



Invasive Plant Species in Horse Manure

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The Question: Does horse manure aid in the spread of invasive and noxious plant species in National Park areas?

Forty-two percent of threatened and endangered species in the U.S. are declining, in part, because of invasive species. Invasive plants, in particular, threaten ecological processes and cause extreme biodiversity losses in natural areas including National Parks. Evidence from previous studies has shown that non-native plant seeds germinate following digestion by large herbivores, but manure sampling techniques in those studies were not always reliable. Meticulous sampling of horse manure, along with correlation to diet, is essential for understanding impacts of horse use in National Parks.

The Project: Monitor the spread of invasive plants through observance of horse manure samples in a laboratory setting.



Horses may introduce weed seeds into wilderness areas in California's National Parks.



Bur clover (*Medicago polymorpha*) germinating from horse manure.

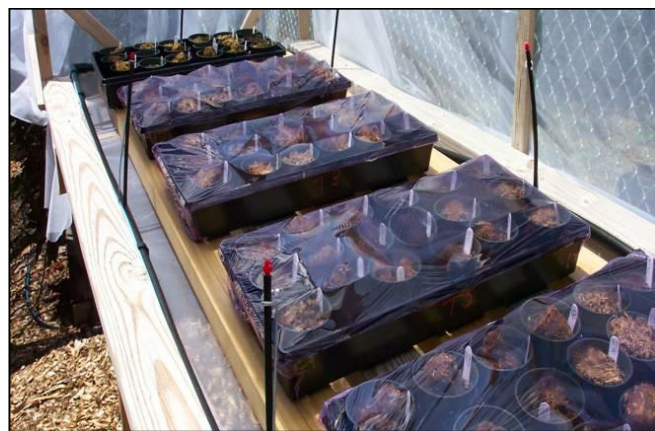
Twenty San Francisco Bay area locations were chosen for the initial trial of this 2005 study. In each location, barn stalls, paddocks, and stables were visited and central portions of horse manure were sampled. The central portion was used in order to avoid contamination by wayward seeds and to ensure accuracy of manure contents. Each of ninety manure samples was planted in 100 grams of sterile, weed free soil. The samples were then placed in a nursery that was enclosed by netting to prevent contamination from outside sources. Germinating plants were then identified by a taxonomic specialist, and cross-checked against the California Invasive Plant Council's (Cal-IPC) list of problematic invasive species. A 2006 trial was started from samples collected in Lassen Volcanic National Park, Whiskeytown National Recreation Area, Point Reyes National Seashore, Golden Gate National Recreation Area, Juan Bautista National Historic Trail, and surrounding areas. This trial is currently underway, and a third trial will sample manure from southern California National Parks.

The Results: The collected horse manure samples contained viable seeds for invasive plants identified on the Cal-IPC's list of problematic invasive species list.

Three species that germinated from the first trial were plants listed on the California Invasive Plant Council's (Cal-IPC) invasive plants list. Two of these, Italian wild rye (*Lolium multiflorum*) and summer mustard (*Hirschfeldia incana*), are listed as moderately invasive, meaning that they have a substantial

but not yet severe impact on ecosystems. Another species, bur clover (*Medicago polymorpha*), is found on Cal-IPC's "limited list," meaning that the species is invasive but not yet an extreme threat in natural areas and landscapes. Three other species germinated, but were unlisted by Cal-IPC. These were cudweed (*Gnaphalium luteoalbum*), common purslane (*Portulaca oleracea*), and toad rush (*Juncus bufonius*).

Based on these trials, it is proven that reliably-sampled horse manure can harbor and potentially spread invasive plants in California's wildlands. Future trials will evaluate germination from horse manure on a regional scale throughout California.



Dominican University horse manure germination study, showing net enclosure that prevented contamination of samples by outside sources.

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Additional Resources

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California Invasive Plant Council (Cal-IPC)
www.cal-ipc.org

Dominican University of California
www.dominican.edu

Weed Free Feeds
www.weedfreefeed.com

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Summer mustard (*Hirschfeldia incana*), Italian ryegrass (*Lolium multiflorum*) and bur clover (*Medicago polymorpha*) shown above, are listed as problematic plants by the California Invasive Plant Council and were among plants that germinated from horse manure.