

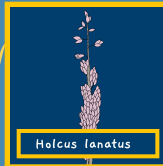
Native and invasive bunchgrasses have different responses to trail disturbance on California coastal prairies



The study was completed at five remnant coastal prairie sites that were physically separated by a forest edge or paved roads located at the University of California, Santa Cruz, USA. The dominant vegetation in these coastal prairies consists of *Danthonia californica* and *Stipa pulchra* and invasive *Dactylis glomerata* and *Holcus lanatus*.



Off-trail plant selection was randomized by flipping a coin into the grassland and choosing an individual of the targeted species closest to where the coin landed. The level of the disturbance on the trail was intermediate, as they were still vegetated and irregularly received periodic disturbance. These areas were considered low or infrequent disturbance areas.

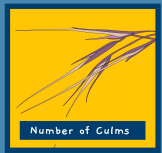
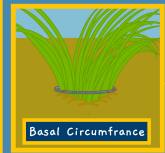


Non-Native

Native



At each site, we marked 10 individuals from each species on-trail and 10 plants off-trail that were measured throughout the experiment. Trail disturbance was classified as areas that experienced periodic disturbance from walking, jogging, or biking along designated dirt trails. On-trail plants were on the trail path, selected haphazardly.



In 2019 and 2020 we quantified the basal circumference, number of flowering culms, and number of

sterile flowering culms for perennial native grasses *D. californica* and *S. pulchra*, and non-native grasses *D. glomerata* and *H. lanatus*. Sterile flowering culms were identified as culms that (1) were absent of chlorophyll, (2) had discolored seeds, and (3) had seeds that were visibly smaller than seeds on nearby stalks. Sterile culm proportion was calculated for each individual as the proportion of sterile culms out of total flowering culms multiplied by 100.



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We found that native and non-native perennial bunchgrasses had differences in basal circumference and proportion of sterile flowering culms, but not average total flowering culms.

Danthonia californica had greater average basal circumference compared to *Holcus lanatus* and *Stipa pulchra*, but not *Dactylis glomerata*. There were no other species differences in basal circumference.



On-trail individuals of *S. pulchra* had greater basal circumference compared to off-trail individuals. The basal circumferences of *D. californica* and the two invasive non-native species, *D. glomerata* and *H. lanatus* were not affected by trail disturbance.



Flower culm production for native *D. californica* and *S. pulchra*, and non-native, *D. glomerata* was not affected by trail disturbance. Flower culm production was lower for on-trail *H. lanatus* individuals.



Although *S. pulchra* had a higher proportion of sterile flowering culms (under-developed seed culms) produced compared to *D. californica*, both *S. pulchra* and *D. californica* had a higher proportion of sterile flowering culms for on-compared to off-trail individuals.



Non-native *D. glomerata* and *H. lanatus* did not produce any sterile seed culms.



This study shows that hiking and biking trail disturbances along California coastal prairies impacts native and non-native grass species differently. Response differences to disturbance can help inform management and restoration. For example, because *Danthonia californica* was less negatively affected by trail disturbance compared to *Stipa pulchra*, it may be more effective to use *D. californica* along trails. Furthermore, because *Holcus lanatus* was negatively affected by trail disturbance, invasive control efforts might focus limited resources on species not negatively affected by trail disturbance first, such as *Dactylis glomerata*.