Status and habitat requirements of *Physaria thamnophila*, an endangered species of Tamaulipan thornscrub

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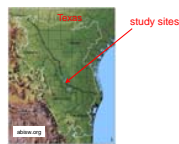## *Physaria* (*Lesquerella*) *thamnophila* (Zapata bladderpod)

• crucifer (Brassicaceae)

• herbaceous short-lived perennial
• endangered
   • 'listed': US Endangered Species Act

Plant community, study sites

• part of Tamaulipan thornscrub biome

Texas
study sites
abiew.org
Tamaulipan Thornscrub Ecoregion

• known populations are on terraces above Rio Grande
• all four study sites had highly erodible calcareous soils
• study sites were dominated by the shrubs *Acacia rigidula* (blackbrush) and *Leucophyllum frutescens* (cenizo)
• the non-native invasive grasses common in similar sites (*Pennisetum ciliare*, buffelgrass; *Dichanthium annulatum*, Kleberg bluestem) were absent or sparse in the study sites
• the study sites had a rich flora of native shrubs, grasses, forbs, and cacti; our data correct and extend previously published descriptions of the community of *P. thamnophila*
• threats to *P. thamnophila* and to Tamaulipan thornscrub in Texas include conversion of habitat to agriculture or pasture; road construction; urbanization; oil and gas extraction; border fence construction; non-native grasses
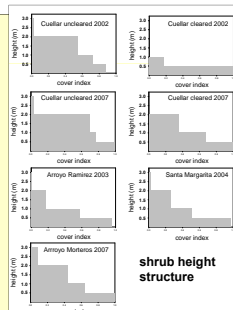
Methods

• 4 populations: Arroyo Morteros (AM), Arroyo Ramirez (AR), Cuellar (CL), Santa Margarita (SM)
• part of Cuellar roller-chopped (right-of-way maintenance) in December 2000; high density of *P. thamnophila* in cleared area in February 2001

pictures of Cuellar cleared area

Methods, continued

• permanent transects through each of the four populations
• permanent plots at random points along transects
• *P. thamnophila* censuses
   • censuses of *P. thamnophila* in Mar, April, or May 2003-2007
   • in each year, 1-4 of the *P. thamnophila* populations censused
   • if a census was made
      • all plants in each plot were counted, plus
      • in some years, # reproductive plants in each plot were counted
      • in some years, # seedlings in each plot were counted
• vegetation data
   • collected in AM 2007; AR 2003; CL 2002 and 2007; SM 2004
   • 5 sub-plots/census plot
   • recorded each plant species present in each sub-plot , in each of 4 height categories: 0 – 0.5 m, 0.5 - 1 m, 1 - 2 m, and 2 - 3 m above ground. There were no plants >3 m tall.
   • calculation of canopy cover index for each plot: (1) used upper 3 ht categories only; (2) summed # of ht categories with any plant in them in each subplot; (3) summed these values over the 5 subplots

Cuellar uncleared 2002
Cuellar cleared 2002
Cuellar uncleared 2007
Cuellar cleared 2007
Arroyo Ramirez 2003
Santa Margarita 2004
Arroyo Morteros 2007
shrub height structure

Acknowledgements

We thank the Lower Rio Grande Wildlife Refuge staff for their assistance; landowner Jorge Gonzales and family for access to Santa Margarita Ranch; and Tom and Elena Patterson, Thomas Adams, Robyn Cobb, Loretta Pressley, Jim Manhart, and Alan Pepper for assistance with field work.

Results

• In both 2002 and 2007, the CL cleared plots had lower canopy cover index values, greater herbaceous-layer species richness, and more grass than the CL uncleared plots. [ANOVAs]
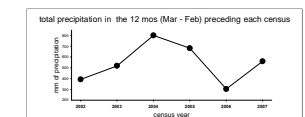
• Average density of *P. thamnophila* was greater in cleared than in uncleared CL plots, if unoccupied plots are included. In all five annual censuses of CL, a higher proportion of cleared plots had *P. thamnophila* plants in them than did uncleared plots, significantly so in 3 of the 5 years (2002: χ^2 = 6.65, P = 0.0099; 2003: χ^2 = 4.02, P = 0.0449; 2006: χ^2 = 5.75, P = 0.0165). However, there were no significant differences in the density of plants in occupied plots between the treatments. [ANOVAs]

• Although the 3 unmanipulated sites (AM, AR, and SM) differed significantly in canopy cover, herbaceous-layer species richness, and grass density [ANOVAs], vegetation characteristics were not related to *P. thamnophila* plot occupancy in these sites [logistic regressions, with site as a class variable].

• Canopy cover was significantly and positively related to total *P. thamnophila* density in 2004 and 2006-2007 and to *P. thamnophila* seedling density in 2007. Herbaceous layer species-richness and grass density were not related to *P. thamnophila* density. [ANCOVAs]

Physaria thamnophila density and canopy cover index
sites P < 0.0001 ****
cover P = 0.02 *
N=75
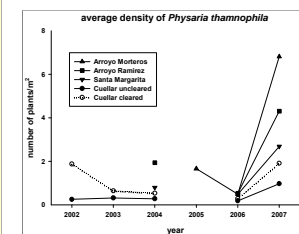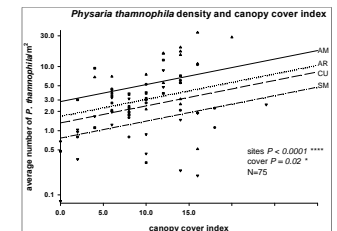
• *P. thamnophila* density varied greatly among years. The proportion of plants setting seed and the number of seedlings varied even more; both were zero in 2006. Precipitation in the preceding 12 months only accounted for 13% of the variation in density and was not significantly related to density. [ANCOVA]

average density of *Physaria thamnophila*
Arroyo Morteros
Arroyo Ramirez
Santa Margarita
Cuellar uncleared
Cuellar cleared

total precipitation in the 12 mos (Mar - Feb) preceding each census

Discussion and Conclusions

• high temporal variation in population size
   • concealed any trends in population size
   • may be typical of small herbaceous perennials in arid climates
   • data from a few years insufficient to assess population status and management efforts

• complex relationship between *P. thamnophila* and shrub cover
   • more cleared plots than uncleared plots occupied by *P. thamnophila* in the brush-cleared site
   • BUT *P. thamnophila* total and seedling density positively correlated with canopy cover in all 4 sites
• may have been due to positive effect of litter on *P. thamnophila* seedlings
   • in undisturbed areas, more litter under shrubs
   • mechanical clearing spread litter, perhaps creating favorable microsites for *P. thamnophila* seedlings away from surviving shrubs
• most likely benefit of litter: reduction of soil erosion rates
• brush-clearing, if it does not increase soil erosion, may be a useful management tool

• Ideally, conservation of endangered species would be based upon demographic data without missing years or inconsistencies between years and populations, and on fully replicated and randomized experiments, but such data are not available for most endangered plant species. We demonstrate here how much can be learned from less-than-ideal data that were collected opportunistically as time and resources allowed.