Appendix 1.  Testing the Influence of Management Regime and Year on Vegetation Structure Variables 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 Bare-Ground Cover (percent)

**Table 1.1.** Generalized linear mixed model (assuming a beta distribution with a logit link) testing the influence of management regime and year on mean bare-ground 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.
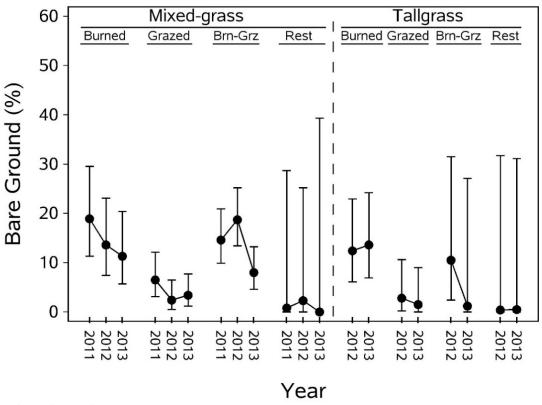
[**, evidence for strong effect ($p \leq 0.05$)]

| Effect | Sources of variation[1] | Numerator degrees of freedom | Denominator degrees of freedom[2] | F-statistic | p-value |
|--------|------------------------|:---:|:---:|:---:|:---:|
| Overall | Grass type × regime × year | 19 | 181.3 | 2.63 | 0.0005** |
| | | | | | |
| Contrasts: | Mixed: regime effect | 3 | 82.1 | 7.68 | 0.0001** |
| | Mixed: year effect | 2 | 132.2 | 0.44 | 0.6448 |
| | Mixed: interaction | 6 | 141.3 | 1.19 | 0.3156 |
| | Tall: regime effect | 3 | 112.8 | 3.36 | 0.0213** |
| | Tall: year effect | 1 | 128.0 | 0.54 | 0.4644 |
| | Tall: interaction | 3 | 129.7 | 0.55 | 0.6509 |
| | Mixed versus tall: burned only | 1 | 95.4 | 0.10 | 0.7507 |
| | Mixed versus tall: grazed only | 1 | 104.0 | 0.65 | 0.4222 |
| | Mixed versus tall: burned-grazed | 1 | 123.4 | 1.63 | 0.2044 |
| | Mixed versus tall: rest | 1 | 97.6 | 0.01 | 0.9055 |

[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 1.2.** Least squares mean (standard error) and back-transformed least squares mean (95-percent confidence intervals) of bare-ground 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 type | Regime | Year | LSMean | SE | LSMean | LCL | UCL |
|---|---|---|---|---|---|---|---|
| Mixed | Burned only | 2011 | −1.395 | 0.292 | 18.9 | 11.3 | 29.5 |
| | | 2012 | −1.765 | 0.315 | 13.6 | 7.4 | 23.1 |
| | | 2013 | −1.966 | 0.339 | 11.3 | 5.7 | 20.4 |
| | Grazed only | 2011 | −2.518 | 0.321 | 6.5 | 3.1 | 12.1 |
| | | 2012 | −3.342 | 0.423 | 2.4 | 0.5 | 6.5 |
| | | 2013 | −3.077 | 0.367 | 3.4 | 1.2 | 7.7 |
| | Burned-grazed | 2011 | −1.688 | 0.212 | 14.6 | 9.9 | 20.9 |
| | | 2012 | −1.408 | 0.190 | 18.7 | 13.4 | 25.2 |
| | | 2013 | −2.311 | 0.263 | 8.0 | 4.6 | 13.2 |
| | Rest | 2011 | −3.985 | 1.594 | 0.8 | 0.0 | 28.7 |
| | | 2012 | −3.390 | 1.201 | 2.3 | 0.0 | 25.2 |
| | | 2013 | −4.595 | 2.144 | 0.0 | 0.0 | 39.3 |
| Tall | Burned only | 2012 | −1.869 | 0.362 | 12.4 | 6.1 | 22.9 |
| | | 2013 | −1.770 | 0.349 | 13.6 | 6.9 | 24.2 |
| | Grazed only | 2012 | −3.227 | 0.610 | 2.8 | 0.2 | 10.6 |
| | | 2013 | −3.676 | 0.753 | 1.5 | 0.0 | 9.0 |
| | Burned-grazed | 2012 | −2.042 | 0.669 | 10.5 | 2.4 | 31.5 |
| | | 2013 | −3.809 | 1.464 | 1.2 | 0.0 | 27.1 |
| | Rest | 2012 | −4.220 | 1.785 | 0.4 | 0.0 | 31.7 |
| | | 2013 | −4.179 | 1.750 | 0.5 | 0.0 | 31.1 |

[Brn-Grz, burned-grazed; %, percent]

Figure 1.1.    Back-transformed least squares mean bare-ground 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.

## B. Standard Deviation of Bare-Ground Cover (percent)

**Table 1.3.** Generalized linear mixed model (assuming a beta distribution with a logit link) testing the influence of management regime and year on the standard deviation of bare-ground 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.

[*, evidence for moderate effect ($0.05 < p \leq 0.10$); **, evidence for strong effect ($p \leq 0.05$)]
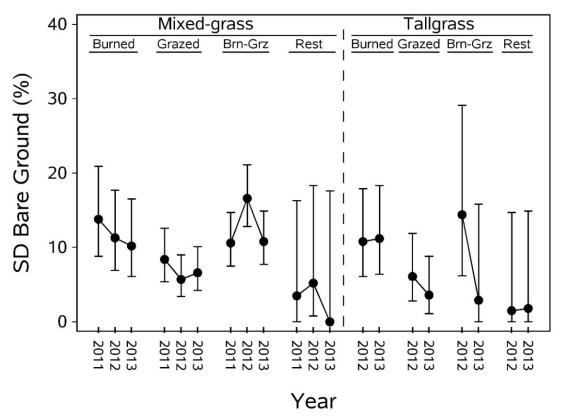
| Effect | Sources of variation[1] | Numerator degrees of freedom | Denominator degrees of freedom[2] | F-statistic | p-value |
|--------|------------------------|------------------------------|-----------------------------------|-------------|---------|
| Overall | Grass type × regime × year | 19 | 181.5 | 2.18 | 0.0043** |
| Contrasts: | Mixed: regime effect | 3 | 81.0 | 4.53 | 0.0055** |
| | Mixed: year effect | 2 | 145.0 | 1.14 | 0.3233 |
| | Mixed: interaction | 6 | 141.7 | 1.97 | 0.0745* |
| | Tall: regime effect | 3 | 106.2 | 2.28 | 0.0838* |
| | Tall: year effect | 1 | 131.8 | 1.54 | 0.2173 |
| | Tall: interaction | 3 | 132.8 | 1.28 | 0.2845 |
| | Mixed versus tall: burned only | 1 | 92.2 | 0.05 | 0.8215 |
| | Mixed versus tall: grazed only | 1 | 99.9 | 0.93 | 0.3371 |
| | Mixed versus tall: burned-grazed | 1 | 109.5 | 1.16 | 0.2840 |
| | Mixed versus tall: rest | 1 | 94.8 | 0.02 | 0.8894 |

[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 1.4.** Least squares mean (standard error) and back-transformed least squares mean (95 percent confidence intervals) of the standard deviation of bare-ground 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 type | Regime | Year | LSMean | SE | LSMean | LCL | UCL |
|---|---|---|---|---|---|---|---|
| Mixed | Burned only | 2011 | −1.748 | 0.242 | 13.8 | 8.8 | 20.9 |
| | | 2012 | −1.965 | 0.252 | 11.3 | 6.9 | 17.7 |
| | | 2013 | −2.066 | 0.262 | 10.2 | 6.1 | 16.5 |
| | Grazed only | 2011 | −2.269 | 0.212 | 8.4 | 5.4 | 12.6 |
| | | 2012 | −2.638 | 0.227 | 5.7 | 3.4 | 9.0 |
| | | 2013 | −2.492 | 0.210 | 6.6 | 4.2 | 10.1 |
| | Burned-grazed | 2011 | −2.032 | 0.178 | 10.6 | 7.5 | 14.7 |
| | | 2012 | −1.547 | 0.147 | 16.6 | 12.8 | 21.1 |
| | | 2013 | −2.009 | 0.173 | 10.8 | 7.7 | 14.9 |
| | Rest | 2011 | −3.066 | 0.767 | 3.5 | 0.0 | 16.3 |
| | | 2012 | −2.718 | 0.657 | 5.2 | 0.8 | 18.3 |
| | | 2013 | −4.595 | 1.590 | 0.0 | 0.0 | 17.6 |
| Tall | Burned only | 2012 | −2.012 | 0.283 | 10.8 | 6.1 | 17.9 |
| | | 2013 | −1.975 | 0.279 | 11.2 | 6.4 | 18.3 |
| | Grazed only | 2012 | −2.570 | 0.337 | 6.1 | 2.8 | 11.9 |
| | | 2013 | −3.035 | 0.414 | 3.6 | 1.1 | 8.8 |
| | Burned-grazed | 2012 | −1.701 | 0.438 | 14.4 | 6.2 | 29.1 |
| | | 2013 | −3.192 | 0.812 | 2.9 | 0.0 | 15.8 |
| | Rest | 2012 | −3.678 | 1.020 | 1.5 | 0.0 | 14.7 |
| | | 2013 | −3.552 | 0.961 | 1.8 | 0.0 | 14.9 |

[Brn-Grz, burned-grazed; %, percent; SD, standard deviation]

**Figure 1.2.** Back-transformed least squares mean standard deviation of bare-ground 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.

## C. Mean Litter Depth (centimeters)

**Table 1.5.**  Generalized linear mixed model (assuming a gamma distribution with a log link) testing the influence of management regime and year on mean litter depth (centimeters) 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.
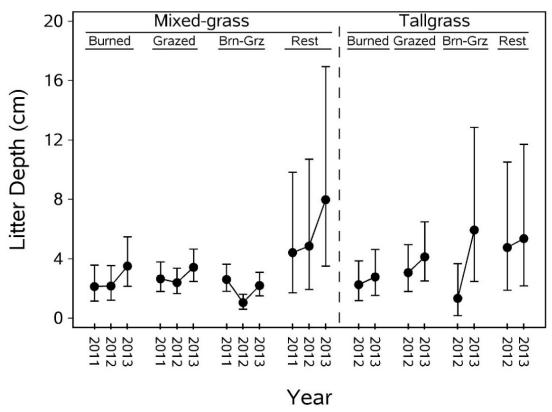
[**, evidence for strong effect ($p{\leq}0.05$)]

| Effect | Sources of variation[1] | Numerator degrees of freedom | Denominator degrees of freedom[2] | $F$-statistic | $p$-value |
|--------|------------------------|------------------------------|-----------------------------------|---------------|-----------|
| Overall | Grass type × regime × year | 19 | 182.2 | 2.76 | 0.0002** |
| | | | | | |
| Contrasts: | Mixed: regime effect | 3 | 79.7 | 3.93 | 0.0113** |
| | Mixed: year effect | 2 | 132.7 | 4.56 | 0.0122** |
| | Mixed: interaction | 6 | 137.5 | 1.44 | 0.2019 |
| | Tall: regime effect | 3 | 106.4 | 1.01 | 0.3936 |
| | Tall: year effect | 1 | 122.4 | 5.82 | 0.0173** |
| | Tall: interaction | 3 | 122.4 | 1.55 | 0.2039 |
| | Mixed versus tall: burned only | 1 | 94.5 | 0.00 | 0.9538 |
| | Mixed versus tall: grazed only | 1 | 100.8 | 0.98 | 0.3235 |
| | Mixed versus tall: burned-grazed | 1 | 103.7 | 1.24 | 0.2684 |
| | Mixed versus tall: rest | 1 | 92.1 | 0.05 | 0.8285 |

[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 1.6.**     Least squares mean (standard error) and back-transformed least squares mean (95-percent confidence intervals) litter depth (centimeters), 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 type | Regime | Year | LSMean | SE | Back-transformed | 95-percent confidence intervals | |
| | | | | | LSMean | LCL | UCL |
|---|---|---|---|---|---|---|---|
| Mixed | Burned only | 2011 | 1.14 | 0.19 | 2.13 | 1.15 | 3.57 |
| | | 2012 | 1.15 | 0.18 | 2.17 | 1.21 | 3.55 |
| | | 2013 | 1.51 | 0.18 | 3.51 | 2.14 | 5.48 |
| | Grazed only | 2011 | 1.30 | 0.14 | 2.65 | 1.79 | 3.79 |
| | | 2012 | 1.22 | 0.13 | 2.40 | 1.65 | 3.36 |
| | | 2013 | 1.49 | 0.12 | 3.43 | 2.47 | 4.66 |
| | Burned-grazed | 2011 | 1.28 | 0.13 | 2.61 | 1.81 | 3.63 |
| | | 2012 | 0.72 | 0.12 | 1.05 | 0.61 | 1.62 |
| | | 2013 | 1.16 | 0.12 | 2.20 | 1.50 | 3.08 |
| | Rest | 2011 | 1.69 | 0.35 | 4.42 | 1.71 | 9.83 |
| | | 2012 | 1.77 | 0.35 | 4.86 | 1.93 | 10.71 |
| | | 2013 | 2.20 | 0.35 | 7.98 | 3.50 | 16.95 |
| Tall | Burned only | 2012 | 1.18 | 0.20 | 2.26 | 1.18 | 3.86 |
| | | 2013 | 1.33 | 0.20 | 2.78 | 1.53 | 4.63 |
| | Grazed only | 2012 | 1.40 | 0.19 | 3.07 | 1.79 | 4.95 |
| | | 2013 | 1.63 | 0.19 | 4.13 | 2.51 | 6.49 |
| | Burned-grazed | 2012 | 0.85 | 0.35 | 1.34 | 0.17 | 3.67 |
| | | 2013 | 1.94 | 0.35 | 5.94 | 2.47 | 12.86 |
| | Rest | 2012 | 1.75 | 0.35 | 4.76 | 1.88 | 10.51 |
| | | 2013 | 1.85 | 0.35 | 5.36 | 2.18 | 11.71 |

[Brn-Grz, burned-grazed; cm, centimeters]

**Figure 1.3.** Back-transformed least squares mean litter depth (centimeters) 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 Litter Depth (centimeters)

**Table 1.7.**    Generalized linear mixed model (assuming a gamma distribution with a log link) testing the influence of management regime and year on the standard deviation of the mean litter depth (centimeters) 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.

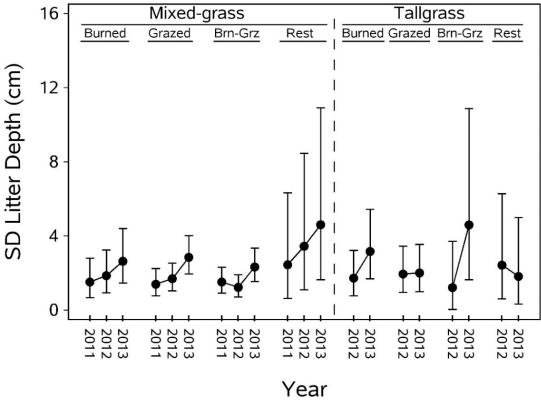[*, evidence for moderate effect $(0.05 < p \leq 0.10)$; **, evidence for strong effect $(p \leq 0.05)$]

| Effect | Sources of variation[1] | Numerator degrees of freedom | Denominator degrees of freedom[2] | F-statistic | p-value |
|---|---|---|---|---|---|
| Overall | Grass type × regime × year | 19 | 184.1 | 1.28 | 0.1982 |
| | | | | | |
| Contrasts: | Mixed: regime effect | 3 | 89.5 | 1.39 | 0.2499 |
| | Mixed: year effect | 2 | 140.1 | 3.16 | 0.0455 |
| | Mixed: interaction | 6 | 147.1 | 0.23 | 0.9670 |
| | Tall: regime effect | 3 | 118.0 | 0.14 | 0.9359 |
| | Tall: year effect | 1 | 123.3 | 2.02 | 0.1579 |
| | Tall: interaction | 3 | 123.3 | 1.19 | 0.3175 |
| | Mixed versus tall: burned only | 1 | 106.1 | 0.37 | 0.5460 |
| | Mixed versus tall: grazed only | 1 | 112.9 | 0.01 | 0.9074 |
| | Mixed versus tall: burned-grazed | 1 | 115.3 | 0.89 | 0.3474 |
| | Mixed versus tall: rest | 1 | 103.3 | 0.88 | 0.3511 |

[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 1.8.** Least squares mean (standard error) and back-transformed least squares mean (95-percent confidence intervals) standard deviation of litter depth (centimeters), 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 type | Regime | Year | LSMean | SE | Back-transformed LSMean | 95-percent confidence intervals LCL | UCL |
|---|---|---|---|---|---|---|---|
| Mixed | Burned only | 2011 | 0.92 | 0.21 | 1.52 | 0.67 | 2.81 |
| | | 2012 | 1.05 | 0.20 | 1.86 | 0.93 | 3.24 |
| | | 2013 | 1.29 | 0.20 | 2.64 | 1.46 | 4.40 |
| | Grazed only | 2011 | 0.88 | 0.15 | 1.40 | 0.78 | 2.24 |
| | | 2012 | 0.99 | 0.14 | 1.70 | 1.05 | 2.54 |
| | | 2013 | 1.35 | 0.14 | 2.85 | 1.95 | 4.02 |
| | Burned-grazed | 2011 | 0.93 | 0.14 | 1.52 | 0.92 | 2.31 |
| | | 2012 | 0.80 | 0.14 | 1.23 | 0.71 | 1.91 |
| | | 2013 | 1.20 | 0.14 | 2.33 | 1.55 | 3.34 |
| | Rest | 2011 | 1.24 | 0.38 | 2.45 | 0.63 | 6.33 |
| | | 2012 | 1.49 | 0.38 | 3.45 | 1.10 | 8.45 |
| | | 2013 | 1.72 | 0.38 | 4.61 | 1.64 | 10.91 |
| Tall | Burned only | 2012 | 1.00 | 0.22 | 1.73 | 0.77 | 3.22 |
| | | 2013 | 1.43 | 0.22 | 3.17 | 1.70 | 5.44 |
| | Grazed only | 2012 | 1.08 | 0.21 | 1.95 | 0.96 | 3.46 |
| | | 2013 | 1.10 | 0.21 | 2.01 | 1.00 | 3.55 |
| | Burned-grazed | 2012 | 0.80 | 0.38 | 1.22 | 0.04 | 3.71 |
| | | 2013 | 1.72 | 0.38 | 4.60 | 1.64 | 10.88 |
| | Rest | 2012 | 1.23 | 0.38 | 2.43 | 0.61 | 6.28 |
| | | 2013 | 1.04 | 0.38 | 1.82 | 0.33 | 4.99 |

[Brn-Grz, burned-grazed; cm, centimeters; SD, standard deviation]

**Figure 1.4.** Back-transformed least squares mean standard deviation of litter depth (centimeters) 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 Maximum Vegetation Height

**Table 1.** Generalized linear mixed model (assuming a gamma distribution with a log link) testing the influence of management regime and year on mean maximum vegetation height (centimeters) 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.

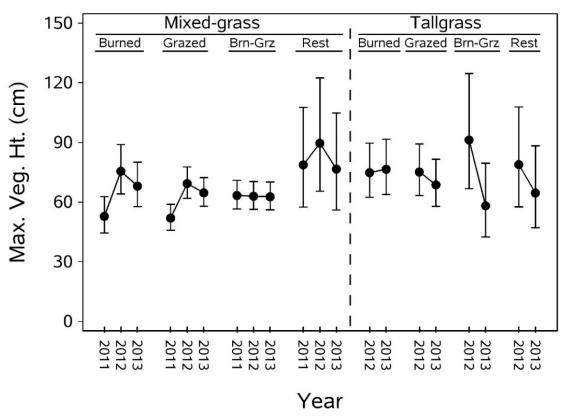[*, evidence for moderate effect ($0.05 < p \leq 0.10$); **, evidence for strong effect ($p \leq 0.05$)]

| Effect | Sources of variation[1] | Numerator degrees of freedom | Denominator degrees of freedom[2] | $F$-statistic | $p$-value |
|---|---|---|---|---|---|
| Overall | Grass type × regime × year | 19 | 180.2 | 2.43 | 0.0013** |
| | | | | | |
| Contrasts: | Mixed: regime effect | 3 | 76.9 | 2.17 | 0.0986* |
| | Mixed: year effect | 2 | 129.2 | 4.57 | 0.0121** |
| | Mixed: interaction | 6 | 135.9 | 1.95 | 0.0777* |
| | Tall: regime effect | 3 | 105.2 | 0.11 | 0.9537 |
| | Tall: year effect | 1 | 114.0 | 4.76 | 0.0311** |
| | Tall: interaction | 3 | 114.0 | 1.44 | 0.2352 |
| | Mixed versus tall: burned only | 1 | 92.9 | 2.97 | 0.0883* |
| | Mixed versus tall: grazed only | 1 | 99.7 | 3.94 | 0.0499** |
| | Mixed versus tall: burned-grazed | 1 | 102.5 | 1.27 | 0.2619 |
| | Mixed versus tall: rest | 1 | 90.3 | 0.67 | 0.4156 |

[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 2.** Least squares mean (standard error) and back-transformed least squares mean (95-percent confidence intervals) maximum vegetation height (centimeters), 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 type | Regime | Year | LSMean | SE | Back-transformed LSMean | 95-percent confidence intervals LCL | UCL |
|---|---|---|---|---|---|---|---|
| Mixed | Burned only | 2011 | 3.99 | 0.09 | 52.84 | 44.47 | 62.77 |
| | | 2012 | 4.34 | 0.08 | 75.52 | 64.11 | 88.93 |
| | | 2013 | 4.23 | 0.08 | 68.04 | 57.75 | 80.14 |
| | Grazed only | 2011 | 3.97 | 0.06 | 52.00 | 45.89 | 58.91 |
| | | 2012 | 4.25 | 0.06 | 69.36 | 61.94 | 77.66 |
| | | 2013 | 4.19 | 0.06 | 64.70 | 57.90 | 72.29 |
| | Burned-grazed | 2011 | 4.16 | 0.06 | 63.36 | 56.56 | 70.95 |
| | | 2012 | 4.16 | 0.06 | 62.97 | 56.35 | 70.35 |
| | | 2013 | 4.15 | 0.06 | 62.72 | 56.12 | 70.08 |
| | Rest | 2011 | 4.38 | 0.16 | 78.75 | 57.55 | 107.64 |
| | | 2012 | 4.51 | 0.16 | 89.63 | 65.53 | 122.46 |
| | | 2013 | 4.35 | 0.16 | 76.64 | 55.99 | 104.76 |
| Tall | Burned only | 2012 | 4.33 | 0.09 | 74.84 | 62.44 | 89.65 |
| | | 2013 | 4.35 | 0.09 | 76.52 | 63.85 | 91.66 |
| | Grazed only | 2012 | 4.33 | 0.09 | 75.19 | 63.32 | 89.24 |
| | | 2013 | 4.24 | 0.09 | 68.69 | 57.84 | 81.55 |
| | Burned-grazed | 2012 | 4.52 | 0.16 | 91.27 | 66.74 | 124.70 |
| | | 2013 | 4.08 | 0.16 | 58.19 | 42.45 | 79.63 |
| | Rest | 2012 | 4.38 | 0.16 | 78.88 | 57.64 | 107.81 |
| | | 2013 | 4.18 | 0.16 | 64.60 | 47.15 | 88.35 |

[Brn-Grz, burned-grazed; cm, centimeters; Max. Veg. Ht., maximum vegetation height; %, percent]

**Figure 1.5.**     Back-transformed least squares mean maximum vegetation height (centimeters) 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 Maximum Vegetation Height (centimeters)

**Table 1.9.** Generalized linear mixed model (assuming a gamma distribution with a log link) testing the influence of management regime and year on the standard deviation of maximum vegetation height (centimeters) 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 ($p \leq 0.05$)]
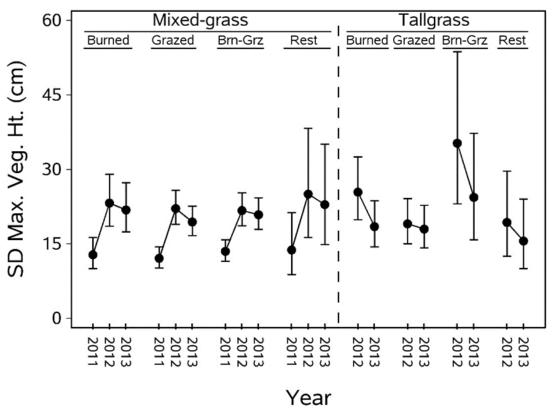
| Effect | Sources of variation[1] | Numerator degrees of freedom | Denominator degrees of freedom[2] | *F*-statistic | *p*-value |
|---|---|---|---|---|---|
| Overall | Grass type × regime × year | 19 | 186.8 | 5.15 | <0.0001** |
| | | | | | |
| Contrasts: | Mixed: regime effect | 3 | 95.2 | 0.42 | 0.7364 |
| | Mixed: year effect | 2 | 146.5 | 23.09 | <0.0001** |
| | Mixed: interaction | 6 | 152.1 | 0.19 | 0.9794 |
| | Tall: regime effect | 3 | 123.9 | 2.26 | 0.0845* |
| | Tall: year effect | 1 | 133.6 | 4.76 | 0.0309** |
| | Tall: interaction | 3 | 133.6 | 0.63 | 0.5942 |
| | Mixed versus tall: burned only | 1 | 111.7 | 1.38 | 0.2421 |
| | Mixed versus tall: grazed only | 1 | 118.4 | 0.35 | 0.5554 |
| | Mixed versus tall: burned-grazed | 1 | 121.2 | 6.92 | 0.0096** |
| | Mixed versus tall: rest | 1 | 109.1 | 0.37 | 0.5432 |

[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 1.10.** Least squares mean (standard error) and back-transformed least squares mean (95-percent confidence intervals) standard deviation of maximum vegetation height (centimeters), 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 type | Regime | Year | LSMean | SE | LSMean | LCL | UCL |
|---|---|---|---|---|---|---|---|
| Mixed | Burned only | 2011 | 2.62 | 0.11 | 12.80 | 10.02 | 16.28 |
| | | 2012 | 3.19 | 0.11 | 23.22 | 18.54 | 29.02 |
| | | 2013 | 3.13 | 0.11 | 21.83 | 17.42 | 27.29 |
| | Grazed only | 2011 | 2.57 | 0.08 | 12.09 | 10.13 | 14.40 |
| | | 2012 | 3.14 | 0.08 | 22.11 | 18.93 | 25.80 |
| | | 2013 | 3.02 | 0.07 | 19.41 | 16.65 | 22.60 |
| | Burned-grazed | 2011 | 2.67 | 0.08 | 13.49 | 11.50 | 15.81 |
| | | 2012 | 3.12 | 0.07 | 21.72 | 18.65 | 25.27 |
| | | 2013 | 3.08 | 0.07 | 20.86 | 17.90 | 24.27 |
| | Rest | 2011 | 2.69 | 0.21 | 13.77 | 8.79 | 21.27 |
| | | 2012 | 3.26 | 0.21 | 25.03 | 16.26 | 38.25 |
| | | 2013 | 3.17 | 0.21 | 22.91 | 14.86 | 35.06 |
| Tall | Burned only | 2012 | 3.27 | 0.12 | 25.42 | 19.84 | 32.49 |
| | | 2013 | 2.97 | 0.12 | 18.48 | 14.37 | 23.69 |
| | Grazed only | 2012 | 3.00 | 0.11 | 19.04 | 15.00 | 24.10 |
| | | 2013 | 2.94 | 0.11 | 17.98 | 14.16 | 22.77 |
| | Burned-grazed | 2012 | 3.59 | 0.21 | 35.27 | 23.05 | 53.69 |
| | | 2013 | 3.23 | 0.21 | 24.37 | 15.83 | 37.27 |
| | Rest | 2012 | 3.01 | 0.21 | 19.33 | 12.48 | 29.66 |
| | | 2013 | 2.81 | 0.21 | 15.58 | 10.00 | 24.01 |

[Brn-Grz, burned-grazed; cm, centimeters; Max. Veg. Ht., maximum vegetation height; %, percent; SD, standard deviation]

**Figure 1.6.** Back-transformed least squares mean standard deviation of maximum vegetation height (cm) 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 Vertical Obstruction Reading (VOR)

**Table 1.11.** Generalized linear mixed model (assuming a gamma distribution with a log link) testing the influence of management regime and year on mean vertical obstruction reading (decimeters) 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.

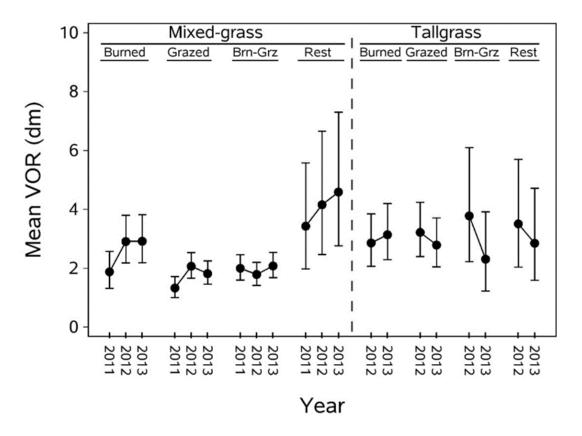[<, less than; *, evidence for moderate effect ($0.05 < p \leq 0.10$); **, evidence for strong effect ($p \leq 0.05$)]

| Effect | Sources of variation[1] | Numerator degrees of freedom | Denominator degrees of freedom[2] | F-statistic | p-value |
|---|---|---|---|---|---|
| Overall | Grass type × regime × year | 19 | 183.8 | 3.20 | <0.0001** |
| | | | | | |
| Contrasts: | Mixed: regime effect | 3 | 84.0 | 6.80 | 0.0004** |
| | Mixed: year effect | 2 | 136.8 | 3.29 | 0.0401** |
| | Mixed: interaction | 6 | 141.5 | 1.94 | 0.0781* |
| | Tall: regime effect | 3 | 110.9 | 0.02 | 0.9965 |
| | Tall: year effect | 1 | 126.9 | 2.33 | 0.1292 |
| | Tall: interaction | 3 | 126.9 | 1.02 | 0.3871 |
| | Mixed versus tall: burned only | 1 | 99.0 | 1.02 | 0.3154 |
| | Mixed versus tall: grazed only | 1 | 105.3 | 13.31 | 0.0004** |
| | Mixed versus tall: burned-grazed | 1 | 108.2 | 2.93 | 0.0898* |
| | Mixed versus tall: rest | 1 | 96.6 | 0.73 | 0.3959 |

[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 1.12.** Least squares mean (standard error) and back-transformed least squares mean (95-percent confidence intervals) vertical obstruction reading (decimeters), 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 type | Regime | Year | LSMean | SE | LSMean | LCL | UCL |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Mixed | Burned only | 2011 | 1.06 | 0.11 | 1.88 | 1.32 | 2.57 |
| | | 2012 | 1.36 | 0.11 | 2.91 | 2.18 | 3.80 |
| | | 2013 | 1.37 | 0.11 | 2.92 | 2.19 | 3.82 |
| | Grazed only | 2011 | 0.85 | 0.08 | 1.33 | 1.00 | 1.72 |
| | | 2012 | 1.12 | 0.07 | 2.07 | 1.66 | 2.53 |
| | | 2013 | 1.04 | 0.07 | 1.82 | 1.46 | 2.25 |
| | Burned-grazed | 2011 | 1.10 | 0.07 | 2.00 | 1.60 | 2.46 |
| | | 2012 | 1.02 | 0.07 | 1.79 | 1.42 | 2.20 |
| | | 2013 | 1.12 | 0.07 | 2.08 | 1.68 | 2.54 |
| | Rest | 2011 | 1.49 | 0.20 | 3.43 | 1.98 | 5.58 |
| | | 2012 | 1.64 | 0.20 | 4.16 | 2.47 | 6.66 |
| | | 2013 | 1.72 | 0.20 | 4.59 | 2.76 | 7.30 |
| Tall | Burned only | 2012 | 1.35 | 0.12 | 2.86 | 2.07 | 3.85 |
| | | 2013 | 1.42 | 0.12 | 3.14 | 2.29 | 4.20 |
| | Grazed only | 2012 | 1.44 | 0.11 | 3.22 | 2.40 | 4.24 |
| | | 2013 | 1.33 | 0.11 | 2.79 | 2.05 | 3.71 |
| | Burned-grazed | 2012 | 1.57 | 0.20 | 3.78 | 2.22 | 6.10 |
| | | 2013 | 1.20 | 0.20 | 2.31 | 1.23 | 3.92 |
| | Rest | 2012 | 1.51 | 0.20 | 3.51 | 2.04 | 5.70 |
| | | 2013 | 1.35 | 0.20 | 2.85 | 1.59 | 4.72 |

[Brn-Grz, burned-grazed; VOR, vertical obstruction reading; dm, decimeters]

**Figure 1.7.**     Back-transformed least squares mean vertical obstruction reading (decimeters) 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 Vertical Obstruction Reading (VOR; decimeters)

**Table 1.13.** Generalized linear mixed model (assuming a gamma distribution with a log link) testing the influence of management regime and year on the standard deviation of vertical obstruction reading (decimeters) 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.

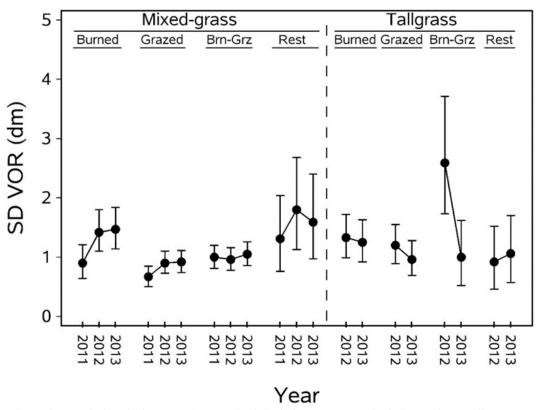[<, less than; *, evidence for moderate effect ($0.05 < p \leq 0.10$); **, evidence for strong effect ($p \leq 0.05$)]

| Effect | Sources of variation[1] | Numerator degrees of freedom | Denominator degrees of freedom[2] | F-statistic | p-value |
|---|---|---|---|---|---|
| Overall | Grass type × regime × year | 19 | 181.3 | 3.05 | <0.0001** |
| | | | | | |
| Contrasts: | Mixed: regime effect | 3 | 77.3 | 5.79 | 0.0013** |
| | Mixed: year effect | 2 | 130.4 | 4.16 | 0.0177** |
| | Mixed: interaction | 6 | 135.4 | 1.36 | 0.2355 |
| | Tall: regime effect | 3 | 104.1 | 1.63 | 0.1870 |
| | Tall: year effect | 1 | 119.8 | 6.65 | 0.0111** |
| | Tall: interaction | 3 | 119.8 | 3.66 | 0.0145** |
| | Mixed versus tall: burned only | 1 | 92.2 | 0.03 | 0.8525 |
| | Mixed versus tall: grazed only | 1 | 98.5 | 3.14 | 0.0794* |
| | Mixed versus tall: burned-grazed | 1 | 101.4 | 5.83 | 0.0176** |
| | Mixed versus tall: rest | 1 | 89.8 | 2.74 | 0.1012 |

[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 1.14.**    Least squares mean (standard error) and back-transformed least squares mean (95-percent confidence intervals) standard deviation of vertical obstruction reading (decimeters), 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 type | Regime | Year | LSMean | SE | LSMean | LCL | UCL |
|---|---|---|---|---|---|---|---|
| Mixed | Burned only | 2011 | 0.64 | 0.08 | 0.90 | 0.64 | 1.21 |
| | | 2012 | 0.89 | 0.07 | 1.42 | 1.10 | 1.80 |
| | | 2013 | 0.90 | 0.07 | 1.47 | 1.14 | 1.84 |
| | Grazed only | 2011 | 0.51 | 0.05 | 0.67 | 0.50 | 0.85 |
| | | 2012 | 0.64 | 0.05 | 0.90 | 0.73 | 1.10 |
| | | 2013 | 0.65 | 0.05 | 0.92 | 0.74 | 1.11 |
| | Burned-grazed | 2011 | 0.69 | 0.05 | 1.00 | 0.81 | 1.20 |
| | | 2012 | 0.67 | 0.05 | 0.96 | 0.78 | 1.16 |
| | | 2013 | 0.72 | 0.05 | 1.05 | 0.86 | 1.26 |
| | Rest | 2011 | 0.84 | 0.14 | 1.31 | 0.76 | 2.04 |
| | | 2012 | 1.03 | 0.14 | 1.80 | 1.13 | 2.68 |
| | | 2013 | 0.95 | 0.14 | 1.59 | 0.97 | 2.40 |
| Tall | Burned only | 2012 | 0.84 | 0.08 | 1.33 | 0.99 | 1.72 |
| | | 2013 | 0.81 | 0.08 | 1.25 | 0.92 | 1.63 |
| | Grazed only | 2012 | 0.79 | 0.08 | 1.20 | 0.89 | 1.55 |
| | | 2013 | 0.67 | 0.08 | 0.96 | 0.69 | 1.28 |
| | Burned-grazed | 2012 | 1.28 | 0.14 | 2.59 | 1.73 | 3.71 |
| | | 2013 | 0.69 | 0.14 | 1.00 | 0.52 | 1.62 |
| | Rest | 2012 | 0.65 | 0.14 | 0.92 | 0.46 | 1.52 |
| | | 2013 | 0.72 | 0.14 | 1.06 | 0.57 | 1.70 |

[Brn-Grz, burned-grazed; dm, decimeters; SD, standard deviation; VOR, vertical obstruction reading]

**Figure 1.8.** Back-transformed least squares mean standard deviation of vertical obstruction reading (decimeters) 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 Standing Dead Cover (percent)

**Table 1.15.** Generalized linear mixed model (assuming a beta distribution with a logit link) testing the influence of management regime and year on mean standing dead 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.

[<, less than; *, evidence for moderate effect ($0.05 < p \leq 0.10$); **, evidence for strong effect ($p \leq 0.05$)]
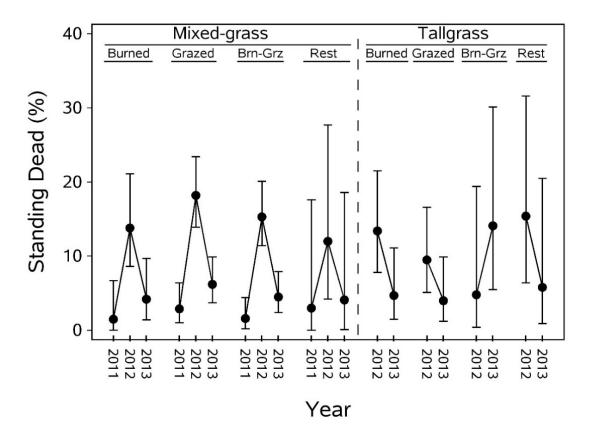
| Effect | Sources of variation[1] | Numerator degrees of freedom | Denominator degrees of freedom[2] | *F*-statistic | *p*-value |
|---|---|---|---|---|---|
| Overall | Grass type × regime × year | 19 | 188.5 | 5.25 | <0.0001** |
| | | | | | |
| Contrasts: | Mixed: regime effect | 3 | 130.0 | 0.78 | 0.5046 |
| | Mixed: year effect | 2 | 152.7 | 19.95 | <0.0001** |
| | Mixed: interaction | 6 | 160.2 | 0.08 | 0.9977 |
| | Tall: regime effect | 3 | 138.6 | 0.28 | 0.8409 |
| | Tall: year effect | 1 | 145.4 | 1.73 | 0.1900 |
| | Tall: interaction | 3 | 145.2 | 1.71 | 0.1683 |
| | Mixed versus tall: burned only | 1 | 136.5 | 1.56 | 0.2138 |
| | Mixed versus tall: grazed only | 1 | 138.0 | 0.20 | 0.6548 |
| | Mixed versus tall: burned-grazed | 1 | 138.9 | 0.81 | 0.3683 |
| | Mixed versus tall: rest | 1 | 127.6 | 0.79 | 0.3766 |

[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 1.16.** Least squares mean (standard error) and back-transformed least squares mean (95-percent confidence intervals) standing dead 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 type | Regime | Year | LSMean | SE | LSMean | LCL | UCL |
|---|---|---|---|---|---|---|---|
| Mixed | Burned only | 2011 | −3.647 | 0.593 | 1.5 | 0.0 | 6.7 |
| | | 2012 | −1.752 | 0.251 | 13.8 | 8.6 | 21.1 |
| | | 2013 | −2.902 | 0.401 | 4.2 | 1.4 | 9.7 |
| | Grazed only | 2011 | −3.208 | 0.350 | 2.9 | 1.0 | 6.4 |
| | | 2012 | −1.435 | 0.156 | 18.2 | 13.9 | 23.4 |
| | | 2013 | −2.559 | 0.233 | 6.2 | 3.7 | 9.9 |
| | Burned-grazed | 2011 | −3.616 | 0.385 | 1.6 | 0.2 | 4.4 |
| | | 2012 | −1.638 | 0.163 | 15.3 | 11.4 | 20.1 |
| | | 2013 | −2.839 | 0.264 | 4.5 | 2.4 | 7.9 |
| | Rest | 2011 | −3.190 | 0.874 | 3.0 | 0.0 | 17.6 |
| | | 2012 | −1.905 | 0.507 | 12.0 | 4.2 | 27.7 |
| | | 2013 | −2.932 | 0.777 | 4.1 | 0.1 | 18.6 |
| Tall | Burned only | 2012 | −1.785 | 0.280 | 13.4 | 7.8 | 21.5 |
| | | 2013 | −2.815 | 0.426 | 4.7 | 1.5 | 11.1 |
| | Grazed only | 2012 | −2.140 | 0.304 | 9.5 | 5.1 | 16.6 |
| | | 2013 | −2.944 | 0.428 | 4.0 | 1.2 | 9.9 |
| | Burned-grazed | 2012 | −2.792 | 0.730 | 4.8 | 0.4 | 19.4 |
| | | 2013 | −1.728 | 0.476 | 14.1 | 5.5 | 30.1 |
| | Rest | 2012 | −1.630 | 0.460 | 15.4 | 6.4 | 31.6 |
| | | 2013 | −2.626 | 0.679 | 5.8 | 0.9 | 20.5 |

[Brn-Grz, burned-grazed; %, percent]

**Figure 1.9.**    Back-transformed least squares mean standing dead 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 Standing Dead Cover (percent)

**Table 1.17.** Generalized linear mixed model (assuming a beta distribution with a logit link) testing the influence of management regime and year on the standard deviation of standing dead 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.

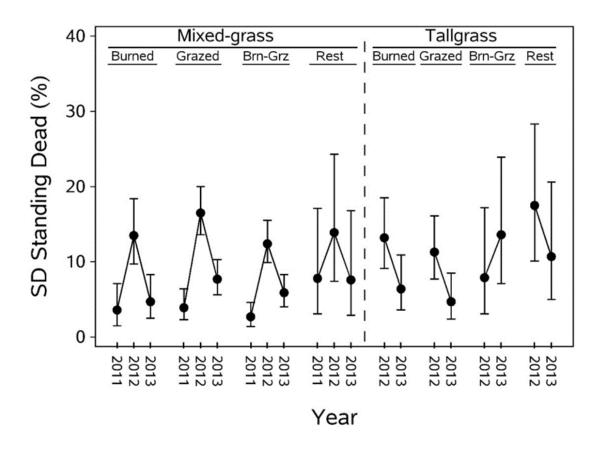[<, less than; *, evidence for moderate effect ($0.05<p\leq0.10$); **, evidence for strong effect ($p\leq0.05$)]

| Effect | Sources of variation[1] | Numerator degrees of freedom | Denominator degrees of freedom[2] | $F$-statistic | $p$-value |
|---|---|---|---|---|---|
| Overall | Grass type × regime × year | 19 | 185.5 | 7.07 | <0.0001** |
| Contrasts: | Mixed: regime effect | 3 | 106.6 | 1.86 | 0.1413 |
| | Mixed: year effect | 2 | 141.6 | 28.05 | <0.0001** |
| | Mixed: interaction | 6 | 149.0 | 0.51 | 0.7967 |
| | Tall: regime effect | 3 | 124.9 | 1.42 | 0.2390 |
| | Tall: year effect | 1 | 131.5 | 3.59 | 0.0603* |
| | Tall: interaction | 3 | 132.0 | 1.97 | 0.1217 |
| | Mixed versus tall: burned only | 1 | 117.4 | 2.55 | 0.1128 |
| | Mixed versus tall: grazed only | 1 | 125.4 | 0.22 | 0.6409 |
| | Mixed versus tall: burned-grazed | 1 | 122.3 | 3.03 | 0.0845* |
| | Mixed versus tall: rest | 1 | 109.2 | 1.26 | 0.2640 |

[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 1.18.** Least squares mean (standard error) and back-transformed least squares mean (95 percent confidence intervals) of the standard deviation of standing dead 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 | Standard error | LSMean | LCL | UCL |
|---|---|---|---|---|---|---|---|
| Mixed | Burned only | 2011 | −3.041 | 0.313 | 3.6 | 1.5 | 7.1 |
| | | 2012 | −1.774 | 0.177 | 13.5 | 9.7 | 18.4 |
| | | 2013 | −2.798 | 0.268 | 4.7 | 2.5 | 8.3 |
| | Grazed only | 2011 | −2.958 | 0.219 | 3.9 | 2.3 | 6.4 |
| | | 2012 | −1.548 | 0.113 | 16.5 | 13.6 | 20.0 |
| | | 2013 | −2.357 | 0.150 | 7.7 | 5.6 | 10.3 |
| | Burned-grazed | 2011 | −3.264 | 0.229 | 2.7 | 1.4 | 4.6 |
| | | 2012 | −1.862 | 0.124 | 12.4 | 9.9 | 15.5 |
| | | 2013 | −2.610 | 0.167 | 5.9 | 4.0 | 8.3 |
| | Rest | 2011 | −2.334 | 0.420 | 7.8 | 3.1 | 17.1 |
| | | 2012 | −1.739 | 0.335 | 13.9 | 7.4 | 24.3 |
| | | 2013 | −2.368 | 0.426 | 7.6 | 2.9 | 16.8 |
| Tall | Burned only | 2012 | −1.803 | 0.198 | 13.2 | 9.1 | 18.5 |
| | | 2013 | −2.521 | 0.262 | 6.4 | 3.6 | 10.9 |
| | Grazed only | 2012 | −1.966 | 0.199 | 11.3 | 7.7 | 16.1 |
| | | 2013 | −2.804 | 0.281 | 4.7 | 2.4 | 8.5 |
| | Burned-grazed | 2012 | −2.326 | 0.419 | 7.9 | 3.1 | 17.2 |
| | | 2013 | −1.769 | 0.338 | 13.6 | 7.1 | 23.9 |
| | Rest | 2012 | −1.481 | 0.307 | 17.5 | 10.1 | 28.3 |
| | | 2013 | −2.018 | 0.371 | 10.7 | 5.0 | 20.6 |

[Brn-Grz, burned-grazed; %, percent; SD, standard deviation]

**Figure 1.10.** Back-transformed least squares mean standard deviation of standing dead 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.

# 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*.]

Littell, R.C., Milliken, G.A., Stroup, W.W., Wolfinger, R.D., and Schabenberger, O., 2006,
SAS® for mixed models (2d ed.): Cary, N.C., SAS Institute, Inc., 814 p.