Three-year effects of aminopyralid on a grassland plant community

Joe DiTomaso, UC Davis

McLaughlin Reserve is a UC research Reserve known for high plant diversity

Goals of project

* Evaluate the long-term (3 years) effect of aminopyralid in typical grasslands on
  * plant biodiversity
  * species richness
  * species composition
  * recovery over time in a grassland plant community with a high diversity of native broadleaf species

Methods

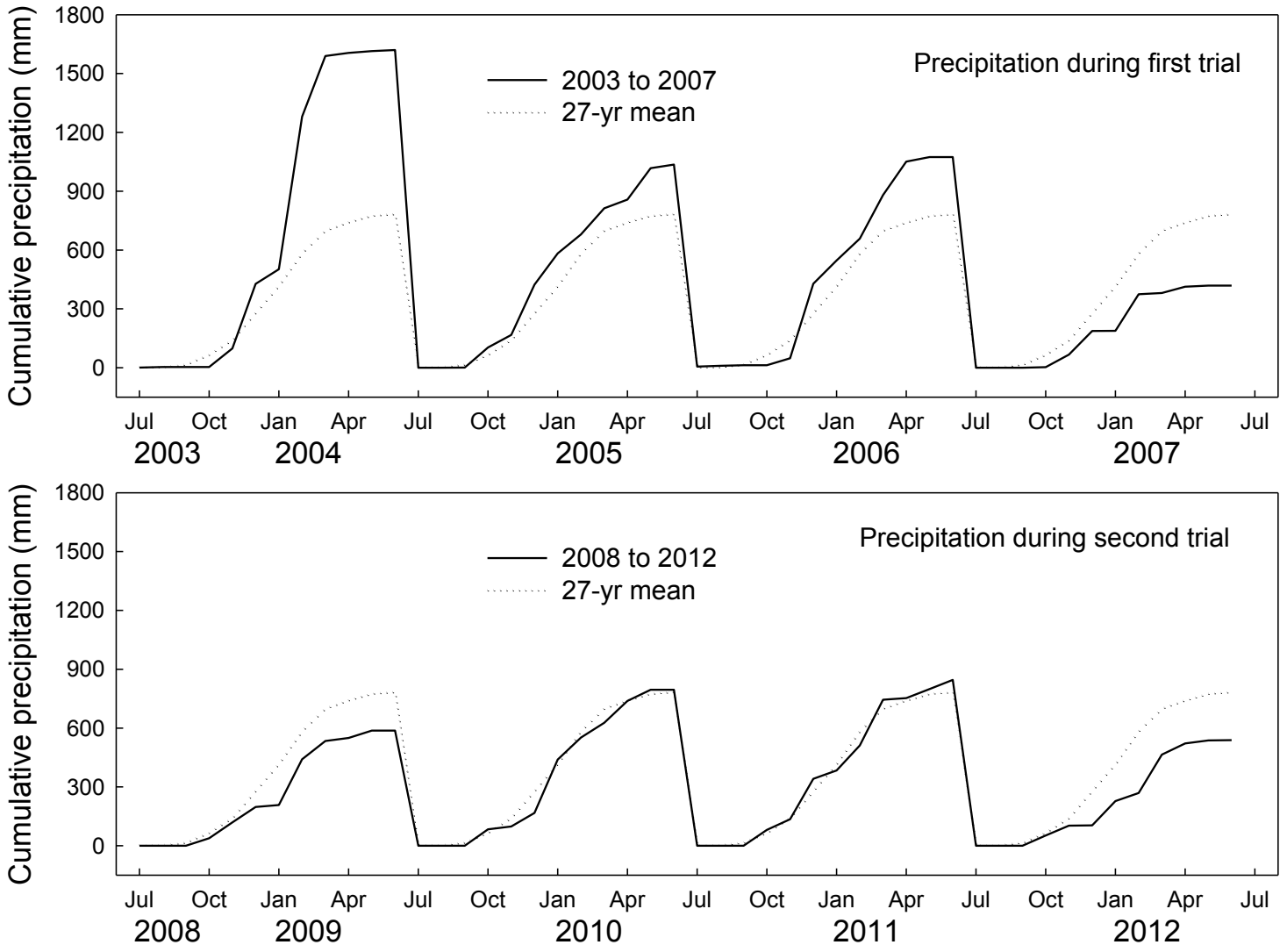
* Established trials at two sites at the University of California McLaughlin Reserve (northern Coast Range in Lake, Napa, and Yolo counties).
  * Site 1 (elevation 625 m) was established in 2005.
  * Site 2 (elevation 639 m) was established in 2010.
* Both sites with diverse grassland community typical of the interior northern California Coast Range. Dominated by annual grasses.
* Plots were 100 ft by 100 ft.
* Tested three rates of *Milestone* (0, 3, and 7 oz product /acre, equal to aminopyralid at 0, 0.75, and 1.75 oz ae/acre)
  * 3 replications in randomized complete blocks
  * 12 gal of spray solution per acre with 0.25% v/v Activator 90 surfactant.
* Treatments made 4 February 2005 (trail 1) and January 27 2010 (trial 2).
* Plant community evaluated in peak flowering in late spring and also in summer using point-intercept transects and quadrats.
  * Transects for main cover species, three 15-m transects per plot and tallied all plant species intercepting each 30-cm mark (150 counts per plot)
  * Quadrats for species richness, tossed a 1-meter quadrat at eight semi-random locations in each plot, recording all plant species in the quadrat

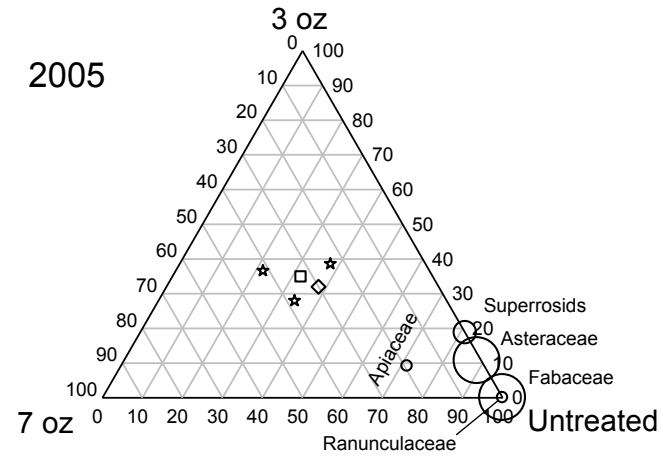
Yellow starthistle
(*Centaurea solstitialis*)

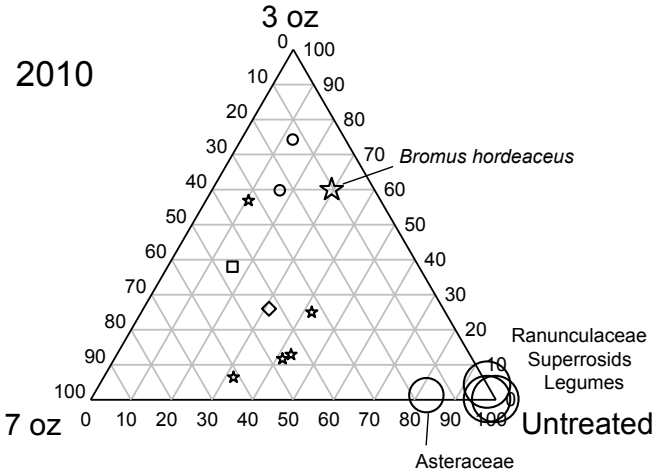
2004-2007 study site

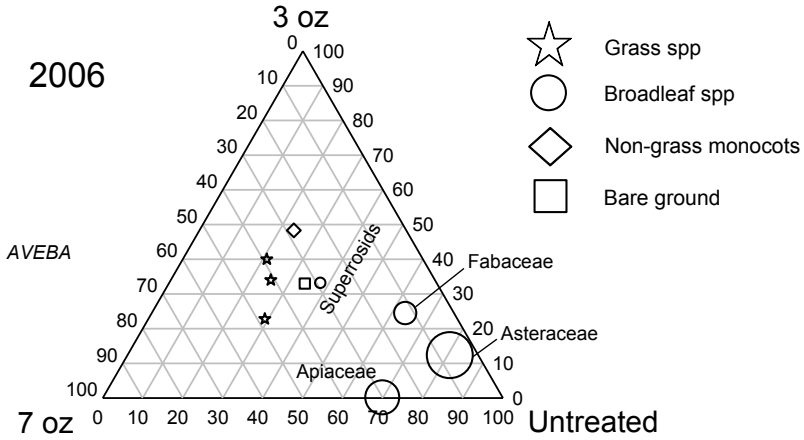
Guy Kyser and quadrat evaluation

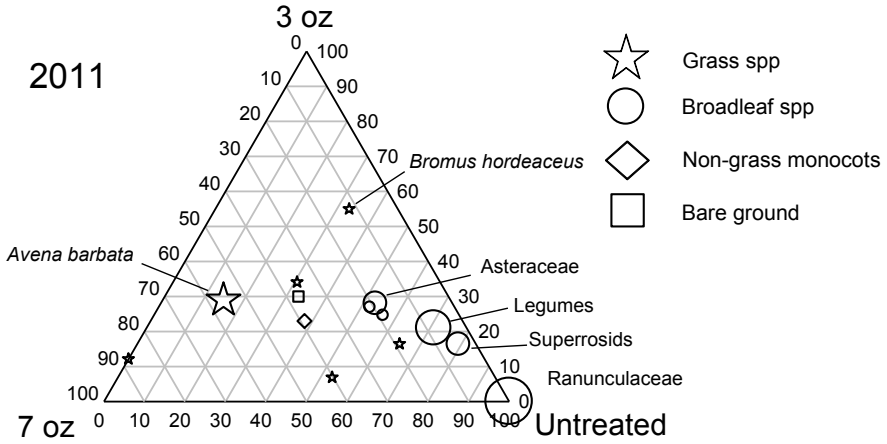
Precipitation data for two study sites over course of experiment

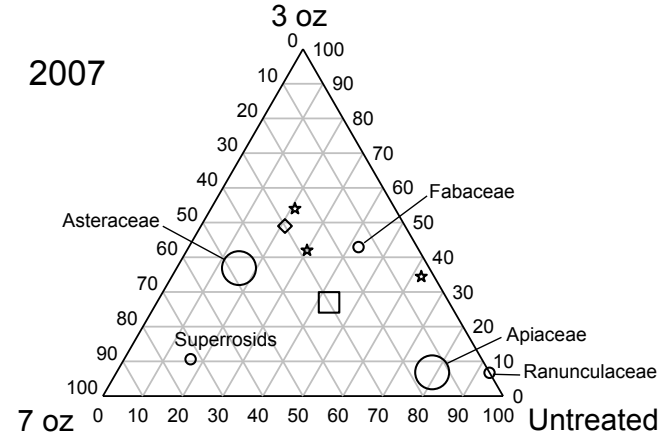


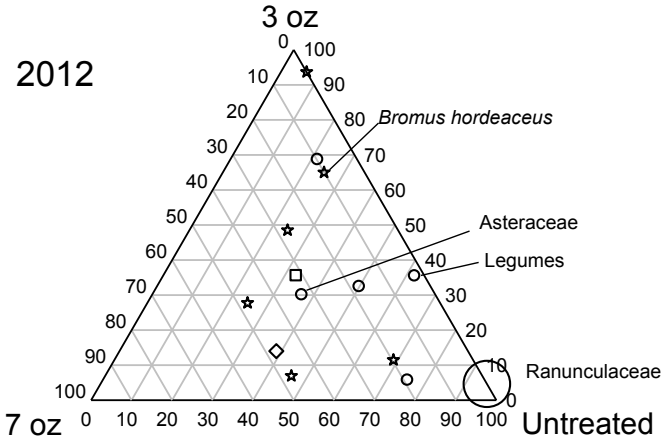

2005
3 oz
7 oz
Untreated
Superrosids
Asteraceae
Fabaceae
Apiaceae
Ranunculaceae


2010
3 oz
7 oz
Untreated
Bromus hordeaceus
Ranunculaceae
Superrosids
Legumes
Asteraceae


2006
3 oz
7 oz
Untreated
Grass spp
Broadleaf spp
Non-grass monocots
Bare ground
AVEBA
Superrosids
Fabaceae
Asteraceae
Apiaceae


2011
3 oz
7 oz
Untreated
Grass spp
Broadleaf spp
Non-grass monocots
Bare ground
Bromus hordeaceus
Avena barbata
Asteraceae
Legumes
Superrosids
Ranunculaceae


2007
3 oz
7 oz
Untreated
Fabaceae
Asteraceae
Superrosids
Apiaceae
Ranunculaceae


2012
3 oz
7 oz
Untreated
Bromus hordeaceus
Asteraceae
Legumes
Ranunculaceae

Species-area analysis for quadrats from all plots. The first-order jackknife estimate uses species-area curves derived from samples to estimate the true number of species present.

Trial	Year	Untreated		3 oz		7 oz	
		Species/plot (observed)	1st-order estimate	Species/plot (observed)	1st-order estimate	Species/plot (observed)	1st-order estimate
1	2005	41	53.5	26	34.6	18	22.8
1	2006	37	43.7	35	47.5	30	37.7
1	2007	25	27.9	30	38.6	27	36.6
2	2010	46	57.2	26	36.3	19	25.5
2	2011	45	54.6	45	51.7	35	40.7
2	2012	43	51.6	40	52.5	36	48.5

Total cover of each species category over the three years of the first study

Group	2004	2005			2006			2007		
	Untreated	Untreated	3 oz	7 oz	Untreated	3 oz	7 oz	Untreated	3 oz	7 oz
Annual grasses	350	295	321	313	292	291	292	200	246	217
Perennial grasses	1	4	0	4	4	4	21	0	0	8
Legumes	82	137	4	4	201	112	59	122	66	42
Lilies	115	192	171	133	143	146	91	271	281	217
Tarweeds	100	79	54	17	50	54	79	58	83	92
Other native Asteraceae	30	58	12	0	76	4	17	33	0	4
Non-native Asteraceae	86	112	12	0	133	137	96	154	170	112
Total Asteraceae	116	170	24	0	209	141	113	187	170	116
Ranunculaceae	18	13	17	0	17	0	0	29	13	0
Apiaceae	33	42	25	46	50	17	29	54	33	21
Other native broadleaves	180	171	46	45	164	122	158	64	79	91
Non-native broadleaves	10	17	12	4	8	21	0	0	8	0
Total other broadleaves	190	185	58	49	172	143	158	64	87	91

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Group	2009	2010			2011			2012		
	Untreated	Untreated	3 oz	7 oz	Untreated	3 oz	7 oz	Untreated	3 oz	7 oz
Annual grasses	222	247	247	254	241	245	270	324	283	291
Perennial grasses	78	33	47	53	25	25	25	46	38	37
Legumes	210	201	7	0	217	217	79	103	112	63
Lilies	111	80	87	80	100	59	104	62	67	71
Tarweeds	67	53	33	0	67	63	25	42	42	21
Other native Asteraceae	66	86	61	27	124	84	121	113	50	54
Non-native Asteraceae	67	40	7	0	54	25	71	120	67	125
Total Asteraceae	133	126	68	27	178	109	192	233	117	179
Ranunculaceae	89	47	7	0	51	13	13	33	8	8
Apiaceae	44	40	27	20	38	33	46	50	29	33
Other native broadleaves	143	187	68	34	150	218	110	125	109	67
Non-native broadleaves	22	40	20	0	21	21	0	8	12	4
Total other broadleaves	165	227	88	34	171	239	110	133	121	71

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Other native Asteraceae	66	86	61	27	124	84	121	113	50	54
Non-native Asteraceae	67	40	7	0	54	25	71	120	67	125
Total Asteraceae	133	126	68	27	178	109	192	233	117	179
Ranunculaceae	89	47	7	0	51	13	13	33	8	8
Apiaceae	44	40	27	20	38	33	46	50	29	33
Other native broadleaves	143	187	68	34	150	218	110	125	109	67
Non-native broadleaves	22	40	20	0	21	21	0	8	12	4
Total other broadleaves	165	227	88	34	171	239	110	133	121	71

Dominant native species in in spring in trial 1 plots over the three years of the study

Species-Spring	2005	2006	2007
Untreated			
2-5%	*Vulpia microstachys* *Lotus wranglerianus* *Trifolium fucatum* *Trifolium gracilientum* *Epilobium brachyantherum* *Perideridia kelloggia* *Agoseris grandiflora* *Euphorbia spathulata*	*Hemizonia congesta*	*Sisyrinchium bellum*
5-25%	*Brodiaea/Dichelostemma* *Sisyrinchium bellum* *Hemizonia congesta*		*Brodiaea/Dichelostemma* *Hemizonia congesta*
3 oz			
2-5%	*Vulpia microstachys* *Hemizonia congesta*	*Perideridia kelloggia* *Hemizonia congesta*	*Calochortus luteus* *Perideridia kelloggia*
5-25%	*Brodiaea/Dichelostemma*		*Brodiaea/Dichelostemma*
>25%			*Hemizonia congesta*
7 oz			
2-5%		*Lotus wranglerianus* *Hemizonia congesta*	*Brodiaea/Dichelostemma*
5-25%	*Brodiaea/Dichelostemma*	*Perideridia kelloggia*	*Perideridia kelloggia*

Dominant native species in summer in trial 1 plots over the three years of the study

Species- Summer	2005	2006	2007
Untreated			
2-5%	Lotus wranglerianus	Hemizonia congesta	Perideridia kelloggia
5-25%	Hemizonia congesta	Perideridia kelloggia	Hemizonia congesta
3 oz			
2-5%	Hemizonia congesta		
5-25%		Hemizonia congesta	Hemizonia congesta
7 oz			
2-5%		Perideridia kelloggia	Hordeum brachyantherum
5-25%		Hemizonia congesta	
>25%			Hemizonia congesta

Dominant native species in in spring in trial 2 plots over the three years of the study

Species Spring	2010	2011	2012
Untreated			
2-5%	*Vulpia microstachys* *Festuca* sp. *Chlorogalum pomeridianum* *Thermopsis macrophylla* *Euphorbia spathulata* *Epilobium brachyantherum* *Erodium brachycarpum* *Ranunuculus occidentalis*	*Brodiaea/Dichelostemma* *Trifolium gracilientum* *Hemizonia congesta* *Clarkia* sp. *Plantago erecta* *Ranunuculus occidentalis*	*Nassella pulchra* *Chlorogalum pomeridianus* *Hemizonia congesta*
5-25%	*Brodiaea/Dichelostemma* *Hemizonia congesta*		
3 oz			
2-5%	*Festuca* sp. *Chlorogalum pomeridianum*	*Brodiaea/Dichelostemma* *Lotus wranglerianus* *Hemizonia congesta*	*Lotus wranglerianus*
5-25%	*Vulpia microstachys* *Brodiaea/Dichelostemma*		*Vulpia microstachys* *Holocarpha virgata*
7 oz			
2-5%	*Chlorogalum pomeridianum* *Wyethia* sp.	*Nassella pulchra* *Brodiaea/Dichelostemma* *Chlorogalum pomeridianum* *Wyethia* sp.	*Chlorogalum pomeridianum* *Wyethia* sp.
5-25%	*Vulpia microstachys* *Festuca* sp. *Brodiaea/Dichelostemma*		

Dominant native species in summer in trial 2 plots over the three years of the study

Species- Summer	2010	2011	2012
Untreated			
2-5%	*Nassella pulchra* *Holocarpha virgata* *Thermopsis macrophylla*	*Nassella pulchra* *Holocarpha virgata*	*Nassella pulchra*
5-25%	*Hemizonia congesta*	*Hemizonia congesta*	*Hemizonia congesta*
3 oz			
2-5%	*Holocarpha virgata*		*Holocarpha virgata*
5-25%		*Holocarpha virgata*	
7 oz			
2-5%	*Nassella pulchra* *Wyethia* sp.	*Wyethia sp.*	

Conclusions

* As is well recognized, aminopyralid primarily impacts Asteraceae and Fabaceae, but also has effects on Ranunculaceae (though the numbers were low)
* Impacts of aminopyralid at 3 oz/acre were very transient and most effects recovered by the second year.
* Impacts of aminopyralid at 7 oz/acre were less transient though recovery was continuing to occur by the third year after treatment
* Restoration programs using aminopyralid should expect short-term impacts on some natives species, but recovery appears to occur by the third year after treatment at typical use rates