

Long-term restoration of riparian understory species over large spatial scales

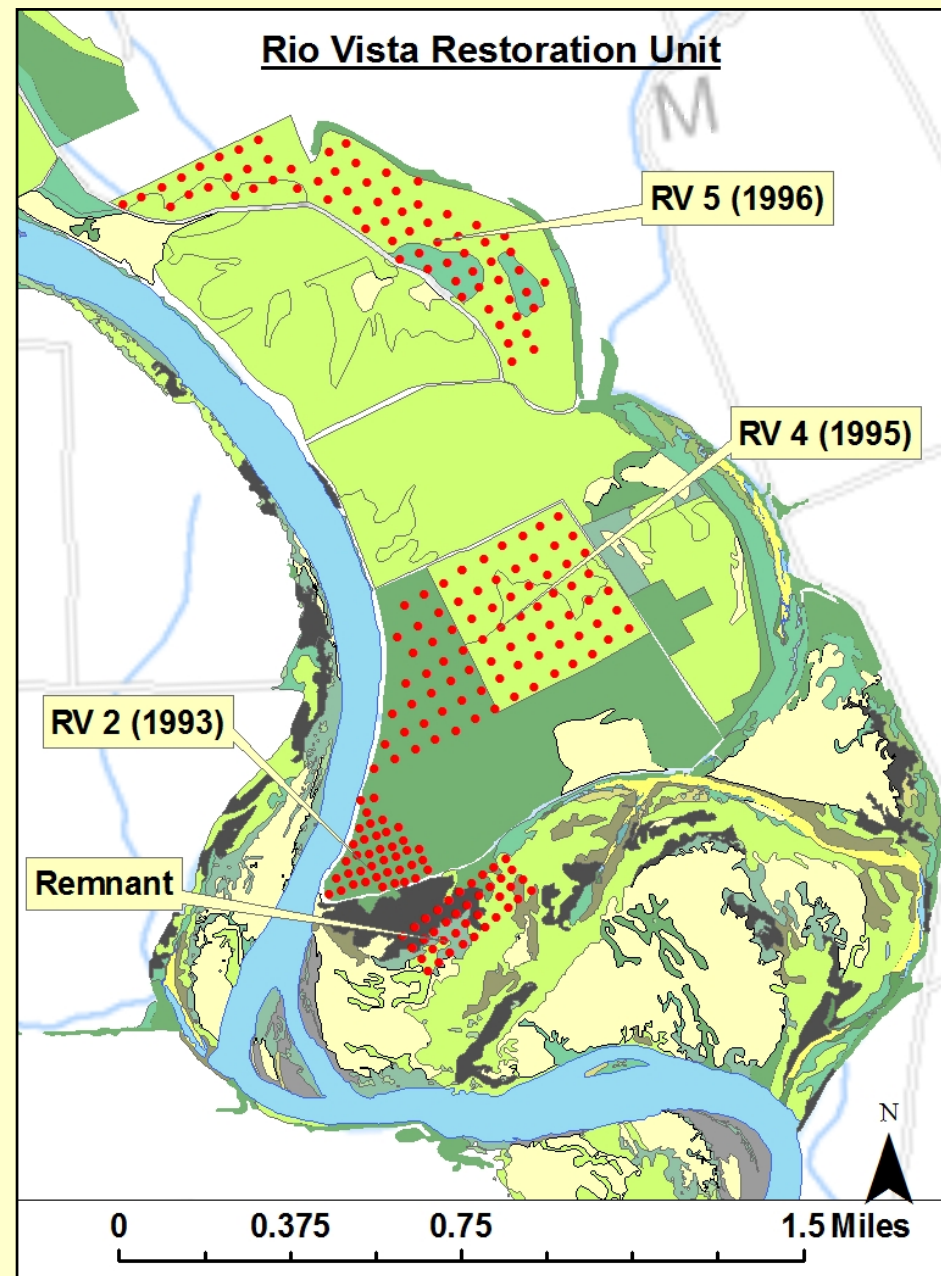
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UC Santa Cruz and CSU Chico

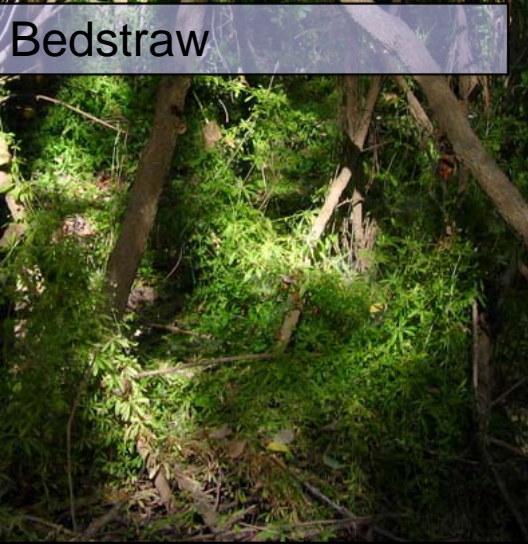


Methods - Survey

Sampled understory vegetation and overstory cover in:

- 15 sites restored 1989-96 in both 2001 and 2007, 20 more sites in 2007
- 10 remnant forests
- 1×1 m quadrats
- 20-80 per site
- 40-80 m apart

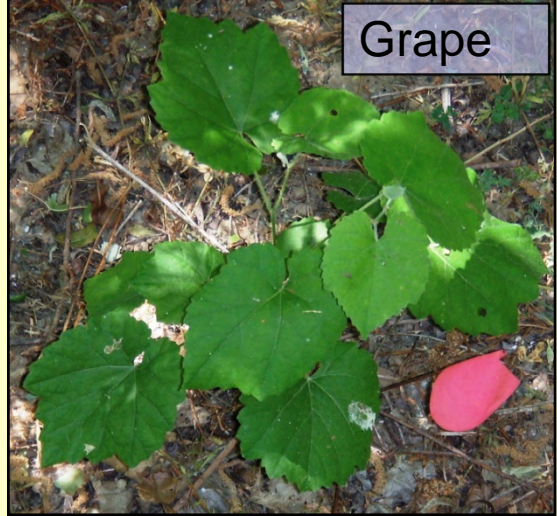




Bedstraw



Santa Barbara sedge



Grape

Native understory species



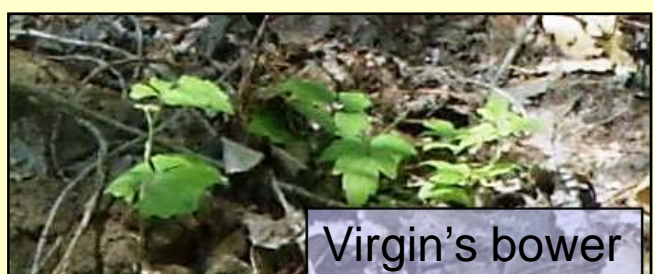
Mugwort



Goldenrod



Blackberry



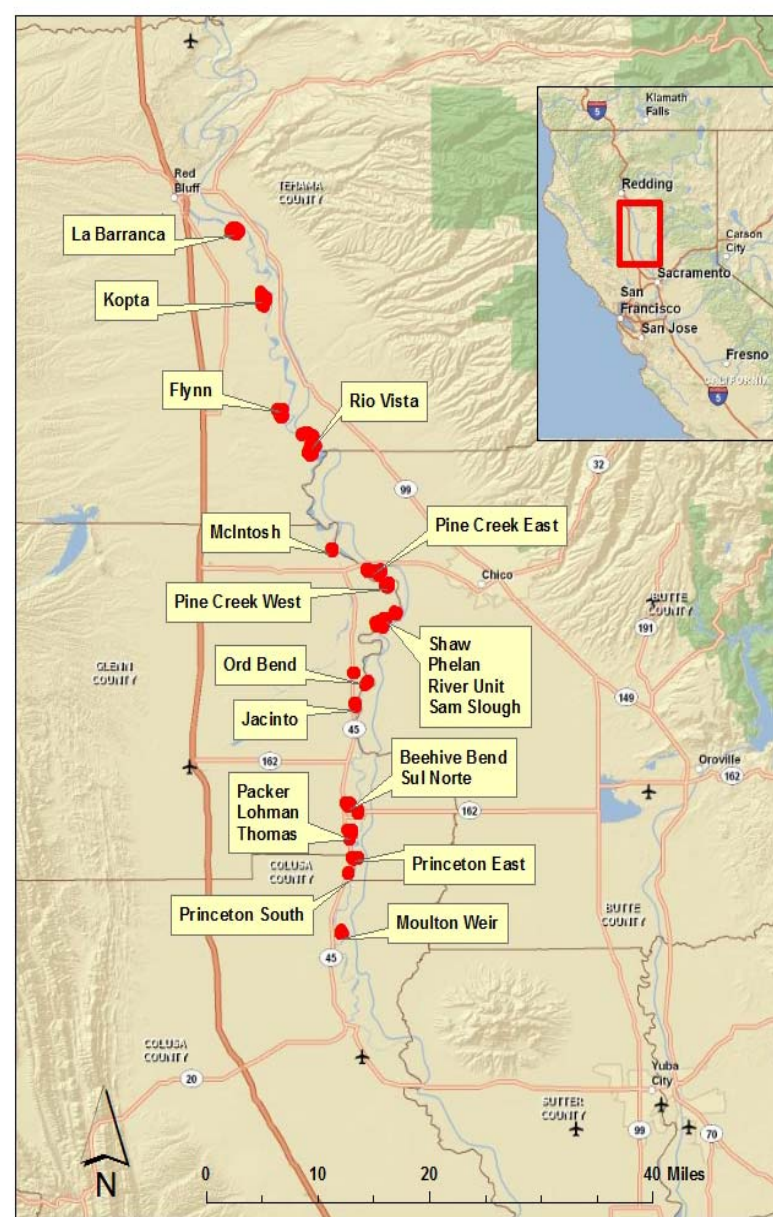
Virgin's bower

Monitoring understory plant species – research question

- Does native understory cover increase over time?
Is the ecosystem continuing to recover naturally?
- What factors affect establishment of native species?
How can we improve strategies to reduce exotic species and restore understory plants?



Sites Surveyed



TEMPORAL ANALYSES – Charles McClain SCRAF presentation summary

Overstory cover increased from 2001 to 2007

Changes in native understory cover were variable across sites but, overall, native cover did not increase over time.

Increasing cover in some sites was largely due to increase in the widespread species *Galium aparine* (bedstraw)

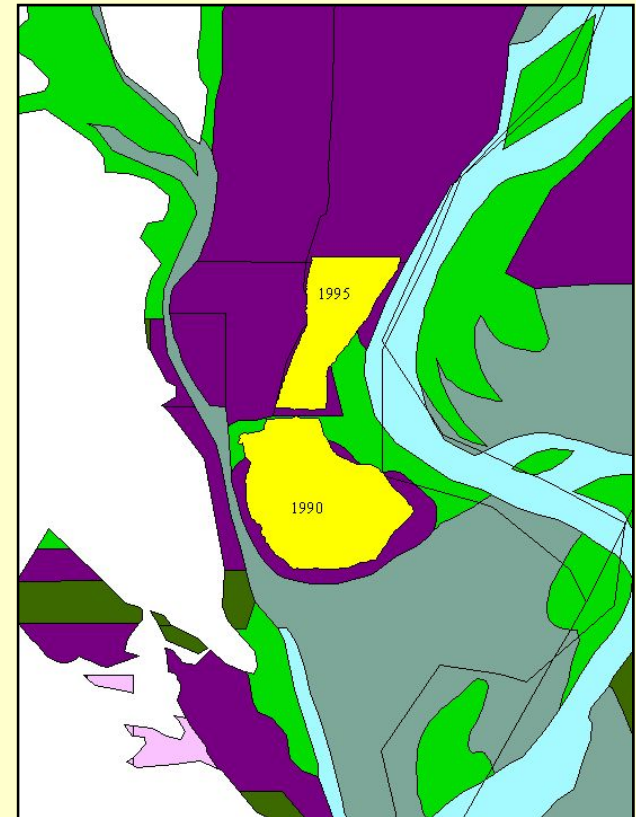
For more details see: McClain, Holl, & Wood. In press. *Restoration Ecology*.

SPATIAL ANALYSES

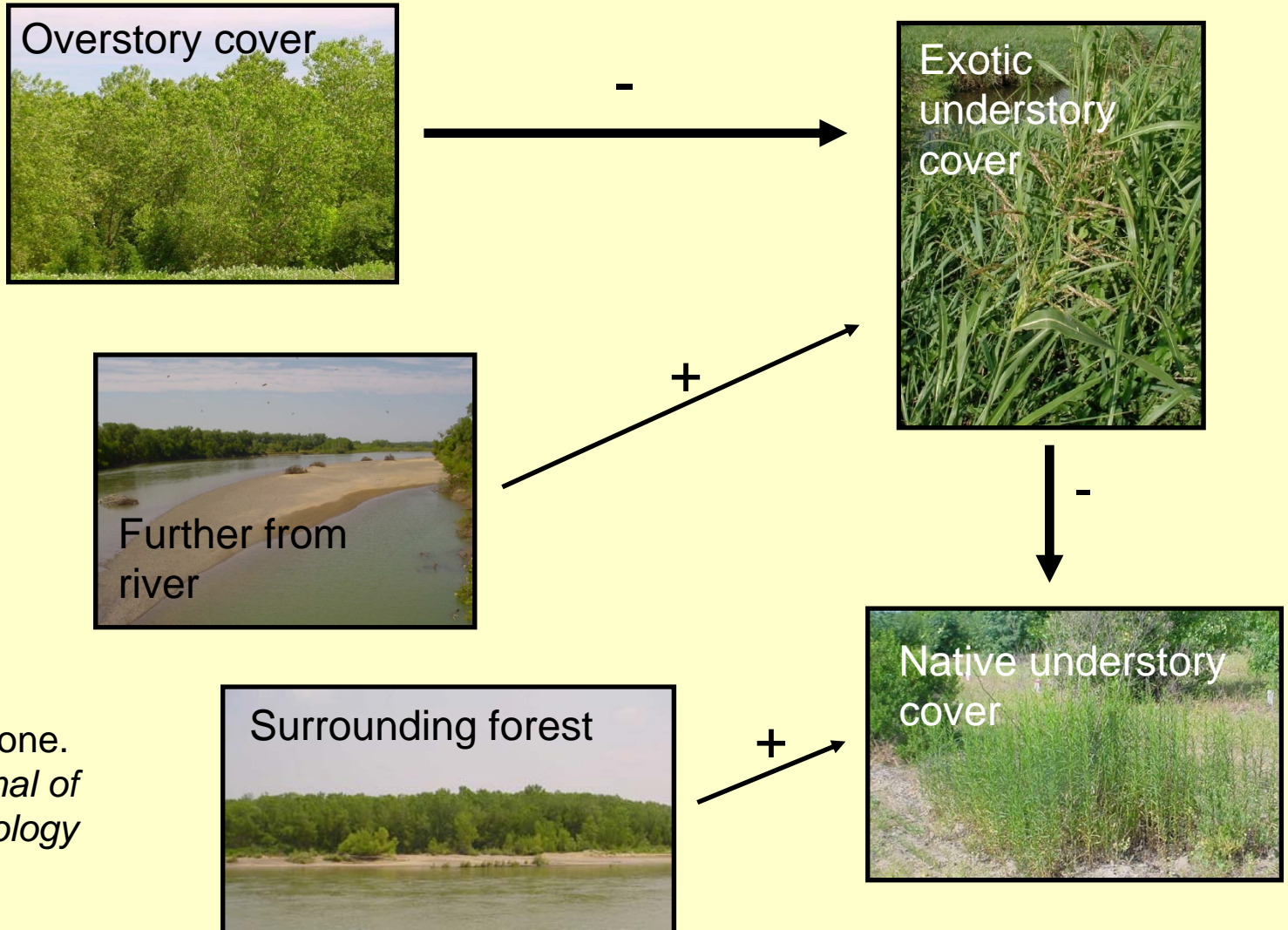
Point variables – soil texture, overstory cover, other species

Site variables – past land use, time since planting, patch size

Landscape variables –
distance to river,
elevation on the floodplain,
distance to remnant forest,
amount of remnant forest surrounding
at 100, 500, 1000 m



2001 survey – Factors affecting native establishment



Holl and Crone.
2004. *Journal of Applied Ecology*
41:922-933

SPATIAL RESULTS – 2007 survey

Consistent with past results:

- exotic cover was lower where there was more overstory tree cover
- native cover (59% *Galium aparine*) was higher where there was lower exotic understory cover and closer to the river

But, factors affecting different plant guilds varied:

- wind-dispersed species (e.g. mugwort) had higher cover where there was more surrounding remnant forest cover
- gravity-dispersed species (e.g. pipevine, Santa Barbara sedge) increased with time since restoration and were higher closer to river
- very few animal dispersed species (e.g. blackberry, grape) anywhere

CONCLUSIONS/RECOMMENDATIONS

- Will need to actively plant most native understory species and continue monitoring survival and natural establishment
- Some species naturally establish nearer to the river and near remnant forest so tailor plantings to site conditions
- Overstory cover is an effective way to control most exotic species.
- Wait to plant some species until overstory cover has shaded out exotics.



Acknowledgements

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People

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