Do Native American kitchen (midden) sites influence the cover of introduced species?

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Introduction: Forms of land use that deviate from historic and natural patterns often change the original vegetation composition. Plants which evolved under the original conditions now face new selection pressures to which they are not adapted. In grasslands where native species compete with introduced species for resources, human land use frequently decreases both diversity and cover of native species. Two major mechansism probably responsible for this change are elevation of nutrients and disturbance. One largely unanswered question is how long the effects of past human disturbance on invasion may persist. This is of ecological importance as the new vegetation composition may be vulnerable to otherwise infrequent natural disasters and disturbances.

•Case study

•Historic land use by Miwok and Pomo kitchen sites occur along the introduced grasslands along the coast of central California, about 90-110 km north of San Francisco.They have been abandoned for more than 100 years.

•Middens were used intensively for cooking over fires and as refuse areas for shells and food wastes, and were probably both highly disturbed and enriched for nutrients, but are now completely revegetated.

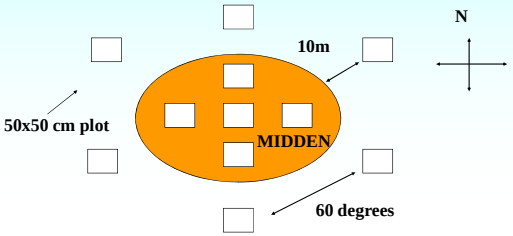
Author on a midden

Predictions:

•Native American midden sites will have higher covers of introduced species than areas off middens.

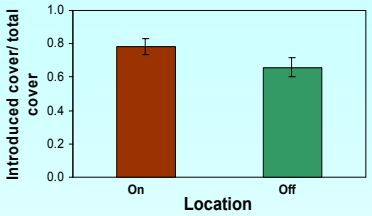
•Inorganic nitrogen concentrations will be higher on middens and will postively affect the cover of introduced species.

Methods: A survey of all recorded midden sites along the coast of Sonoma Country, California, between Bodega Head and the Russian River yielded eight that were located in grassland. Five 50 x 50 cm plots were located on and six plots off each of these middens. In June-July 2007, cover of each plant species in each plot was estimated visually by classes and a soil sample collected for analysis of ammonium, nitrate, and water content. Statistical analyses were carried out in SYSTAT 11.0.

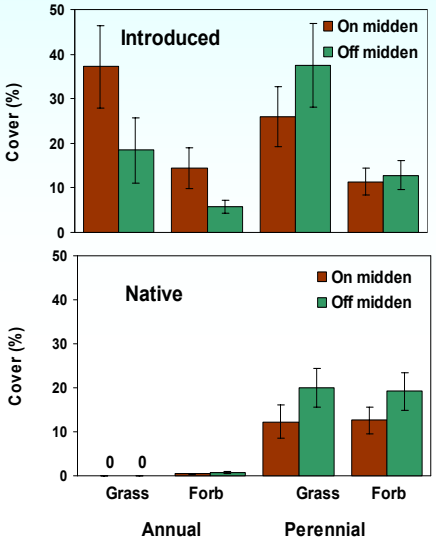


A stretch of Sonoma Coast State Park where several middens were found

Results: Relative cover of introduced species was higher on middens than off (P= 0.005).



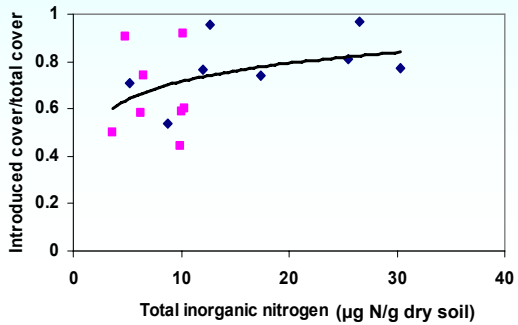
Cover (mean [SE]) of introduced annual grasses was more than twice as high on middens than off (P = 0.005). Native and introduced perennial grasses were marginally higher off middens than on (P = 0.064 and P = 0.079, respectively). Covers of native and introduced forbs did not differ on and off middens.



Concentrations (mean [SE]) of plant-available nitrogen were higher in soils on middens than off. Soil water content and carbon:nitrogen ratio were higher off middens than on.

	Location		P (ANOVA)	
	On midden	Off midden	Location	Site
Inorganic nitrogen (µg N/g dry soil)	8.5(3.01)	7.7(2.72)	0.005	0.390
Nitrate (µg N/g dry soil)	0.4(2.80)	3.8(0.94)	0.053	0.375
Ammonium (µg N/g dry soil)	4.9(.53)	4.1(.33)	0.068	0.048
Water content (% H_2O/dry soil)	0.9 (0.27)	2.1(0.40)	0.037	0.329
Carbon:Nitrogen	11.8(0.13)	12.5(0.07)	0.064	0.205

Relative cover of introduced species on and off middens tended to increase with soil nitrogen availability though the relationship was weak (P = 0.12, R^2 = 0.17).



Conclusion:

• Results confirmed the prediction that cover of introduced plants species would be higher on than off middens.

•This was due to a higher cover of introduced annuals, especially grasses.

•Soil nitrogen availability was also higher on than off middens, and may be one mechanism for their persistent, positive effect on invasion.

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