



Sweet success: restoring coastal prairie on Bodega Head

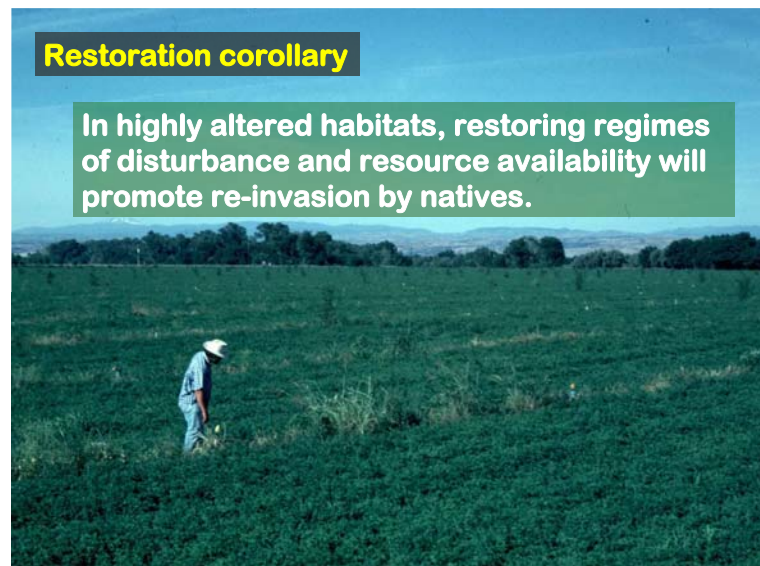
Peter Alpert

University of Massachusetts – Amherst
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USDA Biology of Weedy and Invasive Plants Program,
Jeff Diez, India Clarke, Alicia Flammia, Annette Kolb,
Kate Huxster, Madeline Scheintaub, *et al.*

Restoration corollary

In highly altered habitats, restoring regimes of disturbance and resource availability will promote re-invasion by natives.

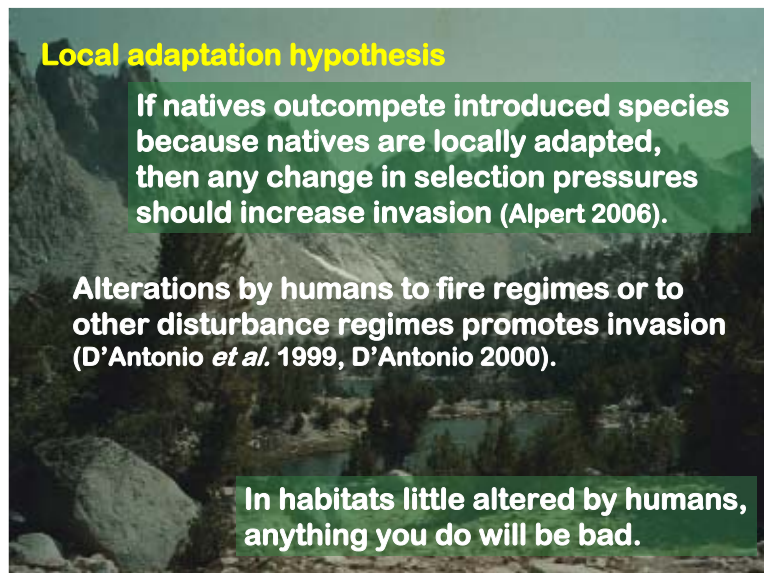


Local adaptation hypothesis

If natives outcompete introduced species because natives are locally adapted, then any change in selection pressures should increase invasion (Alpert 2006).

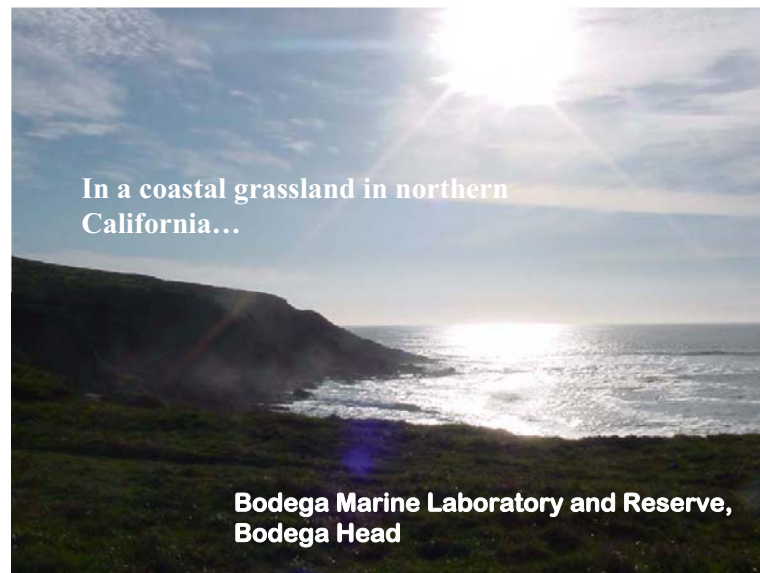
Alterations by humans to fire regimes or to other disturbance regimes promotes invasion (D'Antonio *et al.* 1999, D'Antonio 2000).

In habitats little altered by humans, anything you do will be bad.



In a coastal grassland in northern California...

Bodega Marine Laboratory and Reserve,
Bodega Head





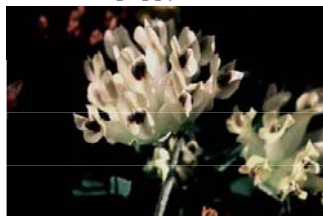
Nemophila menziesii
baby blue eyes



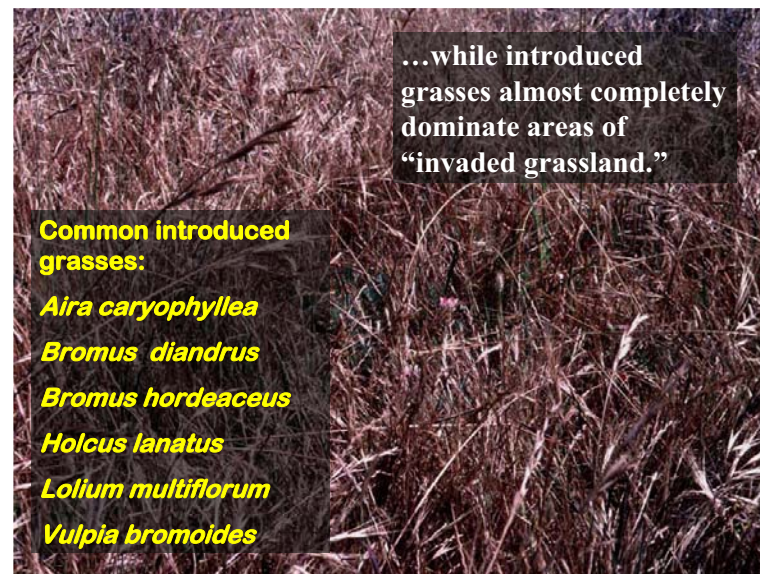
Eschscholtzia californica
California poppy



Iris douglasiana
Douglas iris

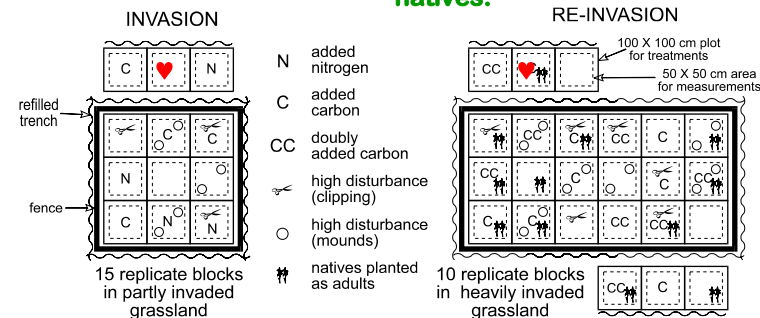


Trifolium fucatum
bull clover



In mixed grassland, either raising or lowering nutrients or disturbance will promote invasion.

In invaded grassland, lowering elevated nutrient levels and adding natives will promote re-establishment of natives.



500,000 locally collected seeds of 12 grass species were added to reduce effects of dispersal. Plots were 1 x 1 m.

Carbon treatment:
0.5 kg sugar / m²,
two times per
year, starting in
November 2002

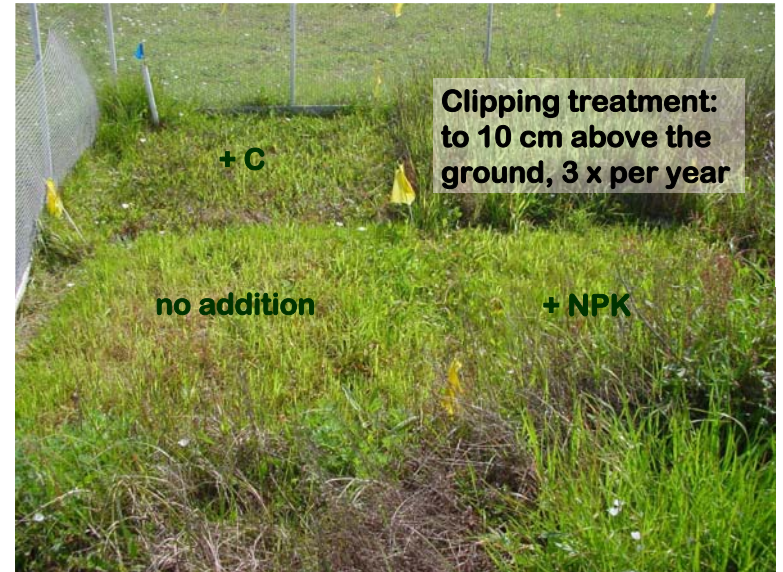


Clipping treatment:
to 10 cm above the
ground, 3 x per year

+ C

no addition

+ NPK

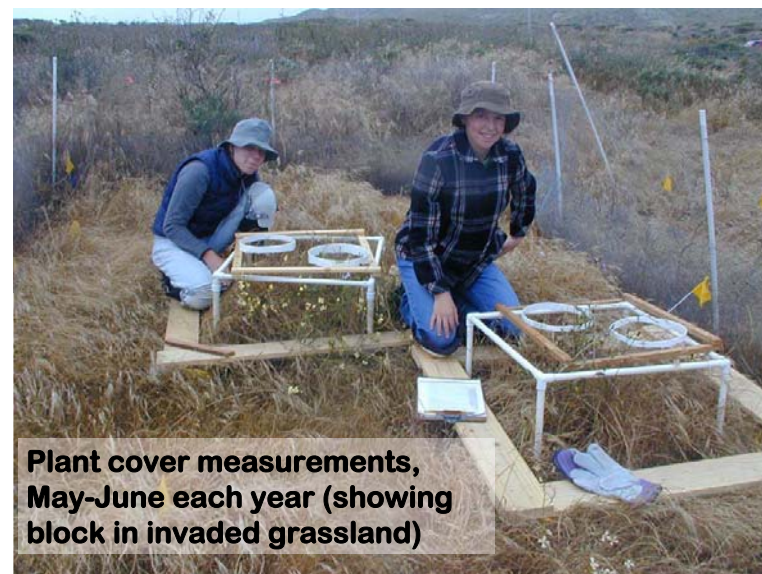
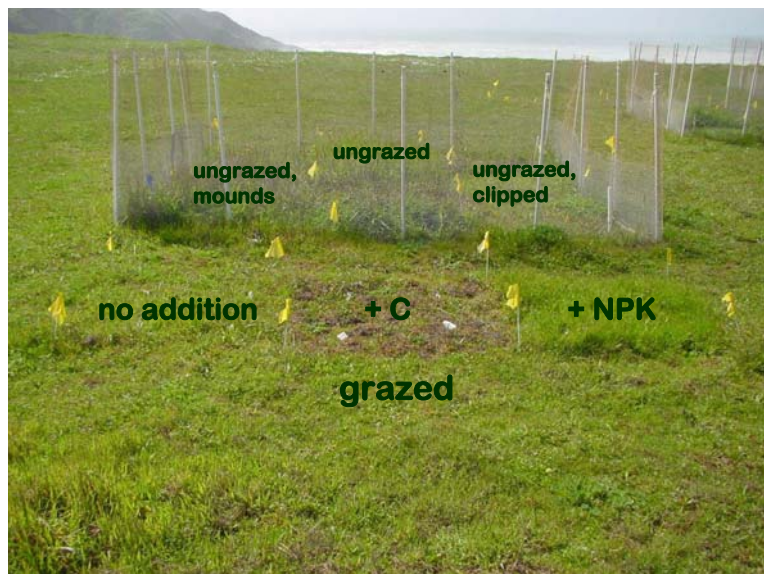


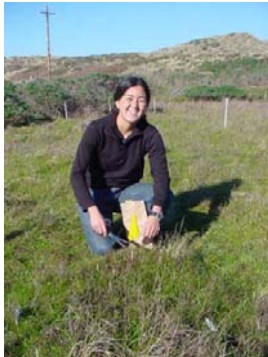
+NPK treatment:
4-month-release
fertilizer, 19-6-12,
7.3 g N / m², once
per year



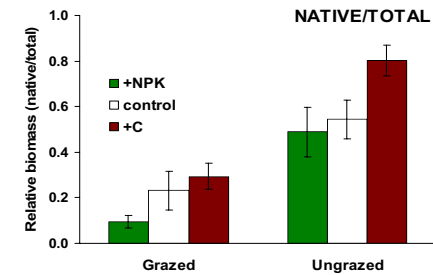
Mound treatment:
25 cm diameter x
10 cm deep, soil
from real mounds,
one time only, 2002







MIXED GRASSLAND: BIOMASS, JAN. 2006

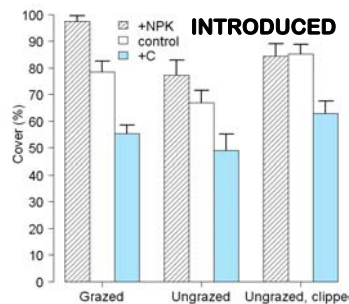


Preventing grazing and adding sugar increased the relative biomass of natives from 20% to 80%.
(Results for June 2006 show an increase from 20% to 60%.)

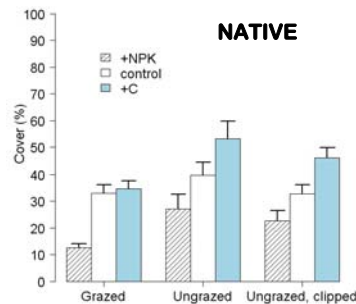
MIXED GRASSLAND: COVER, JUNE 2005

After 3 y, cover of *introduced* plants was 30% *lower* if sugared and 15% *lower* if ungrazed.

Cover of *natives* was 25% *higher* if sugared and 55% *higher* if ungrazed.



P [ANOVA]: nutrients < 0.001, disturbance < 0.001, n x d 0.3

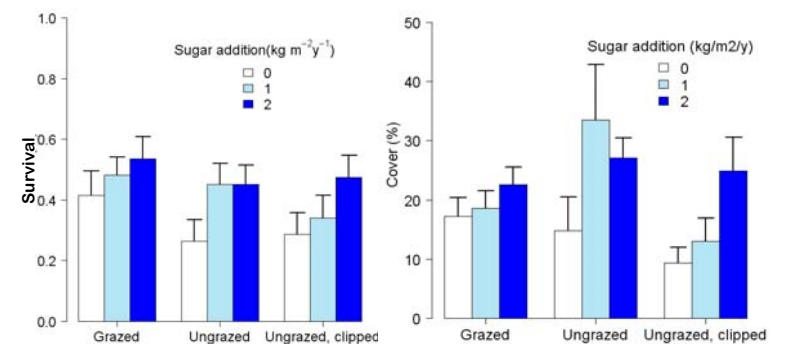


P [ANOVA]: nutrients < 0.001, disturbance 0.2, n x d 0.6

INVADED GRASSLAND: PLANTED NATIVES, JUNE 2005

After 18 mo., 40% survived, 50% if sugared and grazed.

They reached 15% cover, 25% if sugared and ungrazed.



P [ANOVA]: nutrients 0.05, disturbance 0.1, n x d 0.8

P [ANOVA]: nutrients 0.006, disturbance 0.05, n x d 0.05

(No natives established from seed.)

The local adaptation hypothesis was not supported. Instead, invasion in this coastal grassland goes up with nutrients and with disturbance.

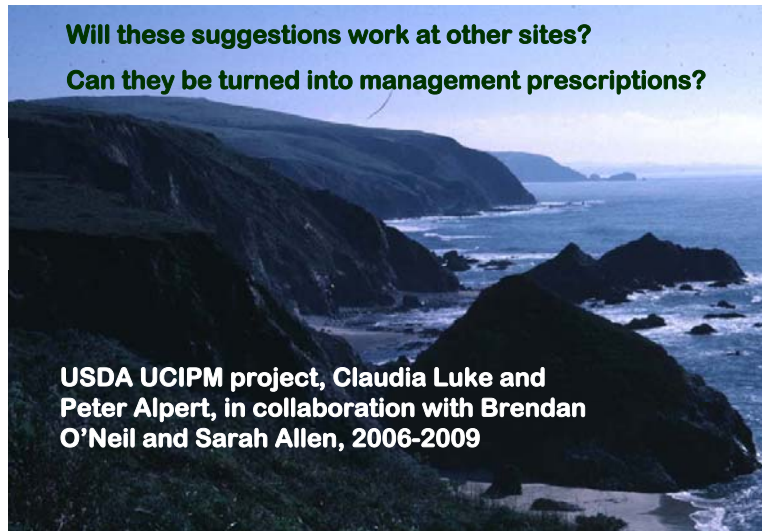
Results do suggest how to control invasion in the coastal prairie:

Where natives remain, add carbon and prevent grazing by deer and rabbits.

In invaded grassland, plant adults. Adding carbon and preventing grazing may increase their survival and will increase their cover.

Will these suggestions work at other sites?

Can they be turned into management prescriptions?



USDA UCIPM project, Claudia Luke and Peter Alpert, in collaboration with Brendan O'Neil and Sarah Allen, 2006-2009

P [repeated-measures ANOVA]: nutrients < 0.001, year < 0.001

In clipped plots, adding **nutrients** increased plant growth; adding **sugar** decreased it.

P [repeated-measures ANOVA]: nutrients 0.04, year 0.009

