Appendix 3. Testing the Influence of Management Regime and Year on Floristic Composition Variables Collected on Two Grass Types on Federal Lands Managed under an Adaptive-Management Framework by the U.S. Fish and Wildlife Service in North Dakota, South Dakota, Minnesota, and Montana, 2011–13

A. Mean Brome Cover (percent)

Table 3.1. Generalized linear mixed model, assuming a beta distribution with a logit link, $y = (y+1)$, testing the influence of management regime and year on mean cover (percent) of smooth brome (*Bromus inermis*) on two grass types (mixed-grass, tallgrass) on Federal lands managed under an adaptive-management framework by the U.S. Fish and Wildlife Service (Gannon and others, 2013) in North Dakota, South Dakota, Minnesota, and Montana, 2011–13.

Effect	Source of variation[1]	Numerator degrees of freedom	Denominator degrees of freedom[2]	*F*-statistic	*p*-value
Overall	Grass type × regime × year	19	181.3	1.44	0.1129
Contrasts:	Mixed: regime effect	3	79.7	1.45	0.2347
	Mixed: year effect	2	131.8	1.82	0.1659
	Mixed: interaction	6	131.6	0.47	0.8294
	Tall: regime effect	3	88.3	2.22	0.0915
	Tall: year effect	1	127.6	0.66	0.4183
	Tall: interaction	3	127.7	0.24	0.8708
	Mixed versus tall: burned only	1	84.3	0.06	0.8124
	Mixed versus tall: grazed only	1	86.9	0.77	0.3822
	Mixed versus tall: burned-grazed	1	87.1	0.04	0.8335
	Mixed versus tall: rest	1	82.4	1.98	0.1628

[1]Sources of variation for the model: Y=Unit(Grass type × Regime) + Grass type × Regime × Year + Year × Unit(Grass type × Regime), where Grass type × Regime × Year is a fixed effect, Unit(Grass type × Regime) and Year × Unit(Grass type × Regime) are random effects in a mixed-model framework, and Year is a repeated-measures factor.
[2]Degrees of freedom are based on Kenward-Roger correction for repeated-measures models (Littell and others, 2006).

Table 3.2. Least squares mean (standard error) and back-transformed least squares mean (95-percent confidence intervals) of brome cover (percent), by grassland type (mixed-grass, tallgrass), overall treatment regime (burned only, grazed only, burned-grazed, or rest), and year (2011, 2012, 2013), on Federal lands managed under an adaptive-management framework by the U.S. Fish and Wildlife Service (Gannon and others, 2013) in North Dakota, South Dakota, Minnesota, and Montana, 2011–13.

[LSMean, least squares mean; SE, standard error; LCL, lower confidence limit; UCL, upper confidence limit]

Grass	Regime	Year	LSMean	SE	Back-transformed LSMean	95-percent confidence intervals LCL	UCL
Mixed	Burned only	2011	−1.722	0.392	14.2	6.7	26.8
		2012	−1.573	0.368	16.2	8.2	28.9
		2013	−1.462	0.355	17.8	9.4	30.7
	Grazed only	2011	−1.020	0.218	25.5	18.0	34.6
		2012	−0.874	0.203	28.4	20.9	37.3
		2013	−0.701	0.197	32.2	24.2	41.2
	Burned-grazed	2011	−1.390	0.233	18.9	12.6	27.2
		2012	−1.366	0.230	19.3	13.0	27.6
		2013	−0.994	0.209	26.0	18.7	34.8
	Rest	2011	−1.404	0.667	18.7	5.2	46.6
		2012	−1.638	0.719	15.3	3.5	43.3
		2013	−1.406	0.668	18.7	5.2	46.6
Tall	Burned only	2012	−1.771	0.435	13.5	5.8	27.5
		2013	−1.655	0.418	15.0	6.8	29.2
	Grazed only	2012	−0.682	0.313	32.6	20.5	47.3
		2013	−0.437	0.298	38.3	25.5	52.7
	Burned-grazed	2012	−1.183	0.627	22.5	7.2	50.1
		2013	−1.053	0.606	24.9	8.6	52.4
	Rest	2012	−0.306	0.537	41.4	19.4	66.9
		2013	−0.349	0.539	40.4	18.7	66.0
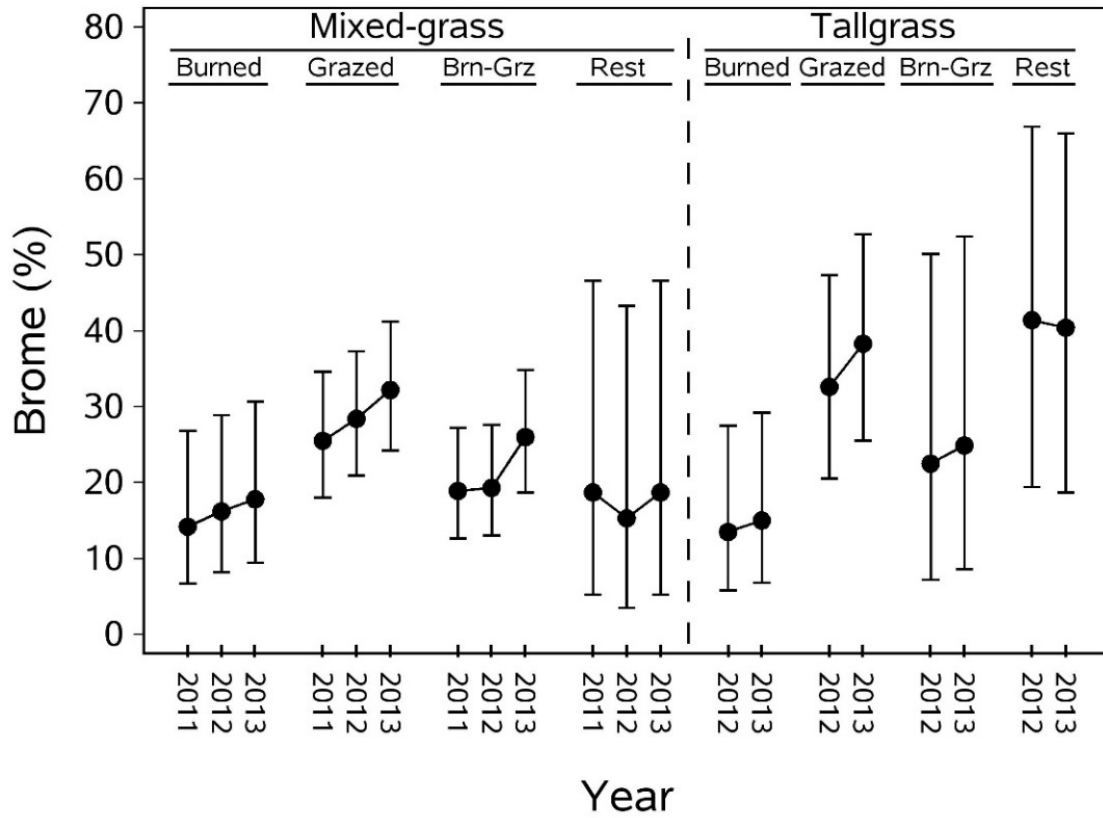
[Brn-Grz, burned-grazed; %, percent]

Figure 3.1. Back-transformed least squares mean cover (percent) of smooth brome (*Bromus inermis*) in Native Prairie Adaptive Management (NPAM) units managed by the U.S. Fish and Wildlife Service in North Dakota, South Dakota, Minnesota, and Montana, 2011–13. Bars represent 95-percent confidence limits.

B. Standard Deviation of Brome Cover (percent)

Table 3.3. Generalized linear mixed model, assuming a beta distribution with a logit link, $y = (y+1)$, testing the influence of management regime and year on standard deviation of the mean cover (percent) of smooth brome (*Bromus inermis*) on two grass types (mixed-grass, tallgrass) on Federal lands managed under an adaptive-management framework by the U.S. Fish and Wildlife Service (Gannon and others, 2013) in North Dakota, South Dakota, Minnesota, and Montana, 2011–13.

Effect	Source of variation[1]	Numerator degrees of freedom	Denominator degrees of freedom[2]	F-statistic	p-value
Overall	Grass type × regime × year	19	181.3	0.65	0.8610
Contrasts:	Mixed: regime effect	3	78.2	0.28	0.8432
	Mixed: year effect	2	130.6	1.08	0.3414
	Mixed: interaction	6	131.0	0.62	0.7106
	Tall: regime effect	3	92.1	1.82	0.1491
	Tall: year effect	1	126.9	0.03	0.8534
	Tall: interaction	3	126.8	0.50	0.6854
	Mixed versus tall: burned only	1	86.2	2.10	0.1506
	Mixed versus tall: grazed only	1	90.0	0.09	0.7706
	Mixed versus tall: burned-grazed	1	90.3	0.03	0.8584
	Mixed versus tall: rest	1	83.7	0.75	0.3879

[1]Sources of variation for the model: Y=Unit(Grass type × Regime) + Grass type × Regime × Year + Year × Unit(Grass type × Regime), where Grass type × Regime × Year is a fixed effect, Unit(Grass type × Regime) and Year × Unit(Grass type × Regime) are random effects in a mixed-model framework, and Year is a repeated-measures factor.

[2]Degrees of freedom are based on Kenward-Roger correction for repeated-measures models (Littell and others, 2006).

Table 3.4. Least squares mean (standard error) and back-transformed least squares mean (95-percent confidence intervals) of standard deviation of the mean cover (percent) of smooth brome (*Bromus inermis*), by grassland type (mixed-grass, tallgrass), overall treatment regime (burned only, grazed only, burned-grazed, or rest), and year (2011, 2012, 2013), on Federal lands managed under an adaptive-management framework by the U.S. Fish and Wildlife Service (Gannon and others, 2013) in North Dakota, South Dakota, Minnesota, and Montana, 2011–13.

[LSMean, least squares mean; SE, standard error; LCL, lower confidence limit; UCL, upper confidence limit]

| | | | | | Back-transformed | | |
| | | | | | | 95-percent confidence intervals | |
Grass	Regime	Year	LSMean	SE	LSMean	LCL	UCL
Mixed	Burned only	2011	−1.368	0.200	19.3	13.7	26.4
		2012	−1.236	0.188	21.5	15.7	28.6
		2013	−1.112	0.182	23.7	17.7	31.0
	Grazed only	2011	−1.170	0.131	22.7	18.3	27.6
		2012	−1.168	0.124	22.7	18.6	27.4
		2013	−1.175	0.124	22.6	18.5	27.3
	Burned-grazed	2011	−1.269	0.128	20.9	16.9	25.6
		2012	−1.368	0.131	19.3	15.5	23.8
		2013	−1.306	0.129	20.3	16.4	24.9
	Rest	2011	−1.202	0.357	22.1	12.0	36.7
		2012	−1.421	0.380	18.5	9.3	32.7
		2013	−1.128	0.350	23.5	13.0	38.1
Tall	Burned only	2012	−1.663	0.237	14.9	9.6	22.2
		2013	−1.613	0.233	15.6	10.2	22.9
	Grazed only	2012	−1.112	0.196	23.8	17.3	31.6
		2013	−1.107	0.191	23.8	17.5	31.4
	Burned-grazed	2012	−1.495	0.389	17.3	8.5	31.5
		2013	−1.265	0.363	21.0	11.2	35.5
	Rest	2012	−0.763	0.323	30.8	18.9	45.7
		2013	−0.968	0.337	26.5	15.4	41.4
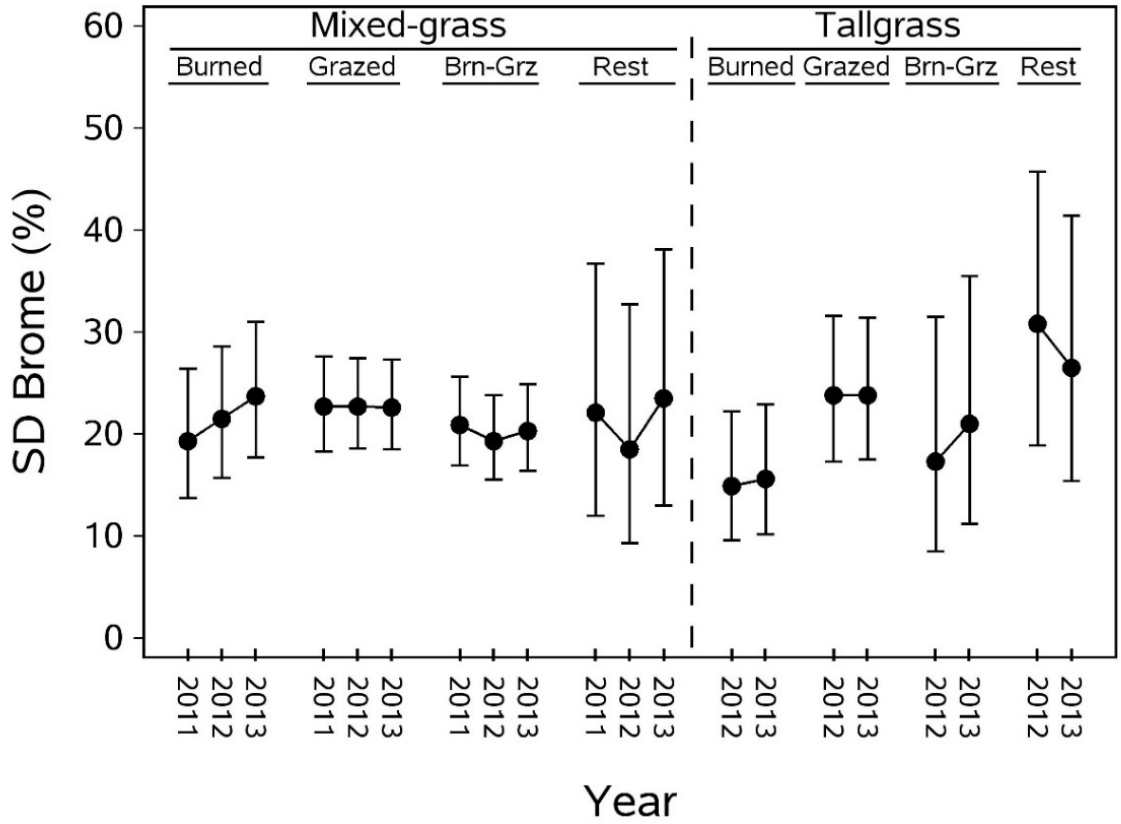
[Brn-Grz, burned-grazed; %, percent; SD, standard deviation]

Figure 3.2. Back-transformed least squares mean standard deviation of the mean cover (percent) of smooth brome (*Bromus inermis*) in Native Prairie Adaptive Management (NPAM) units managed by the U.S. Fish and Wildlife Service in North Dakota, South Dakota, Minnesota, and Montana, 2011–13. Bars represent 95-percent confidence limits.

C. Mean Kentucky Bluegrass Cover (percent)

Table 3.5. Generalized linear mixed model, assuming a beta distribution with a logit link, $y = (y+1)$, testing the influence of management regime and year on the mean cover (percent) of Kentucky bluegrass (*Poa pratensis*) on two grass types (mixed-grass, tallgrass) on Federal lands managed under an adaptive-management framework by the U.S. Fish and Wildlife Service (Gannon and others, 2013) in North Dakota, South Dakota, Minnesota, and Montana, 2011–13.

Effect	Source of variation[1]	Numerator degrees of freedom	Denominator degrees of freedom[2]	*F*-statistic	*p*-value
Overall	Grass type × regime × year	19	180.1	1.44	0.1121
Contrasts:	Mixed: regime effect	3	74.5	0.50	0.6860
	Mixed: year effect	2	127.5	3.71	0.0272
	Mixed: interaction	6	128.1	1.40	0.2200
	Tall: regime effect	3	89.7	0.59	0.6203
	Tall: year effect	1	123.5	0.93	0.3356
	Tall: interaction	3	123.5	0.49	0.6931
	Mixed versus tall: burned only	1	83.1	1.03	0.3141
	Mixed versus tall: grazed only	1	87.7	0.54	0.4660
	Mixed versus tall: burned-grazed	1	87.6	0.73	0.3954
	Mixed versus tall: rest	1	81.3	0.03	0.8673

[1]Sources of variation for the model: Y=Unit(Grass type × Regime) + Grass type × Regime × Year + Year × Unit(Grass type × Regime), where Grass type × Regime × Year is a fixed effect, Unit(Grass type × Regime) and Year × Unit(Grass type × Regime) are random effects in a mixed-model framework, and Year is a repeated-measures factor.

[2]Degrees of freedom are based on Kenward-Roger correction for repeated-measures models (Littell and others, 2006).

Table 3.6. Least squares mean (standard error) and back-transformed least squares mean cover (percent) of Kentucky bluegrass (*Poa pratensis*) (95-percent confidence intervals), by grassland type (mixed-grass, tallgrass), overall treatment regime (burned only, grazed only, burned-grazed, or rest), and year (2011, 2012, 2013), on Federal lands managed under an adaptive-management framework by the U.S. Fish and Wildlife Service (Gannon and others, 2013) in North Dakota, South Dakota, Minnesota, and Montana, 2011–13.

[LSMean, least squares mean; SE, standard error; LCL, lower confidence limit; UCL, upper confidence limit]

| | | | | | Back-transformed | | |
| | | | | | | 95-percent confidence intervals | |
Grass	Regime	Year	LSMean	SE	LSMean	LCL	UCL
Mixed	Burned only	2011	−0.932	0.306	27.2	16.8	40.8
		2012	−0.589	0.281	34.7	23.2	48.0
		2013	−0.661	0.284	33.1	21.9	46.4
	Grazed only	2011	−0.517	0.199	36.3	27.8	45.8
		2012	−0.523	0.186	36.2	28.1	45.1
		2013	−1.046	0.206	25.0	18.0	33.5
	Burned-grazed	2011	−0.680	0.193	32.6	24.8	41.5
		2012	−0.886	0.198	28.2	20.9	36.8
		2013	−1.162	0.213	22.8	16.1	31.2
	Rest	2011	−1.250	0.619	21.3	6.9	48.1
		2012	−0.896	0.567	28.0	10.8	54.4
		2013	−1.535	0.674	16.7	4.4	43.7
Tall	Burned only	2012	−1.202	0.353	22.1	12.1	36.5
		2013	−1.079	0.342	24.4	13.8	38.9
	Grazed only	2012	−0.893	0.319	28.1	17.0	42.4
		2013	−0.992	0.317	26.0	15.6	39.9
	Burned-grazed	2012	−0.689	0.546	32.4	13.7	58.4
		2013	−0.239	0.519	43.1	21.2	67.5
	Rest	2012	−1.479	0.662	17.6	4.9	44.5
		2013	−1.243	0.618	21.4	6.9	48.2
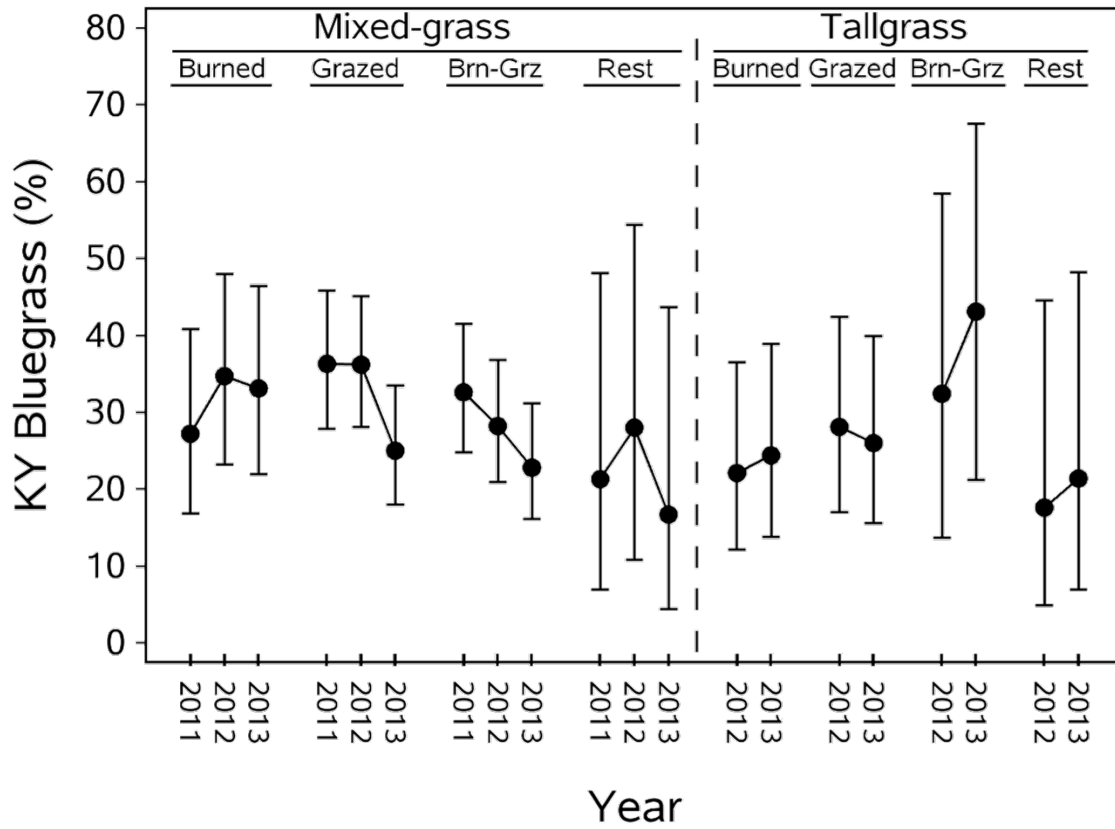
[Brn-Grz, burned-grazed; %, percent; KY, Kentucky]

Figure 3.3.   Back-transformed least squares mean cover (percent) of Kentucky bluegrass (*Poa pratensis*) in Native Prairie Adaptive Management (NPAM) units managed by the U.S. Fish and Wildlife Service in North Dakota, South Dakota, Minnesota, and Montana, 2011–13. Bars represent 95-percent confidence limits.

D. Standard Deviation of Kentucky Bluegrass Cover (percent)

Table 3.7. Generalized linear mixed model, assuming a beta distribution with a logit link, $y = (y+1)$, testing the influence of management regime and year on standard deviation of the mean cover (percent) of Kentucky bluegrass (*Poa pratensis*) on two grass types (mixed-grass, tallgrass) on Federal lands managed under an adaptive-management framework by the U.S. Fish and Wildlife Service (Gannon and others, 2013) in North Dakota, South Dakota, Minnesota, and Montana, 2011–13.

Effect	Source of variation[1]	Numerator degrees of freedom	Denominator degrees of freedom[2]	*F*-statistic	*p*-value
Overall	Grass type × regime × year	19	181.1	1.43	0.1183
Contrasts:	Mixed: regime effect	3	76.3	2.51	0.0650
	Mixed: year effect	2	127.6	3.97	0.0213
	Mixed: interaction	6	130.0	0.45	0.8426
	Tall: regime effect	3	95.6	0.24	0.8714
	Tall: year effect	1	124.6	0.92	0.3394
	Tall: interaction	3	125.3	1.72	0.1659
	Mixed versus tall: burned only	1	87.8	5.53	0.0209
	Mixed versus tall: grazed only	1	92.7	0.02	0.8803
	Mixed versus tall: burned-grazed	1	93.1	0.05	0.8190
	Mixed versus tall: rest	1	85.5	0.62	0.4349

[1]Sources of variation for the model: Y=Unit(Grass type × Regime) + Grass type × Regime × Year + Year × Unit(Grass type × Regime), where Grass type × Regime × Year is a fixed effect, Unit(Grass type × Regime) and Year × Unit(Grass type × Regime) are random effects in a mixed-model framework, and Year is a repeated-measures factor.

[2]Degrees of freedom are based on Kenward-Roger correction for repeated-measures models (Littell and others, 2006).

Table 3.8. Least squares mean (standard error) and back-transformed least squares mean cover (percent) of Kentucky bluegrass (*Poa pratensis*) (95-percent confidence intervals), by grassland type (mixed-grass, tallgrass), overall treatment regime (burned only, grazed only, burned-grazed, or rest), and year (2011, 2012, 2013), on Federal lands managed under an adaptive-management framework by the U.S. Fish and Wildlife Service (Gannon and others, 2013) in North Dakota, South Dakota, Minnesota, and Montana, 2011–13.

[LSMean, least squares mean; SE, standard error; LCL, lower confidence limit; UCL, upper confidence limit]

| | | | | | Back-transformed | | |
| | | | | | | 95-percent confidence intervals | |
Grass	Regime	Year	LSMean	SE	LSMean	LCL	UCL
Mixed	Burned only	2011	−1.013	0.161	25.6	19.9	32.2
		2012	−0.852	0.151	28.9	23.1	35.4
		2013	−1.021	0.156	25.5	20.0	31.9
	Grazed only	2011	−1.392	0.125	18.9	15.3	23.1
		2012	−1.338	0.114	19.8	16.3	23.7
		2013	−1.431	0.118	18.3	14.9	22.2
	Burned-grazed	2011	−1.089	0.108	24.2	20.4	28.4
		2012	−1.073	0.106	24.5	20.7	28.6
		2013	−1.275	0.113	20.8	17.3	24.8
	Rest	2011	−1.022	0.299	25.5	15.7	38.3
		2012	−0.957	0.295	26.7	16.7	39.6
		2013	−1.433	0.335	18.3	10.0	30.5
Tall	Burned only	2012	−1.692	0.210	14.6	9.9	20.8
		2013	−1.263	0.184	21.1	15.5	27.9
	Grazed only	2012	−1.311	0.183	20.2	14.9	26.8
		2013	−1.406	0.182	18.7	13.6	24.9
	Burned-grazed	2012	−1.290	0.321	20.6	11.8	33.1
		2013	−1.138	0.308	23.3	13.9	36.0
	Rest	2012	−1.431	0.335	18.3	10.0	30.5
		2013	−1.467	0.338	17.7	9.6	29.9
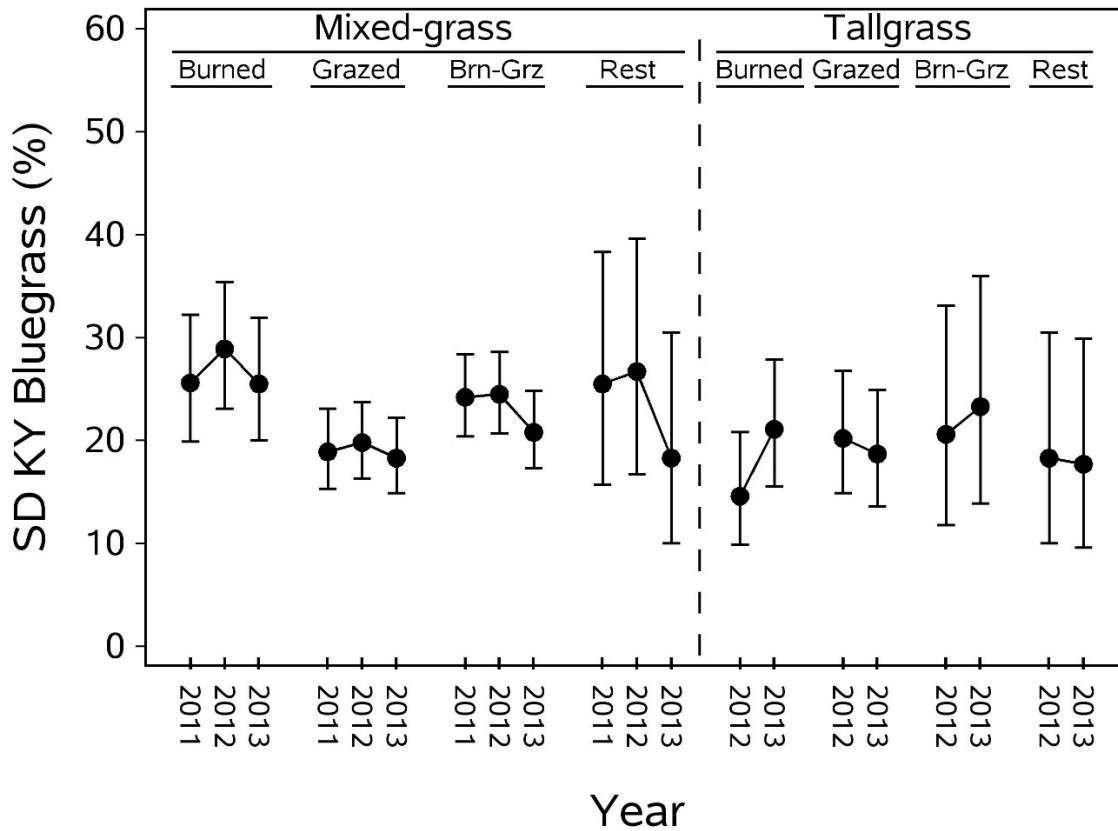
[Brn-Grz, burned-grazed; %, percent; KY, Kentucky; SD, standard deviation]

Figure 3.4.   Back-transformed least squares mean standard deviation of the mean cover (percent) of Kentucky bluegrass (*Poa pratensis*) in Native Prairie Adaptive Management (NPAM) units managed by the U.S. Fish and Wildlife Service in North Dakota, South Dakota, Minnesota, and Montana, 2011–13. Bars represent 95-percent confidence limits.

E. Mean Native Forb Cover (percent)

Table 3.9. Generalized linear mixed model, assuming a beta distribution with a logit link, $y = (y+1)$, testing the influence of management regime and year on mean native forb cover (percent) on two grass types (mixed-grass, tallgrass) on Federal lands managed under an adaptive-management framework by the U.S. Fish and Wildlife Service (Gannon and others, 2013) in North Dakota, South Dakota, Minnesota, and Montana, 2011–13.

[<, less than; *, evidence for moderate effect ($0.05 < p \leq 0.10$); **, evidence for strong effect ($p \leq 0.05$)]

Effect	Source of variation[1]	Numerator degrees of freedom	Denominator degrees of freedom[2]	F-statistic	p-value
Overall	Grass type × regime × year	19	181.8	2.96	<0.0001**
Contrasts:	Mixed: regime effect	3	77.3	1.27	0.2914
	Mixed: year effect	2	133.0	0.58	0.5628
	Mixed: interaction	6	138.6	0.54	0.7732
	Tall: regime effect	3	106.1	3.88	0.0112**
	Tall: year effect	1	130.5	2.23	0.1381
	Tall: interaction	3	134.3	2.03	0.1124
	Mixed versus tall: burned only	1	92.0	2.39	0.1253
	Mixed versus tall: grazed only	1	102.2	0.07	0.7989
	Mixed versus tall: burned-grazed	1	101.4	0.04	0.8422
	Mixed versus tall: rest	1	83.5	3.59	0.0616*

[1]Sources of variation for the model: Y=Unit(Grass type × Regime) + Grass type × Regime × Year + Year × Unit(Grass type × Regime), where Grass type × Regime × Year is a fixed effect, Unit(Grass type × Regime) and Year × Unit(Grass type × Regime) are random effects in a mixed-model framework, and Year is a repeated-measures factor.

[2]Degrees of freedom are based on Kenward-Roger correction for repeated-measures models (Littell and others, 2006).

Table 3.10. Least squares mean (standard error) and back-transformed least squares mean (95-percent confidence intervals) of native forb cover (percent), by grassland type (mixed-grass, tallgrass), overall treatment regime (burned only, grazed only, burned-grazed, or rest), and year (2011, 2012, 2013), on Federal lands managed under an adaptive-management framework by the U.S. Fish and Wildlife Service (Gannon and others, 2013) in North Dakota, South Dakota, Minnesota, and Montana, 2011–13.

[LSMean, least squares mean; SE, standard error; LCL, lower confidence limit; UCL, upper confidence limit]

Grass	Regime	Year	LSMean	SE	Back-transformed LSMean	95-percent confidence intervals LCL	UCL
Mixed	Burned only	2011	−3.636	0.373	1.6	0.3	4.2
		2012	−3.617	0.355	1.6	0.3	4.1
		2013	−3.503	0.336	1.9	0.5	4.5
	Grazed only	2011	−3.401	0.240	2.2	1.0	4.1
		2012	−3.567	0.234	1.7	0.8	3.3
		2013	−3.231	0.200	2.8	1.6	4.5
	Burned-grazed	2011	−3.498	0.231	1.9	0.9	3.5
		2012	−4.167	0.312	0.5	0.0	1.8
		2013	−3.826	0.265	1.1	0.3	2.5
	Rest	2011	−3.191	0.557	3.0	0.4	9.9
		2012	−3.095	0.533	3.3	0.6	10.4
		2013	−3.174	0.552	3.0	0.4	10.0
Tall	Burned only	2012	−3.693	0.407	1.4	0.1	4.2
		2013	−2.324	0.220	7.9	5.0	12.1
	Grazed only	2012	−3.705	0.406	1.4	0.1	4.2
		2013	−3.270	0.316	2.7	1.0	5.6
	Burned-grazed	2012	−3.767	0.730	1.3	0.0	7.8
		2013	−4.176	0.888	0.5	0.0	7.1
	Rest	2012	−2.342	0.384	7.8	3.3	15.9
		2013	−2.053	0.342	10.4	5.2	19.1
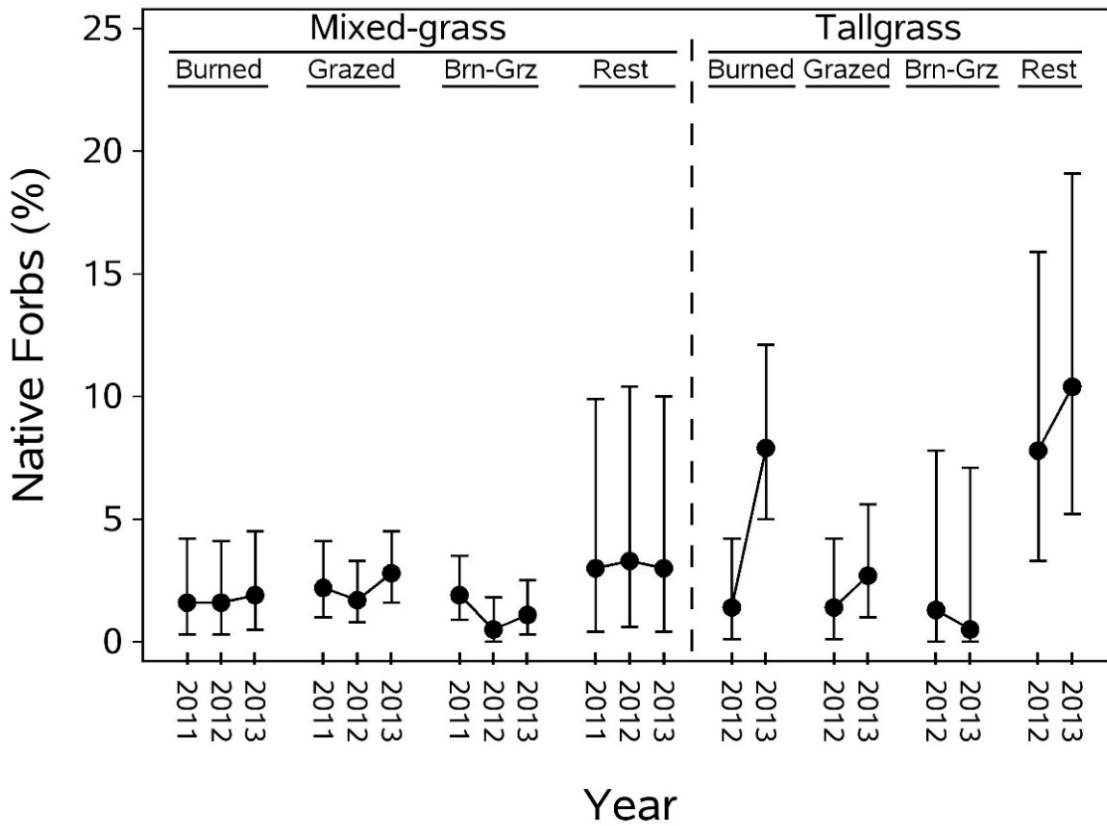
[Brn-Grz, burned-grazed; %, percent]

Figure 3.5.   Back-transformed least squares mean native forb cover (percent) in Native Prairie
Adaptive Management (NPAM) units managed by the U.S. Fish and Wildlife Service in North
Dakota, South Dakota, Minnesota, and Montana, 2011–13. Bars represent 95-percent confidence
limits.

F. Standard Deviation of Native Forb Cover (percent)

Table 3.11. Generalized linear mixed model, assuming a beta distribution with a logit link, $y = (y+1)$, testing the influence of management regime and year on standard deviation of native forb cover (percent) on two grass types (mixed-grass, tallgrass) on Federal lands managed under an adaptive-management framework by the U.S. Fish and Wildlife Service (Gannon and others, 2013) in North Dakota, South Dakota, Minnesota, and Montana, 2011–13.

[**, evidence for strong effect ($p{\leq}0.05$)]

Effect	Source of variation[1]	Numerator degrees of freedom	Denominator degrees of freedom[2]	*F*-statistic	*p*-value
Overall	Grass type × regime × year	19	182.4	2.06	0.0076**
Contrasts:	Mixed: regime effect	3	79.0	2.81	0.0446**
	Mixed: year effect	2	137.7	1.71	0.1851
	Mixed: interaction	6	143.2	0.73	0.6292
	Tall: regime effect	3	109.5	1.52	0.2125
	Tall: year effect	1	132.5	2.03	0.1564
	Tall: interaction	3	134.0	0.86	0.4624
	Mixed versus tall: burned only	1	94.4	0.78	0.3806
	Mixed versus tall: grazed only	1	106.1	0.00	0.9854
	Mixed versus tall: burned-grazed	1	105.1	0.02	0.8914
	Mixed versus tall: rest	1	92.1	0.03	0.8703

[1]Sources of variation for the model: Y=Unit(Grass type × Regime) + Grass type × Regime × Year + Year × Unit(Grass type × Regime), where Grass type × Regime × Year is a fixed effect, Unit(Grass type × Regime) and Year × Unit(Grass type × Regime) are random effects in a mixed-model framework, and Year is a repeated-measures factor.
[2]Degrees of freedom are based on Kenward-Roger correction for repeated-measures models (Littell and others, 2006).

Table 3.12. Least squares mean (standard error) and back-transformed least squares mean (95-percent confidence intervals) of standard deviation of native forb cover (percent), by grassland type (mixed-grass, tallgrass), overall treatment regime (burned only, grazed only, burned-grazed, or rest), and year (2011, 2012, 2013), on Federal lands managed under an adaptive-management framework by the U.S. Fish and Wildlife Service (Gannon and others, 2013) in North Dakota, South Dakota, Minnesota, and Montana, 2011–13.

[LSMean, least squares mean; SE, standard error; LCL, lower confidence limit; UCL, upper confidence limit]

| | | | | | Back-transformed | | |
| | | | | | | 95-percent confidence intervals | |
Grass	Regime	Year	LSMean	SE	LSMean	LCL	UCL
Mixed	Burned only	2011	−2.967	0.314	3.9	1.7	7.7
		2012	−3.153	0.327	3.1	1.2	6.5
		2013	−2.874	0.288	4.3	2.1	8.0
	Grazed only	2011	−2.908	0.220	4.2	2.4	6.7
		2012	−3.371	0.245	2.3	1.1	4.3
		2013	−3.135	0.220	3.2	1.8	5.3
	Burned-grazed	2011	−3.019	0.212	3.7	2.1	5.9
		2012	−3.919	0.317	0.9	0.1	2.6
		2013	−3.472	0.257	2.0	0.8	3.9
	Rest	2011	−2.531	0.475	6.4	2.0	15.8
		2012	−2.323	0.436	7.9	3.0	17.7
		2013	−2.390	0.448	7.4	2.7	17.1
Tall	Burned only	2012	−3.172	0.365	3.0	1.0	6.9
		2013	−2.233	0.243	8.7	5.3	13.7
	Grazed only	2012	−3.490	0.421	2.0	0.3	5.5
		2013	−2.798	0.292	4.7	2.3	8.8
	Burned-grazed	2012	−3.257	0.658	2.7	0.0	11.3
		2013	−3.863	0.875	1.1	0.0	9.5
	Rest	2012	−2.657	0.502	5.6	1.6	14.8
		2013	−2.012	0.385	10.8	4.9	21.2
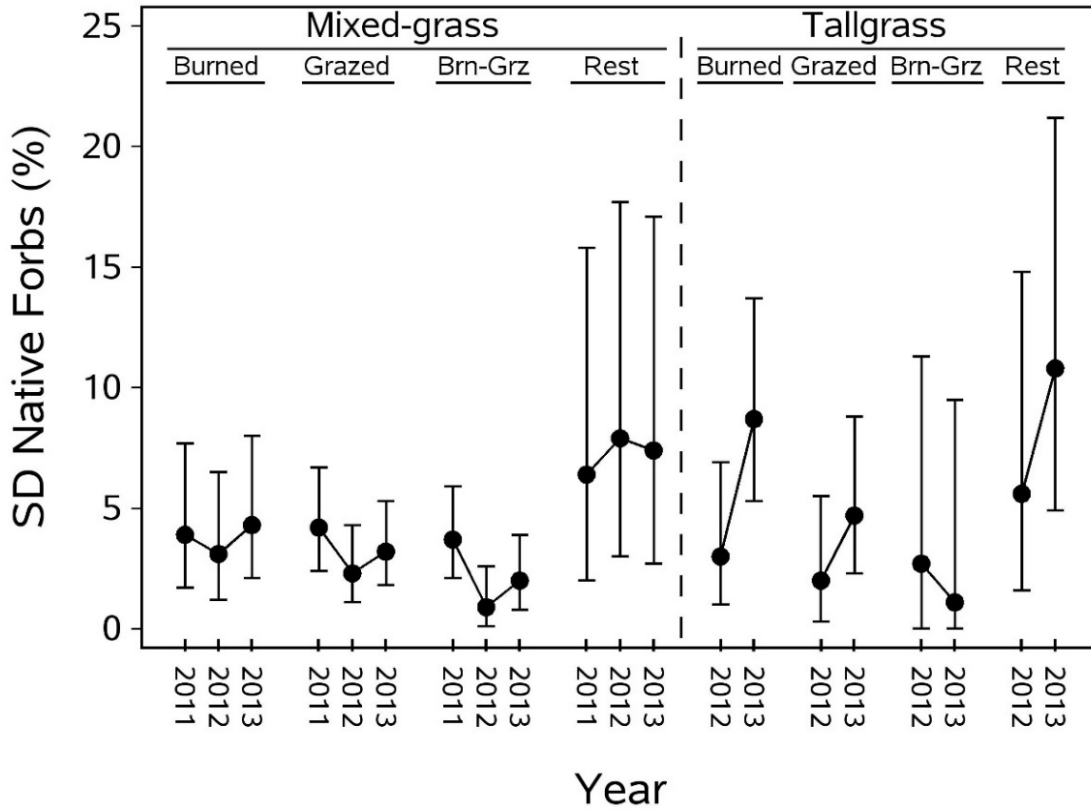
[Brn-Grz, burned-grazed; %, percent; SD, standard deviation]

Figure 3.6. Back-transformed least squares mean standard deviation of native forb cover (percent) in Native Prairie Adaptive Management (NPAM) units managed by the U.S. Fish and Wildlife Service in North Dakota, South Dakota, Minnesota, and Montana, 2011–13. Bars represent 95-percent confidence limits.

G. Mean Native Grass Cover (percent)

Table 3.13. Generalized linear mixed model, assuming a beta distribution with a logit link, $y = (y+1)$, testing the influence of management regime and year on mean native grass cover (percent) on two grass types (mixed-grass, tallgrass) on Federal lands managed under an adaptive-management framework by the U.S. Fish and Wildlife Service (Gannon and others, 2013) in North Dakota, South Dakota, Minnesota, and Montana, 2011–13.

[*, evidence for moderate effect (0.05 $p \leq 0.10$); **, evidence for strong effect ($p \leq 0.05$)]

Effect	Source of variation[1]	Numerator degrees of freedom	Denominator degrees of freedom[2]	F-statistic	p-value
Overall	Grass type × regime × year	19	182.0	1.63	0.0533*
Contrasts:	Mixed: regime effect	3	79.8	2.17	0.0982*
	Mixed: year effect	2	130.0	0.03	0.9704
	Mixed: interaction	6	131.6	1.43	0.2070
	Tall: regime effect	3	94.2	3.96	0.0105**
	Tall: year effect	1	128.7	0.82	0.3680
	Tall: interaction	3	128.7	0.56	0.6404
	Mixed versus tall: burned only	1	87.0	2.03	0.1578
	Mixed versus tall: grazed only	1	92.3	0.02	0.8968
	Mixed versus tall: burned-grazed	1	92.9	2.82	0.0964*
	Mixed versus tall: rest	1	86.7	0.30	0.5832

[1]Sources of variation for the model: Y=Unit(Grass type × Regime) + Grass type × Regime × Year + Year × Unit(Grass type × Regime), where Grass type × Regime × Year is a fixed effect, Unit(Grass type × Regime) and Year × Unit(Grass type × Regime) are random effects in a mixed-model framework, and Year is a repeated-measures factor.
[2]Degrees of freedom are based on Kenward-Roger correction for repeated-measures models (Littell and others, 2006).

Table 3.14. Least squares mean (standard error) and back-transformed least squares mean (95-percent confidence intervals) of native grass cover (percent), by grassland type (mixed-grass, tallgrass), overall treatment regime (burned only, grazed only, burned-grazed, or rest), and year (2011, 2012, 2013), on Federal lands managed under an adaptive-management framework by the U.S. Fish and Wildlife Service (Gannon and others, 2013) in North Dakota, South Dakota, Minnesota, and Montana, 2011–13.

[LSMean, least squares mean; SE, standard error; LCL, lower confidence limit; UCL, upper confidence limit]

Grass	Regime	Year	LSMean	SE	Back-transformed LSMean	95-percent confidence intervals LCL	UCL
Mixed	Burned only	2011	−0.346	0.278	40.4	28.1	54.0
		2012	−0.653	0.282	33.2	22.0	46.5
		2013	−0.645	0.282	33.4	22.2	46.7
	Grazed only	2011	−1.225	0.227	21.7	14.8	30.4
		2012	−1.211	0.213	22.0	15.4	30.1
		2013	−1.104	0.208	23.9	17.1	32.3
	Burned-grazed	2011	−0.800	0.196	30.0	22.4	38.7
		2012	−0.440	0.184	38.2	30.0	47.0
		2013	−0.608	0.189	34.3	26.3	43.1
	Rest	2011	−0.586	0.534	34.7	15.3	60.3
		2012	−0.667	0.541	32.9	14.1	58.7
		2013	−0.732	0.547	31.5	13.1	57.4
Tall	Burned only	2012	0.160	0.297	53.0	38.6	66.7
		2013	−0.203	0.297	44.0	30.3	58.4
	Grazed only	2012	−1.266	0.348	21.0	11.5	34.8
		2013	−1.189	0.332	22.3	12.7	35.8
	Burned-grazed	2012	−1.704	0.710	14.4	3.3	41.2
		2013	−1.881	0.756	12.2	2.3	39.1
	Rest	2012	−0.942	0.570	27.0	10.3	53.4
		2013	−1.179	0.604	22.5	7.6	49.1
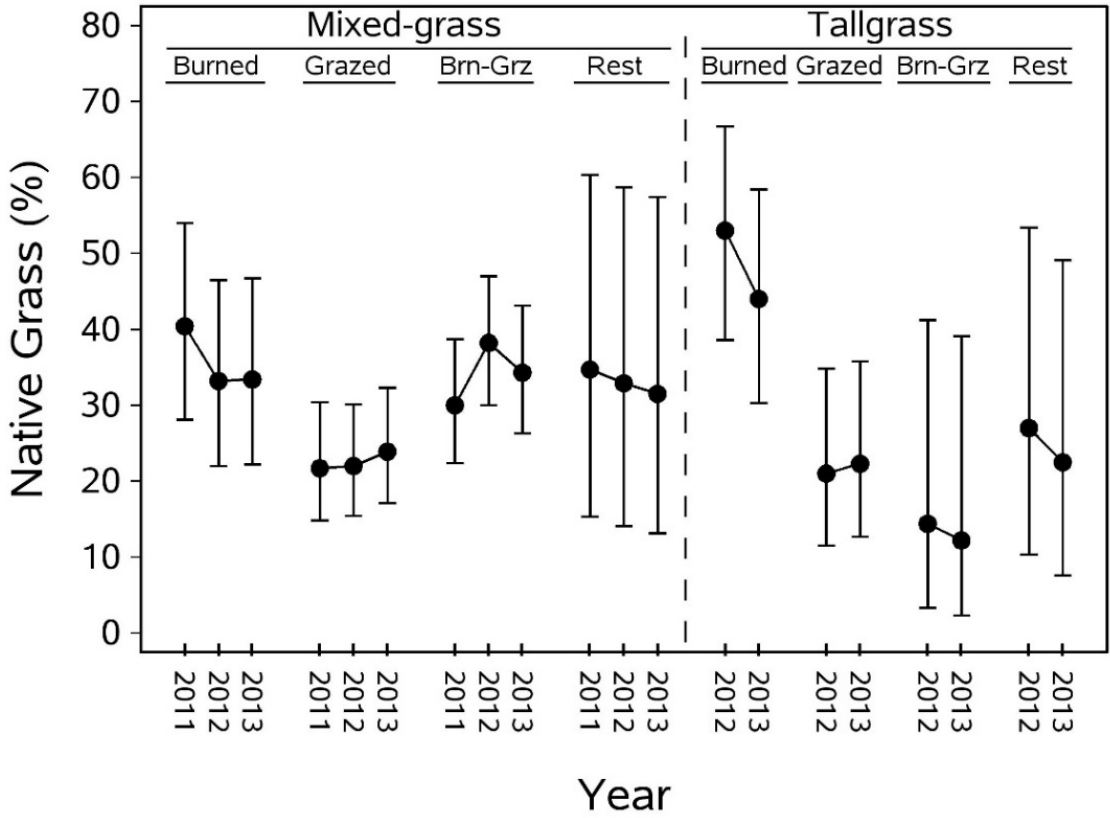
[Brn-Grz, burned-grazed; %, percent]

Figure 3.7. Back-transformed least squares mean native grass cover (percent) in Native Prairie Adaptive Management (NPAM) units managed by the U.S. Fish and Wildlife Service in North Dakota, South Dakota, Minnesota, and Montana, 2011–13. Bars represent 95-percent confidence limits.

H. Standard Deviation of Native Grass Cover (percent)

Table 3.15. Generalized linear mixed model, assuming a beta distribution with a logit link, $y = (y+1)$, testing the influence of management regime and year on standard deviation of native grass cover (percent) on two grass types (mixed-grass, tallgrass) on Federal lands managed under an adaptive-management framework by the U.S. Fish and Wildlife Service (Gannon and others, 2013) in North Dakota, South Dakota, Minnesota, and Montana, 2011–13.

[*, evidence for moderate effect (0.05<p≤0.10)]

Effect	Source of variation[1]	Numerator degrees of freedom	Denominator degrees of freedom[2]	F-statistic	p-value
Overall	Grass type × regime × year	19	180.6	1.56	0.0713*
Contrasts:	Mixed: regime effect	3	76.4	2.37	0.0769*
	Mixed: year effect	2	127.1	2.52	0.0843*
	Mixed: interaction	6	128.3	1.44	0.2030
	Tall: regime effect	3	90.1	0.37	0.7753
	Tall: year effect	1	126.6	1.84	0.1773
	Tall: interaction	3	126.5	2.07	0.1079
	Mixed versus tall: burned only	1	83.9	1.68	0.1991
	Mixed versus tall: grazed only	1	87.8	1.11	0.2939
	Mixed versus tall: burned-grazed	1	88.6	1.49	0.2262
	Mixed versus tall: rest	1	82.4	0.03	0.8710

[1]Sources of variation for the model: Y=Unit(Grass type × Regime) + Grass type × Regime × Year + Year × Unit(Grass type × Regime), where Grass type × Regime × Year is a fixed effect, Unit(Grass type × Regime) and Year × Unit(Grass type × Regime) are random effects in a mixed-model framework, and Year is a repeated-measures factor.
[2]Degrees of freedom are based on Kenward-Roger correction for repeated-measures models (Littell and others, 2006).

Table 3.16. Least squares mean (standard error) and back-transformed least squares mean (95-percent confidence intervals) of standard deviation of native grass cover (percent), by grassland type (mixed-grass, tallgrass), overall treatment regime (burned only, grazed only, burned-grazed, or rest), and year (2011, 2012, 2013), on Federal lands managed under an adaptive-management framework by the U.S. Fish and Wildlife Service (Gannon and others, 2013) in North Dakota, South Dakota, Minnesota, and Montana, 2011–13.

[LSMean, least squares mean; SE, standard error; LCL, lower confidence limit; UCL, upper confidence limit]

| | | | | | Back-transformed | | |
| | | | | | | 95-percent confidence intervals | |
Grass	Regime	Year	LSMean	SE	LSMean	LCL	UCL
Mixed	Burned only	2011	−0.724	0.154	31.7	25.4	38.6
		2012	−0.882	0.155	28.3	22.4	35.0
		2013	−1.022	0.160	25.5	19.8	32.0
	Grazed only	2011	−1.360	0.125	19.4	15.7	23.7
		2012	−1.251	0.114	21.3	17.6	25.4
		2013	−1.310	0.116	20.2	16.7	24.3
	Burned-grazed	2011	−1.048	0.109	25.0	21.1	29.3
		2012	−0.974	0.106	26.4	22.5	30.7
		2013	−1.126	0.111	23.5	19.7	27.7
	Rest	2011	−1.305	0.331	20.3	11.4	33.1
		2012	−0.813	0.294	29.7	19.0	43.1
		2013	−0.852	0.296	28.9	18.3	42.2
Tall	Burned only	2012	−1.246	0.188	21.3	15.6	28.4
		2013	−1.075	0.180	24.4	18.4	31.7
	Grazed only	2012	−1.085	0.175	24.3	18.3	31.3
		2013	−1.125	0.172	23.5	17.8	30.3
	Burned-grazed	2012	−1.356	0.336	19.5	10.8	32.2
		2013	−1.565	0.358	16.3	8.4	28.7
	Rest	2012	−0.832	0.295	29.3	18.6	42.7
		2013	−1.278	0.328	20.8	11.8	33.6
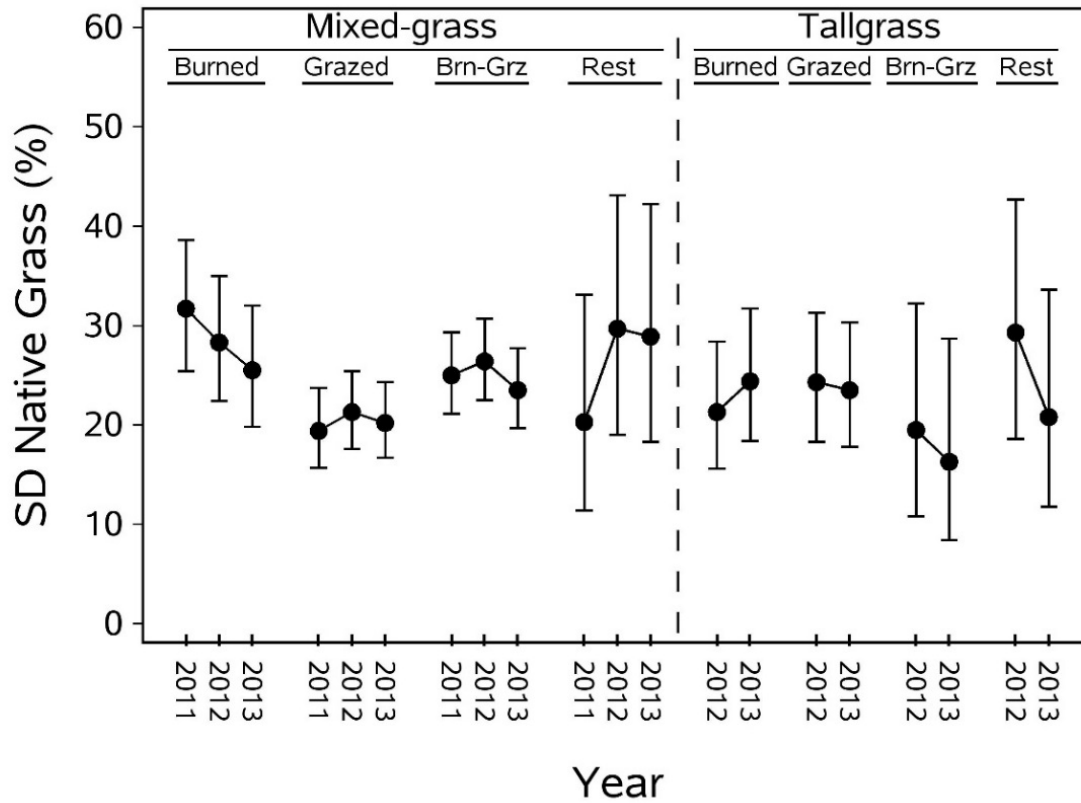
[Brn-Grz, burned-grazed; %, percent; SD, standard deviation]

Figure 3.8. Back-transformed least squares mean standard deviation of native grass cover (percent) in Native Prairie Adaptive Management (NPAM) units managed by the U.S. Fish and Wildlife Service in North Dakota, South Dakota, Minnesota, and Montana, 2011–13. Bars represent 95-percent confidence limits.

I. Mean Nonnative Forb Cover (percent)

Table 3.17. Generalized linear mixed model, assuming a beta distribution with a logit link, $y = (y+1)$, testing the influence of management regime and year on mean nonnative forb cover (percent) on two grass types on Federal lands managed under an adaptive-management framework by the U.S. Fish and Wildlife Service (Gannon and others, 2013) in North Dakota, South Dakota, Minnesota, and Montana, 2011–13.

Effect	Source of variation[1]	Numerator degrees of freedom	Denominator degrees of freedom[2]	F-statistic	p-value
Overall	Grass type × regime × year	19	177.5	0.77	0.7417
Contrasts:	Mixed: regime effect	3	70.5	0.19	0.9020
	Mixed: year effect	2	132.7	4.02	0.0201
	Mixed: interaction	6	137.5	0.66	0.6859
	Tall: regime effect	3	98.6	0.33	0.8045
	Tall: year effect	1	108.2	0.03	0.8545
	Tall: interaction	3	108.9	0.21	0.8867
	Mixed versus tall: burned only	1	84.1	1.13	0.2913
	Mixed versus tall: grazed only	1	93.8	0.60	0.4401
	Mixed versus tall: burned-grazed	1	95.4	0.08	0.7776
	Mixed versus tall: rest	1	85.0	0.19	0.6660

[1]Sources of variation for the model: Y=Unit(Grass type × Regime) + Grass type × Regime × Year + Year × Unit(Grass type × Regime), where Grass type × Regime × Year is a fixed effect, Unit(Grass type × Regime) and Year × Unit(Grass type × Regime) are random effects in a mixed-model framework, and Year is a repeated-measures factor.

[2]Degrees of freedom are based on Kenward-Roger correction for repeated-measures models (Littell and others, 2006).

Table 3.18. Least squares mean (standard error) and back-transformed least squares mean (95-percent confidence intervals) of nonnative forb cover (percent), by grassland type (mixed-grass, tallgrass), overall treatment regime (burned only, grazed only, burned-grazed, or rest), and year (2011, 2012, 2013), on Federal lands managed under an adaptive-management framework by the U.S. Fish and Wildlife Service (Gannon and others, 2013) in North Dakota, South Dakota, Minnesota, and Montana, 2011–13.

[LSMean, least squares mean; SE, standard error; LCL, lower confidence limit; UCL, upper confidence limit]

| | | | | | Back-transformed | | |
| | | | | | | 95-percent confidence intervals | |
Grass	Regime	Year	LSMean	SE	LSMean	LCL	UCL
Mixed	Burned only	2011	−2.606	0.313	5.9	2.8	11.0
		2012	−3.405	0.428	2.2	0.4	6.1
		2013	−4.060	0.585	0.7	0.0	4.2
	Grazed only	2011	−2.997	0.269	3.8	1.9	6.8
		2012	−3.264	0.271	2.7	1.2	5.1
		2013	−3.076	0.249	3.4	1.8	6.0
	Burned-grazed	2011	−2.806	0.225	4.7	2.7	7.6
		2012	−3.394	0.288	2.2	0.9	4.6
		2013	−3.231	0.267	2.8	1.3	5.3
	Rest	2011	−2.394	0.522	7.4	2.2	19.3
		2012	−3.381	0.811	2.3	0.0	13.3
		2013	−3.390	0.814	2.3	0.0	13.3
Tall	Burned only	2012	−2.811	0.361	4.7	1.9	9.9
		2013	−3.016	0.396	3.7	1.2	8.6
	Grazed only	2012	−2.624	0.332	5.8	2.6	11.2
		2013	−3.092	0.389	3.3	1.1	7.9
	Burned-grazed	2012	−3.478	0.849	2.0	0.0	13.0
		2013	−3.171	0.736	3.0	0.0	14.1
	Rest	2012	−3.437	0.832	2.1	0.0	13.1
		2013	−3.362	0.804	2.4	0.0	13.3
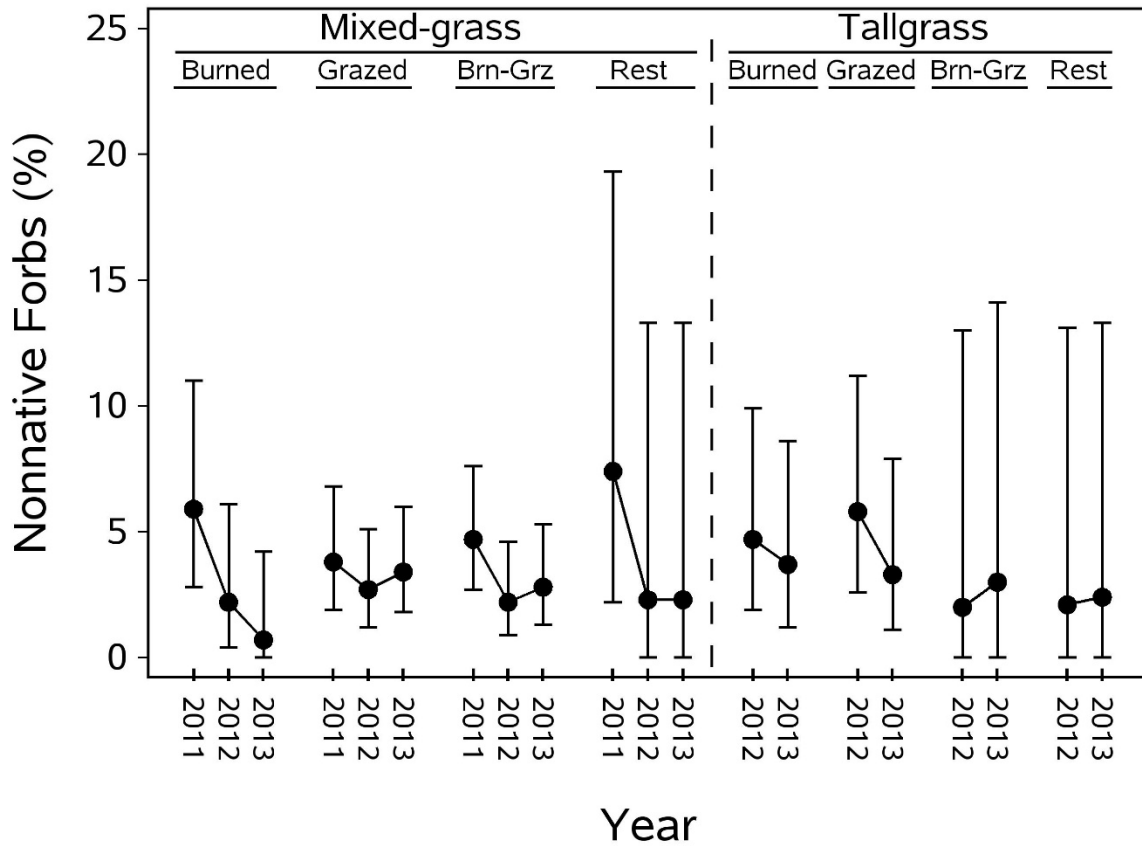
[Brn-Grz, burned-grazed; %, percent]

Figure 3.9. Back-transformed least squares mean nonnative forb cover (percent) in Native Prairie Adaptive Management (NPAM) units managed by the U.S. Fish and Wildlife Service in North Dakota, South Dakota, Minnesota, and Montana, 2011–13. Bars represent 95-percent confidence limits.

J. Standard Deviation of Nonnative Forb Cover (percent)

Table 3.19. Generalized linear mixed model, assuming a beta distribution with a logit link, $y = (y+1)$, testing the influence of management regime and year on standard deviation of nonnative forb cover (percent) on two grass types on Federal lands managed under an adaptive-management framework by the U.S. Fish and Wildlife Service (Gannon and others, 2013) in North Dakota, South Dakota, Minnesota, and Montana, 2011–13.

Effect	Source of variation[1]	Numerator degrees of freedom	Denominator degrees of freedom[2]	F-statistic	p-value
Overall	Grass type × regime × year	19	180.4	1.19	0.2705
Contrasts:	Mixed: regime effect	3	75.5	0.10	0.9586
	Mixed: year effect	2	140.9	5.88	0.0035
	Mixed: interaction	6	141.7	1.08	0.3768
	Tall: regime effect	3	103.0	0.18	0.9120
	Tall: year effect	1	118.6	0.00	0.9984
	Tall: interaction	3	119.2	0.73	0.5363
	Mixed versus tall: burned only	1	89.4	0.26	0.6087
	Mixed versus tall: grazed only	1	98.8	0.22	0.6419
	Mixed versus tall: burned-grazed	1	98.7	0.28	0.5958
	Mixed versus tall: rest	1	90.5	0.45	0.5055

[1]Sources of variation for the model: Y=Unit(Grass type × Regime) + Grass type × Regime × Year + Year × Unit(Grass type × Regime), where Grass type × Regime × Year is a fixed effect, Unit(Grass type × Regime) and Year × Unit(Grass type × Regime) are random effects in a mixed-model framework, and Year is a repeated-measures factor.

[2]Degrees of freedom are based on Kenward-Roger correction for repeated-measures models (Littell and others, 2006).

Table 3.20. Least squares mean (standard error) and back-transformed least squares mean (95-percent confidence intervals) of standard deviation of nonnative forb cover (percent), by grassland type (mixed-grass, tallgrass), overall treatment regime (burned only, grazed only, burned-grazed, or rest), and year (2011, 2012, 2013), on Federal lands managed under an adaptive-management framework by the U.S. Fish and Wildlife Service (Gannon and others, 2013) in North Dakota, South Dakota, Minnesota, and Montana, 2011–13.

[LSMean, least squares mean; SE, standard error; LCL, lower confidence limit; UCL, upper confidence limit]

| | | | | | Back-transformed | | |
| | | | | | | 95-percent confidence intervals | |
Grass	Regime	Year	LSMean	SE	LSMean	LCL	UCL
Mixed	Burned only	2011	−2.093	0.252	10.0	6.0	15.8
		2012	−2.692	0.309	5.3	2.6	10.0
		2013	−3.343	0.415	2.4	0.5	6.4
	Grazed only	2011	−2.580	0.222	6.0	3.7	9.5
		2012	−2.845	0.224	4.5	2.6	7.3
		2013	−2.606	0.202	5.9	3.7	8.9
	Burned-grazed	2011	−2.335	0.183	7.8	5.3	11.2
		2012	−2.824	0.221	4.6	2.7	7.4
		2013	−2.954	0.235	4.0	2.2	6.6
	Rest	2011	−1.860	0.423	12.5	5.4	25.3
		2012	−2.911	0.652	4.2	0.5	15.3
		2013	−2.661	0.584	5.5	1.2	17.0
Tall	Burned only	2012	−2.544	0.321	6.3	3.0	11.8
		2013	−2.519	0.317	6.5	3.1	12.0
	Grazed only	2012	−2.257	0.283	8.5	4.7	14.4
		2013	−2.823	0.343	4.6	1.9	9.4
	Burned-grazed	2012	−2.583	0.565	6.0	1.4	17.6
		2013	−2.336	0.509	7.8	2.4	19.8
	Rest	2012	−3.069	0.700	3.4	0.2	14.5
		2013	−2.772	0.613	4.9	0.8	16.2
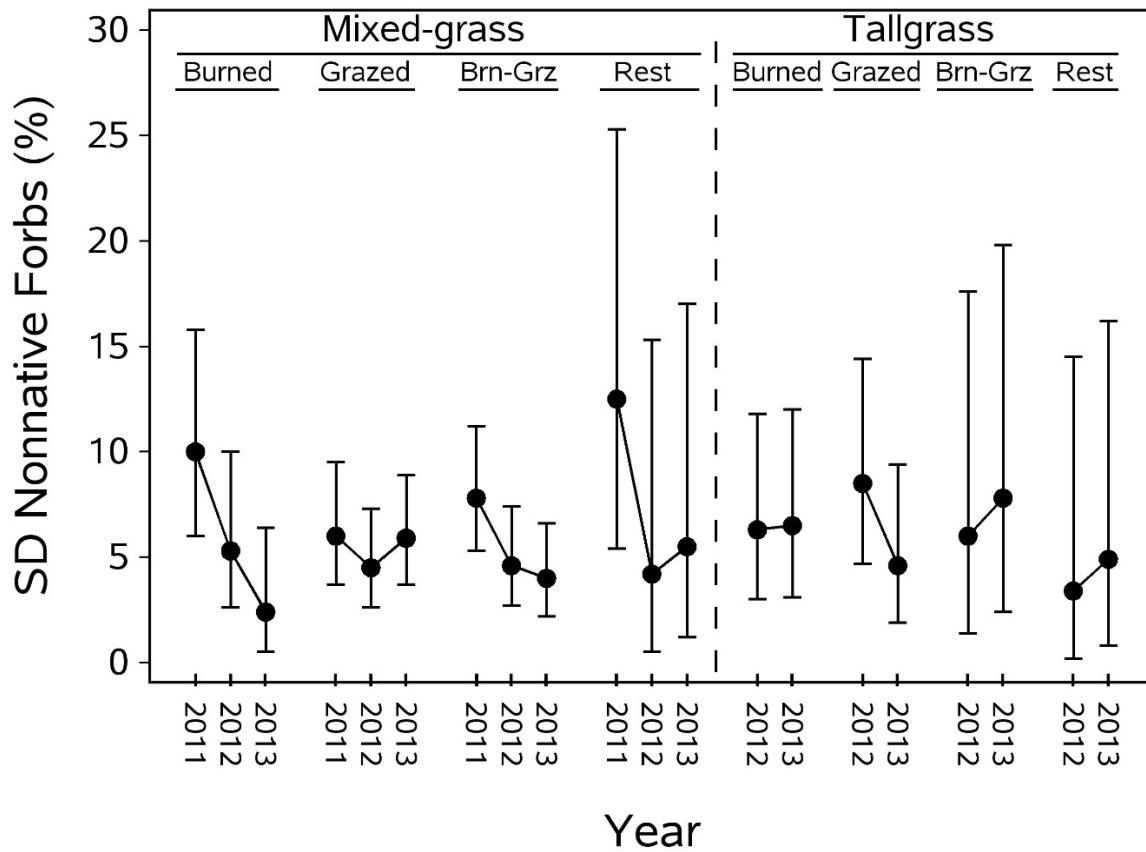
[Brn-Grz, burned-grazed; %, percent; SD, standard deviation]

Figure 3.10. Back-transformed least squares mean standard deviation of nonnative forb cover (percent) in Native Prairie Adaptive Management (NPAM) units managed by the U.S. Fish and Wildlife Service in North Dakota, South Dakota, Minnesota, and Montana, 2011–13. Bars represent 95-percent confidence limits.

K. **Mean Nonnative Grass Cover (percent)**

Table 3.21. Generalized linear mixed model, assuming a beta distribution with a logit link, $y = (y+1)$, testing the influence of management regime and year on mean nonnative grass cover (percent) on two grass types (mixed-grass, tallgrass) on Federal lands managed under an adaptive-management framework by the U.S. Fish and Wildlife Service (Gannon and others, 2013) in North Dakota, South Dakota, Minnesota, and Montana, 2011–13.

[**, evidence for strong effect ($p \leq 0.05$)]

Effect	Source of variation[1]	Numerator degrees of freedom	Denominator degrees of freedom[2]	F-statistic	p-value
Overall	Grass type × regime × year	19	180.8	1.64	0.0500**
Contrasts:	Mixed: regime effect	3	78.3	3.29	0.0248**
	Mixed: year effect	2	128.6	0.97	0.3834
	Mixed: interaction	6	130.9	1.07	0.3861
	Tall: regime effect	3	95.8	4.30	0.0069**
	Tall: year effect	1	130.1	1.89	0.1714
	Tall: interaction	3	128.8	0.65	0.5833
	Mixed versus tall: burned only	1	87.3	1.04	0.3097
	Mixed versus tall: grazed only	1	93.4	0.31	0.5800
	Mixed versus tall: burned-grazed	1	94.2	2.71	0.1033
	Mixed versus tall: rest	1	86.2	0.73	0.3945

[1]Sources of variation for the model: Y=Unit(Grass type × Regime) + Grass type × Regime × Year + Year × Unit(Grass type × Regime), where Grass type × Regime × Year is a fixed effect, Unit(Grass type × Regime) and Year × Unit(Grass type × Regime) are random effects in a mixed-model framework, and Year is a repeated-measures factor.

[2]Degrees of freedom are based on Kenward-Roger correction for repeated-measures models (Littell and others, 2006).

Table 3.22. Least squares mean (standard error) and back-transformed least squares mean (95-percent confidence intervals) of nonnative grass cover (percent), by grassland type (mixed-grass, tallgrass), overall treatment regime (burned only, grazed only, burned-grazed, or rest), and year (2011, 2012, 2013), on Federal lands managed under an adaptive-management framework by the U.S. Fish and Wildlife Service (Gannon and others, 2013) in North Dakota, South Dakota, Minnesota, and Montana, 2011–13.

[LSMean, least squares mean; SE, standard error; LCL, lower confidence limit; UCL, upper confidence limit]

Grass	Regime	Year	LSMean	SE	Back-transformed LSMean	95-percent confidence intervals LCL	UCL
Mixed	Burned only	2011	−0.257	0.273	42.6	30.2	55.9
		2012	0.173	0.264	53.3	40.5	65.6
		2013	0.189	0.265	53.7	40.8	66.0
	Grazed only	2011	0.740	0.203	66.7	57.5	74.7
		2012	0.891	0.195	69.9	61.5	77.1
		2013	0.656	0.187	64.8	56.2	72.6
	Burned-grazed	2011	0.245	0.180	55.1	46.3	63.5
		2012	0.133	0.177	52.3	43.7	60.8
		2013	0.226	0.181	54.6	45.8	63.1
	Rest	2011	−0.132	0.505	45.7	23.6	69.2
		2012	0.135	0.505	52.4	28.8	74.5
		2013	0.084	0.505	51.1	27.8	73.5
Tall	Burned only	2012	−0.407	0.297	39.0	26.1	53.4
		2013	−0.241	0.293	43.0	29.7	57.3
	Grazed only	2012	0.950	0.318	71.1	57.1	81.8
		2013	0.938	0.307	70.9	57.3	81.3
	Burned-grazed	2012	0.741	0.539	66.7	41.2	84.8
		2013	1.525	0.658	81.1	54.9	93.3
	Rest	2012	0.528	0.522	61.9	36.9	81.5
		2013	0.632	0.530	64.3	39.0	83.2
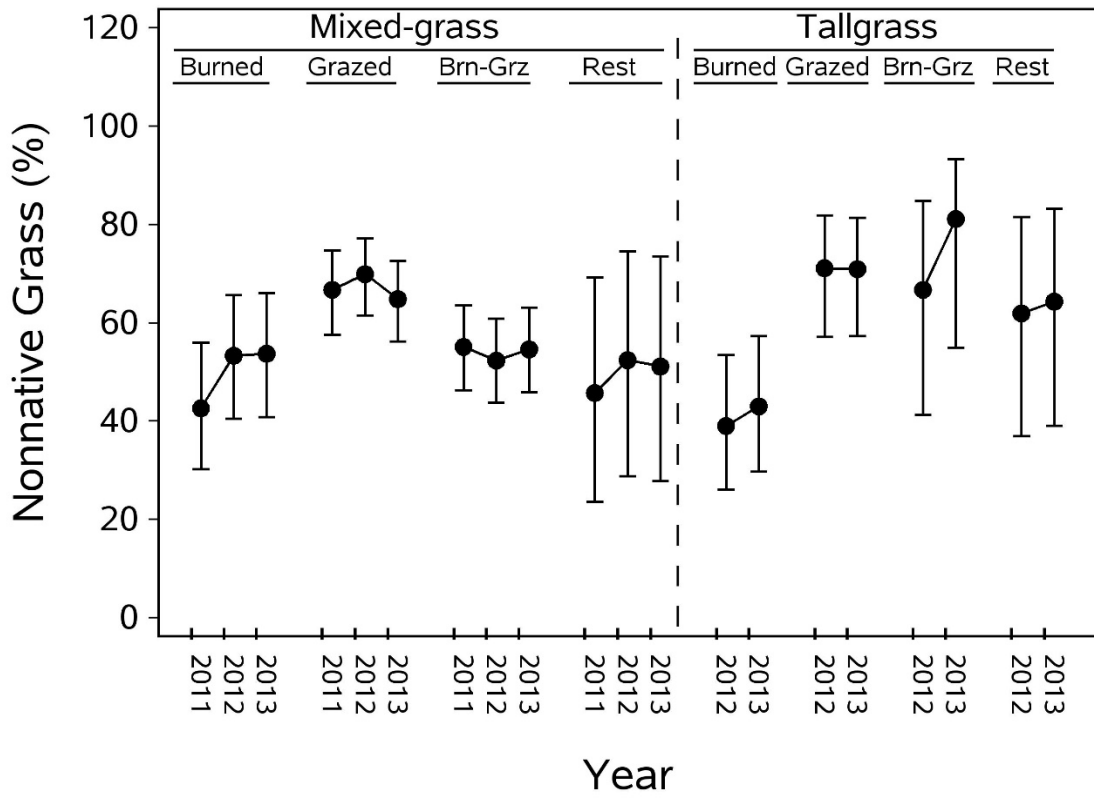
[Brn-Grz, burned-grazed; %, percent]

Figure 3.11.   Back-transformed least squares mean nonnative grass cover (percent) in Native Prairie Adaptive Management (NPAM) units managed by the U.S. Fish and Wildlife Service in North Dakota, South Dakota, Minnesota, and Montana, 2011–13. Bars represent 95-percent confidence limits.

L. Standard Deviation of Nonnative Grass Cover (percent)

Table 3.23. Generalized linear mixed model, assuming a beta distribution with a logit link, $y = (y+1)$, testing the influence of management regime and year on standard deviation of nonnative grass cover (percent) on two grass types (mixed-grass, tallgrass) on Federal lands managed under an adaptive-management framework by the U.S. Fish and Wildlife Service (Gannon and others, 2013) in North Dakota, South Dakota, Minnesota, and Montana, 2011–13.

Effect	Source of variation[1]	Numerator degrees of freedom	Denominator degrees of freedom[2]	F-statistic	p-value
Overall	Grass type × regime × year	19	182.0	1.30	0.1879
Contrasts:	Mixed: regime effect	3	78.2	3.04	0.0340
	Mixed: year effect	2	130.2	1.51	0.2255
	Mixed: interaction	6	134.0	1.16	0.3335
	Tall: regime effect	3	101.8	1.25	0.2951
	Tall: year effect	1	125.3	0.40	0.5276
	Tall: interaction	3	125.6	1.28	0.2827
	Mixed versus tall: burned only	1	91.5	3.97	0.0494
	Mixed versus tall: grazed only	1	98.1	3.32	0.0716
	Mixed versus tall: burned-grazed	1	99.1	1.42	0.2367
	Mixed versus tall: rest	1	88.1	0.49	0.4876

[1]Sources of variation for the model: Y=Unit(Grass type × Regime) + Grass type × Regime × Year + Year × Unit(Grass type × Regime), where Grass type × Regime × Year is a fixed effect, Unit(Grass type × Regime) and Year × Unit(Grass type × Regime) are random effects in a mixed-model framework, and Year is a repeated-measures factor.

[2]Degrees of freedom are based on Kenward-Roger correction for repeated-measures models (Littell and others, 2006).

Table 3.24. Least squares mean (standard error) and back-transformed least squares mean (95-percent confidence intervals) of standard deviation of nonnative grass cover (percent), by grassland type (mixed-grass, tallgrass), overall treatment regime (burned only, grazed only, burned-grazed, or rest), and year (2011, 2012, 2013), on Federal lands managed under an adaptive-management framework by the U.S. Fish and Wildlife Service (Gannon and others, 2013) in North Dakota, South Dakota, Minnesota, and Montana, 2011–13.

[LSMean, least squares mean; SE, standard error; LCL, lower confidence limit; UCL, upper confidence limit]

| Grass | Regime | Year | LSMean | SE | Back-transformed | | |
| | | | | | | 95-percent confidence intervals | |
					LSMean	LCL	UCL
Mixed	Burned only	2011	−0.815	0.121	29.7	24.9	35.0
		2012	−0.835	0.118	29.3	24.6	34.3
		2013	−0.917	0.120	27.6	23.0	32.6
	Grazed only	2011	−1.188	0.094	22.4	19.2	25.8
		2012	−1.125	0.085	23.5	20.6	26.7
		2013	−1.168	0.086	22.7	19.8	25.9
	Burned-grazed	2011	−0.858	0.081	28.8	25.6	32.2
		2012	−0.942	0.081	27.0	24.0	30.4
		2013	−1.000	0.082	25.9	22.8	29.2
	Rest	2011	−1.358	0.256	19.5	12.5	28.8
		2012	−0.821	0.224	29.6	21.1	39.6
		2013	−0.867	0.226	28.6	20.2	38.6
Tall	Burned only	2012	−1.261	0.144	21.1	16.6	26.3
		2013	−1.060	0.137	24.7	20.0	30.2
	Grazed only	2012	−0.891	0.130	28.1	23.1	33.6
		2013	−0.957	0.126	26.7	22.1	32.0
	Burned-grazed	2012	−1.055	0.236	24.8	17.0	34.6
		2013	−1.341	0.255	19.7	12.7	29.1
	Rest	2012	−0.783	0.223	30.4	21.8	40.4
		2013	−0.874	0.227	28.4	20.1	38.4
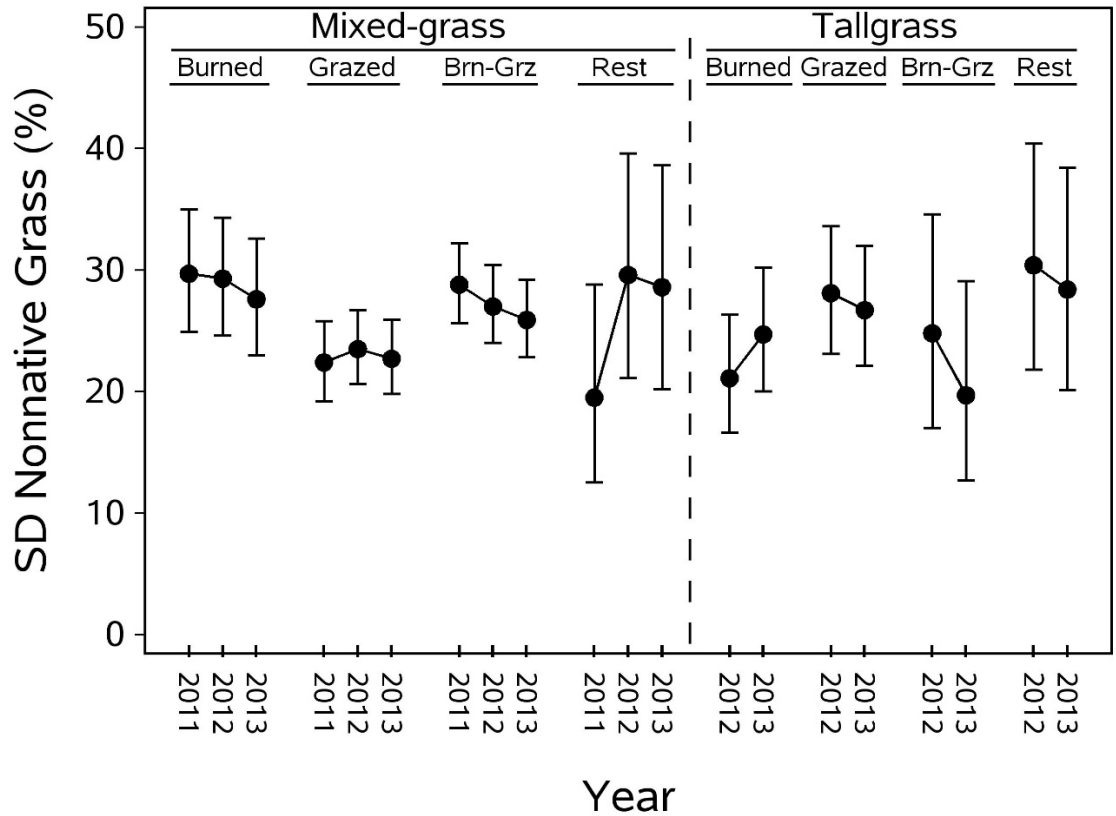
[Brn-Grz, burned-grazed; %, percent; SD, standard deviation]

Figure 3.12. Back-transformed least squares mean standard deviation of nonnative grass cover (percent) in Native Prairie Adaptive Management (NPAM) units managed by the U.S. Fish and Wildlife Service in North Dakota, South Dakota, Minnesota, and Montana, 2011–13. Bars represent 95-percent confidence limits.

M. Defoliation Index

Table 3.25. Generalized linear mixed model, assuming a gamma distribution with a log link, $y = (y+1)$, testing the influence of management regime and year on mean the Defoliation Index on two grass types on Federal lands managed under an adaptive-management framework by the U.S. Fish and Wildlife Service (Gannon and others, 2013) in North Dakota, South Dakota, Minnesota, and Montana, 2011–13.

[<, less than; *, evidence for moderate effect ($0.05 < p \leq 0.10$); **, evidence for strong effect ($p \leq 0.05$)]

Effect	Source of variation[1]	Numerator degrees of freedom	Denominator degrees of freedom[2]	F-statistic	p-value
Overall	Grass type × regime × year	19	182.1	7.93	<0.0001**
Contrasts:	Mixed: regime effect	3	79.4	32.51	<0.0001**
	Mixed: year effect	2	128.7	0.12	0.8910
	Mixed: interaction	6	129.6	0.95	0.4646
	Tall: regime effect	3	88.2	2.68	0.0519*
	Tall: year effect	1	127.5	0.01	0.9129
	Tall: interaction	3	127.5	1.47	0.2252
	Mixed versus tall: burned only	1	84.1	2.60	0.1108
	Mixed versus tall: grazed only	1	86.2	20.43	<0.0001**
	Mixed versus tall: burned-grazed	1	87.3	1.28	0.2618
	Mixed versus tall: rest	1	83.4	9.66	0.0026**

[1]Sources of variation for the model: Y=Unit(Grass type × Regime) + Grass type × Regime × Year + Year × Unit(Grass type × Regime), where Grass type × Regime × Year is a fixed effect, Unit(Grass type × Regime) and Year × Unit(Grass type × Regime) are random effects in a mixed-model framework, and Year is a repeated-measures factor.

[2]Degrees of freedom are based on Kenward-Roger correction for repeated-measures models (Littell and others, 2006).

Table 3.26. Least squares mean (standard error) and back-transformed least squares mean (95-percent confidence intervals) of the Defoliation Index, by grassland type (mixed-grass, tallgrass), overall treatment regime (burned only, grazed only, burned-grazed, or rest), and year (2011, 2012, 2013), on Federal lands managed under an adaptive-management framework by the U.S. Fish and Wildlife Service (Gannon and others, 2013) in North Dakota, South Dakota, Minnesota, and Montana, 2011–13.

[LSMean, least squares mean; SE, standard error; LCL, lower confidence limit; UCL, upper confidence limit]

| | | | | | Back-transformed | | |
| | | | | | | 95-percent confidence intervals | |
Grass	Regime	Year	LSMean	SE	LSMean	LCL	UCL
Mixed	Burned only	2011	1.42	0.09	3.15	2.48	3.95
		2012	1.40	0.09	3.05	2.41	3.83
		2013	1.46	0.09	3.32	2.63	4.15
	Grazed only	2011	1.67	0.06	4.31	3.71	4.99
		2012	1.76	0.06	4.79	4.16	5.50
		2013	1.79	0.06	4.97	4.31	5.71
	Burned-grazed	2011	1.66	0.06	4.24	3.66	4.89
		2012	1.70	0.06	4.47	3.87	5.15
		2013	1.71	0.06	4.52	3.92	5.21
	Rest	2011	0.22	0.17	0.24	0.00	0.74
		2012	0.15	0.17	0.17	0.00	0.63
		2013	0.09	0.17	0.09	0.00	0.52
Tall	Burned only	2012	1.26	0.10	2.52	1.90	3.26
		2013	1.20	0.10	2.31	1.73	3.01
	Grazed only	2012	1.30	0.09	2.68	2.06	3.41
		2013	1.23	0.09	2.41	1.84	3.09
	Burned-grazed	2012	1.42	0.17	3.13	1.96	4.76
		2013	1.57	0.17	3.81	2.45	5.71
	Rest	2012	0.87	0.17	1.40	0.72	2.35
		2013	0.84	0.17	1.31	0.66	2.23
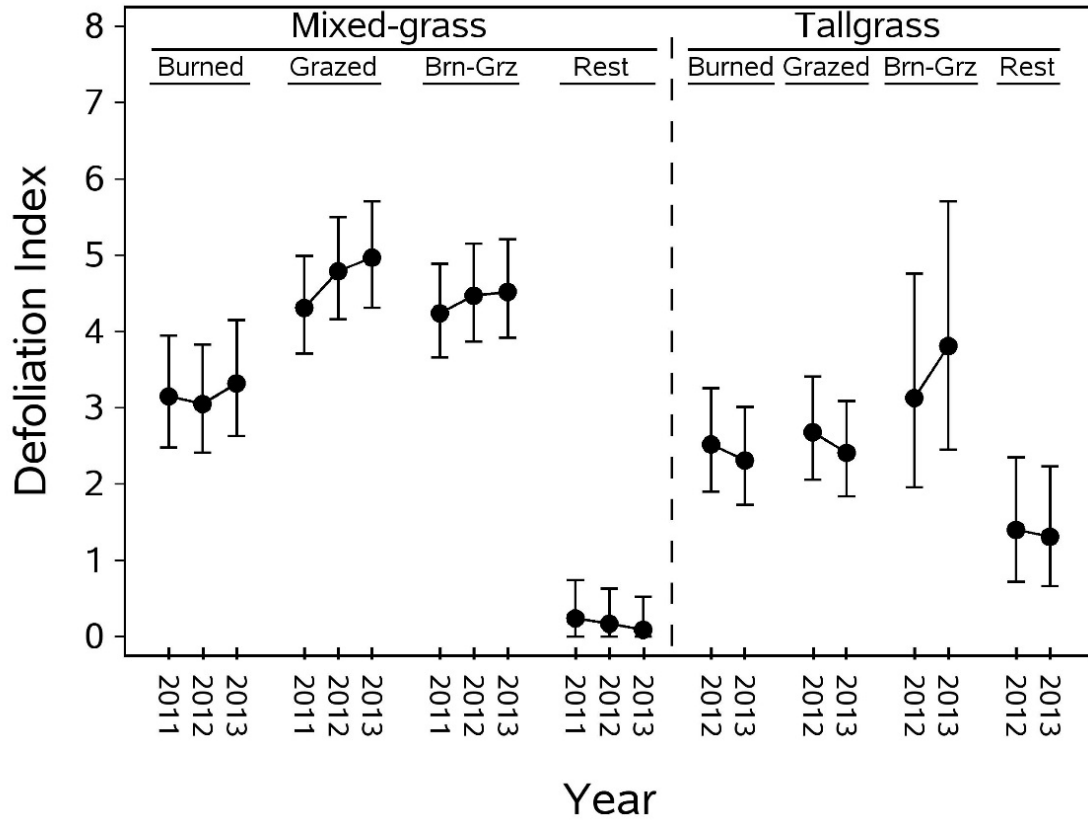
[Brn-Grz, burned-grazed]

Figure 3.13. Back-transformed least squares mean Defoliation Index in Native Prairie Adaptive Management (NPAM) units managed by the U.S. Fish and Wildlife Service in North Dakota, South Dakota, Minnesota, and Montana, 2011–13. Bars represent 95-percent confidence limits.

References

Gannon, J.J., Shaffer, T.L., and Moore, C.T., 2013, Native Prairie Adaptive Management—A multi-region adaptive approach to invasive plant management on Fish and Wildlife Service owned native prairies: U.S. Geological Survey Open-File Report 2013–1279, 184 p. [Also available at *https://dx.doi.org/10.3133/ofr20131279*.]

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