



Research Brief for Resource Managers

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High Elevation Extremes Limit Alien Plant Success

Rundel, P.W., and J.E. Keeley. 2016. Dispersal limitation does not control high elevation distribution of alien plant species in southern Sierra Nevada, CA. Natural Areas Journal 36: 277-287. DOI: <http://dx.doi.org/10.3375/043.036.0308>

Why aren't globally successful, weedy plant species generally found at high altitudes? This study suggests that it's due to extreme abiotic conditions in association with the alien species' life history traits, not a lack of opportunity.

In the southern Sierra Nevada, the steep elevation gradient and 100+ years of grazing disturbance history made conditions perfect for testing three hypotheses that get at our question: 1) Alien species should have broader niche dimensions than natives. 2) Increased environmental stress should restrict the upper elevational limits for plant species. 3) There should be an increase in perennials with increased elevation. Only the first hypothesis was disproven as weedy species exhibited the same general niche dimensions as native plant species.

In contrast, hypotheses 2 and 3 were supported by the evidence. Loosely interpreted, non-native annuals tended to dominate lower elevations, while native perennials tended to dominate higher elevations (Figs. 3 & 4).

Management Implications

- Life history traits and abiotic stressors limit alien species establishment in high elevation zones more than dispersal path or opportunity.
- Global warming will likely reduce the high elevation barrier to invasive plant species.

Although the combination of cold air extremes, soil temperature extremes, heavy snowfall, short growing season and low resource availability all work together to make alien plant species unable to colonize high elevation areas, these results show that climate change could make currently impenetrable high elevation areas more accessible to these species over time.

By comparing only the native and non-native species within four families, statistical bias was avoided and phylogenetic coherency was preserved for this study. The century long history of heavy grazing, major logging, and recreational use for all NPS, BLM, and USFS study locations ensured that a lack of dispersal opportunity for the alien species was not a factor in these comparisons.

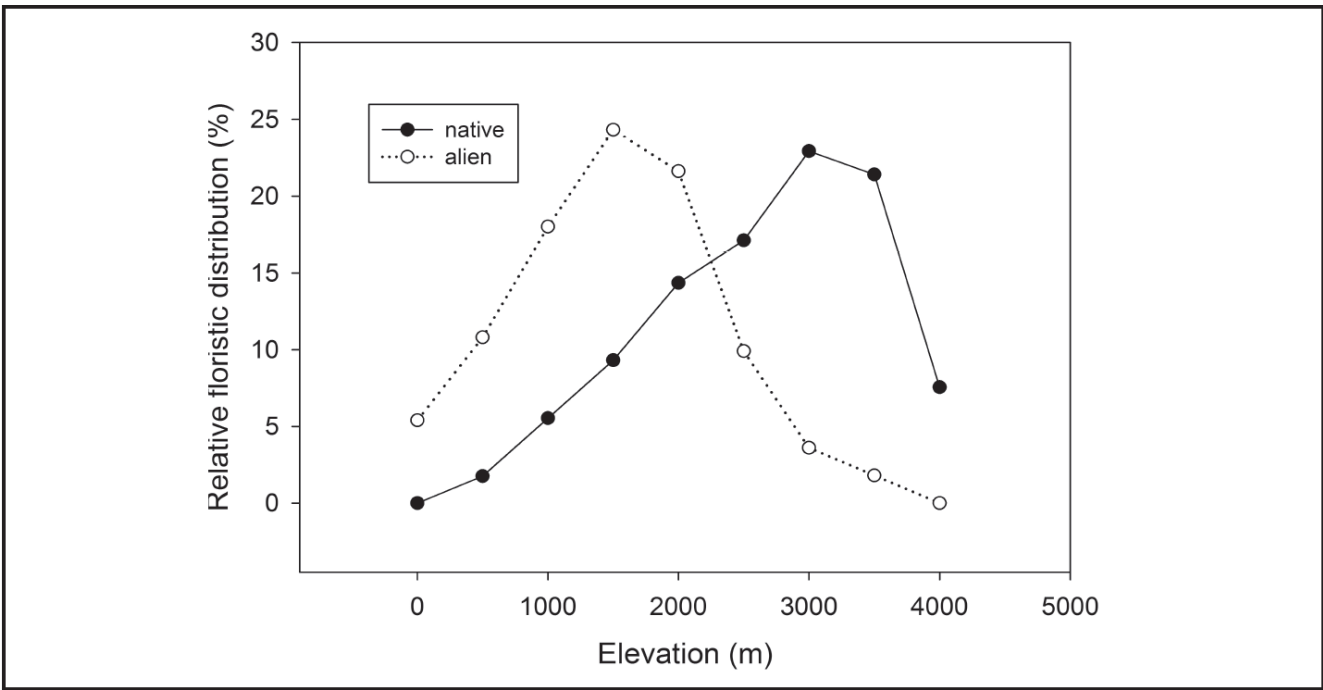


Figure 3. Relative floristic distribution of native and alien species plotted by their upper elevation limit of occurrence in California. These data include all members of the Asteraceae, Brassicaceae, Fabaceae, and Poaceae present in Sequoia and Kings Canyon National Parks, California.

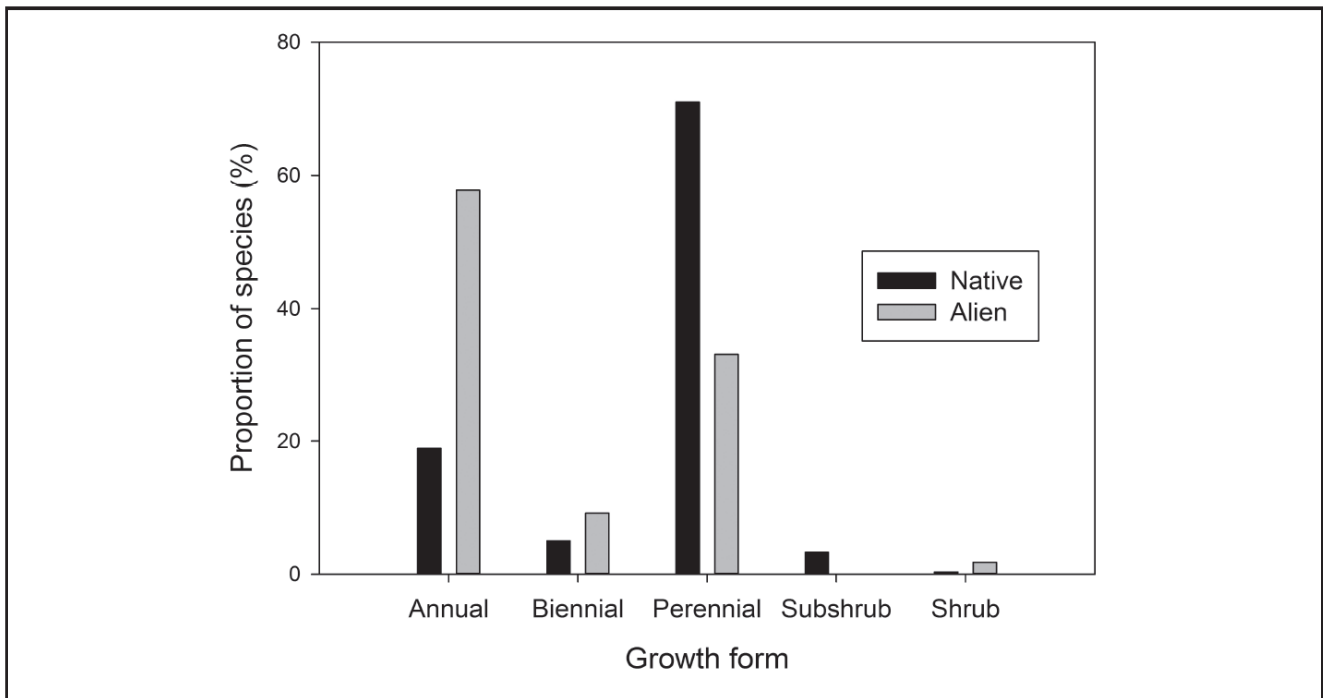


Figure 4. Relative distribution of plant growth forms among native and alien members of the Asteraceae, Brassicaceae, Fabaceae, and Poaceae present in Sequoia and Kings Canyon National Parks, California.