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GLOBAL IMPACTS

A GLOBAL ASSESSMENT OF FERAL HORSE IMPACTS ON ENVIRONMENTAL QUALITY

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Invasive species have had profound effects on ecological processes worldwide. Invasive herbivores, in particular, can have major effects on ecosystems, both directly—by altering plant community structure and composition—and indirectly—by changing soil processes and ecosystem processes, which feed back to alter ecosystem functions and biotic communities. One invader, the feral horse (*Equus caballus*), has presented considerable problems for land managers worldwide, particularly national park managers, rangeland ecologists, pastoralists and farmers. To our knowledge, there have been few attempts to assemble a global synthesis of their impacts on ecosystems to determine the net effect of increasing horse grazing on environmental quality.

We combined a structured, qualitative search of global literature with a quantitative meta-analysis to explore the net effects of feral horses on ecosystems worldwide. We retrieved 4,150 observations from 159 studies in 72 publications that reported quantitative data on the effects of feral horses on 30 ecosystem response variables ranging from plant community composition and cover, to soil chemistry and soil stability. Most observations (55%) were from North America, followed by Australasia (22%), Europe (11%) and South America (10%). For each observation, we calculated a log response ratio that compared the effect of increasing horse grazing with either no horse grazing or a lower intensity of horse grazing, such that a more positive value represented an improvement in environmental quality due to horses based on the specific attribute (e.g. greater plant cover, more soil carbon, less erosion). When we examined the average effect across all attributes, we found that the log response ratio increased for some attributes but declined for others. Averaged across all 4,150 observations, the average log response ratio (lnRR) was –0.17, which represented a decline in environmental quality of 16±12% (mean ± Standard Error) due to horses. This highlights the average degree of degradation resulting from horse grazing, despite the wide environmental variation in our dataset across different communities, systems, environments and types of land management at the global scale. Despite the significant average effect across all attributes, when we arranged our data into structural (e.g. plant cover, plant height), compositional (e.g. plant richness, plant or animal abundance) and functional (e.g. soil carbon, plant productivity) categories, we found that the lnRR did not differ from zero, largely because of the large confidence intervals (CI) due to wide environmental variability.

We then examined the response to increasing horse grazing for those attributes for which we had >250 observations. These were plant abundance, plant biomass, plant cover, plant richness and soil stability. Plant biomass declined, on average, by 34% (lnRR = –0.41, 95% CI: –0.12 to –0.70), soil stability declined by 32% (lnRR = –0.39, 95% CI: –0.17 to –0.62), and plant abundance declined by 15%

(lnRR = –0.41, 95% CI: –0.07 to –0.25). The average effects of horse grazing on plant cover and plant richness were close to zero (lnRR = –0.01), with broad confidence intervals (0.33 to –0.35), indicating that cover and richness increased under increasing horse grazing in some areas, but declined in others. Overall, our results are consistent with previous regional and local studies of feral horse impacts on plants, soils and biotic communities and indicate that, overall, increases in the intensity of feral horse grazing will lead to reductions in environmental quality.

Campsite, Blue Waterholes, Kosciuszko National Park.

Feral horses have eaten the grass and roots surrounding the fireplace leaving the soil exposed to needle ice and erosion, October 2018.

Source: Di Thompson.

Right: Headwaters of the mighty Snowy River at Charlotte Pass, Kosciuszko National Park.

Source: Mel Schroder.