Are horses responsible for introducing noxious weeds onto trails and adjacent ecosystems in the western USA?

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Introduction

Non-native species have a pronounced economic impact. Weeds cost the U.S. economy $32 billion a year by decreasing crop production by 12% (Pimentel et al. 1999), and 73% of the weeds are non-native (Pimentel 1993). The costs estimates provided by Pimentel and his colleagues excluded costs of (i) producing the herbicides ($4 billion), (ii) programs to control non-native plant species ($3 billion), and (iii) environmental and public health damage caused by herbicides ($9 billion). Pastures for livestock are especially susceptible to invasion by native and non-native, with an estimated 45% of the invading species being non-native plants (Pimentel 1993). Forage production from pasture is a $10 billion industry in the U.S. with losses from yield caused by non-native species totaling $1 billion annually (USDA 1998). For these reasons, minimizing the introduction of non-native plant species is a reasonable ecological and management goal.

Some people have speculated that horses may facilitate the dispersal and spread of invasive or non-native plant species; however, there are few data to support or refute this assertion. AERC funded a five-state (NC, KY, IL, MI, and WI) study to determine if horse hay, manure and hoof debris contained viable seeds of non-native weeds, and if so, do the seeds of non-native weeds successfully germinate on horse trails. In addition the study compared the presence and abundance of non-native plant species along horse trails and trails that prohibited horses. The results of the study showed that non-native weeds did not germinate from hoof debris or manure samples grown in pots, but on average 5.4 % of the hay samples from 20 horse/rider teams at the five endurance rides did contain non-native weeds (Gower 2008). The most prevalent weed was Canadian thistle. However, no non-native weeds germinated from the hay, manure, or hoof debris samples placed on the trails at the five sites. While these results are relevant for many ecosystems in the eastern United States, it is unclear if horses are responsible for introducing non-native weeds in the western United States.

A new study funded by AERC and Dean Witter Foundation was started in 2008. The study included nine endurance rides (Table 1) that were located in five AERC regions and included five of the major ecoregions of the western United States (Figure 1). The ecoregions encompassed grassland, shrubland, woodland

Table 1. Summary of study site location and the state or province represented by the twenty horse/rider teams sampled.

Ride/Date	**Location**	**States/provinces represented**	**AERC Region**
Cuyama Oaks XP (March 22 – 24)	Cuyama, CA (Private ranch)	AZ, CA	Pacific South
Shine & Shine Only III (April 12)	San Jose, CA Quicksilver Park	CA	West
Whiskeytown Chaser (April 19)	Redding, CA (Whiskeytown Nat'l Recreation Area)	CA	West
Wild West Pioneer (May 23-25)	Nevada City, CA	CA, MT, NV	West
Owyhee Fandango (May 24-26)	Oreana, ID BLM	ID, VA, CO, WA, BC, CA, NV, UT	Northwest
Ft. Howes (June 7-8)	Ashland, MT (private ranch & Custer National Forest)	CA, CO, MT, WY, UT, MB, NB, BC, WA	Mountain
Shamrock Pioneer (July 4-6)	Wheatland, WY (Private ranch)	CO, MT, WY, MO, UT	Mountain
Ft. Stanton II Pioneer (July 10-12)	FT. Stanton, NM BLM	NM, IN, TX, CO, AZ, ON	Southwest
Redwood Ride II (August 2)	Orick, CA	CA, OR	West

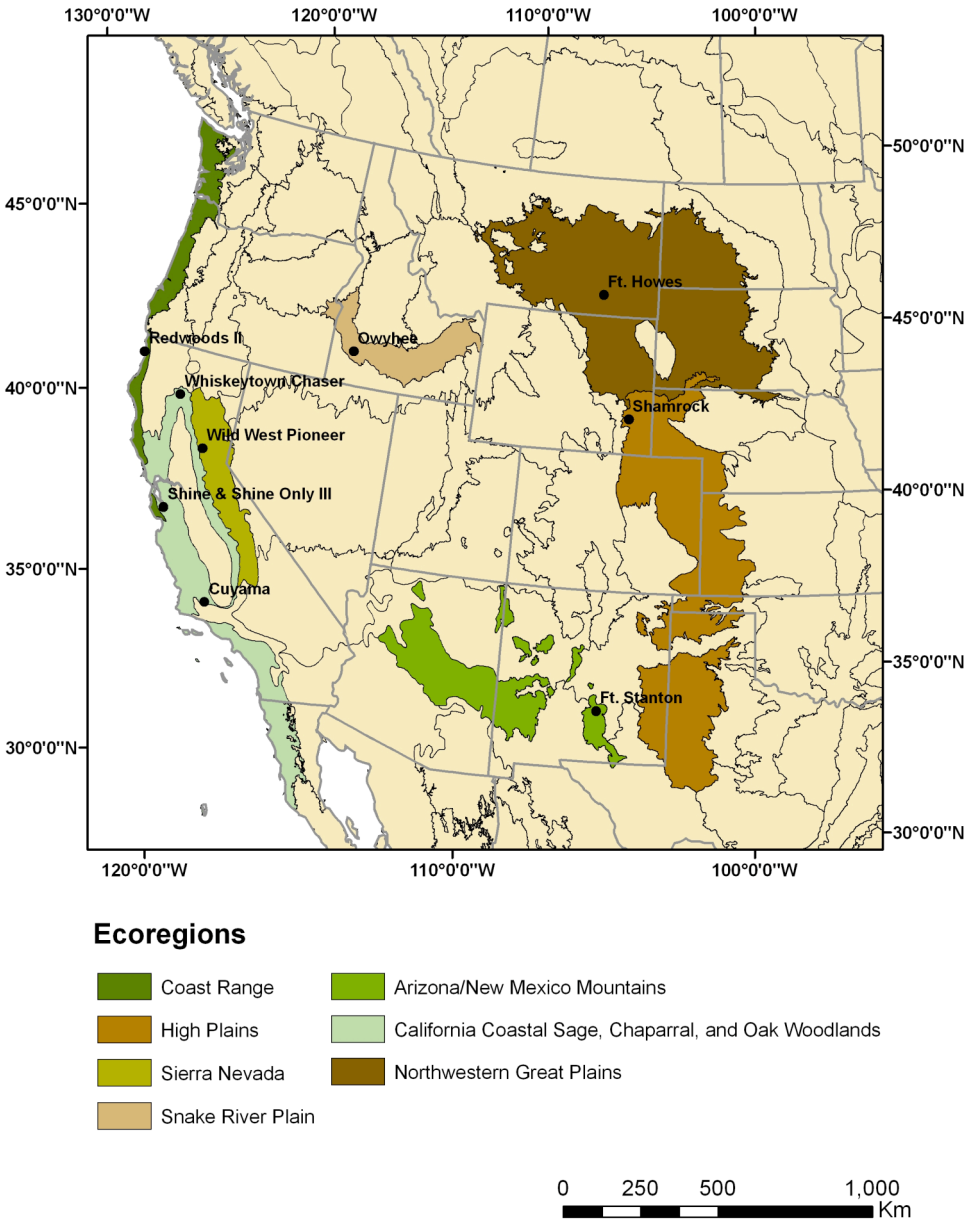

Figure 1. The location of the nine western United States study site used to examine if horses introduce non-native weeds on trails. The study sites encompass seven major ecoregions including grasslands, shrublands, woodlands and forests.

and forest ecosystems. The selection of sites was based on logistics and proper experimental controls. Twenty horses were selected for study at each ride. Each horse selected for study was sampled at the vet check-in for (i) seeds adhering to his/her coat; additional samples were collected from their (ii) hooves, (iii) manure, and (iv) hay. Each hay, manure, and hoof debris sample was thoroughly mixed , sub-sampled, and either planted in pots and grown under ideal light, nutrient and water conditions or planted back on the trail to determine if seeds could germinate and become established in the "real world".

The sources for forage for the 20 horse/rider teams sampled at the nine rides were hay (45%), pasture and hay (40%), and pasture (15%) (Figure 2). With the exception of the Cuyama ride, less than 10% of the horses randomly selected were on pasture. Certified weed free hay was only fed to three of the horses at the Cuyama and Owyhee rides and one horse at the Shine and Shine Only III and Redwood II rides for a total of 4.4% of the sampled horses (data not shown).

Like the eastern United States study, no seeds were found on the coat, tail or mane of any horse at the nine rides. Also, non-native weeds did not germinate from manure or hoof debris samples placed in the pots and grown in ideal conditions. The striking difference between the eastern and western studies was the lower overall average germination rate of non-native weeds from the western hay samples (1.4%) than eastern United States hay samples (5.2%). All twenty hay samples from four of the nine sites did not contain non-native seeds that germinated into weeds while hay samples from four of the sites had only 2% or less non-native weeds, and only hay samples from one site had 5% non-native weeds (Figure 3). All the commercially grown, but not certified weed-free timothy, oat and alfalfa hays were void of seeds that germinated into nonnative weeds, while the hay samples that contained seeds of non-native weeds appeared to be home-grown. The common non-native weeds that germinated were Canadian and yellow star thistles. The most common plants that germinated in the pots that were not classified as non-native weeds included ryegrass, timothy, fescue, bluegrass, and dandelion.

The ongoing research will conclude in 2009 after all the samples placed on the trail are re-surveyed. The study will provide the most comprehensive data for major ecoregions in the western United States. Ride managers and riders should work closely with local private, state, and federal land managers to ensure they are aware of the results from the eastern United States study, and the preliminary results from the western United States study. Anyone interested in learning more details about the project or would like to receive additional references related to the ecology of invasive plants can contact the author (stgower@wisc.edu) or visit the website http://forestecology.forest.wisc.edu/research.html.

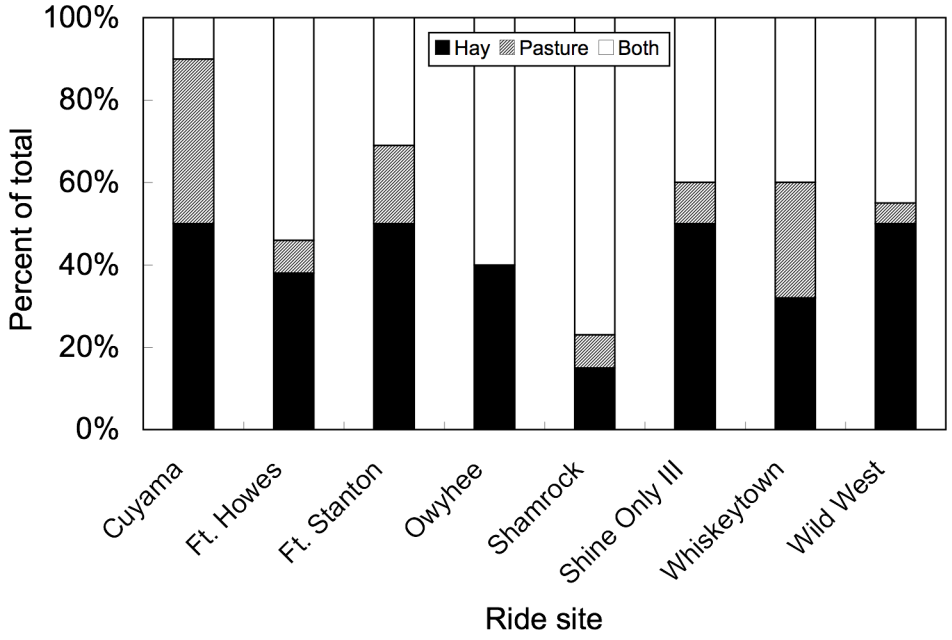

Figure 2. The percentage of the twenty horses at each ride whose primary source of forage was hay (i.e. dry paddock), pasture, or pasture and hay.

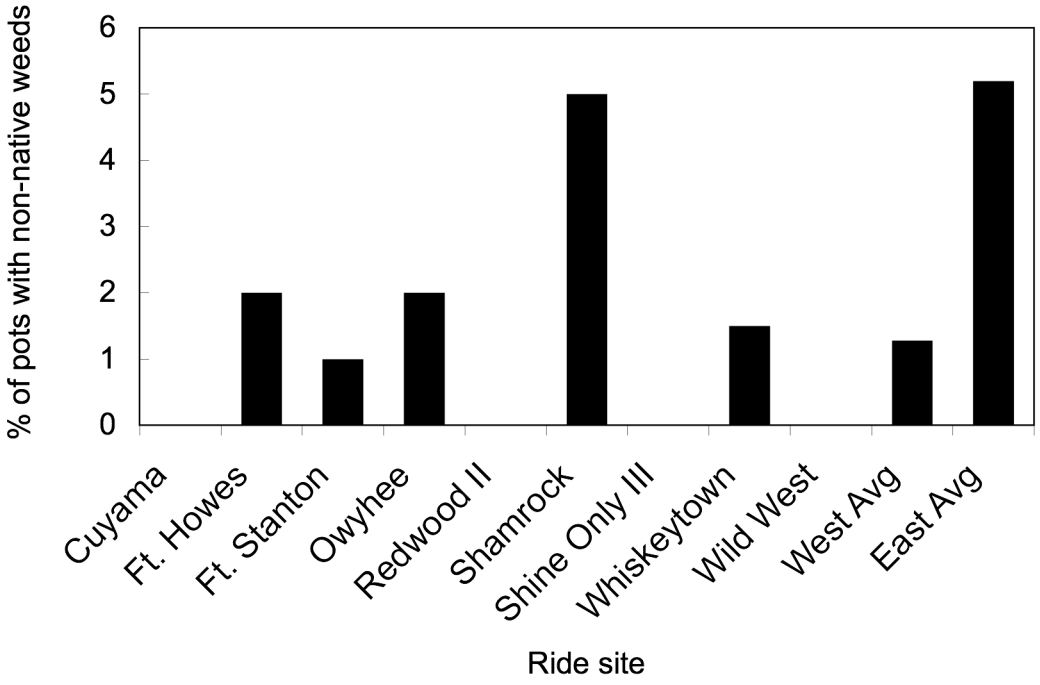

Figure 3. The percentage of plants in each pot from the 20 horse/rider teams that were non-native weeds.