

The Role of Recreational Trail Horse Use In The Introduction and Spread of Invasive Species¹

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Introduction

There can be no doubt that the invasive species issue is one of the foremost challenges facing not only the United States, but the entire global community. Organisms great, small, and microscopic have been moved about the planet for thousands of years. But as civilizations have advanced in modes and extent of travel, the intentional and unintentional movement of species over broad geographical areas has become greater. Not only has potential for spread of species due to human actions within the borders of a nation become great, in the context of the current "global community" and "global economy" the potential looms at gargantuan proportions.

As this presentation will show, the adverse impacts of invasive species are real, widely recognized in science, and being responded to at substantial scales by land management and regulatory agencies. However, what is at question is the role of the recreational trail horse as an agent in the introduction and spread of invasives, specifically invasive plant species at landscape levels. It will be suggested here that the infrastructure of the nation, its construction and use have provided a labyrinth of pathways and modes for the transport of propagative plant parts (propagules) that may become established in new locations. In addition, the introduction and spread of plant propagules within and between ecosystems is a common process enabled by natural wind, water, and wildlife vectors.

This paper will conclude that the scientific evidence fails to demonstrate that recreational trail stock significantly contribute to the invasives problem at the landscape level. Furthermore, when all aspects of the problem are thoroughly considered, it is very difficult to even imagine recreational trail stock as a significant contributor to the problem when considered in the context of all other well known pathways and vectors. The immediate importance of this point is in the debate concerning invasive plant management strategies that require the use of weed-free-feed (WFF) for recreational trail stock used on public lands. The long range importance in the argument is the potential for the assumptions that have led to the WFF regulations to progressively lead to a situation in which the use of recreational trail stock will be impracticable on public lands.

The Invasives Issue

¹ A presentation at the Southeastern Equestrian Trails Conference 2005, High Point, North Carolina, July 16, 2005. Also published in Back Country Horsemen of America News, Fall 2005.

Writing in the respected scientific journal, *BioScience*, Pimentel et al. (2000)² estimated that between 5,000 and 50,000 species of plants, animals, and microbes have been introduced to the United States since the beginning of European invasion. It is commonly known that the introduction of exotic, disease causing organisms by early Spanish explorers greatly reduced Native American populations. In contemporary cultures, introduced Human Immunodeficiency Virus (HIV) has had devastating effects on humans, while West Nile Virus threatens the health of humans, some species of wildlife, and the lives of equine species. Annually, new flu causing viruses imported from the Orient are of great national concern in the United States.

The introduction of plant diseases such as chestnut blight and Dutch elm disease has changed whole ecosystems. Introduced insects, such as the gypsy moth, Japanese beetle, and fire ant, have had major adverse impacts on forest and agricultural systems. The introduction of the sea lamprey caused the collapse of the lake trout and whitefish fisheries of the Great Lakes. Introductions of plant species such as kudzu, privet, purple loosestrife, leafy spurge, and spotted knapweed have had major adverse impacts on forest and agricultural productivity as well as natural ecosystem integrity.³

While the number of historical introductions of exotics is large, the actual percentage that has become established is relatively small. The Office of Technology Assessment⁴ estimated that 10-15% of introduced species have become established in the nation, and that about 10% of the established species are invasive. Nevertheless, those that do become invasive take heavy economic and ecological tolls on agricultural and natural systems. Estimates cited by the National Invasive Species Council⁴ indicate that total annual economic costs in the United States may be in the range of \$137 billion. Ecological costs in terms of losses to ecosystem structure and function are unknown. However, it has been estimated that invasives have contributed, directly or indirectly, to the imperilment of 40-46% of the species that are federally listed as threatened or endangered (Wilcove et al. 1998).⁵

Invasive plants are estimated to infest 100 million acres in the U. S., and an additional 3 million acres are infested annually.⁴ Perhaps the West has been affected at greater scales in time and space than has been the East. In 1996, the Bureau of Land Management estimated that the increase of infestations in federally managed natural areas of the West was 4,600 acres per day.⁶

The accumulation of evidence that invasive species would be one of the greatest environmental issues of the 21st Century led 500 scientists and resource managers in 1997

² Pimentel, D., L. Lach, R. Zuniga, and D. Morrison. 2000. Environmental and economic costs of nonindigenous species in the United States. *BioScience* 50:53-65.

³ National Invasive Species Council. 2001. Meeting the Invasive Species Challenge: National Invasive Species Management Plan. 80 pp.

⁴ U. S. Congress, Office of Technology Assessment. 1993. Harmful non-indigenous species of the United States. OTA-F-565. U. S. Government Printing Office. Washington, D.C. 391 pp.

⁵ Wilcove, D. S., D. Rothstein, J. Dubow, A. Phillips, and E. Losos. 1998. Quantifying threats to imperiled species in the United States. *BioScience*. 48:607-615.

⁶ Bureau of Land Management. 1996. Partners against weeds – An Action plan of the Bureau of Land Management.

to petition Vice President Albert Gore for administrative action to address the problem. In response, an interagency team was formed to develop a comprehensive and coordinated strategy. A result of that team's work was an executive order that provided standards and a framework for ongoing action.

On February 3, 1999, President William J. Clinton issued Executive Order 13112 that launched federal actions that would create a major federal initiative aimed at the prevention and suppression of introduction and spread of invasive species. First, the Order defined invasive species as those that: 1) are non-native to the ecosystem under consideration, and 2) cause or are likely to cause economic or environmental harm or harm to human health. In addition, the Order applied to all federal agencies that might take actions affecting the status of invasive species, and required that they take specified actions to address the problem consistent with their authorities and budgetary resources.

Furthermore, the Order established the National Invasive Species Council chaired by the secretaries of Agriculture, Commerce, and Interior. Other members included the secretaries of State, Defense, Treasury, Transportation, and the Administrator of the Environmental Protection Agency. The purpose of the Council was to provide national leadership and oversight on invasive species and to see that federal agency activities were coordinated and effective.⁴

The federal natural resource management agencies have developed various invasive species program strategies at the national level. Web-based information on these plans can be found as follows:

USDA-Forest Service (2004): National Strategy and Implementation Plan for Invasive Species Management.

USDA-Forest Service (1998): Stemming the Invasive Tide: Forest Service Strategy for Noxious and Nonnative Invasive Plant Management.

USDI-Bureau of Land Management (1996): Partners Against Weeds: An Action Plan for the BLM.

National Park Service (1996): A Strategic Plan for Managing Invasive Nonnative Plants on National Park System Lands.

www.nature.nps.gov/biology/invasivespecies/strat.pl.gtm

U.S. Fish and Wildlife Service: National Wildlife Refuge System. Invasive Species Program. <http://invasives.fws.gov/>.

These strategies look to Executive Order 13112 as their directive and to a number of statutes, the most recent of which is the Plant Protection Act of 2000 and its 2004 amendment, the Noxious Weed Control and Eradication Act (NWCEA), for legal authority and funding at cross-jurisdictional levels. The NWCEA was aimed at federal support for non-federal efforts at the rate of \$100 million annually for four years. In addition to the

federal legislation, most states have some type of noxious weed control laws.

Definitions

The basic terms important to discussions of the invasives issue have been defined in federal statutes. However, state statutes may not always be in agreement with federal designations. For example, "...a native species that expands its range within Colorado due to human influences and otherwise meets the descriptive criteria as a noxious weed may not be listed as such."⁷ However, wherever federal programs, including federal funding for cross-jurisdictional programs, are in effect, it is likely that the following definitions will prevail:

Noxious Weed means any living stage, such as seeds and reproductive parts, of any parasitic or other kind of plant, which is of foreign origin, is new to or not widely prevalent in the United States, and can directly or indirectly injure crops, other useful plants, livestock, or poultry or other interests of agriculture, including irrigation, or navigation, or the fish or wildlife resources of the United States or the public health.⁸

Undesirable Plant Species means plant species that are classified as undesirable, noxious, exotic, injurious, or poisonous, pursuant to state or federal law."⁹

Alien Species means, with respect to a particular ecosystem, any species, including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem¹⁰

Invasive Species means an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health¹¹

Introduction means the intentional or unintentional escape, release, dissemination, or placement of a species into an ecosystem as a result of human activity¹¹

Context for Concerns for Recreational Trail Stock Use

The invasive species issue involves both terrestrial and aquatic systems, and urban, agricultural, and natural landscapes. It encompasses all life forms including animals (vertebrate and invertebrate), plants, and microbes (including viruses). However, with respect to recreational horse use, the concerns are limited almost entirely to plant species that might be introduced or spread on wildlands.

Based on traditionally accepted principles, plant ecologists have expected that plant invasions would be primarily limited to disturbed areas where habitat niche space was available to accommodate sufficiently aggressive species. However, as Schmitz and Simberloff (1997)¹¹ have pointed out, we know now that invasives may become established

⁷ Colorado Noxious Weed Act of 1996, Title 35 Article 5.5

⁸ Federal Noxious Weed Act of 1974

⁹ National Undesirable Plant Management Act of 1990

¹⁰ Executive Order 13112, February 3, 1999

¹¹ Schmitz, D. C., and D. Simberloff. 1997. Biological invasions: A growing threat. Issues in Science and Technology Online. <http://issues.org/13.4/schmit.html>

and ecologically disruptive in systems that are already well stocked and fully functional with native species. The invader simply needs to be sufficiently competitive for growing space in that environment.

In the context of recreational horse use, one caveat that becomes very important is the abiotic environment. An important aspect of the abiotic environment is sunlight. Shade intolerant species are not going to be sufficiently competitive to disrupt ecosystem function when located under a closed tree canopy. Weed seeds that are associated with grains and hays were produced in full sunlight. It is extremely unlikely that such species will become invasive in full or near full shade situations characteristic of most forest ecosystems.

It has been argued that because disturbed soil is common on recreational horse trails and campsites an excellent seedbed awaits potential invaders as a result of horse-use. While this is the prevailing assumption, scientifically conducted studies have failed to support the theory.

Soehn (2001),¹² working in Great Smoky Mountains National Park, studied 86 back country campsites for ground coverage of “exotic plant field species” and found no significant difference (Kruskal Wallis Test: $p = 0.552$) between horse-use and hiker-only sites. However, when she compared auto-access, front country horse campsites ($n = 4$) with back country campsites ($n = 60$), the former exceeded the latter in ground coverage by exotic species by a factor of about 20. In terms of species counts, the auto-access horse camps had 21 species compared to 24 species on currently active back country horse camps, 12 on horse campsites closed for at least 20 years, and 3 on hiker only sites. These data may suggest that exotics are being transported to the back country sites by horses, but they are not sufficiently competitive to become invasive in these environments. The author concluded

“... the threat of exotic invasions originating in horse manure or feed is minimal in backcountry sites within the Park.”

Spotted knapweed is an invasive species of major concern in northern Rocky Mountain areas. Marcus et al. (1998)¹³ studied the likelihood that the spread of this species was being enhanced by recreational horse-use in the Selway-Bitterroot Wilderness in Montana. They found that the species was present in only 6 of 30 campsites and on very limited portions of 5 trails that were studied. They reported

“There was no significant difference in knapweed frequency between areas

¹² Soehn, D. 2001. Exotic plant species at backcountry campsites in Great Smoky Mountains National Park. Final Report. USDI —National Park Service. Gatlinburg, Tennessee. 12 pp.

¹³ Marcus, W. A., G. Milner, and R. Maxwell. 1998. Spotted knapweed distribution in stock camps and trails of the Selway-Bitterroot Wilderness. Great Basin Naturalist 52(2):156-166.

predominantly used by horses and those used by humans in camps. Over 95% of the knapweed along trails was found within 0.5 km [0.3 mi.] of the trailhead, occurred within 4.6 m [15.3 ft.] of the trail, and had low reproductive potential.”

The authors concluded:

“If the Bitterroot portion of the Selway-Bitterroot Wilderness is representative of the forested areas of the Northern Rockies, then the perceived threat of spotted knapweed to wilderness areas may substantially exceed the actual danger in many instances.”

In a study evaluating changes in campsite conditions on the Bob Marshall Wilderness Area in Montana between 1981 and 1990, Cole and Hall (1992)¹⁴ estimated the ground coverage by invasive species in 1981 for hiker-only (n=5), private horse group (n=19) and outfitter campsites (n=4) to be 3, 16, and 39%, respectively. However, the probability of a significant difference was 7% ($p=0.07$). By 1990, the comparable values were 7, 19, and 44%, respectively, and the probability of a significant difference was 10% ($p=0.10$). The authors suggested that the likelihood of a statistically demonstrable difference between these sites would have been improved had there been a greater number of hiker only sites. That argument might have had more plausibility had they published the standard error of the mean estimates. It is also possible that high variability within types of campsites and typical of such studies would in fact mean that there was no difference.

Nevertheless, the limitations of the Cole and Hall (1992) data did not constrain McClaran (2000)¹⁵ when he wrote

“... recreation livestock camps have a higher abundance of nonnative species than hiker camps (Cole and Hall 1992).”

McClaran went on to suggest that as research had shown no pelleting processes to completely eliminate viable weed seed from stock feed

“Pelleted feed [requirements] may not be aggressive enough, and more attention should be paid to quarantining animals for one to two days before admission into wilderness to prevent transport of ingested seed.”

“Invasive species with thick seed coats dispersed by endozoochory [passing through an animal's gut], in addition to benefiting from transport may have enhanced germination owing to gut scarification (Schiffman 1997).”

¹⁴ Cole, D. N., and T. Ball. 1992. Trends in Campsite condition: Eagle Rock Wilderness, Bob Marshall Wilderness, and Grand Canyon National Park. USDA-Forest Service. Intermountain Forest and Range Experiment Station. Research Paper INT-453. 41pp.

¹⁵ McClaran, M. P. 2000 Improving livestock management in wilderness. Pages 49-63 in D. N. Cole et al. (compilers) Wilderness Science in a Time of Change Conference. Vol. 5. Wilderness Ecosystems, Threats, and Management. USDA-Forest Service. Rocky Mountain Research Station. Proceedings RMRS-P-15-VOL-5.

In an appendix paper supporting the Draft Environmental Impact Statement (DEIS) for the USDA-Forest Service Pacific Northwest Invasive Plant Program, Parks et al. (2004)¹⁶ wrote the following:

“Invasive plant seeds have been recovered from feces and found viable in numerous studies. Seeds of leafy spurge (*Euphorbia esula* L.) are viable for 4 days following sheep ingestion (Olson and Wallander 2002). Thill et al. fed achenes of common crupina (*Crupina vulgaris* Cass.) to several large herbivores and found none in sheep feces; but horses, mule deer, and cows excreted 5, 3, and 25%, respectively. The percentage of achenes consumed and excreted that are viable ranged from 29% in cows to 81% in deer. Seeds of spotted knapweed fed to mule deer and sheep were collectable and viable for more than 2 days (Wallander et al. 1995).

“It is not certain how important endozoochory is in initiating or increasing infestations in natural systems (Gill and Beardall 2001). ...Malo et al. (2000) concluded that the effect of seed input to the seed bank from ungulate transport may be low at large and medium-sized spatial scales, but very important at small scales and for colonization processes.”

In short, in a review of worldwide literature that included 84 references, Parks and her coworkers were unable to find scientific evidence that ungulates of any kind were in fact responsible for landscape level invasions of plant species through endozoochory, although, it seemed theoretically possible.

Management and Regulatory Agency Actions

The USDA-Forest Service has been in the lead among federal agencies moving aggressively in the development and implementation of invasive plant species management. As a part of its strategy, the Forest Service appears to be rapidly moving towards weed-free-feed (WFF) standards for National Forest System (NES) lands.

As of June 1, 2005 USDA-Forest Service Region 2 (Rocky Mountain Region) implemented a WFF standard for all livestock entering NFS lands under its jurisdiction (Order Number: R2-2005-01). The standard is part of the Rocky Mountain Region Invasive Species Management Strategy which was published and implemented without reference to scientific justification for this measure. The order implementing the standard was summarized as follows:

“For many years, the WSF [weed seed-free] forage closure has been one of the most important prevention and education efforts of our invasive plants program. By adopting the improved closure order, we will achieve better

¹⁶ Parks, C. G., M. J. Wisdom, and J. G. Kie. 2004. The influence of ungulates on non-native plant invasions in forests and rangelands: A review. Appendix D PNW Causal Paper Ungulates. USDA-Forest Service Pacific Northwest Invasive Plant Program. Preventing and Managing Invasive Plants Draft Environmental Impact Statement.

public understanding, and add the clarity needed to enhance the legal enforceability of this important prevention tool.”

Nowhere in the strategy document was there mention of data establishing the efficacy of this “tool.”

The USDA-Forest Service Pacific Northwest Region published in its 2004 DEIS for invasive plant management the intention to implement a WFF standard for all recreational stock used in Wilderness Areas in the Region. While the DEIS failed to show that recreational trail stock were a significant contributor to the introduction and spread of invasive species, the Region's opinion was made clear in the statement

“Regardless of choice of [DEIS] alternative, pack stock use will continue to be a source of invasive plant spread.”

In its Guide to Noxious Weed Prevention Practices (2001), the USDA-Forest Service offered 12 guidelines for recreation, wilderness, and special management areas. Of these 12, 5 specifically referred to WFF practices for recreational stock.

WFF standards will be guided by the Federal Seed Act, the Plant Protection Act, and the minimum standards developed by the North American Weed Management Association and published as the North American Weed Free Forage Program.¹⁷

What Are the Real Risks?

It would seem reasonable to assume that if recreational trail stock were significantly important vectors for the spread of noxious species at the landscape level, the scientific literature would have this fact well documented by now. Clearly, that is not the case. All reviews of the literature have failed to find that documentation. Furthermore, research specifically looking for the linkage between recreational stock use and landscape level spread of invasives has failed to find it in both the eastern and western U. S.

That seeds of many plant species, particularly those with resistant seed coats, can pass through the gut of an equid and be viable is obvious. However, what is the probability that a given seed will be viable in the first place, and that, following ingestion, a given seed can survive mastication, the biological and chemical digestion processes, the high nitrogen environment of manure, and the desiccation process of drying manure, to germinate? And then following germination, what is the probability that a given seedling will survive, grow to maturity, and produce viable seed that might colonize a site? What is the probability that conditions of a particular site will be conducive to the support and spread of a population of this species to the surrounding landscape? Obviously, it is at the least, highly improbable in forest systems.

Furthermore, it seems reasonable to consider the potential importance of recreational

¹⁷ http://www.nawma.org/documents/Weed%20Free%20Forage/WFF_Standards.html

horse trails and their use in the invasives problem relative to the potential contributions of all of the other pathways and vectors common to the landscape. What are the risks taken with trail stock, largely or completely confined to trails, relative to risks taken with the use of land management equipment and vehicles moving throughout the transportation systems of the public lands? Reportedly, the transportation system of the NFS alone has more mileage than does the Interstate Highway System.

What are the risks posed by actively used recreational horse trails that might act as pathways for noxious plant species invasion relative to the pathways offered by the infrastructure of road systems and utility rights-of-way embedded in the landscape plus the inextricable waterways along which plant propagules move freely?

What are the risks posed by trails and campsites with disturbed soil relative to the risks posed on landscapes subject to both wild and prescribed fires? Almost every forest and grassland ecosystem in the nation has proposals for prescribed fire activities. lightning-caused fires in the West are typically of stand-replacement severity. All fire areas typically have substantial soil disturbance that results from the creation of firelines.

What are the risks with trail stock as vectors for invasive species relative to the uncontrollable natural vectors of wind, water, and wildlife that have moved plant seed within and between ecosystems throughout the natural history of the planet? The rapidity with which "natural" invasion rates can occur is currently being demonstrated on the fields of pyroclastic flow materials that resulted from the 1981 eruption of Mount St. Helens. D. B. Williams (2005)¹⁸ writing in Smithsonian magazine reported "flourishing life on the Pumice Plain." Within a decade of the eruption, one scientist had found 27 species of plants on one "200 square-yard" study plot. The earliest invader, lupine, had 35,000 stems. Furthermore, plant life on this recently dead landscape was already supporting a substantial array of fauna ranging from elk to rodents and the raptors and predators that fed on them. Presumably, no recreational trail stock were contributing to these invasions. Natural processes were driving a dynamic far more vigorous than most ecologists would have imagined possible.

The Progression of Condemnation

The implemented WFF standard for USDA-Forest Service Region 2, proposed for the Wilderness Areas of Region 6, and already in effect for specific federal and state land management units may well be a first step in a progression of regulations that will make recreational trail stock use impracticable on the public lands. First, the costs of certified weed-free feeds will have to be substantial. 'trail stock in camp or in transport, usually need hay or roughage, baled or cubed, that provides bulk beyond what pelletized feed can provide. Hay will have to come from certified weed free fields, which will obviously require a government inspection process. Also, obviously, such a process can be open to substantial amounts of cheating. When cheating is discovered to be at some significant scale, what will be the government response?

¹⁸ Williams, D. B. 2005. Rising from the ashes. *Smithsonian*. 36(2):28, 20-31.

If endozoochory is really a problem, how can we not need certified weed free pastures for trail stock while they are at home? This would be another layer of costs that the stock-owner would have to bear.

If recreational stock entering public lands is a significant risk for introduction of invasive species, how can McClarin's¹⁶ recommendation for quarantining animals be ignored? If his recommendation is followed, where will the agency personnel and funding for the quarantining process come from? Undoubtedly, the stock user would have to pay a substantial fee for this process, if it were to be implemented.

If trail stock are important to the spread of invasives through either endozoochory or epizoochory (plant propagules attached to the body, tack, or harness), how can they be allowed to pass through areas already infested with invasive species?

If soil disturbance on trails enhances the spread of invasives, not only is stock use in question, but how can we build or maintain trails when soil disturbance is inextricably inherent to these processes?

The Potential Endpoint

If the assumptions that have led land management agencies to begin implementation of WFF standards are presumed to be correct, and that presumption continues to guide policy, a fatal endpoint for recreational trail stock use looms on the horizon. Certified WFF is going to be very expensive due to the procedures needed to produce it plus the costs of inspection and certification. These costs will be added to what is an already inescapable rise in costs for production due to increased fuel costs at the farm level.

Furthermore, if a quarantine process is put into place, it is going to be expensive to develop and operate. The recreational stock user will have to pay those costs. However, it is more likely that where an agency perceives a need for a quarantining process, it will conclude that personnel are not available to do the work, so stock use will have to be discontinued.

These financial and process burdens will be added to future higher costs for fuel to transport stock to recreational areas. We are already seeing a growing reluctance to haul stock for long distances due to recent increased fuel costs. According to petroleum economics experts, we are still a considerable way from a fuel cost plateau.

For a large portion of the current population of recreational trail riders, the potential endpoint may be the economic impracticability of recreational trail stock use on most public lands of the nation.

Summary

The invasive species issue is one of the greatest conservation concerns of the 21st Century. All levels of government in the U. S. are responding to this problem. Response is greatest at the federal level, which also intends to offer support funding for state and local level programs.

With respect to invasive terrestrial plant species, land management agencies, particularly the USDA-Forest Service, has responded aggressively. However, they are painting with a very broad brush that threatens the future use of recreational trail stock. Their assumption that this recreational activity is significant in causing and enhancing landscape level invasions by noxious weed species lacks validation in science. In fact, research aimed specifically at documenting the linkage between invasive species spread at the landscape level and recreational stock use has failed to develop that documentation. In a world where bureaucracies respond to administrative directives and do the easy tasks first, it appears that land management agencies have acted on unproven assumptions and targeted recreational trail stock use as an easy potential problem to neutralize simply through regulation. Within a bureaucracy, such a move puts points on the board of presumed progress, whether or not any real progress has been made in address of the real problem.