Spatial Analysis of Perennial Pepperweed Infestation in a Seasonal Floodplain

Ingrid Hogle, Joshua H. Viers, James F. Quinn, Mark W. Schwartz, Becky Waegell, Kaylene Keller

Perennial Pepperweed *(Lepidium latifolium)*

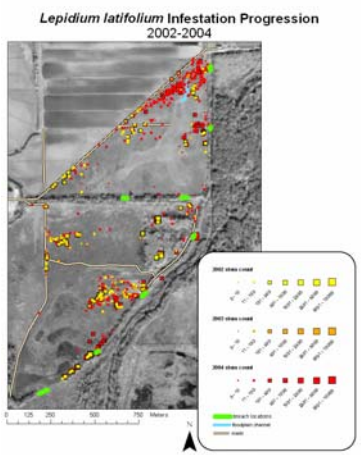
Abstract

Rapid on-going expansion of *Lepidium latifolium* (perennial pepperweed) populations threatens to create vegetation monocultures in riparian and wetland habitats throughout California. Understanding site characteristics that promote spread of *Lepidium latifolium* can help resource managers target and prioritize areas for weed control and future habitat restoration.

We are developing a site-specific, GIS-based model that can be used to identify and examine correlations between rate of *Lepidium latifolium* spread, hydrological characteristics, disturbance regime and existing plant community types.

Here we present our results from three years of monitoring *Lepidium latifolium* on a recently restored seasonal floodplain at the Cosumnes River Preserve in Sacramento County, California. These monitoring data are overlaid with elevation, distance to potential seed sources and disturbance using ArcGIS to assess patterns of *Lepidium latifolium* infestation. Physical and environmental site characteristics can then be used to assess future infestation risk and to target areas for management.

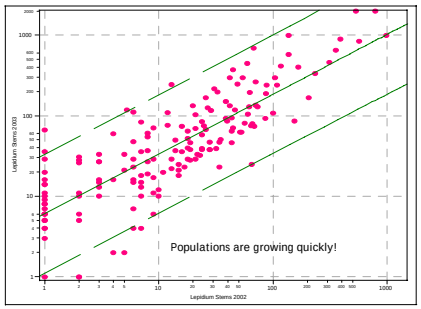
Lepidium floodplain habitat



Lepidium populations are crowded around potential seed sources: roads and levee breaches.

Objective

To inform restoration management and monitoring by tracking and modeling the expansion of *Lepidium latifolium* populations on a restored floodplain.



Graphical analysis of growth variables affecting the expansion of *Lepidium latifolium*. Log(03_stems) = 1.805411 + 0.7429744 Log(02_stems) Adjusted R^2 = 0.67; DF=163; F=339.22; P < 0.001

Parameters measured

Number of Stems at each pepperweed patch

Area of each pepperweed patch

Relative elevation as a correlate for flooding/inundation

Distance to Levee Breaches

Distance to Roads

Discussion

Populations of perennial pepperweed (*Lepidium latifolium)* are increasing rapidly in the Cosumnes River Preserve's restored floodplain. Introductions appear to be from both roads and breaches, and are spreading quickly. In 3 years, area covered by perennial pepperweed has increased from 1% to 7% of the 1122 km^2 floodplain.

We are modeling growth trajectories and dispersal patterns to inform management priorities. We are also designing an adaptive management strategy which we will implement next spring, testing the efficacy of different control methods at sites with differing physical characteristics.

Elevation, size of previous year's population, and distance to nearest disturbance vector (road or levee breach) all affected change in patch stem numbers between 2002 and 2003.

Analysis of Lepidium Data

Summary of Fit

RSquare	0.761995
RSquare Adj	0.751583
Root Mean Square Error	90.98621
Mean of Response	75.48214
Observations (or Sum Wgts)	168

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	7	4155382.3	593626	73.1794
Error	160	1297907.7	8112	Prob > F
C. Total	167	5453289.9		<.0001

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	159	1297903.2	8162.91	1813.981
Pure Error	1	4.5	4.50	Prob > F
Total Error	160	1297907.7		0.0187
				Max RSq
				1.0000

Parameter Estimates

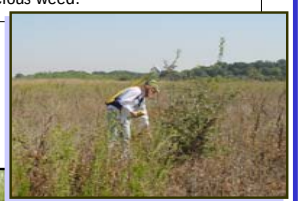
Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	79.773289	46.96307	1.70	0.0913
elevation	-39.31479	18.61899	-2.11	0.0363
02_Stems	0.5830413	0.066463	8.77	<.0001
(elevation-2.24405)*(02_Stems-50.8095)	-1.682308	0.215325	-7.81	<.0001
minSourceDist	0.4107086	0.098583	4.17	<.0001
(elevation-2.24405)*(minSourceDist-108.847)	-0.758058	0.256157	-2.96	0.0036
(02_Stems-50.8095)*(minSourceDist-108.847)	-0.004078	0.001027	-3.97	0.0001
(elevation-2.24405)*(02_Stems-50.8095)*(minSourceDist-108.847)	-0.017799	0.002287	-7.78	<.0001

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
elevation	1	1	36167.90	4.4586	0.0363
02_Stems	1	1	624255.84	76.9553	<.0001
elevation*02_Stems	1	1	495162.27	61.0413	<.0001
minSourceDist	1	1	140981.92	17.3574	<.0001
elevation*minSourceDist	1	1	71041.84	8.7577	0.0036
02_Stems*minSourceDist	1	1	128003.62	15.7797	0.0001
elevation*02_Stems*minSourceDist	1	1	491234.46	60.5571	<.0001

Future Directions

- CRG Researchers will be creating probability surface models of future *Lepidium latifolium* invasion by using statistical relationships between relevant factors, such as elevation, distance to disturbance vector, and proximity to former invasion.
- Other information, such as LIDAR imagery of canopy cover and mapping of infestations in other sites on the Preserve, will allow a more synoptic view of *Lepidium latifolium* invasions that can be applied to other areas within the aegis of CALFED.
- Correlating invasion probabilities with management activities and restoration site analysis will allow natural resource managers to more effectively manage this pernicious weed.



GPS tracking of *Lepidium latifolium* infestations in open floodplain and cottonwood-willow forest restoration areas

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