Native flowering plants and pollinator services: hedgerow plantings

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Background and Results

Background

Goal: Determine best forb (flowering plant) mix at best rate for pollinator services

Setup: Three native forb mixes seeded at three rates in 8m^2 experimental plot

Location: 6 privately-owned farms with hedgerow shrub plantings in Yolo County

Measures of success: germination, cover, floral resources for pollinators, and cost-effectiveness

Seed Mix	Species	Common Name	Flowering phenology	Life-cycle
Mix A	*Lupinus succulentus*	Arroyo lupine	Spring	Annual
	Eschscholzia californica	California poppy	Spring - summer	Annual/perennial
	Phacelia californica	California phacelia	Spring-summer	Perennial
	Lupinus densiflorus	Chick lupine	Late spring – early summer	Annual
	Grindelia camporum	Gum plant	Summer – fall	Perennial
Mix B	*Phacelia californica*	California phacelia	Spring-summer	Perennial
	Trifolium fucatum	Bull clover	Late spring	Annual
	Lupinus formosus	Summer lupine	Late spring – summer	Perennial
	Trifolium obtusiflorum	Spiney clover	Late spring – summer	Annual
	Lotus purshianus	Spanish clover	Summer - fall	Annual
Mix AB	*Lupinus succulentus*	Arroyo lupine	Spring	Annual
	Eschscholzia californica	California poppy	Spring - summer	Annual/perennial
	Phacelia californica	California phacelia	Spring-summer	Perennial
	Trifolium fucatum	Bull clover	Late spring	Annual
	Lupinus densiflorus	Chick lupine	Late spring - summer	Annual
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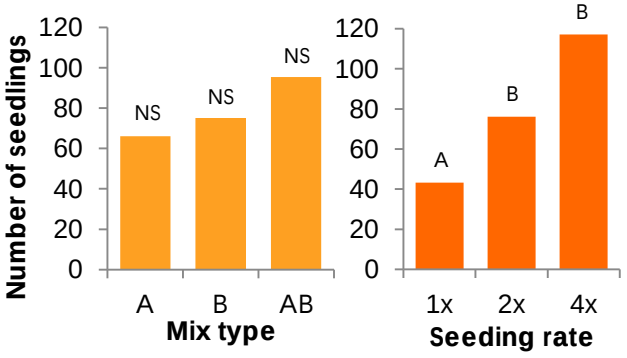
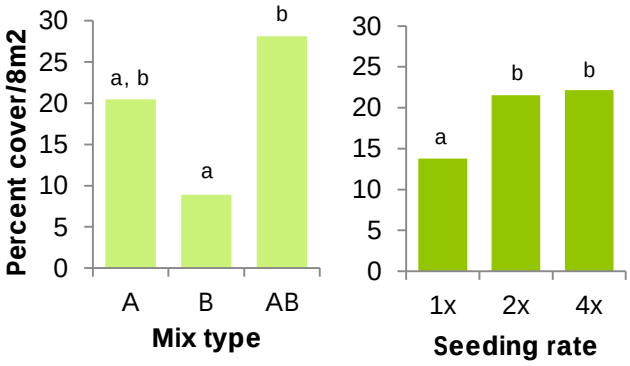
	Grindelia camporum	Gum plant	Summer – fall	Perennial
	Lotus purshianus	Spanish clover	Summer - fall	Annual

Results

- 1st year germination and cover:
  - Mix AB produced the highest average cover above Mix B (Mix A in the middle)
  - Seeding rates 2x and 4x (highest two) produced, on average, the most germinants and cover but were not statistically different from each other

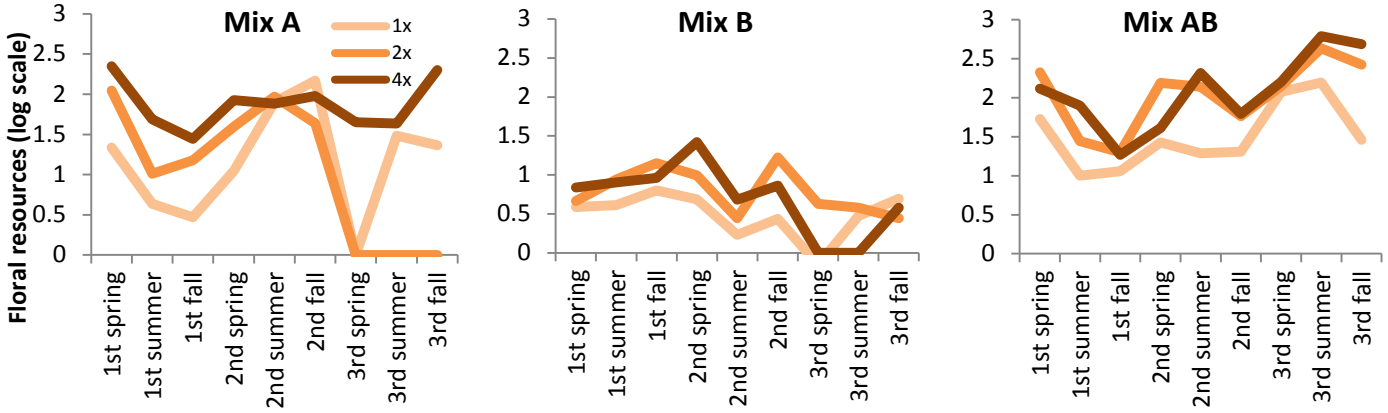




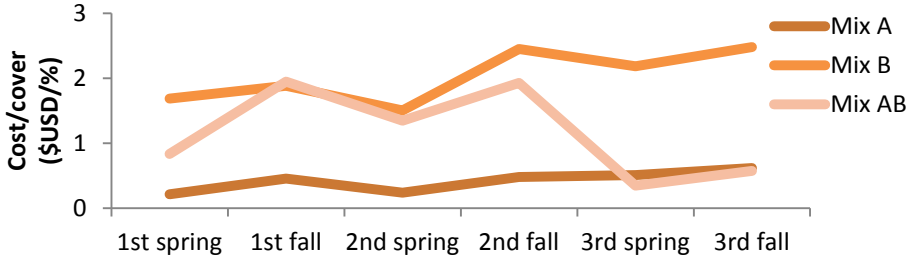
Note: letters above bars signify strongly different groups; NS stands for statistical non-significance

Results continued

- Multi-year cover and floral resources
  - Seeding rate (*not* mix) important for multi-year cover → Rate 4x and 2x produced the highest average cover but were not different from each other
  - Mix *and* rate important for multi-year floral resources → Mix A and AB produced the highest average number of flowers and Rates 4x and 2x also produced the highest



- Multi-year cost-effectiveness
  - Cost-effectiveness is cost of seed/cover ($USD/% cover)
  - Overall, Mix A was, on average, the most cost-effective (the most bang for the buck)



  - On a species level, summer lupine (*L.formosis*) was least cost-effective and California poppy (*E. californica*), phacelia (*P. californica*), and gumplant (*G. camporum*) were most cost-effective

- Diversity through time
  - Number of species (richness) decreased significantly after the first year (though cover increased!)
  - Dominant species changed

1st year: from lupines, lotus, and phacelia

2nd-3rd year: to gumplant

1st year: all species germinated

2nd year: No clovers (*Trifolium* species)

3rd year: No clovers and no Spanish clover (*L. purshianus*)

Take-Home Messages and Recommendations

Take-home messages

- Seeding rate is key, over mix type → individual components of a mix may not matter is seeding rate is too low or too high
- *Point of diminishing returns* with increased seeding rate → no need to overseed!
- After first year, there may be a tradeoff between cover and diversity, especially if there is a very dominant species → determine your planting goal (for example, counter weeds vs. attract diverse pollinator community)
- There may be a tradeoff between seeding with more species per mix and cost-efficiency → determine your planting goal (for example, greater biodiversity vs. lower cost)
- Gumplant, *Grindelia camporum*, dominated after first year → may compete with other native forbs
- BUT gumplant was also the most attractive forb species for a diverse array of pollinators

Recommendations

- Mix A at rate 2x if goal is to attract pollinators, save money, and get good cover
- Mix AB at rate 2x if goal is to attract pollinators, have greater biodiversity, and get good cover but spend a little more money
- Do not plant in conjunction with native grasses
- Weed management pre-planting and post-planting (for up to 2 years) is a must

		Relative rate 1x		Relative rate 2x		Relative rate 4x	
Seed mix	Species	PLS lbs/ft^2	Live seed/ft^2	PLS lbs/ft^2	Live seed/ft^2	PLS lbs/ft^2	Live seed/ft^2
Mix A	*E. californica*	0.0011	2.53	0.0022	5.06	0.0044	10.12
	P. californica	0.0007	1.66	0.0013	3.31	0.0026	6.63
	G. camporum	0.0011	1.81	0.0022	3.62	0.0044	7.24
	L. succulentus	0.0110	1.26	0.0220	2.52	0.0440	5.03
	L. densiflora	0.0198	1.05	0.0396	2.11	0.0792	4.22
	Total	0.0337	8.31	0.0674	16.62	0.1347	33.24
Mix B	*L. purshianus*	0.0033	2.67	0.0066	5.33	0.0132	10.67
	L. formosis	0.0308	2.24	0.0616	4.48	0.1233	8.97
	T. obtusiflorum	0.0033	3.42	0.0066	6.83	0.0132	13.67
	T. fucatum	0.0066	4.32	0.0132	8.64	0.0264	17.28
	P. californica	0.0007	1.66	0.0013	3.31	0.0026	6.63
	Total	0.0447	14.30	0.0894	28.60	0.1787	57.21
Mix AB	*E. californica*	0.0011	2.53	0.0022	5.06	0.0044	10.12
	P. californica	0.0007	1.66	0.0013	3.31	0.0026	6.63
	G. camporum	0.0011	1.81	0.0022	3.62	0.0044	7.24
	L. succulentus	0.0110	1.26	0.0220	2.52	0.0440	5.03
	L. densiflora	0.0198	1.05	0.0396	2.11	0.0792	4.22
	L. purshianus	0.0033	2.67	0.0066	5.33	0.0132	10.67
	L. formosis	0.0308	2.24	0.0616	4.48	0.1233	8.97
	T. obtusiflorum	0.0033	3.42	0.0066	6.83	0.0132	13.67
	T. fucatum	0.0066	4.32	0.0132	8.64	0.0264	17.28
	Total	0.0777	20.96	0.1554	41.91	0.3108	83.82