Idaho fescue rangeland.”** (Jacobs and Sheley, 1997).
- i. **“We’ve seen that a vigorous stand of grass will restrict the invasion and establishment of weedy forbs, e.g., diffuse or spotted knapweed.”** (Roche and Roche, 1988).

These statements strongly suggest that grazing, roads, ORV use, logging, and other human disturbances are the **major** causes of invasions by spotted knapweed. All of these studies suggest that only by removing or minimizing livestock pressure and ORV disturbances will spotted knapweed invasions be slowed or stopped.

9. Numerous studies have provided advice concerning how to manage lands to prevent the types of human disturbances that cause and accelerate weed invasions. These emphasize prevention of both exotic seed introductions and disturbances that enhance seed establishment. For example, in the Ecological Society of America’s report on the biology and management of exotic plant invasions, the authors described the importance of prevention and the need to address underlying causes of invasive species problems:

Effective prevention and control of biotic invasions require a long-term, large-scale strategy rather than a tactical approach focused on battling individual

invaders. **An underlying philosophy of such a strategy should be to establish why non-native species are flourishing in a region and to address the underlying causes rather than simply destroying the currently most oppressive invaders.** System management, rather than species management, ought to be the focus.

(Mack *et al.* 2000) (emphasis added).

10. In the 1999 book by Sheley and Petroff, weed experts wrote chapters on the management and biology of important rangeland weed species. Quotes from several of the chapters illustrate expert recommendations that improve the ability of a management plan to meet its weed control objectives:

- (a) “Preventing the further introduction and spread of the plant [i.e., St. Johnswort] to uninfested areas is much easier, more environmentally desirable, and more cost-effective than is the subsequent management of large-scale infestations (H.L. Piper, p. 376).”
- (b) “Reducing or stopping the spread of ragwort seed into uninfested areas is probably the most important and cost-effective control measure (E.M. Coombs, P.B. McEvoy, and C.E. Turner, p. 394).”
- (c) “The most cost-effective method for managing these weeds [i.e., whitetop] is to prevent their encroachment (R.L. Sheley, J. Stivers, p. 405).”
- (d) “Preventing spotted knapweed from spreading onto adjacent rangeland is the most cost-effective management strategy (R.L. Sheley, J.S. Jacobs, and M.L. Carpinelli, p. 355).”

Biologists with the BLM have reached the same conclusions. In the Eastside Draft Environmental Impact Statement for the Interior Columbia Basin Ecosystem Management Project, or “ICBEMP,” (U.S. Forest Service and Bureau of Land Management 1997), the authors concluded that “[t]he least expensive, most effective, and highest priority weed management technique is prevention” (p. 105.)

Problems with the SEORMP’s proposed weed management

11. In spite of the above recommendations from top weed experts, the SEORMP includes no preventative treatments. Instead, it promises to combine a variety of tools to combat the spread of weeds, including biological, chemical, manual, and mechanical methods, and states that weed management will continue to be based on an outdated (over 25-year old) plan (the Vale District Five-Year Integrated Weed Control Plan, 1987) until a new district wide weed EIS, and an agency-wide Vegetation Treatment EIS currently being developed, is finalized. It provides vague, non-quantitative promises of future, unspecified, site-specific measures to be taken to combat the spread of weeds only after new infestations are detected. The SEORMP justifies this reactive approach by stating that its mandate to provide for multiple uses prevents the BLM from enacting preventative measures such as excluding uses and forces them to rely on control measures. This excuse reflects a lack of creative thinking and willpower to determine how to enact the type of management actions that the BLM's own scientists have stated are necessary to confront the weed problem. The SEORMP's overall strategy for combating the spread of noxious weeds is inadequate given the scale and severity of the problem. Below, I will provide further details on why this is the case.

12. First, the omission of preventative treatments is an issue of serious concern because the BLM would not have this problem today if it had avoided from the beginning, or more appropriately managed, activities such as livestock grazing and use of mud-caked ORVs that introduce and spread weeds along roads, as well as and from the roadsides and into adjacent natural ecosystems.

13. Instead of creating standards that would prevent the invasion and spread of weeds into uninfested or sparsely infested rangelands, the SEORMP proposes to use Integrated Weed Management (IWM) to "slow" and "reduce" the spread of weeds. IWM emphasizes weed control

(actions to combat the spread of weeds only after they have already invaded) over prevention (taking steps to reduce the causes of the invasions, such as seed introductions and disturbances). It says little about preventing livestock, ORVs, and other human disturbances from causing disturbances and reducing native plant vigor. References to minimizing soil disturbances and vegetative vigor are only briefly and vaguely (i.e., without specific, proposed measures or quantitative objectives) mentioned in a long and otherwise detailed document. Recent BLM weed management plans that utilize this same IWM strategy emphasize herbicide control of weeds, while largely ignoring weed prevention by limiting the movements of livestock and ORVs and their disturbances to the soil, biological soil crust, and native plants. The above may explain why noxious weed control on BLM lands has, as ICBEMP states, “generally been ineffective.” It also explains why IWM will not successfully control weeds in the Malheur Resource Area (hereafter “MRA”) and Jordan Resource Area (hereafter “JRA”). There is nothing in the SEORMP’s standards or in the all-too-brief (p. 431) description of IWM to force managers to reduce disturbances to the soil and biological soil crusts or permit native species to become more competitive.

14. There is simply no reason for the BLM to mechanically, biologically, or chemically eradicate weeds from the planning area without changing current grazing or ORV management so that the weeds do not return. This is like receiving chemotherapy to cure lung cancer, but continuing to smoke 3 packs of cigarettes a day.

15. Even if many weed species currently infesting the planning area are eradicated by IWM, they will be re-introduced into the area without preventative work. This is because they still exist in large numbers in lands and roads surrounding MRA and JRA and will gain entry and spread in the same ways as they originally became pests. In the SEORMP, the BLM does not

propose specific measures to change its management, such as by altering the presence, extent, intensity, duration, or timing of livestock grazing; and does not propose changes to ORV use or road management; both of which caused the weed problems in the first case. Then, the work, time, cost of weed control, and addition of toxic herbicides to infested areas will be in vain and will have to be repeated time after time.

16. The SEORMP implies that one reason for downplaying the contributions of human disturbances such as livestock grazing and ORVs to weed invasions is that natural disturbances, such as those caused by wildlife, wind, and flooding streams, also contribute to the problem. This is faulty logic for failing to limit the extent, timing, and presence of human disturbances within the planning area. Just because non-smokers can have heart attacks doesn't mean that smoking isn't a major cause of heart attacks. Similarly, just because a few weedy species can enter ungrazed communities protected from ORV use doesn't mean that grazing and ORV use aren't damaging to these communities and cannot cause weed invasions.

17. Unless the SEORMP focuses more on prevention, it is simply a matter of time before some subset of new weed species will be brought into JRA and MRA. There are three lines of prevention, none of which were considered in detail in the SEORMP:

- (a) Weed seeds can be prevented from being introduced into the planning area by cleaning vehicles, logging equipment, and ORVs and by sequestering cattle for one to two weeks before allowing them to enter uninfested areas;
- (b) Vehicles and livestock can be kept completely out of the lands; which would also prevent them from introducing weed seeds;
- (c) Disturbances to the ground surface, as caused by livestock, ORVs, should be reduced or eliminated to maintain the health of biological soil crusts and native vegetation.

As a subset of the above options, the extent and timing of use by livestock and ORVs can be altered to avoid the presence of vehicles and livestock during the times that weeds are setting seed, or that biological soil crusts and native plants are especially vulnerable. However, the SEORMP's discussion concerning the effects of intensity and season of grazing on lands do not include effects on weed invasions. This is a substantial omission that fails to consider the rapidly growing body of evidence that demonstrates that altering the extent and timing of grazing can have a profound influence the competitive abilities, growth, and reproduction of non-native weeds.

18. The SEORMP proposes none of the above preventative measures, but instead proposes to graze on 97% of the 4.6 million acres of land that it covers, allows use ORVs on over 99% of lands (on over 51% of lands—over 2.3 million acres—ORV access is “unrestricted”), and entirely fails to consider the role of biological soil crusts in preventing and slowing invasions. This is in spite of overwhelming evidence that cattle and sheep (reviewed by Belsky and Gelbard, 2000) and roads (Gelbard and Belnap 2003, Gelbard and Harrison 2003) are playing a major role in causing the spread of weeds. Ignoring this evidence will only lead to more invasions and the need for expensive control measures.

19. I am especially concerned about BLM's statement that it will rely upon monitoring and adaptive management to respond to new noxious weed invasions on a site-specific basis. This is because in other portions of the SEORMP, it claims that many sites are too remote to monitor the health of the land to prevent they type of degradation that causes and accelerates weed invasions. This implies that it is unlikely that range technicians will be able to adequately monitor the entire planning area, and difficult for restoration technicians to restore native vegetation, soils, and biological soil crusts on the many areas of land that become

degraded or infested with weeds each year. These probable shortcomings in personnel illustrate why preventing and minimizing weed invasions into uninfested areas requires excluding uses that spread noxious weeds from lands that remain relatively uninvaded. There are simply not enough personnel on hand to sufficiently police and monitor over 4 million acres and prevent livestock and ORVs from introducing noxious weed seeds and creating disturbances that facilitate their establishment and spread. That is why a better approach would be to conduct landscape-level planning with a Geographic Information System (GIS) to reconfigure the allocation of the multiple uses so that agents of weed seed introduction and disturbances (e.g., livestock, ORVs) are excluded from allotments and pastures that remain relatively uninvaded.

20. It is clear that under the proposed management, the SEORMP will fail to achieve its desired future condition under which “new infestations of noxious weeds are not common across the landscape, and existing large infestations are declining.” (p. 139). It will also fail to achieve the rangeland vegetation objective to (a) “restore, protect, and enhance the diversity and distribution of desirable vegetation communities, including perennial native . . . and [p]rovide for their continued existence and normal function in nutrient, water, and energy,” (p. 411) and (b) “control the introduction and proliferation of noxious weed species and reduce the extent and density of established weed species to within acceptable limits.”

Ecology and management of biological soil crusts, soils, and nutrient cycles

21. Biological soil crusts are the living crusts that blanket exposed soils in arid grasslands, shrublands, and open forests. These crusts, which are composed of algae, bacteria, lichens, and mosses, enrich the soil with nutrients, especially nitrogen, and increase the vigor of native plants. They are the primary source of nitrogen (N) in southeast Oregon’s deserts, which is important because next to water, N is the second most critical resource required for plant

growth. There is broad consensus among biologists that these fragile, living covers of the soil surface play a vital role in arid and semiarid rangeland ecosystems (including among ICBEMP scientific reviewers Dr. J.D. Williams (1994), BLM botanist J. Kaltenecker, Boise State Univ. Professor M. Wicklow-Howard (1994); see also Kaltenecker et al. 1999, Rosentreter 1999, and Belnap et al. 2001; and reflected in a new book on their structure, function and management (Belnap and Lange 2001)). The most important role of crusts is their ability to stabilize soil surfaces and improve soil fertility. In addition, crusts increase herbaceous productivity, act as a physical barrier to invasions by some noxious weeds (including cheatgrass, whose invasion is critical to prevent because at high densities, it not only displaces native species, but also dramatically increases the susceptibility of sites to wildfire), fix nitrogen from the air, and increase plant nutrient content. Recent reports have strongly emphasized both the critical importance of biological soil crusts to high desert ecosystems, and warned of dramatic, region-wide declines in soil productivity and increases in weed invasions if land managers fail to prevent disturbances to them. For example:

- (1) Stohlgren et al. (2001) examined patterns of native and exotic species diversity at multiple spatial scales and in multiple plant community types in Grand Staircase-Escalante National Monument, which is managed by the BLM. The authors found that **both the number and cover of exotic species were strongly negatively correlated with biological soil crust cover.** They suggested that the crusts act as a physical barrier to weed seed germination, establishment, and growth by preventing their seeds or radicles from contacting mineral soil, i.e., preempting space. **The authors concluded that continued disturbance of crusts by livestock, people, and vehicles may facilitate further non-native plant invasions.**
- (2) The problem is so important that even ABC New ran a story entitled “Deserts getting stomped” about an article in the scientific journal, *Ecological Applications*, in which crust experts Evans and Belnap (1999) warned that 30 years after trampling disturbance at a site, N levels still remained surprisingly low. The authors concluded that widespread disturbances to crusts would dramatically reduce plant growth and cause shifts in vegetation to weedy species tolerant of low N throughout deserts of the American West.

Problems with the SEORMP's proposed management of biological soil crusts

22. Although biological soil crusts are extensive throughout the Intermountain West, including in southeastern Oregon, the SEORMP ignored the consensus of the scientific community, as well as the **strong advice of the authors of BLM's own scientific assessments**, by barely addressing their importance or altering management to avoid damaging them. Given the increasing realization by ecologists of the importance of biological soil crusts to desert ecosystems, it is not scientifically sound that little of this information was included in the SEORMP. For example, while the integrity of crusts is critical for maintaining native vegetation and the nutrient cycles that support it, no mention of biological crusts was made in the SEORMP/FEIS's sections discussing the environmental consequences of the proposed alternatives to rangeland vegetation (pp. 411–413), or of proposed grazing use (pp. 564–565).

23. The SEORMP states that grazing within the planning area will follow the advice of ICBEMP. The authors of ICBEMP assessments on biological soil crusts explicitly recommended that rangelands be managed for healthy biological soil crusts (Dr. John Williams, 1994, p. 42) and appealed for strong protection for all remaining areas in the Great Basin with intact crusts (Kaltenecker and Wicklow-Howard, 1994, p. 38). Based on my experience and review of the scientific information, this management plan covering 4.6 million acres of public lands—a natural area larger than several states—has failed to rely on the best available information to support its decisions about how and whether to protect biological soil crusts.

24. For example, The Standards for Rangeland Health, offered in the SEORMP as the BLM's primary standards governing livestock management, contain little information on the importance of protecting biological soil crusts relative to their actual importance to the function of these high desert ecosystems. The SEORMP will fail to achieve its own Rangeland Health

regulations' objective "to promote healthy, sustainable rangeland ecosystems" unless it includes measures to protect crusts.

25. This was apparent in Appendix R (p. 386, "Effects of Intensity and Season of Grazing"), which states that "most grazing schedules . . . were designed to promote plant vigor, seed production, seedling establishment, root production, and litter accumulation for herbaceous plants in upland ecosystems," and were "designed for the physiological needs of herbaceous upland plants." There is no mention of protection for biological soil crusts in describing the benefits and potential impacts of grazing intensity and season of use, which is why the SEORMP will not adequately protect them.

26. Appropriate land management to protect biological soil crusts may include controlled winter grazing, which can reduce impacts of trampling disturbances on crusts because they are either soft and wet (and thus pliable), are frozen (and thus relatively resistant to disturbance) or are covered by snow (and thus protected from disturbance). Spring and summer grazing effects are more damaging because crusts are brittle and disintegrate when trampled.

27. Even with the presence of the above information in the Plan itself (e.g., Appendix pp. 378-384), the Plan proposes to graze the vast majority of allotments during summer rather than winter. Only 17 of the 101 allotments that contain allotment management plans (AMPs) are listed as grazed during winter, when impacts to crusts are lower. In contrast, 90 of 101 allotments with AMPs are grazed during summer and virtually all are grazed during spring, when effects are, as the SEORMP itself states, "more damaging." The majority of proposed grazing is simply not "controlled" or "winter" in these cold desert BLM lands, as is required to minimize damage to biological soil crusts. Rather, the grazing proposed by the plan falls into the category of timing that is "more damaging." Thus, the Plan's contention that "grazing schedules would improve

health, vigor, and productivity of desirable perennial vegetation, resulting in additional forage availability” (p. 560) does not make scientific sense.

28. In addition, the SEORMP states (p. 379) that during winter, the appropriate time to graze to avoid damaging biological soil crusts, “livestock management actions to maintain animal distribution are often times limited by weather and accessibility,” and that “livestock are normally off public land during winter,” (p. 561) the SEORMP also points out that during this time of year, resources are most limited, and thus conflicts for forage between livestock and wildlife may be more common than at other times of the year. If grazing during the appropriate time for minimizing damage to biological soil crusts will still cause negative environmental impacts, that implies that in these high desert ecosystems there is no time of year that grazing is truly sustainable—which is what the scientific literature suggests concerning the ability of intermountain West’s deserts, grasslands, shrublands, and woodlands to support livestock grazing (see Mack and Thompson 1982, Mack 1989, Milchunas *et al.* 1993).

29. The SEORMP will therefore fail to prevent degradation of biological soil crusts, and instead will result in long-term damage and, at human time scales, permanent impairment to them. In many areas, it will take centuries for these lands to fully recover once biological soil crusts have been disturbed. For example, experts have suggested that crusts may take at least 200 years to fully recover following trampling disturbances. As the SEORMP itself states (p. 36), “because soil recovery processes are . . . slow, disruption of soils can lead to long-term changes in ecological condition and productivity.” Thus, the Plan will clearly fail to maintain ecological processes such as nutrient cycles and it is doubtful that proposed management will achieve significant progress towards their attainment.

30. The SEORMP does not even propose current monitoring the health of biological soil crusts, but rather merely lists them as a “potential indicator” of watershed function in uplands. This omission of commitment to monitoring the health of biological soil crusts will limit the ability of BLM to protect this critical component of the MRA’s and JRA’s desert ecosystems. It also points to a lack of basic inventory and baseline information concerning the distribution and status of biological soil crusts in MRA and JRA, and this information is critical to determining which lands to allocate for soil-disturbing vs. non-disturbing land uses, and also how and where to alter management to avoid destroying biological soil crusts. It is insufficient to state that monitoring will happen at some point in the future, such as when a soil survey and inventory of biological crusts is finally completed, and to ignore impacts of human disturbances to crusts until that point. There is not even a standard of how to protect biological soil crusts in the standards and guidelines for sustainable grazing.

31. In conclusion, it is my professional opinion that the grazing proposed by the plan will cause serious damage to biological soil crusts. The likely result will be continued disruption of (1) this natural barrier to weed invasions, (2) the nitrogen cycle, and (3) soil stability throughout the 4.6 million acre planning area. As the SEORMP’s appendix itself states (p. 366), “interrupting or slowing nutrient cycling can lead to site degradation, as this land becomes increasingly deficient in the nutrients plants require.” Unless the SEORMP is revised to include measures that minimize damage to biological soil crusts, such interruption or slowing of nutrient cycling and its consequences will become widespread in the planning area.

II. PRIMARY CAUSES OF ENVIRONMENTAL DEGRADATION

Ecology and management of livestock grazing in southeastern Oregon

32. During the past century, a large number of scientific studies have documented that

cattle and sheep are major causes of the degradation of arid and semi-arid grasslands, shrublands, and woodlands of the Intermountain West (including southeastern Oregon), including by causing soil erosion, losses and localized gains in soil nutrients, endangerment of plant and animal species, pollution of streams, and, as noted above, vegetation changes such as weed invasions (Fleischner 1994). There is ample evidence that all but the lowest levels of livestock grazing are excessive in the arid rangelands of the Intermountain West (Mack and Thompson 1982, Mack 1989), illustrated by the progressive decline of rangeland function over the last hundred years and the widespread invasions by weeds and woody species.

Livestock grazing and weed invasions

33. For example, as noted above, livestock contribute to invasions of non-native weeds and displacement of native vegetation. They do this in several ways. First, livestock carry weed seeds on their coats, in mud on their hooves, and in their guts. Where these seeds are brushed off the animals or excreted in dung, they grow into mature plants capable of producing hundreds to thousands of seeds per plant. One study in Alberta, for example, found that in a single growing season one cow moved 270,000 viable weed seeds around a pasture. It is clear that the cattle grazing the MRA and JRA can possibly move tens of thousands, if not millions of weed seeds from roadsides, lands surrounding cattle water sources and salt licks, and other weed-infested communities and into uninfested areas.

34. Second, livestock weaken native plants by grazing them, thus removing their leaves and flowering stems (i.e., their photosynthetic and reproductive organs). Grasses and other plants of the Intermountain West are especially vulnerable to grazing by large herbivores since they evolved in an environment that has not been home to large herds of grazers over the past 10,000 years. As a consequence, native plant species of the Intermountain West do not have adaptations, such as

ground-level buds and distasteful compounds, necessary to help them avoid or tolerate grazing. As one study (Milchunas and Lauenroth 1993) stated, in terms of grazing impacts, where we graze (i.e., the question of whether a site is located in a geographic location where plants have been subjected to a long evolutionary history of grazing by large hooved herbivores) may be more important than how we graze (e.g., the intensity, timing, or duration of grazing).

35. In addition, livestock prefer native plants over weeds, which are often covered with spines or contain toxic and distasteful compounds. Thus, livestock preferentially consume native grasses and wildflowers, leaving weeds to grow unharmed and without competition from native plants. In areas grazed by livestock, weedy species often grow vigorously, produce large numbers of seeds, and increase in number while species native to the Northwest decline in size and density. In a recent study, for example, Gelbard and Harrison (in preparation) found that where high levels of bare, disturbed soil corresponded with the loss of native perennial grasses, the growth of the noxious weed, yellow starthistle, was greatest.

36. Finally, and most importantly, livestock contribute to weed invasions by disturbing the soil surface with their hooves, which increases the vulnerability of grasslands, shrublands, and open forests to invasion. Several factors are involved:

- Livestock consume grasses and trample soils, creating patches of bare, disturbed ground that serve as natural seed beds for the germination of weed seeds. Trampling also compacts the soil, damaging the roots of native plants and decreasing water infiltration into the soil, preventing them from acquiring sufficient water and nutrients for vigorous growth.
- Livestock increase wind and water erosion by reducing plant cover through grazing and by disturbing the soil surface with their hooves. Dislodged soil particles then bury the weed seeds, increasing their ability to germinate.
- As noted above, livestock hooves destroy fragile biological soil crusts. As the hooves of livestock break up and ultimately destroy the biological soil crusts, they reduce the stability and fertility of the soil and remove a natural defense against weed invasions.

- Livestock deposit nitrogen and phosphorus on the ground in their urine and feces, literally fertilizing areas that they have just disturbed. These fertilized patches, or nutrient “hot spots,” are concentrated where livestock congregate, especially near streams, trails, water tanks, and salt licks. Most weedy species respond more favorably to this excessive fertilization. Experimental studies have shown that where sites are both disturbed and fertilized, weeds grow the largest and produce the most seeds.
- By reducing plant and litter cover and compacting the soil, livestock create warm, dry soils, an impact especially severe in southeastern Oregon where plants are stressed by high temperatures and lack of water during the summer and fall. These warm, dry soils reduce the vigor of native plants, while annual and biennial weeds simply go dormant.

37. Most, but not all, non-native weed species require the type of disturbances and open spaces created by livestock to germinate and grow vigorously. A few species are also able to invade ungrazed, undisturbed plant communities, as can be seen in national parks and other natural areas. This is because vehicles, hikers, native wildlife, wind and flooding streams also transport weed seeds throughout the natural areas and disturb the soils. In most cases, however, weeds are denser in currently or recently (e.g., past 10 years) grazed areas than in areas that have experienced little or no cattle (or other human-caused) disturbances.

38. In one striking example, Anderson and Inouye (2001) conducted a long-term study in Idaho’s high desert (a system with similar plant species and biological soil crusts to southeastern Oregon) to explore the remarkable recovery of native bunchgrasses and sagebrush following 45 years of livestock exclusion. The authors observed a multi-fold increase in native perennial bunchgrass cover following livestock exclusion, and emphasized that the density of highly invasive cheatgrass was negatively correlated with total cover of native perennials. They concluded that “[m]aintaining richness and cover of native species should be a high management priority for these ecosystems” (abstract). Specifically, “good cover of perennial species in sagebrush steppe appears to increase resistance to invasion” (p. 552).

Livestock management proposed in the SEORMP

39. While the FEIS's appendix includes some appropriate (albeit non-specific) guidelines for livestock management, the SEORMP fails to develop livestock management strategies for either protecting the still healthy rangelands or for restoring the rest. In spite of its own statements concerning the value of ungrazed lands to native wildlife (p. 378) (with no mention of benefits for protection against weed invasions, which should have been considered), the SEORMP proposes to close only 3% of 4.6 million acres to grazing, with serious questions as to the quality of proposed management on the 97% of remaining lands on which grazing will be permitted.

40. First, **1,555,281 acres of grazed lands contain no AMP** whatsoever. This is an issue of serious concern for the health of this land, because to prevent livestock from causing environmental degradation, carefully planned management is critical. As the SEORMP states (p. 96), **AMPS contain "guidance necessary for the management of livestock grazing on specified public lands to achieve objectives relating to desired resource conditions, sustained yield, multiple use, and economics."** The above impacts of livestock grazing, combined with the SEORMP's proposed grazing management, demonstrate why the management recommendations in the SEORMP do not reflect current science or consider a balanced range of alternatives, and thus will not prevent environmental degradation.

41. Current scientific information suggests that lands managed under the SEORMP are highly sensitive to livestock grazing, but the SEORMP has not relied on this information to justify its proposed grazing management. For example, as noted above, scientists have advised that to protect biological soil crusts, it is necessary to either not graze livestock or to allow light to moderate grazing during the winter (the time of year that native elk typically grazed these

lands). However, BLM proposes to allow grazing on 97% of the planning area, and proposes to graze during winter on only 17 of 101 allotments that contain AMPs. Conversely, while the SEORMP states that biological soil crusts are highly sensitive to trampling disturbance during spring through fall, it still proposes to allow spring, summer, or fall grazing on 97 of 101 allotments with AMPs. This will result in considerable damage to biological soil crusts, disruption of nutrient cycles, soil erosion, and weed invasions in many areas, especially where livestock tend to congregate. The SEORMP justifies these statements by stating that many lands typically do not receive use or are only lightly used. This implies that other areas must be overused, and such areas are typically flatter sites near water sources and riparian habitats, which are the most species-rich habitats and thus stand to lose the most biological value from overuse.

42. The SEORMP states that to avoid environmental degradation caused by grazing, site-specific changes may be implemented as a part of the adaptive management process, by which management changes are made in line with results of monitoring activity. It justifies allowing grazing on 97% of lands by claiming that in more heavily used habitats, management will be changed on a site specific basis if monitoring data shows that damage is occurring.

43. The fact that the SEORMP will utilize adaptive management to determine areas requiring site-specific management changes is frequently used to justify the vague, non-quantitative livestock management that it proposes. For example:

Where livestock grazing is found not to be consistent with meeting objectives, actions that control the intensity, duration, and timing of grazing and/or provide for periodic deferment and/or rest would be required to meet the physiological requirements of key Plant species and to meet other resource objectives. (p. 246).

Upon determining through the adaptive management process that existing grazing management practices or levels of grazing on public land are significant factors in failing to achieve resource objectives, appropriate actions would be implemented. (p. 246).

44. However, the fact that 40 of 168 allotments are already in the “improve” category indicates that site-specific changes have failed in the past to prevent environmental degradation. This casts doubt on whether such site specific changes will be adequate to prevent environmental degradation in the future. Further casting doubt on the reliability of the BLM’s ability to preemptively make “site specific changes” to prevent and minimize environmental degradation, the SEORMP states that the remoteness of many areas makes them difficult to reach, which means that they area also difficult to access to conduct the monitoring required to recognize areas where the management changes are needed. Thus, it appears unlikely that managers will be able to reliably use adaptive management to recognize and respond to all instances of environmental degradation caused by grazing. If an area is too isolated to inventory for and monitor grazing impacts, perhaps it should not be grazed.

45. Furthermore, no specific monitoring plan/schedule is proposed, and thus it is not clear how or by what standard changes will be made according to monitoring results. This is particularly alarming because adaptive management remains a relatively new endeavor and buzz word within the environmental management community. While both well-intentioned and an excellent idea if carried out appropriately, the reality (as discussed within academic circles, including at a recent adaptive management/monitoring workshop that I attended) is that adaptive management is notoriously hindered by (1) lack of funding for monitoring and (2) political difficulties in actually implementing changes where monitoring data suggest that environmental degradation to be occurring. This is another reason that I fear that if grazing is allowed on 97% of the vast area of lands covered by the SEORMP, it is doubtful that monitoring will be sufficient to recognize many of the areas where environmental degradation occurs.

46. It is my professional opinion that when it comes to livestock management, the SEORMP will not provide for a sustained level of grazing that is “consistent with other resource objectives and public land use allocations.” (p. 559). A more balanced allocation of the planning area’s multiple land uses is clearly warranted.

Environmental impacts of roads and off-road vehicles (ORVs)

47. Roads have been implicated as an important factor contributing to multiple types of environmental degradation, as they are the conduits for a range of human impacts, from arson fires to invasive species, from erosion to landslides, and from siltation of streams to destruction of critical fish and wildlife habitat (Frenkel 1970, Forman and Alexander 1998, Parendes & Jones 2000; Trombulak & Frissel 2000; Forman 2000).

48. I study one of their major ecological effects—their role in providing a major conduit for the spread of non-native plants into natural areas, particularly in arid and semiarid landscapes of the American West. Declines in the presence of exotic species with increasing distance from roads have been reported in Glacier National Park, U.S.A., California, southern Utah and eastern Nevada, and the Mojave desert. A number of mechanisms have been proposed as explanations for these patterns. Vehicles and road-fill operations transport non-native plant seeds into uninfested areas, and road construction and maintenance operations provide safe sites for seed germination and seedling establishment. Clearing of vegetation and soils during construction, addition of road fill, and grading of unpaved roads creates areas of bare and deeper soil that allow non-native seeds to become established. Mowing roadside verges may favor exotic plant species that are less sensitive to clipping than native flora. Similarly, roadside herbicide treatments that reduce the cover of some exotic species may favor others and at the same time reduce the cover of native species. Compaction by vehicles contributes to roadside

invasions by reducing native plant vigor and creating areas of competition-free space that are open to invasion. I have found that plant communities adjacent to more improved roads (e.g., paved, gravel roads) are more invaded than those adjacent to infrequently used primitive roads (Gelbard and Belnap 2003). Improvement of four-wheel-drive tracks increases the richness and cover of exotic species, while reducing the richness of natives in adjacent natural ecosystems.

49. Conversely, roadless areas act as refuges for native plant species from weed invasions. For example, in two recent studies, we have found grasslands isolated (more than 1000m) from roads to contain considerably more native and fewer non-native species than grasslands 10m or even 100m from roads (Gelbard and Harrison 2003; Gelbard, in preparation). We concluded that “the effects of distance from roads may be even more pronounced in less thoroughly invaded landscapes, such as remote grasslands and shrublands of the Colorado Plateau and Great Basin” (this includes southeastern Oregon) (Gelbard and Harrison 2003).

50. It is important to remember, however, that these patterns of greater native and lower non-native plant diversity in roadless areas are dynamic, not static, and that both natural and human influences can substantially speed or slow the rate of continued invasion. Thus, careful management is needed to protect roadless habitats, with appropriate measures including preventing construction of new roads; carefully regulating road maintenance to favor native species; and limiting off-road vehicle access into areas with low road densities.

51. In the MRA and JRA, perhaps the most worrisome impact of roads is ORV use. ORVs include motorcycles, all-terrain vehicles (ATVs), dune buggies, four-wheel drive vehicles when used off-road, and any other vehicle designed for and/or capable of off-road travel. ORV users are notorious for disregarding laws requiring them to remain on roads and trails. Thus, ORVs can spread exotic plant seeds into uninfested habitats, compact soils, destroy vegetation

and biological soil crusts, decrease soil stability, increase erosion and water channeling, damage riparian habitats, and harm wildlife, not only along roads, but also in adjacent natural ecosystems. As one report by Montana weed scientists Lacey and others (1992) stated:

Knapweed plants are often caught in the undercarriage of recreational vehicles, ranch machinery, trains and logging equipment. Vehicles driven several feet through a knapweed site can pick up nearly two thousand seeds, 10 percent of which may still be attached to the vehicle after 10 miles of driving. Thus, seed can be spread rapidly over hundreds of miles. Off-road vehicles also damage existing vegetation and disturb the soil surface, making it easier for knapweed to invade.

52. In addition, because of the noisy engines of one class of ORVs—ATVs and dirt bikes—they can be heard for miles around and therefore pose a noise pollution threat. Their noise has been shown to alarm wildlife and in some areas results in frequent complaints from hikers, fishers, and hunters. Use of ATVs and dirt bikes is clearly not compatible with non-motorized land uses.

The SEORMP's proposed management of ORVs

53. In spite of the impacts of roads and ORVs described above, the SEORMP allows ORV use on over 99% of the 4.6 million acre planning area, including unrestricted use on 56% of lands and restricted use (limited to roads and trails) on 43% of lands. While an expanding body of scientific literature has shown ORV use to be a major cause of environmental degradation and therefore advised limiting its extent to specially designated areas, the SEORMP actually lifts ORV use restrictions on 376,353 acres, or over 500 square miles of land (p. 588). Clearly, failing to restrict ORV use by allowing it to be unlimited on over 2.5 million acres of the planning area, and excluding it on less than 1% of lands fails to provide for multiple uses in a balanced manner.

54. Even where ORV use is restricted to roads and trails, it is likely that enforcement of restrictions is minimal. It is my experience that even in areas with “restricted use,” many ORV users frequently leave trails and roads. For example, a University of California Natural Reserve that I conduct research on sits adjacent to a BLM-designated ORV use area. It has not been infrequent for ORV users to not only to stray off roads and trails, destroy vegetation (including sensitive plant species), cause severe soil erosion, and destroy researcher study plots, but even to stray on to private ranches and sometimes threaten ranchers with physical harm. With just a few enforcement officers spread across 4.6 million acres of land, “restricted use” realistically differs little from “unrestricted use.” The SEORMP states (p. 269) that monitoring would include only “periodic patrols to check designation boundaries, signing, and use.” This is clearly insufficient to protect resources and non-motorized users from ORV users and their impacts.

55. Based on my experience and review of the best available scientific information (including that noted above), a more balanced allocation of lands among ORV users, non-motorized recreationalists, extractive uses, and natural habitat is clearly necessary, or ORV use is likely to cause noxious weed invasions and substantial degradation of biological soil crusts and native vegetation. One possible solution is that land allocated to ORV use can be far more balanced with land allocated to non-recreational and non-extractive uses.

56. For example, GIS analyses can be used to identify soil types and other terrain not susceptible to weed invasions (e.g. due to soil rockiness or infertility) or erosion, and to not contain sensitive species or relatively uninvaded native plant communities. Such lands could then be designated as “suitable” for ORV use because impacts to vegetation and soils would be less severe than in sites with invasible, erosive soils, sensitive species, or relatively uninvaded plant communities. Another way to reduce impacts would be to regulate the timing of ORV use.

For example, it could be limited to trails on lands containing biological soil crusts during spring through fall, and should be limited or excluded from areas containing noxious weeds during the time that they are flowering and setting seed. These are just two examples of constructive suggestions. My point is that based on current scientific information, more factors, such as soil fertility/susceptibility to erosion and invasion, presence of biological soil crusts, and presence of noxious weeds, should have been considered as part of the process of determining which lands are suitable for ORV use and when. I therefore conclude that management proposed by the Plan will fail to meet its objective of managing ORV use “to *protect resource values*, promote public safety, provide ORV use opportunities *where appropriate*, and *minimize conflict among various users*.”

Road management proposed by the SEORMP

57. The Planning area contains 1,571 miles of roads, of which 68 miles are surfaced for all-weather use and likely contain bands of vegetation along them that are dominated by non-native weeds (Gelbard and Belnap 2003). Certainly, many of these roads will be kept open, both to provide recreation and to allow for fire suppression, weed control, and search and rescue activities. However, these activities can be conducted on roads while still restricting access to reduce their ability to act as conduits for weed invasions, abusive ORV use, and other human environmental impacts such as arson fires.

58. It will also be necessary to ensure that the timing of road maintenance (e.g. grading, herbiciding) is appropriate to avoid favoring noxious weeds and spreading their seeds. Currently, there is no directive in the SEORMP to do so—if the SEORMP had considered articles such as Benefield (1999), it would have realized the importance of such measures.

59. Rather, the SEORMP states that there is not yet a complete inventory of roads (p. 390) and in the future, BLM will develop a transportation plan, which will identify roads to be rehabilitated, closed, or abandoned. While this is certainly a good idea, such measures should be included in this resource management plan. This lack of complete information on the distribution and status of roads in the planning area suggests that key inventory information is lacking from the SEORMP's decision-making process of how to manage roads. In the case of roads, such missing information is important because (as described above) roads have a substantial impact on the condition and availability of resources.

60. On a matter functionally related to roads, I am concerned that best management practices (BMPs) concerning construction of fire breaks do not include sufficient directives to prevent fire suppression equipment (e.g., bulldozers) from creating corridors that (1) become hot spots of new noxious weed infestations (especially if equipment is contaminated with weed seeds) and (2) become primitive roads frequented by ORVs that subsequently introduce weed seeds and create disturbances that prepare soils for seed establishment. The SEORMP should include measures to (1) restore and/or block fire breaks following the conclusion of fire suppression efforts, and (2) monitor these new corridors during the initial 2–3 years following fire to allow for early detection and eradication of new noxious weed infestations. The BLM should also ensure that fire breaks (1) are not accessible for use by the public as primitive roads that act as corridors for ORVs and weed invasions, and (2) do not provide new corridors into roadless areas by which ORVs can access previously inaccessible lands and damage their vegetation and soils.

CONCLUSION

61. It is my professional opinion that the SEORMP will fail to protect the public lands within the Malheur and Jordan Resource Areas from environmental degradation unless both the proposed management activities on these lands, and the unbalanced allocation of land uses is changed to reduce the extent and severity of impacts caused by livestock grazing, roads, and ORVs. In summary, this is because:

- To combat the spread of noxious weeds, the SEORMP proposes to use reactive measures taken only after weeds have already invaded. This ignores the consensus of biologists and environmental economists that it is critical for weed management strategies to focus on prevention of invasions (altering management to prevent and minimize their causes, which are primarily seed dispersal and soil disturbance such as that caused by livestock grazing and ORV use).
- The SEORMP virtually ignores the growing consensus of scientists that it is critical to the health of high desert ecosystems such as those in southeastern Oregon to protect biological soil crusts, the living crusts that blanket the soil surface between individual grasses, shrubs, and trees. This is important because biological soil crusts are key components of soil fertility and stability, and provide a natural physical barrier against weed invasions.
- The SEORMP ignores its own scientific advice and fails to include additional scientific information concerning how to prevent and minimize destruction of biological soil crusts, such as by altering the presence and timing of livestock grazing and ORV use.
- The SEORMP lacks critical baseline information concerning the extent and status of its road network, as well as the distribution and status of biological soil crusts.

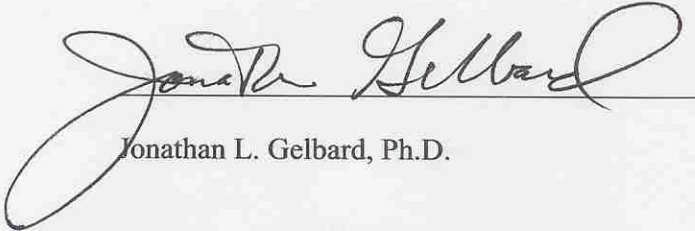
This missing information is important because if included, it would have been critical for determining how to manage lands that contain roads and biological soil crusts.

- The SEORMP is plagued by a bias towards resource extraction and fails to provide a balanced approach that accommodates the multiple extractive, non-extractive, motorized, non-motorized, and wilderness uses of these public lands.

The unfortunate consequence of these failures will be considerable environmental damage, such as the spread of noxious weeds, destruction of biological soil crusts, reductions in soil stability and increases in erosion. Thus, the proposed actions are unlikely to sustain many of the resource values of the area for future generations of users.

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge.

DATED this 6 day of July 2004.



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