

Introduction of nonindigenous plants to Alaska's Seward Peninsula: A consequence of new reindeer management strategies?

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Abstract

Invasive species present a serious threat to ecosystems worldwide and are typically most effectively managed through prevention rather than eradication. Though Alaskan ecosystems are relatively pristine compared to those at more moderate latitudes, introduction and range expansion of nonindigenous plants in Alaska is expected to occur. The grazing system of Alaska's Seward Peninsula encompasses over 4 million hectares of rangeland and supports the bulk of the state's 18,000 reindeer. In response to the recent and dramatic range expansion of the Western Arctic Caribou Herd (WACH) onto the peninsula, some herders have begun to use geographically isolated refugia or fenced enclosures to protect herds during times when caribou are present. Provision of supplemental feed to animals held in these areas may help to increase control of animals and mitigate localized overuse of the range. However, feedstuffs, and consequently feces, can contain viable weed seeds. Dispersal through fecal matter and spilled feed is one mechanism by which nonindigenous plant species could be introduced. The objective of this study is to determine whether supplemental feeding of reindeer in a tundra grazing system is likely to result in the introduction of nonindigenous plant species to the Seward Peninsula.

Feed and fecal samples from three Alaskan reindeer operations were sown under greenhouse and field conditions to investigate germination and survival of seeds in controlled and realistic feeding environments. Feed A was a loose milled ration, Feed B was a milled and pelleted ration and Feed C was a ration of pellets and whole unprocessed barley (*Hordeum vulgare vulgare*). A replicated completely randomized design was used in the greenhouse experiment. Feed or fecal samples were sown in flats containing weed free soil and maintained in a greenhouse at 18 ° - 20 ° C with 16 hours of light per day and fertilized with Peters' 15-16-17 fertilizer. Emergent vascular plants were counted at 40 days after sowing and allowed to mature until identifiable. Barley and weed species data (germinations) were categorized and analyzed separately. There were significant differences in germinations of barley $F_{(5,11)} 41.0$, ($p = 0.0001$) and weed species per treatment $F_{(5,11)} 52.2$, ($p < 0.0001$).

The field trial was a replicated randomized block design experiment conducted on undisturbed tundra at two locations near Eagle Summit in Interior Alaska (65° 26' 5" N, 145 ° 24' 52" W), a location similar to the Seward Peninsula in latitude, plant communities, landscape features, growing season and climatic conditions. Feed or fecal samples were dispersed in plots on top of the snowpack during April to simulate winter feeding conditions. Plots were monitored for two years and the number and species of emergent nonindigenous vascular plants was determined. Average daily air temperature during the growing season was 8 ° C with a growing season length of 107 days, defined as continuous days above -2 ° C without sustained snow cover. There were no significant differences among treatments (no germinations in any treatment) in the field trial.

Results of the greenhouse trial show that viable seeds are present in some reindeer feeds but indicate that both feed processing and ruminant digestion have a negative effect on seed viability (Fig 2.). Lack of nonindigenous seedlings on the tundra plots suggests that the temperate

agricultural weeds and grains contained in reindeer feeds are not well suited to non-cultivated, sub-arctic environments. The cold soil and air temperatures of tundra ecosystems preclude the establishment of most temperate species and temperature is likely a factor in the difference in germination rates between greenhouse and tundra plots. Changes to ecosystem processes as a result of global climate change and the potential for tundra disturbances are two factors that may affect the likelihood of establishment of weedy species on the Seward Peninsula. However, this study suggests that under current climatic conditions and in the absence of disturbance, the risk is low.