Appendix 7. Model Selection Results for Candidate Sets of Models Relating Vegetation Structure and Vegetation Composition and Other Variables to Breeding Densities (Pairs per 100 Hectares) of 23 Common Breeding Bird Species and Grassland Species of Conservation Concern 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. Red-winged Blackbird (*Agelaius phoeniceus*)

Table 7.1. Model selection results for candidate sets of models relating vegetation structure and vegetation composition and other variables to breeding densities (pairs per 100 hectares) of red-winged blackbirds (*Agelaius phoeniceus*) 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. Vegetation structural models were evaluated first, and then vegetation composition and other variables were added to the vegetation structural model with the lowest AIC_C to see if they improved the model fit.

[k, number of parameters considered in the model; AIC_C, Akaike Information Criterion corrected for small samples; ΔAIC_C, difference between the model with the lowest AIC_C and each subsequent model; ω_i, Akaike weights indicating the relative likelihood of each model; VOR, vertical obstruction reading (decimeters); StandDead, cover of standing dead vegetation (percent); BareGround, cover of bare ground (percent); LitDepth, litter depth (centimeters); MaxHeight, maximum vegetation height (centimeters); DefIndex, Defoliation Index; NonNativeGrass, nonnative grass (percent); Non/NativeForb, ratio of nonnative to native forbs (percent); Brome/NativeGrass, ratio of smooth brome (*Bromus inermis*) to native grass (percent); KYBlue/NativeGrass, ratio of Kentucky bluegrass (*Poa pratensis*) to native grass (percent); Easting, eastward-measured distance (kilometer); Northing, northward-measured distance (kilometers); Area, total area surveyed for breeding birds (hectares)]

Variables[1]	k	AIC_C	ΔAIC_C	ω_i
Vegetation structural models				
Year, VOR	8	674.96	0.00	0.9992
Year, VOR, StandDead	11	689.66	14.70	0.0006
Year	5	692.85	17.89	0.0001
Year, VOR, BareGround	11	701.12	26.16	0.0000
Year, MaxHeight	8	702.56	27.60	0.0000
Year, MaxHeight, StandDead	11	718.61	43.65	0.0000
Year, MaxHeight, LitDepth	11	719.70	44.74	0.0000
Year, MaxHeight, BareGround	11	727.71	52.75	0.0000
Year, VOR, LitDepth	11	727.84	52.88	0.0000
Null	2	894.23	219.27	0.0000
Vegetation composition and other variable models				
Year, VOR	8	674.96	0.00	0.9980
Year, VOR, DefIndex	11	688.03	13.07	0.0015
Year, VOR, Non/NativeForb	11	690.07	15.11	0.0005
Year, VOR, Brome/NativeGrass, KYBlue/NativeGrass	14	698.78	23.82	0.0000
Year, VOR, NonNativeGrass	11	700.28	25.32	0.0000
Year, VOR, Northing	11	704.75	29.79	0.0000
Year, VOR, Easting	11	706.37	31.41	0.0000
Year, VOR, Area	11	708.78	33.82	0.0000

[1]Explanatory variables included Year and the listed covariates. All covariates were included in the candidate models only as interaction terms with year.

Table 7.2. Maximum likelihood parameter estimates (intercepts and slopes for each year) from model with the lowest Akaike Information Criteria (AIC_C; table 7.1) for red-winged blackbirds (*Agelaius phoeniceus*) 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.

[SE, standard error; r, model fit; VOR, vertical obstruction reading (decimeters); ln, natural logarithm]

Model parameters					Model fit[1]
Type	Effect	Year	Parameter[2]	SE	r
Intercept	Year	2011	2.46	0.28	0.16
	Year	2012	2.27	0.21	0.40
	Year	2013	1.44	0.24	0.47
Slope	Year × VOR	2011	0.17	0.12	
	Year × VOR	2012	0.27	0.07	
	Year × VOR	2013	0.40	0.09	

[1]Correlation between observed ln(pairs per 100 hectares) and predicted ln(pairs per 100 hectares) for each year.
[2]Parameter estimates are on a log-normal scale.

B. Clay-colored Sparrow (*Spizella pallida*)

Table 7.3. Model selection results for candidate sets of models relating vegetation structure and vegetation composition and other variables to breeding densities (pairs per s100 hectares) of clay-colored sparrow (*Spizella pallida*) 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. Vegetation structural models were evaluated first, and then vegetation composition and other variables were added to the vegetation structural model with the lowest AIC_C to see if they improved the model fit.

[k, number of parameters considered in the model; AIC_C, Akaike Information Criterion corrected for small samples; ΔAIC_C, difference between the model with the lowest AIC_C and each subsequent model; ω_i, Akaike weights indicating the relative likelihood of each model; VOR, vertical obstruction reading (decimeters); StandDead, cover of standing dead vegetation (percent); BareGround, cover of bare ground (percent); LitDepth, litter depth (centimeters); MaxHeight, maximum vegetation height (centimeters); DefIndex, Defoliation Index; NonNativeGrass, nonnative grass (percent); Non/NativeForb, ratio of nonnative to native forbs (percent); Brome/NativeGrass, ratio of smooth brome (*Bromus inermis*) to native grass (percent); KYBlue/NativeGrass, ratio of Kentucky bluegrass (*Poa pratensis*) to native grass (percent); Easting, eastward-measured distance (kilometers); Northing, northward-measured distance (kilometers); Area, total area surveyed for breeding birds (hectares)]

Variables[1]	k	AIC_C	ΔAIC_C	ω_i
Vegetation structural models				
Year, VOR, LitDepth	11	715.96	0.00	0.97565
Year	5	724.37	8.41	0.01456
Year, VOR	8	725.17	9.21	0.00976
Year, MaxHeight, LitDepth	11	737.19	21.23	0.00002
Year, VOR, StandDead	11	739.66	23.70	0.00001
Year, VOR, BareGround	11	739.99	24.03	0.00001
Year, MaxHeight	8	748.54	32.58	0.00000
Year, MaxHeight, BareGround	11	761.33	45.37	0.00000
Year, MaxHeight, StandDead	11	763.53	47.57	0.00000
Null	2	834.78	118.82	0.00000
Vegetation composition and other variable models				
Year, VOR, LitDepth	11	715.96	0.00	0.99773
Year, VOR, LitDepth, DefIndex	14	728.92	12.96	0.00153
Year, VOR, LitDepth NonNative/Native Forb	14	730.53	14.57	0.00068
Year, VOR, LitDepth, Northing	14	735.98	20.02	0.00004
Year, VOR, LitDepth, Brome/NativeGrass, KYBlue/NativeGrass	17	740.38	24.42	0.00000
Year, VOR, LitDepth, NonNativeGrass	14	743.16	27.20	0.00000
Year, VOR, LitDepth, Area	14	748.32	32.36	0.00000
Year, VOR, LitDepth, Easting	14	753.76	37.80	0.00000

[1]Explanatory variables included Year and the listed covariates. All covariates were included in the candidate models only as interaction terms with year.

Table 7.4. Maximum likelihood parameter estimates (intercepts and slopes for each year) from model with the lowest Akaike Information Criteria (AIC_C; table 7.3) for clay-colored sparrows (*Spizella pallida*) 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.

[SE, standard error; r, model fit; VOR, vertical obstruction reading (decimeters); LitDepth, litter depth (centimeters) ln, natural logarithm]

Model parameters					Model fit[1]
Type	Effect	Year	Parameter[2]	SE	r
Intercept	Year	2011	0.77	0.31	0.45
	Year	2012	1.77	0.23	0.29
	Year	2013	1.88	0.26	0.20
Slope	Year × VOR	2011	0.21	0.13	
	Year × VOR	2012	0.03	0.08	
	Year × VOR	2013	0.18	0.09	
	Year × LitDepth	2011	0.28	0.06	
	Year × LitDepth	2012	0.16	0.06	
	Year × LitDepth	2013	0.06	0.04	

[1]Correlation between observed ln(pairs per 100 hectares) and predicted ln(pairs per 100 hectares) for each year.
[2]Parameter estimates are on a log-normal scale.

C. Bobolink (*Dolichonyx oryzivorus*)

Table 7.5. Model selection results for candidate sets of models relating vegetation structure and vegetation composition and other variables to breeding densities (pairs per 100 hectares) of bobolinks (*Dolichonyx oryzivorus*) 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. Vegetation structural models were evaluated first, and then vegetation composition and other variables were added to the vegetation structural model with the lowest AIC_C to see if they improved the model fit.

[k, number of parameters considered in the model; AIC_C, Akaike Information Criterion corrected for small samples; ΔAIC_C, difference between the model with the lowest AIC_C and each subsequent model; ω_i, Akaike weights indicating the relative likelihood of each model; VOR, vertical obstruction reading (decimeters); StandDead, cover of standing dead vegetation (percent); BareGround, cover of bare ground (percent); LitDepth, litter depth (centimeters); MaxHeight, maximum vegetation height (centimeters); DefIndex, Defoliation Index; NonNativeGrass, nonnative grass (percent); Non/NativeForb, ratio of nonnative to native forbs (percent); Brome/NativeGrass, ratio of smooth brome (*Bromus inermis*) to native grass (percent); KYBlue/NativeGrass, ratio of Kentucky bluegrass (*Poa pratensis*) to native grass (percent); Easting, eastward-measured distance (kilometers); Northing, northward-measured distance (kilometers); Area, total area surveyed for breeding birds (hectares)]

Variables[1]	k	AIC_C	ΔAIC_C	ω_i
Vegetation structural models				
Year, VOR	8	686.68	0.00	0.99751
Year, MaxHeight	8	699.19	12.51	0.00192
Year, VOR, LitDepth	11	701.85	15.17	0.00051
Year, VOR, StandDead	11	706.42	19.74	0.00005
Year, VOR, BareGround	11	709.11	22.43	0.00001
Year, MaxHeight, LitDepth	11	713.62	26.94	0.00000
Year, MaxHeight, StandDead	11	720.66	33.98	0.00000
Year, MaxHeight, BareGround	11	723.67	36.99	0.00000
Year	5	755.87	69.19	0.00000
Null	2	938.79	252.11	0.00000
Vegetation composition and other variable models				
Year, VOR	8	686.68	0.00	0.98717
Year, VOR, NonNativeGrass	11	696.42	9.74	0.00757
Year, VOR, Non/NativeForb	11	697.78	11.10	0.00384
Year, VOR, DefIndex	11	700.04	13.36	0.00124
Year, VOR, Brome/NativeGrass, KYBlue/NativeGrass	14	703.91	17.23	0.00018
Year, VOR, Area	11	714.21	27.53	0.00000
Year, VOR, Northing	11	715.36	28.68	0.00000
Year, VOR, Easting	11	724.79	38.11	0.00000

[1]Explanatory variables included Year and the listed covariates. All covariates were included in the candidate models only as interaction terms with year.

Table 7.6. Maximum likelihood parameter estimates (intercepts and slopes for each year) from model with the lowest Akaike Information Criteria (AIC_C; table 7.5) for bobolinks (*Dolichonyx oryzivorus*) 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.

[SE, standard error; r, model fit; VOR, vertical obstruction reading (decimeters); ln, natural logarithm]

Model parameters					Model fit[1]
Type	Effect	Year	Parameter[2]	SE	r
Intercept	Year	2011	0.78	0.29	0.57
	Year	2012	0.76	0.23	0.55
	Year	2013	1.23	0.25	0.52
Slope	Year × VOR	2011	0.67	0.14	
	Year × VOR	2012	0.56	0.08	
	Year × VOR	2013	0.55	0.09	

[1]Correlation between observed ln(pairs per 100 hectares) and predicted ln(pairs per 100 hectares) for each year.
[2]Parameter estimates are on a log-normal scale.

D. Grasshopper Sparrow (*Ammodramus savannarum*)

Table 7.7. Model selection results for candidate sets of models relating vegetation structure and vegetation composition and other variables to breeding densities (pairs per 100 hectares) of grasshopper sparrows (*Ammodramus savannarum*) 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. Vegetation structural models were evaluated first, and then vegetation composition and other variables were added to the vegetation structural model with the lowest AIC_C to see if they improved the model fit.

[k, number of parameters considered in the model; AIC_C, Akaike Information Criterion corrected for small samples; ΔAIC_C, difference between the model with the lowest AIC_C and each subsequent model; ω_i, Akaike weights indicating the relative likelihood of each model; VOR, vertical obstruction reading (decimeters); StandDead, cover of standing dead vegetation (percent); BareGround, cover of bare ground (percent); LitDepth, litter depth (centimeters); MaxHeight, maximum vegetation height (centimeters); DefIndex, Defoliation Index; NonNativeGrass, nonnative grass (percent); Non/NativeForb, ratio of nonnative to native forbs (percent); Brome/NativeGrass, ratio of smooth brome (*Bromus inermis*) to native grass (percent); KYBlue/NativeGrass, ratio of Kentucky bluegrass (*Poa pratensis*) to native grass (percent); Easting, eastward-measured distance (kilometers); Northing, northward-measured distance (kilometers); Area, total area surveyed for breeding birds (hectares)]

Variables[1]	k	AIC_C	ΔAIC_C	ω_i
Vegetation structural models:				
Year, VOR, BareGround	11	704.31	0.00	0.99856
Year, VOR, LitDepth	11	718.71	14.40	0.00075
Year, VOR	8	719.08	14.77	0.00062
Year, VOR, StandDead	11	723.44	19.13	0.00007
Year	5	741.29	36.98	0.00000
Year, MaxHeight, BareGround	11	751.37	47.06	0.00000
Year, MaxHeight, LitDepth	11	758.44	54.13	0.00000
Year, MaxHeight	8	760.23	55.92	0.00000
Year, MaxHeight, StandDead	11	763.97	59.66	0.00000
Null	2	881.89	177.58	0.00000
Vegetation composition and other variable models:				
Year, VOR, BareGround	11	704.31	0.00	0.98942
Year, VOR, BareGround, DefIndex	14	714.70	10.39	0.00549
Year, VOR, BareGround, Non/NativeForb	14	714.85	10.54	0.00509
Year, VOR, BareGround, NonNativeGrass	14	728.62	24.31	0.00001
Year, VOR, BareGround, Area	14	730.48	26.17	0.00000
Year, VOR, BareGround, Brome/NativeGrass, KYBlue/NativeGrass	17	733.42	29.11	0.00000
Year, VOR, BareGround, Easting	14	736.76	32.45	0.00000
Year, VOR, BareGround, Northing	14	745.20	40.89	0.00000

[1]Explanatory variables included Year and the listed covariates. All covariates were included in the candidate models only as interaction terms with year.

Table 7.8. Maximum likelihood parameter estimates (intercepts and slopes for each year) from model with the lowest Akaike Information Criteria (AIC_C; table 7.7) for grasshopper sparrows (*Ammodramus savannarum*) 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.

[SE, standard error; r, model fit; VOR, vertical obstruction reading (decimeters); BareGround, cover of bare ground (percent); ln, natural logarithm]

Model parameters					Model fit[1]
Type	Effect	Year	Parameter[2]	SE	r
Intercept	Year	2011	3.02	0.34	0.44
	Year	2012	3.79	0.26	0.53
	Year	2013	3.80	0.28	0.64
Slope	Year × VOR	2011	−0.24	0.14	
	Year × VOR	2012	−0.46	0.08	
	Year × VOR	2013	−0.55	0.09	
	Year × BareGround	2011	−0.04	0.01	
	Year × BareGround	2012	−0.04	0.01	
	Year × BareGround	2013	−0.03	0.01	

[1]Correlation between observed ln(pairs per 100 hectares) and predicted ln(pairs per 100 hectares) for each year.
[2]Parameter estimates are on a log-normal scale.

E. Savannah Sparrow (*Passerculus sandwichensis*)

Table 7.9. Model selection results for candidate sets of models relating vegetation structure and vegetation composition and other variables to breeding densities (pairs per 100 hectares) of Savannah sparrows (*Passerculus sandwichensis*) 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. Vegetation structural models were evaluated first, and then vegetation composition and other variables were added to the vegetation structural model with the lowest AIC_C to see if they improved the model fit.

[k, number of parameters considered in the model; AIC_C, Akaike Information Criterion corrected for small samples; ΔAIC_C, difference between the model with the lowest AIC_C and each subsequent model; ω_i, Akaike weights indicating the relative likelihood of each model; VOR, vertical obstruction reading (decimeters); StandDead, cover of standing dead vegetation (percent); BareGround, cover of bare ground (percent); LitDepth, litter depth (centimeters); MaxHeight, maximum vegetation height (centimeters); DefIndex, Defoliation Index; NonNativeGrass, nonnative grass (percent); Non/NativeForb, ratio of nonnative to native forbs (percent); Brome/NativeGrass, ratio of smooth brome (*Bromus inermis*) to native grass (percent); KYBlue/NativeGrass, ratio of Kentucky bluegrass (*Poa pratensis*) to native grass (percent); Easting, eastward-measured distance (kilometers); Northing, northward-measured distance (kilometers); Area, total area surveyed for breeding birds (hectares)]

Variables[1]	k	AIC_C	ΔAIC_C	ω_i
Vegetation structural models				
Year	5	675.88	0.00	0.97276
Year, VOR	8	683.04	7.16	0.02712
Year, VOR, LitDepth	11	694.58	18.70	0.00008
Year, MaxHeight	8	696.50	20.62	0.00003
Year, VOR, BareGround	11	700.97	25.09	0.00000
Year, VOR, StandDead	11	704.62	28.74	0.00000
Year, MaxHeight, LitDepth	11	709.46	33.58	0.00000
Year, MaxHeight, BareGround	11	712.05	36.17	0.00000
Year, MaxHeight, StandDead	11	717.52	41.64	0.00000
Null	2	844.07	168.19	0.00000
Vegetation composition and other variable models				
Year	5	675.88	0.00	0.99852
Year, Non/NativeForb	8	689.69	13.81	0.00100
Year, DefIndex	8	691.28	15.40	0.00045
Year, Brome/NativeGrass, KYBlue/NativeGrass	11	697.43	21.55	0.00002
Year, Easting	8	700.62	24.74	0.00000
Year, NonNativeGrass	8	703.15	27.27	0.00000
Year, Northing	8	707.91	32.03	0.00000
Year, Area	8	709.82	33.94	0.00000

[1]Explanatory variables included Year and the listed covariates. All covariates were included in the candidate models only as interaction terms with year.

Table 7.10. Maximum likelihood parameter estimates (intercepts and slopes for each year) from model with the lowest Akaike Information Criteria (AIC_C; table 7.9) for Savannah sparrows (*Passerculus sandwichensis*) 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.

[SE, standard error; r, model fit; NC, not computable; ln, natural logarithm]

Model parameters					Model fit[1]
Type	Effect	Year	Parameter[2]	SE	r
Intercept	Year	2011	2.26	0.15	NC
	Year	2012	2.05	0.13	NC
	Year	2013	2.47	0.13	NC

[1]Correlation between observed ln(pairs per 100 hectares) and predicted ln(pairs per 100 hectares) for each year. NC = Not computable because year is considered a discrete fixed effect.
[2]Parameter estimates are on a log-normal scale.

F. Western Meadowlark (*Sturnella neglecta*)

Table 7.11. Model selection results for candidate sets of models relating vegetation structure and vegetation composition and other variables to breeding densities (pairs per 100 hectares) of western meadowlarks (*Sturnella neglecta*) 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. Vegetation structural models were evaluated first, and then vegetation composition and other variables were added to the vegetation structural model with the lowest AIC_C to see if they improved the model fit.

[k, number of parameters considered in the model; AIC_C, Akaike Information Criterion corrected for small samples; ΔAIC_C, difference between the model with the lowest AIC_C and each subsequent model; ω_i, Akaike weights indicating the relative likelihood of each model; VOR, vertical obstruction reading (decimeters); StandDead, cover of standing dead vegetation (percent); BareGround, cover of bare ground (percent); LitDepth, litter depth (centimeters); MaxHeight, maximum vegetation height (centimeters); DefIndex, Defoliation Index; NonNativeGrass, nonnative grass (percent); Non/NativeForb, ratio of nonnative to native forbs (percent); Brome/NativeGrass, ratio of smooth brome (*Bromus inermis*) to native grass (percent); KYBlue/NativeGrass, ratio of Kentucky bluegrass (*Poa pratensis*) to native grass (percent); Easting, eastward-measured distance (kilometers); Northing, northward-measured distance (kilometers); Area, total area surveyed for breeding birds (hectares)]

Variables[1]	k	AIC_C	ΔAIC_C	ω_i
Vegetation structural models				
Year	5	595.91	0.00	0.99075
Year, VOR	8	605.26	9.35	0.00924
Year, MaxHeight	8	619.11	23.20	0.00001
Year, VOR, LitDepth	11	622.69	26.78	0.00000
Year, VOR, StandDead	11	627.99	32.08	0.00000
Year, VOR, BareGround	11	631.66	35.75	0.00000
Year, MaxHeight, LitDepth	11	634.69	38.78	0.00000
Year, MaxHeight, StandDead	11	642.35	46.44	0.00000
Year, MaxHeight, BareGround	11	647.03	51.12	0.00000
Null	2	751.10	155.19	0.00000
Vegetation composition and other variable models				
Year	5	595.91	0.00	0.99698
Year, DefIndex	8	607.69	11.78	0.00276
Year, Non/NativeForb	8	612.38	16.47	0.00026
Year, NonNativeGrass	8	624.76	28.85	0.00000
Year, Brome/NativeGrass, KYBlue/NativeGrass	11	626.39	30.48	0.00000
Year, Area	8	631.05	35.14	0.00000
Year, Northing	8	632.59	36.68	0.00000
Year, Easting	8	638.63	42.72	0.00000

[1]Explanatory variables included Year and the listed covariates. All covariates were included in the candidate models only as interaction terms with year.

Table 7.12. Maximum likelihood parameter estimates (intercepts and slopes for each year) from model with the lowest Akaike Information Criteria (AIC_C; table 7.11) for western meadowlarks (*Sturnella neglecta*) 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.

[SE, standard error; r, model fit; NC, not computable; ln, natural logarithm]

Model parameters					Model fit[1]
Type	Effect	Year	Parameter[2]	SE	r
Intercept	Year	2011	2.03	0.13	NC
	Year	2012	1.99	0.11	NC
	Year	2013	2.10	0.11	NC

[1]Correlation between observed ln(pairs per 100 hectares) and predicted ln(pairs per 100 hectares) for each year. NC = Not computable because year is considered a discrete fixed effect.
[2]Parameter estimates are on a log-normal scale.

G. Brown-headed Cowbird (*Molothrus ater*)

Table 7.13. Model selection results for candidate sets of models relating vegetation structure and vegetation composition and other variables to breeding densities (pairs per 100 hectares) of brown-headed cowbirds (*Molothrus ater*) 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. Vegetation structural models were evaluated first, and then vegetation composition and other variables were added to the vegetation structural model with the lowest AIC_C to see if they improved the model fit.

[k, number of parameters considered in the model; AIC_C, Akaike Information Criterion corrected for small samples; ΔAIC_C, difference between the model with the lowest AIC_C and each subsequent model; ω_i, Akaike weights indicating the relative likelihood of each model; VOR, vertical obstruction reading (decimeters); StandDead, cover of standing dead vegetation (percent); BareGround, cover of bare ground (percent); LitDepth, litter depth (centimeters); MaxHeight, maximum vegetation height (centimeters); DefIndex, Defoliation Index; NonNativeGrass, nonnative grass (percent); Non/NativeForb, ratio of nonnative to native forbs (percent); Brome/NativeGrass, ratio of smooth brome (*Bromus inermis*) to native grass (percent); KYBlue/NativeGrass, ratio of Kentucky bluegrass (*Poa pratensis*) to native grass (percent); Easting, eastward-measured distance (kilometers); Northing, northward-measured distance (kilometers); Area, total area surveyed for breeding birds (hectares)]

Variables[1]	k	AIC_C	ΔAIC_C	ω_i
Vegetation structural models				
Year	5	587.62	0.00	0.99382
Year, VOR	8	597.78	10.16	0.00618
Year, MaxHeight	8	615.72	28.10	0.00000
Year, VOR, LitDept	11	616.61	28.99	0.00000
Year, VOR, StandDead	11	619.52	31.90	0.00000
Year, VOR, BareGround	11	623.48	35.86	0.00000
Year, MaxHeight, LitDepth	11	633.71	46.09	0.00000
Year, MaxHeight, StandDead	11	638.85	51.23	0.00000
Year, MaxHeight, BareGround	11	640.68	53.06	0.00000
Null	2	790.04	202.42	0.00000
Vegetation composition and other variable models				
Year	5	587.62	0.00	0.95842
Year, Brome/NativeGrass, KYBlue/NativeGrass	11	594.02	6.40	0.03907
Year, DefIndex	8	600.75	13.13	0.00135
Year, NonNativeGrass	8	602.32	14.70	0.00062
Year, Non/NativeForb	8	602.55	14.93	0.00055
Year, Area	8	620.06	32.44	0.00000
Year, Easting	8	622.11	34.49	0.00000
Year, Northing	8	624.73	37.11	0.00000

[1]Explanatory variables included Year and the listed covariates. All covariates were included in the candidate models only as interaction terms with year.

Table 7.14. Maximum likelihood parameter estimates (intercepts and slopes for each year) from model with the lowest Akaike Information Criteria (AIC_C; table 7.13) for brown-headed cowbirds (*Molothrus ater*) 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.

[SE, standard error; r, model fit; NC, not computable; ln, natural logarithm]

Model Parameters					Model fit[1]
Type	Effect	Year	Parameter[2]	SE	r
Intercept	Year	2011	2.29	0.12	NC
	Year	2012	1.79	0.09	NC
	Year	2013	1.74	0.09	NC

[1]Correlation between observed ln(pairs per 100 hectares) and predicted ln(pairs per 100 hectares) for each year. NC = Not computable because year is considered a discrete fixed effect.
[2]Parameter estimates are on a log-normal scale.

H. Sedge Wren (*Cistothorus platensis*)

Table 7.15. Model selection results for candidate sets of models relating vegetation structure and vegetation composition and other variables to breeding densities (pairs per 100 hectares) of sedge wrens (*Cistothorus platensis*) 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. Vegetation structural models were evaluated first, and then vegetation composition and other variables were added to the vegetation structural model with the lowest AIC_C to see if they improved the model fit.

[k, number of parameters considered in the model; AIC_C, Akaike Information Criterion corrected for small samples; ΔAIC_C, difference between the model with the lowest AIC_C and each subsequent model; ω_i, Akaike weights indicating the relative likelihood of each model; VOR, vertical obstruction reading (decimeters); StandDead, cover of standing dead vegetation (percent); BareGround, cover of bare ground (percent); LitDepth, litter depth (centimeters); MaxHeight, maximum vegetation height (centimeters); DefIndex, Defoliation Index; NonNativeGrass, nonnative grass (percent); Non/NativeForb, ratio of nonnative to native forbs (percent); Brome/NativeGrass, ratio of smooth brome (*Bromus inermis*) to native grass (percent); KYBlue/NativeGrass, ratio of Kentucky bluegrass (*Poa pratensis*) to native grass (percent); Easting, eastward-measured distance (kilometers); Northing, northward-measured distance (kilometers); Area, total area surveyed for breeding birds (hectares)]

Variables[1]	k	AIC_C	ΔAIC_C	ω_i
Vegetation structural models				
Year, VOR, LitDepth	11	689.28	0.00	0.96575
Year, VOR	8	695.96	6.68	0.03422
Year, VOR, StandDead	11	710.58	21.30	0.00002
Year, MaxHeight, LitDepth	11	714.59	25.31	0.00000
Year, VOR, BareGround	11	716.47	27.19	0.00000
Year	5	727.79	38.51	0.00000
Year, MaxHeight	8	735.49	46.21	0.00000
Year, MaxHeight, BareGround	11	752.44	63.16	0.00000
Year, MaxHeight, StandDead	11	752.72	63.44	0.00000
Null	2	795.96	106.68	0.00000
Vegetation composition and other variable models				
Year, VOR, LitDepth	11	689.28	0.00	0.93628
Year, VOR, LitDepth, DefIndex	14	694.71	5.43	0.06199
Year, VOR, LitDepth, Non/NativeForb	14	701.86	12.58	0.00174
Year, VOR, LitDepth, NonNativeGrass	14	716.66	27.38	0.00000
Year, VOR, LitDepth, Brome/NativeGrass, KYBlue/NativeGrass	17	717.79	28.51	0.00000
Year, VOR, LitDepth, Easting	14	719.70	30.42	0.00000
Year, VOR, LitDepth, Area	14	723.27	33.99	0.00000
Year, VOR, LitDepth, Northing	14	731.91	42.63	0.00000

[1]Explanatory variables included Year and the listed covariates. All covariates were included in the candidate models only as interaction terms with year.

Table 7.16. Maximum likelihood parameter estimates (intercepts and slopes for each year) from model with the lowest Akaike Information Criteria (AIC_C; table 7.15) for sedge wrens (*Cistothorus platensis*) 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.

[SE, standard error; r, model fit; VOR, vertical obstruction reading (decimeters); LitDepth, litter depth (centimeters); ln, natural logarithm]

Model parameters					Model fit[1]
Type	Effect	Year	Parameter[2]	SE	r
Intercept	Year	2011	0.07	0.31	0.37
	Year	2012	0.16	0.22	0.56
	Year	2013	−0.35	0.25	0.68
Slope	Year × VOR	2011	0.17	0.14	
	Year × VOR	2012	0.29	0.10	
	Year × VOR	2013	0.35	0.10	
	Year × LitDepth	2011	0.12	0.07	
	Year × LitDepth	2012	0.20	0.08	
	Year × LitDepth	2013	0.17	0.04	

[1]Correlation between observed ln(pairs per 100 hectares) and predicted ln(pairs per 100 hectares) for each year.
[2]Parameter estimates are on a log-normal scale.

I. Common Yellowthroat (*Geothlypis trichas*)

Table 7.17. Model selection results for candidate sets of models relating vegetation structure and vegetation composition and other variables to breeding densities (pairs per 100 hectares) of common yellowthroats (*Geothlypis trichas*) 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. Vegetation structural models were evaluated first, and then vegetation composition and other variables were added to the vegetation structural model with the lowest AIC_C to see if they improved the model fit.

[k, number of parameters considered in the model; AIC_C, Akaike Information Criterion corrected for small samples; ΔAIC_C, difference between the model with the lowest AICC and each subsequent model; ω_i, Akaike weights indicating the relative likelihood of each model; VOR, vertical obstruction reading (decimeters); StandDead, cover of standing dead vegetation (percent); BareGround, cover of bare ground (percent); LitDepth, litter depth (centimeters); MaxHeight, maximum vegetation height (centimeters); DefIndex, Defoliation Index; NonNativeGrass, nonnative grass (percent); Non/NativeForb, ratio of nonnative to native forbs (percent); Brome/NativeGrass, ratio of smooth brome (*Bromus inermis*) to native grass (percent); KYBlue/NativeGrass, ratio of Kentucky bluegrass (*Poa pratensis*) to native grass (percent); Easting, eastward-measured distance (kilometers); Northing, northward-measured distance (kilometers); Area, total area surveyed for breeding birds (hectares)]

Variables[1]	k	AIC_C	ΔAIC_C	ω_i
Vegetation structural models				
Year, VOR	8	560.69	0.00	0.97723
Year, VOR, LitDepth	11	568.21	7.52	0.02275
Year, VOR, StandDead	11	583.30	22.61	0.00001
Year, VOR, BareGround	11	589.45	28.76	0.00000
Year, MaxHeight	8	618.33	57.64	0.00000
Year, MaxHeight, LitDepth	11	618.60	57.91	0.00000
Year	5	629.26	68.57	0.00000
Year, MaxHeight, StandDead	11	642.70	82.01	0.00000
Year, MaxHeight, BareGround	11	647.23	86.54	0.00000
Null	2	709.80	149.11	0.00000
Vegetation composition and other variable models				
Year, VOR	8	560.69	0.00	0.61490
Year, VOR, DefIndex	11	561.63	0.94	0.38431
Year, VOR, Non/NativeForb	11	574.00	13.31	0.00079
Year, VOR, NonNativeGrass	11	592.78	32.09	0.00000
Year, VOR, Area	11	593.02	32.33	0.00000
Year, VOR, Brome/NativeGrass, KYBlue/NativeGrass	14	594.55	33.86	0.00000
Year, VOR, Easting	11	599.07	38.38	0.00000
Year, VOR, Northing	11	599.32	38.63	0.00000

[1]Explanatory variables included Year and the listed covariates. All covariates were included in the candidate models only as interaction terms with year.

Table 7.18. Maximum likelihood parameter estimates (intercepts and slopes for each year) from model with the lowest Akaike Information Criteria (AIC_C; table 7.17) for common yellowthroats (*Geothlypis trichas*) 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.

[SE, standard error; r, model fit; VOR, vertical obstruction reading (decimeters); ln, natural logarithm]

Model parameters					Model fit[1]
Type	Effect	Year	Parameter[2]	SE	r
Intercept	Year	2011	0.10	0.22	0.54
	Year	2012	0.20	0.17	0.71
	Year	2013	0.13	0.19	0.66
Slope	Year × VOR	2011	0.44	0.10	
	Year × VOR	2012	0.42	0.06	
	Year × VOR	2013	0.52	0.07	

[1]Correlation between observed ln(pairs per 100 hectares) and predicted ln(pairs per 100 hectares) for each year.
[2]Parameter estimates are on a log-normal scale.

J. Chestnut-collared Longspur (*Calcarius ornatus*)

Table 7.19. Model selection results for candidate sets of models relating vegetation structure and vegetation composition and other variables to breeding densities (pairs per 100 hectares) of chestnut-collared longspurs (*Calcarius ornatus*) 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. Vegetation structural models were evaluated first, and then vegetation composition and other variables were added to the vegetation structural model with the lowest AIC_C to see if they improved the model fit.

[k, number of parameters considered in the model; AIC_C, Akaike Information Criterion corrected for small samples; ΔAIC_C, difference between the model with the lowest AIC_C and each subsequent model; ω_i, Akaike weights indicating the relative likelihood of each model; VOR, vertical obstruction reading (decimeters); StandDead, cover of standing dead vegetation (percent); BareGround, cover of bare ground (percent); LitDepth, litter depth (centimeters); MaxHeight, maximum vegetation height (centimeters); DefIndex, Defoliation Index; NonNativeGrass, nonnative grass (percent); Non/NativeForb, ratio of nonnative to native forbs (percent); Brome/NativeGrass, ratio of smooth brome (*Bromus inermis*) to native grass (percent); KYBlue/NativeGrass, ratio of Kentucky bluegrass (*Poa pratensis*) to native grass (percent); Easting, eastward-measured distance (kilometers); Northing, northward-measured distance (kilometers); Area, total area surveyed for breeding birds (hectares)]

Variables[1]	k	AIC_C	ΔAIC_C	ω_i
Vegetation structural models				
Year	5	625.54	0.00	0.52490
Year, VOR	8	625.76	0.22	0.47022
Year, VOR, LitDepth	11	635.32	9.78	0.00395
Null	2	638.47	12.93	0.00082
Year, MaxHeight	8	643.09	17.55	0.00008
Year, VOR, BareGround	11	645.23	19.69	0.00003
Year, VOR, StandDead	11	648.49	22.95	0.00001
Year, MaxHeight, LitDepth	11	651.87	26.33	0.00000
Year, MaxHeight, BareGround	11	662.90	37.36	0.00000
Year, MaxHeight, StandDead	11	664.70	39.16	0.00000
Vegetation composition and other variable models				
Year	5	625.54	0.00	0.99609
Year, DefIndex	8	637.68	12.14	0.00230
Year, Non/NativeForb	8	638.65	13.11	0.00142
Year, Easting	8	642.73	17.19	0.00018
Year, NonNativeGrass	8	651.03	25.49	0.00000
Year, Brome/NativeGrass, KYBlue/NativeGrass	11	655.62	30.08	0.00000
Year, Area	8	659.79	34.25	0.00000
Year, Northing	8	669.77	44.23	0.00000

[1]Explanatory variables included Year and the listed covariates. All covariates were included in the candidate models only as interaction terms with year.

Table 7.20. Maximum likelihood parameter estimates (intercepts and slopes for each year) from model with the lowest Akaike Information Criteria (AIC_C; table 7.19) for chestnut-collared longspurs (*Calcarius ornatus*) 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.

[SE, standard error; r, model fit; NC, not computable; ln, natural logarithm]

Model Parameters					Model fit[1]
Type	Effect	Year	Parameter[2]	SE	r
Intercept	Year	2011	0.70	0.14	NC
	Year	2012	0.64	0.13	NC
	Year	2013	0.57	0.13	NC

[1]Correlation between observed ln(pairs per 100 hectares) and predicted ln(pairs per 100 hectares) for each year. NC = Not computable because year is considered a discrete fixed effect.
[2]Parameter estimates are on a log-normal scale.

K. Eastern Kingbird (*Tyrannus tyrannus*)

Table 7.21. Model selection results for candidate sets of models relating vegetation structure and vegetation composition and other variables to breeding densities (pairs per 100 hectares) of eastern kingbirds (*Tyrannus tyrannus*) 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. Vegetation structural models were evaluated first, and then vegetation composition and other variables were added to the vegetation structural model with the lowest AIC_C to see if they improved the model fit.

[k, number of parameters considered in the model; AIC_C, Akaike Information Criterion corrected for small samples; ΔAIC_C, difference between the model with the lowest AIC_C and each subsequent model; ω_i, Akaike weights indicating the relative likelihood of each model; VOR, vertical obstruction reading (decimeters); StandDead, cover of standing dead vegetation (percent); BareGround, cover of bare ground (percent); LitDepth, litter depth (centimeters); MaxHeight, maximum vegetation height (centimeters); DefIndex, Defoliation Index; NonNativeGrass, nonnative grass (percent); Non/NativeForb, ratio of nonnative to native forbs (percent); Brome/NativeGrass, ratio of smooth brome (*Bromus inermis*) to native grass (percent); KYBlue/NativeGrass, ratio of Kentucky bluegrass (*Poa pratensis*) to native grass (percent); Easting, eastward-measured distance (kilometers); Northing, northward-measured distance (kilometers); Area, total area surveyed for breeding birds (hectares)]

Variables[1]	k	AIC_C	ΔAIC_C	ω_i
Vegetation structural models				
Year	5	582.80	0.00	0.99868
Year, VOR	8	596.06	13.26	0.00132
Year, VOR, LitDepth	11	608.75	25.95	0.00000
Year, MaxHeight	8	609.06	26.26	0.00000
Year, MaxHeight, LitDepth	11	620.78	37.98	0.00000
Year, VOR, StandDead	11	621.35	38.55	0.00000
Year, VOR, BareGround	11	626.05	43.25	0.00000
Year, MaxHeight, StandDead	11	634.54	51.74	0.00000
Year, MaxHeight, BareGround	11	639.67	56.87	0.00000
Null	2	666.29	83.49	0.00000
Vegetation composition and other variable models				
Year	5	582.80	0.00	0.99870
Year, DefIndex	8	597.01	14.21	0.00082
Year, Non/NativeForb	8	598.09	15.29	0.00048
Year, Brome/NativeGrass, KYBlue/NativeGrass	11	612.60	29.80	0.00000
Year, NonNativeGrass	8	615.07	32.27	0.00000
Year, Area	8	617.11	34.31	0.00000
Year, Northing	8	618.97	36.17	0.00000
Year, Easting	8	622.52	39.72	0.00000

[1]Explanatory variables included Year and the listed covariates. All covariates were included in the candidate models only as interaction terms with year.

Table 7.22. Maximum likelihood parameter estimates (intercepts and slopes for each year) from model with the lowest Akaike Information Criteria (AIC_C; table 7.21) for eastern kingbirds (*Tyrannus tyrannus*) 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.

[SE, standard error; r, model fit; NC, not computable; ln, natural logarithm]

Model parameters					Model fit[1]
Type	Effect	Year	Parameter[2]	SE	r
Intercept	Year	2011	1.14	0.12	NC
	Year	2012	1.25	0.10	NC
	Year	2013	1.18	0.10	NC

[1]Correlation between observed ln(pairs per 100 hectares) and predicted ln(pairs per 100 hectares) for each year. NC = Not computable because year is considered a discrete fixed effect.
[2]Parameter estimates are on a log-normal scale.

L. Yellow Warbler (*Setophaga petechia*)

Table 7.23. Model selection results for candidate sets of models relating vegetation structure and vegetation composition and other variables to breeding densities (pairs per 100 hectares) of yellow warblers (*Setophaga petechia*) 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. Vegetation structural models were evaluated first, and then vegetation composition and other variables were added to the vegetation structural model with the lowest AIC_C to see if they improved the model fit.

[k, number of parameters considered in the model; AIC_C, Akaike Information Criterion corrected for small samples; ΔAIC_C, difference between the model with the lowest AIC_C and each subsequent model; ω_i, Akaike weights indicating the relative likelihood of each model; VOR, vertical obstruction reading (decimeters); StandDead, cover of standing dead vegetation (percent); BareGround, cover of bare ground (percent); LitDepth, litter depth (centimeters); MaxHeight, maximum vegetation height (centimeters); DefIndex, Defoliation Index; NonNativeGrass, nonnative grass (percent); Non/NativeForb, ratio of nonnative to native forbs (percent); Brome/NativeGrass, ratio of smooth brome (*Bromus inermis*) to native grass (percent); KYBlue/NativeGrass, ratio of Kentucky bluegrass (*Poa pratensis*) to native grass (percent); Easting, eastward-measured distance (kilometers); Northing, northward-measured distance (kilometers); Area, total area surveyed for breeding birds (hectares)]

Variables[1]	k	AIC_C	ΔAIC_C	ω_i
Vegetation structural models				
Year	5	438.07	0.00	0.99992
Year, VOR	8	457.05	18.98	0.00008
Null	2	463.96	25.89	0.00000
Year, MaxHeight	8	474.40	36.33	0.00000
Year, VOR, LitDepth	11	478.45	40.38	0.00000
Year, VOR, StandDead	11	486.22	48.15	0.00000
Year, VOR, BareGround	11	487.24	49.17	0.00000
Year, MaxHeight, LitDepth	11	495.86	57.79	0.00000
Year, MaxHeight, StandDead	11	503.32	65.25	0.00000
Year, MaxHeight, BareGround	11	504.99	66.92	0.00000
Vegetation composition and other variable models				
Year	5	438.07	0.00	0.99621
Year, Non/NativeForb	8	449.24	11.17	0.00374
Year, DefIndex	8	457.99	19.92	0.00005
Year, Brome/NativeGrass, KYBlue/NativeGrass	11	469.39	31.32	0.00000
Year, NonNativeGrass	8	469.52	31.45	0.00000
Year, Area	8	475.56	37.49	0.00000
Year, Easting	8	480.18	42.11	0.00000
Year, Northing	8	484.19	46.12	0.00000

[1]Explanatory variables included Year and the listed covariates. All covariates were included in the candidate models only as interaction terms with year.

Table 7.24. Maximum likelihood parameter estimates (intercepts and slopes for each year) from model with the lowest Akaike Information Criteria (AIC_C; table 7.23) for yellow warblers (*Setophaga petechia*) 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.

[SE, standard error; r, model fit; NC, not computable; ln, natural logarithm]

Model parameters					Model fit[1]
Type	Effect	Year	Parameter[2]	SE	r
Intercept	Year	2011	0.53	0.12	NC
	Year	2012	0.49	0.12	NC
	Year	2013	0.68	0.12	NC

[1]Correlation between observed ln(pairs per 100 hectares) and predicted ln(pairs per 100 hectares) for each year. NC = Not computable because year is considered a discrete fixed effect.
[2]Parameter estimates are on a log-normal scale.

M. Brewer's Blackbird (*Euphagus cyanocephalus*)

Table 7.25. Model selection results for candidate sets of models relating vegetation structure and vegetation composition and other variables to breeding densities (pairs per 100 hectares) of Brewer's blackbird (*Euphagus cyanocephalus*) 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. Vegetation structural models were evaluated first, and then vegetation composition and other variables were added to the vegetation structural model with the lowest AIC_C to see if they improved the model fit.

[k, number of parameters considered in the model; AIC_C, Akaike Information Criterion corrected for small samples; ΔAIC_C, difference between the model with the lowest AIC_C and each subsequent model; ω_i, Akaike weights indicating the relative likelihood of each model; VOR, vertical obstruction reading (decimeters); StandDead, cover of standing dead vegetation (percent); BareGround, cover of bare ground (percent); LitDepth, litter depth (centimeters); MaxHeight, maximum vegetation height (centimeters); DefIndex, Defoliation Index; NonNativeGrass, nonnative grass (percent); Non/NativeForb, ratio of nonnative to native forbs (percent); Brome/NativeGrass, ratio of smooth brome (*Bromus inermis*) to native grass (percent); KYBlue/NativeGrass, ratio of Kentucky bluegrass (*Poa pratensis*) to native grass (percent); Easting, eastward-measured distance (kilometers); Northing, northward-measured distance (kilometers); Area, total area surveyed for breeding birds (ha)]

Variables[1]	k	AIC_C	ΔAIC_C	ω_i
Vegetation structural models				
Year	5	654.63	0.00	0.98213
Year, VOR	8	662.74	8.11	0.01703
Year, VOR, BareGround	11	670.12	15.49	0.00043
Year, VOR, LitDepth	11	670.15	15.52	0.00042
Year, MaxHeight	8	682.78	28.15	0.00000
Year, VOR, StandDead	11	683.73	29.10	0.00000
Year, MaxHeight, BareGround	11	689.80	35.17	0.00000
Null	2	692.89	38.26	0.00000
Year, MaxHeight, LitDepth	11	693.95	39.32	0.00000
Year, MaxHeight, StandDead	11	704.06	49.43	0.00000
Vegetation composition and other variable models				
Year	5	654.63	0.00	0.99535
Year, DefIndex	8	665.72	11.09	0.00389
Year, Non/NativeForb	8	669.01	14.38	0.00075
Year, Northing	8	678.25	23.62	0.00001
Year, NonNativeGrasses	8	679.34	24.71	0.00000
Year, Area	8	681.63	27.00	0.00000
Year, Brome/NativeGrass, KYBlue/NativeGrass	11	684.65	30.02	0.00000
Year, Easting	8	689.16	34.53	0.00000

[1]Explanatory variables included Year and the listed covariates. All covariates were included in the candidate models only as interaction terms with year.

Table 7.26. Maximum likelihood parameter estimates (intercepts and slopes for each year) from model with the lowest Akaike Information Criteria (AIC_C; table 7.25) for Brewer's blackbird (*Euphagus cyanocephalus*) 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.

[SE, standard error; r, model fit; not computable; ln, natural logarithm]

Model parameters					Model fit[1]
Type	Effect	Year	Parameter[2]	SE	r
Intercept	Year	2011	0.97	0.14	NC
	Year	2012	0.59	0.11	NC
	Year	2013	0.46	0.11	NC

[1]Correlation between observed ln(pairs per 100 hectares) and predicted ln(pairs per 100 hectares) for each year. NC = Not computable because year is considered a discrete fixed effect.
[2]Parameter estimates are on a log-normal scale.

N. Common Grackle (*Quiscalus quiscula*)

Table 7.27. Model selection results for candidate sets of models relating vegetation structure and vegetation composition and other variables to breeding densities (pairs per 100 hectares) of common grackle (*Quiscalus quiscula*) 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. Vegetation structural models were evaluated first, and then vegetation composition and other variables were added to the vegetation structural model with the lowest AIC_C to see if they improved the model fit.

[k, number of parameters considered in the model; AIC_C, Akaike Information Criterion corrected for small samples; ΔAIC_C, difference between the model with the lowest AIC_C and each subsequent model; ω_i, Akaike weights indicating the relative likelihood of each model; VOR, vertical obstruction reading (decimeters); StandDead, cover of standing dead vegetation (percent); BareGround, cover of bare ground (percent); LitDepth, litter depth (centimeters); MaxHeight, maximum vegetation height (centimeters); DefIndex, Defoliation Index; NonNativeGrass, nonnative grass (percent); Non/NativeForb, ratio of nonnative to native forbs (percent); Brome/NativeGrass, ratio of smooth brome (*Bromus inermis*) to native grass (percent); KYBlue/NativeGrass, ratio of Kentucky bluegrass (*Poa pratensis*) to native grass (percent); Easting, eastward-measured distance (kilometers); Northing, northward-measured distance (kilometers); Area, total area surveyed for breeding birds (hectares)]

Variables[1]	k	AIC_C	ΔAIC_C	ω_i
Vegetation structural models				
Year	5	660.48	0.00	0.99375
Year, VOR	8	670.62	10.14	0.00624
Year, VOR, LitDepth	11	683.50	23.02	0.00001
Year, MaxHeight	8	688.37	27.89	0.00000
Year, VOR, StandDead	11	694.54	34.06	0.00000
Year, VOR, BareGround	11	696.06	35.58	0.00000
Year, MaxHeight, LitDepth	11	698.84	38.36	0.00000
Null	2	709.19	48.71	0.00000
Year, MaxHeight, StandDead	11	712.10	51.62	0.00000
Year, MaxHeight, BareGround	11	713.23	52.75	0.00000
Vegetation composition and other variable models				
Year	5	660.48	0.00	0.98705
Year, DefIndex	8	669.86	9.38	0.00907
Year, Non/NativeForb	8	671.56	11.08	0.00388
Year, NonNativeGrass	8	685.48	25.00	0.00000
Year, Brome/NativeGrass, KYBlue/NativeGrass	11	689.63	29.15	0.00000
Year, Area	8	693.70	33.22	0.00000
Year, Easting	8	697.50	37.02	0.00000
Year, Northing	8	704.30	43.82	0.00000

[1]Explanatory variables included Year and the listed covariates. All covariates were included in the candidate models only as interaction terms with year.

Table 7.28. Maximum likelihood parameter estimates (intercepts and slopes for each year) from model with the lowest Akaike Information Criteria (AIC_C; table 7.27) for common grackles (*Quiscalus quiscula*) 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.

[SE, standard error; r, model fit; NC, not computable; ln, natural logarithm]

Model parameters					Model fit[1]
Type	Effect	Year	Parameter[2]	SE	r
Intercept	Year	2011	0.47	0.13	NC
	Year	2012	0.81	0.11	NC
	Year	2013	0.68	0.11	NC

[1]Correlation between observed ln(pairs per 100 hectares) and predicted ln(pairs per 100 hectares) for each year. NC = Not computable because year is considered a discrete fixed effect.
[2]Parameter estimates are on a log-normal scale.

O. Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*)

Table 7.29. Model selection results for candidate sets of models relating vegetation structure and vegetation composition and other variables to breeding densities (pairs per 100 hectares) of yellow-headed blackbirds (*Xanthocephalus xanthocephalus*) 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. Vegetation structural models were evaluated first, and then vegetation composition and other variables were added to the vegetation structural model with the lowest AIC_C to see if they improved the model fit.

[k, number of parameters considered in the model; AIC_C, Akaike Information Criterion corrected for small samples; ΔAIC_C, difference between the model with the lowest AIC_C and each subsequent model; ω_i, Akaike weights indicating the relative likelihood of each model; VOR, vertical obstruction reading (decimeters); StandDead, cover of standing dead vegetation (percent); BareGround, cover of bare ground (percent); LitDepth, litter depth (centimeters); MaxHeight, maximum vegetation height (centimeters); DefIndex, Defoliation Index; NonNativeGrass, nonnative grass (percent); Non/NativeForb, ratio of nonnative to native forbs (percent); Brome/NativeGrass, ratio of smooth brome (*Bromus inermis*) to native grass (percent); KYBlue/NativeGrass, ratio of Kentucky bluegrass (*Poa pratensis*) to native grass (percent); Easting, eastward-measured distance (kilometers); Northing, northward-measured distance (kilometers); Area, total area surveyed for breeding birds (hectares)]

Variables[1]	k	AIC_C	ΔAIC_C	ω_i
Vegetation structural models				
Year	5	612.56	0.00	0.98191
Year, VOR	8	620.55	7.99	0.01807
Year, MaxHeight	8	635.62	23.06	0.00001
Year, VOR, LitDepth	11	637.70	25.14	0.00000
Year, VOR, StandDead	11	642.96	30.40	0.00000
Year, VOR, BareGround	11	645.79	33.23	0.00000
Year, MaxHeight, LitDepth	11	653.06	40.50	0.00000
Year, MaxHeight, StandDead	11	658.93	46.37	0.00000
Year, MaxHeight, BareGround	11	661.64	49.08	0.00000
Null	2	667.69	55.13	0.00000
Vegetation composition and other variable models				
Year	5	612.56	0.00	0.99457
Year, Non/NativeForb	8	623.08	10.52	0.00517
Year, DefIndex	8	629.22	16.66	0.00024
Year, Brome/NativeGrass, KYBlue/NativeGrass	11	633.95	21.39	0.00002
Year, Area	8	639.54	26.98	0.00000
Year, NonNativeGrass	11	639.60	27.04	0.00000
Year, Northing	8	640.34	27.78	0.00000
Year, Easting	8	654.58	42.02	0.00000

[1]Explanatory variables included Year and the listed covariates. All covariates were included in the candidate models only as interaction terms with year.

Table 7.30. Maximum likelihood parameter estimates (intercepts and slopes for each year) from model with the lowest Akaike Information Criteria (AIC_C; table 7.29) for yellow-headed blackbirds (*Xanthocephalus xanthocephalus*) 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.

[SE, standard error; r, model fit; NC, not computable; ln, natural logarithm]

Model parameters					Model fit[1]
Type	Effect	Year	Parameter[2]	SE	r
Intercept	Year	2011	0.94	0.12	NC
	Year	2012	0.64	0.10	NC
	Year	2013	0.29	0.10	NC

[1]Correlation between observed ln(pairs per 100 hectares) and predicted ln(pairs per 100 hectares) for each year. NC = Not computable because year is considered a discrete fixed effect.
[2]Parameter estimates are on a log-normal scale.

P. Song Sparrow (*Melospiza melodia*)

Table 7.31. Model selection results for candidate sets of models relating vegetation structure and vegetation composition and other variables to breeding densities (pairs per 100 hectares) of song sparrows (*Melospiza melodia*) 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. Vegetation structural models were evaluated first, and then vegetation composition and other variables were added to the vegetation structural model with the lowest AIC_C to see if they improved the model fit.

[k, number of parameters considered in the model; AIC_C, Akaike Information Criterion corrected for small samples; ΔAIC_C, difference between the model with the lowest AIC_C and each subsequent model; ω_i, Akaike weights indicating the relative likelihood of each model; VOR, vertical obstruction reading (decimeters); StandDead, cover of standing dead vegetation (percent); BareGround, cover of bare ground (percent); LitDepth, litter depth (centimeters); MaxHeight, maximum vegetation height (centimeters); DefIndex, Defoliation Index; NonNativeGrass, nonnative grass (percent); Non/NativeForb, ratio of nonnative to native forbs (percent); Brome/NativeGrass, ratio of smooth brome (*Bromus inermis*) to native grass (percent); KYBlue/NativeGrass, ratio of Kentucky bluegrass (*Poa pratensis*) to native grass (percent); Easting, eastward-measured distance (kilometers); Northing, northward-measured distance (kilometers); Area, total area surveyed for breeding birds (hectares)]

Variables[1]	k	AIC_C	ΔAIC_C	ω_i
Vegetation structural models				
Year	5	542.53	0.00	0.98210
Year, VOR	8	550.54	8.01	0.01790
Year, VOR, LitDepth	11	569.94	27.41	0.00000
Year, MaxHeight	8	570.95	28.42	0.00000
Year, VOR, StandDead	11	574.06	31.53	0.00000
Year, VOR, BareGround	11	579.81	37.28	0.00000
Null	2	581.95	39.42	0.00000
Year, MaxHeight, LitDepth	11	590.18	47.65	0.00000
Year, MaxHeight, StandDead	11	594.65	52.12	0.00000
Year, MaxHeight, BareGround	11	601.30	58.77	0.00000
Vegetation composition and other variable models				
Year	5	542.53	0.00	0.99969
Year, Non/NativeForb	8	559.73	17.20	0.00018
Year, DefIndex	8	560.53	18.00	0.00012
Year, NonNativeGrass	8	570.23	27.70	0.00000
Year, Brome/NativeGrass, KYBlue/NativeGrass	11	576.45	33.92	0.00000
Year, Area	8	576.91	34.38	0.00000
Year, Easting	8	582.56	40.03	0.00000
Year, Northing	8	586.04	43.51	0.00000

[1]Explanatory variables included Year and the listed covariates. All covariates were included in the candidate models only as interaction terms with year.

Table 7.32. Maximum likelihood parameter estimates (intercepts and slopes for each year) from model with the lowest Akaike Information Criteria (AIC_C; table 7.31) for song sparrows (*Melospiza melodia*) 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.

[SE, standard error; r, model fit; NC, not computable; ln, natural logarithm]

Model parameters					Model fit[1]
Type	Effect	Year	Parameter[2]	SE	r
Intercept	Year	2011	0.47	0.11	NC
	Year	2012	0.76	0.09	NC
	Year	2013	0.57	0.09	NC

[1]Correlation between observed ln(pairs per 100 hectares) and predicted ln(pairs per 100 hectares) for each year. NC = Not computable because year is considered a discrete fixed effect.
[2]Parameter estimates are on a log-normal scale.

Q. American Goldfinch (*Spinus tristis*)

Table 7.33. Model selection results for candidate sets of models relating vegetation structure and vegetation composition and other variables to breeding densities (pairs per 100 hectares) of American goldfinches (*Spinus tristis*) 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. Vegetation structural models were evaluated first, and then vegetation composition and other variables were added to the vegetation structural model with the lowest AIC_C to see if they improved the model fit.

[k, number of parameters considered in the model; AIC_C, Akaike Information Criterion corrected for small samples; ΔAIC_C, difference between the model with the lowest AIC_C and each subsequent model; ω_i, Akaike weights indicating the relative likelihood of each model; VOR, vertical obstruction reading (decimeters); StandDead, cover of standing dead vegetation (percent); BareGround, cover of bare ground (percent); LitDepth, litter depth (centimeters); MaxHeight, maximum vegetation height (centimeters); DefIndex, Defoliation Index; NonNativeGrass, nonnative grass (percent); Non/NativeForb, ratio of nonnative to native forbs (percent); Brome/NativeGrass, ratio of smooth brome (*Bromus inermis*) to native grass (percent); KYBlue/NativeGrass, ratio of Kentucky bluegrass (*Poa pratensis*) to native grass (percent); Easting, eastward-measured distance (kilometers); Northing, northward-measured distance (kilometers); Area, total area surveyed for breeding birds (hectares)]

Variables[1]	k	AIC_C	ΔAIC_C	ω_i
Vegetation structural models				
Year, VOR	8	515.08	0.00	0.94514
Year	5	520.78	5.70	0.05467
Year, MaxHeight	8	532.72	17.64	0.00014
Year, VOR, LitDepth	11	535.10	20.02	0.00004
Year, VOR, StandDead	11	538.38	23.30	0.00001
Year, VOR, BareGround	11	545.25	30.17	0.00000
Year, MaxHeight, LitDepth	11	551.97	36.89	0.00000
Year, MaxHeight, StandDead	11	555.46	40.38	0.00000
Year, MaxHeight, BareGround	11	562.33	47.25	0.00000
Null	2	574.10	59.02	0.00000
Vegetation composition and other variable models				
Year, VOR	8	515.08	0.00	0.99953
Year, VOR, Non/NativeForb	11	531.39	16.31	0.00029
Year, VOR DefIndex	11	532.33	17.25	0.00018
Year, VOR, NonNativeGrass	11	539.23	24.15	0.00001
Year, VOR, Brome/NativeGrass, KYBlue/NativeGrass	14	544.98	29.90	0.00000
Year, VOR Easting	11	549.58	34.50	0.00000
Year, VOR Area	11	551.23	36.15	0.00000
Year, VOR Northing	11	561.04	45.96	0.00000

[1]Explanatory variables included Year and the listed covariates. All covariates were included in the candidate models only as interaction terms with year.

Table 7.34. Maximum likelihood parameter estimates (intercepts and slopes for each year) from model with the lowest Akaike Information Criteria (AIC_C; table 7.33) for American goldfinches (*Spinus tristis*) 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.

[SE, standard error; r, model fit; VOR, vertical obstruction reading (decimeters); ln, natural logarithm]

Model parameters					Model fit[1]
Type	Effect	Year	Parameter[2]	SE	r
Intercept	Year	2011	0.50	0.19	0.21
	Year	2012	0.54	0.15	0.30
	Year	2013	0.46	0.17	-0.17
Slope	Year × VOR	2011	0.02	0.09	
	Year × VOR	2012	0.10	0.05	
	Year × VOR	2013	−0.01	0.06	

[1]Correlation between observed ln(pairs per 100 hectares) and predicted ln(pairs per 100 hectares) for each year.
[2]Parameter estimates are on a log-normal scale.

R. Upland Sandpiper (*Bartramia longicauda*)

Table 7.35. Model selection results for candidate sets of models relating vegetation structure and vegetation composition and other variables to breeding densities (pairs per 100 hectares) of upland sandpipers (*Bartramia longicauda*) 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. Vegetation structural models were evaluated first, and then vegetation composition and other variables were added to the vegetation structural model with the lowest AIC_C to see if they improved the model fit.

[k, number of parameters considered in the model; AIC_C, Akaike Information Criterion corrected for small samples; ΔAIC_C, difference between the model with the lowest AIC_C and each subsequent model; ω_i, Akaike weights indicating the relative likelihood of each model; VOR, vertical obstruction reading (decimeters); StandDead, cover of standing dead vegetation (percent); BareGround, cover of bare ground (percent); LitDepth, litter depth (centimeters); MaxHeight, maximum vegetation height (centimeters); DefIndex, Defoliation Index; NonNativeGrass, nonnative grass (percent); Non/NativeForb, ratio of nonnative to native forbs (percent); Brome/NativeGrass, ratio of smooth brome (*Bromus inermis*) to native grass (percent); KYBlue/NativeGrass, ratio of Kentucky bluegrass (*Poa pratensis*) to native grass (percent); Easting, eastward-measured distance (kilometers); Northing, northward-measured distance (kilometers); Area, total area surveyed for breeding birds (hectares)]

Variables[1]	k	AIC_C	ΔAIC_C	ω_i
Vegetation structural models				
Year, VOR, LitDepth	11	509.47	0.00	0.83459
Year, VOR	8	512.73	3.26	0.16352
Year	5	522.20	12.73	0.00144
Year, VOR, BareGround	11	524.75	15.28	0.00040
Year, VOR, StandDead	11	529.08	19.61	0.00005
Year, MaxHeight, LitDepth	11	532.56	23.09	0.00001
Year, MaxHeight	8	536.44	26.97	0.00000
Year, MaxHeight, BareGround	11	549.47	40.00	0.00000
Year, MaxHeight, StandDead	11	554.78	45.31	0.00000
Null	2	601.69	92.22	0.00000
Vegetation composition and other variable models				
Year, VOR, LitDepth	11	509.47	0.00	0.99958
Year, VOR, LitDepth, NonNative/Native Forb	14	525.87	16.40	0.00027
Year, VOR, LitDepth, DefIndex	14	527.23	17.76	0.00014
Year, VOR, LitDepth, NonNativeGrass	14	535.63	26.16	0.00000
Year, VOR, LitDepth, Area	14	543.61	34.14	0.00000
Year, VOR, LitDepth, Brome/NativeGrass, KYBlue/NativeGrass	17	544.16	34.69	0.00000
Year, VOR, LitDepth, Northing	14	547.79	38.32	0.00000
Year, VOR, LitDepth, Easting	14	553.88	44.41	0.00000

[1]Explanatory variables included Year and the listed covariates. All covariates were included in the candidate models only as interaction terms with year.

Table 7.36. Maximum likelihood parameter estimates (intercepts and slopes for each year) from model with the lowest Akaike Information Criteria (AIC_C; table 7.35) for upland sandpipers (*Bartramia longicauda*) 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.

[SE, standard error; r, model fit; VOR, vertical obstruction reading (decimeters); LitDepth, litter depth (centimeters); ln, natural logarithm]

Model parameters					Model fit[1]
Type	Effect	Year	Parameter[2]	SE	r
Intercept	Year	2011	1.13	0.20	0.31
	Year	2012	1.26	0.15	0.51
	Year	2013	1.12	0.16	0.36
Slope	Year × VOR	2011	−0.13	0.09	
	Year × VOR	2012	0.01	0.07	
	Year × VOR	2013	−0.22	0.06	
	Year × LitDepth	2011	−0.09	0.04	
	Year × LitDepth	2012	−0.23	0.05	
	Year × LitDepth	2013	−0.01	0.03	

[1]Correlation between observed ln(pairs per 100 hectares) and predicted ln(pairs per 100 hectares) for each year.
[2]Parameter estimates are on a log-normal scale.

S. Killdeer (*Charadrius vociferus*)

Table 7.37. Model selection results for candidate sets of models relating vegetation structure and vegetation composition and other variables to breeding densities (pairs per 100 hectares) of killdeer (*Charadrius vociferus*) 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. Vegetation structural models were evaluated first, and then vegetation composition and other variables were added to the vegetation structural model with the lowest AIC_C to see if they improved the model fit.

[k, number of parameters considered in the model; AIC_C, Akaike Information Criterion corrected for small samples; ΔAIC_C, difference between the model with the lowest AIC_C and each subsequent model; ω_i, Akaike weights indicating the relative likelihood of each model; VOR, vertical obstruction reading (decimeters); StandDead, cover of standing dead vegetation (percent); BareGround, cover of bare ground (percent); LitDepth, litter depth (centimeters); MaxHeight, maximum vegetation height (centimeters); DefIndex, Defoliation Index; NonNativeGrass, nonnative grass (percent); Non/NativeForb, ratio of nonnative to native forbs (percent); Brome/NativeGrass, ratio of smooth brome (*Bromus inermis*) to native grass (percent); KYBlue/NativeGrass, ratio of Kentucky bluegrass (*Poa pratensis*) to native grass (percent); Easting, eastward-measured distance (kilometers); Northing, northward-measured distance (kilometers); Area, total area surveyed for breeding birds (hectares)]

Variables[1]	k	AIC_C	ΔAIC_C	ω_i
Vegetation structural models				
Year, VOR	8	514.11	0.00	0.95679
Year	5	520.53	6.42	0.03861
Year, MaxHeight	8	525.03	10.92	0.00407
Year, VOR, StandDead	11	529.27	15.16	0.00049
Year, VOR, LitDepth	11	534.18	20.07	0.00004
Year, VOR, BareGround	11	541.90	27.79	0.00000
Year, MaxHeight, StandDead	11	543.26	29.15	0.00000
Year, MaxHeight, LitDepth	11	544.98	30.87	0.00000
Year, MaxHeight, BareGround	11	552.30	38.19	0.00000
Null	2	580.49	66.38	0.00000
Vegetation composition and other variable models				
Year, VOR	8	514.11	0.00	0.99958
Year, VOR, Non/NativeForb	11	530.61	16.50	0.00026
Year, VOR DefIndex	11	531.76	17.65	0.00015
Year, VOR, NonNativeGrass	11	536.49	22.38	0.00001
Year, VOR Brome/NativeGrass, KYBlue/NativeGrass	14	541.30	27.19	0.00000
Year, VOR Northing	11	543.65	29.54	0.00000
Year, VOR Area	11	547.60	33.49	0.00000
Year, VOR Easting	11	552.66	38.55	0.00000

[1]Explanatory variables included Year and the listed covariates. All covariates were included in the candidate models only as interaction terms with year.

Table 7.38. Maximum likelihood parameter estimates (intercepts and slopes for each year) from model with the lowest Akaike Information Criteria (AIC_C; table 7.37) for killdeer (*Charadrius vociferus*) 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.

[SE, standard error; r, model fit; VOR, vertical obstruction reading (decimeters); ln, natural logarithm]

Model parameters					Model fit[1]
Type	Effect	Year	Parameter[2]	SE	r
Intercept	Year	2011	0.85	0.20	0.26
	Year	2012	1.26	0.16	0.35
	Year	2013	0.43	0.17	0.15
Slope	Year × VOR	2011	−0.20	0.09	
	Year × VOR	2012	−0.22	0.05	
	Year × VOR	2013	−0.10	0.06	

[1]Correlation between observed ln(pairs per 100 hectares) and predicted ln(pairs per 100 hectares) for each year.
[2]Parameter estimates are on a log-normal scale.

T. Tree Swallow (*Tachycineta bicolor*)

Table 7.39. Model selection results for candidate sets of models relating vegetation structure and vegetation composition and other variables to breeding densities (pairs per 100 hectares) of tree swallows (*Tachycineta bicolor*) 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. Vegetation structural models were evaluated first, and then vegetation composition and other variables were added to the vegetation structural model with the lowest AIC_C to see if they improved the model fit.

[k, number of parameters considered in the model; AIC_C, Akaike Information Criterion corrected for small samples; ΔAIC_C, difference between the model with the lowest AIC_C and each subsequent model; ω_i, Akaike weights indicating the relative likelihood of each model; VOR, vertical obstruction reading (decimeters); StandDead, cover of standing dead vegetation (percent); BareGround, cover of bare ground (percent); LitDepth, litter depth (centimeters); MaxHeight, maximum vegetation height (centimeters); DefIndex, Defoliation Index; NonNativeGrass, nonnative grass (percent); Non/NativeForb, ratio of nonnative to native forbs (percent); Brome/NativeGrass, ratio of smooth brome (*Bromus inermis*) to native grass (percent); KYBlue/NativeGrass, ratio of Kentucky bluegrass (*Poa pratensis*) to native grass (percent); Easting, eastward-measured distance (kilometers); Northing, northward-measured distance (kilometers); Area, total area surveyed for breeding birds (hectares)]

Variables[1]	k	AIC_C	ΔAIC_C	ω_i
Vegetation structural models				
Year	5	503.86	0.00	0.98803
Year, VOR	8	512.69	8.83	0.01195
Year, MaxHeight	8	526.18	22.32	0.00001
Year, VOR, LitDepth	11	530.46	26.60	0.00000
Year, VOR, BareGround	11	536.61	32.75	0.00000
Year, VOR, StandDead	11	543.08	39.22	0.00000
Null	11	544.40	40.54	0.00000
Year, MaxHeight, LitDepth	2	549.26	45.40	0.00000
Year, MaxHeight, BareGround	11	549.68	45.82	0.00000
Year, MaxHeight, StandDead	11	556.68	52.82	0.00000
Vegetation composition and other variable models				
Year	5	503.86	0.00	0.99903
Year, Non/NativeForb	8	518.20	14.34	0.00077
Year, DefIndex	8	522.33	18.47	0.00010
Year, NonNativeGrass	8	535.94	32.08	0.00000
Year, Brome/NativeGrass, KYBlue/NativeGrass	8	537.30	33.44	0.00000
Year, Area	8	539.14	35.28	0.00000
Year, Northing	11	539.81	35.95	0.00000
Year, Easting	8	543.68	39.82	0.00000

[1]Explanatory variables included Year and the listed covariates. All covariates were included in the candidate models only as interaction terms with year.

Table 7.40. Maximum likelihood parameter estimates (intercepts and slopes for each year) from model with the lowest Akaike Information Criteria (AIC_C; table 7.39) for tree swallows (*Tachycineta bicolor*) 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.

[SE, standard error; r, model fit; NC, not computable; ln, natural logarithm]

Model parameters					Model fit[1]
Type	Effect	Year	Parameter[2]	SE	r
Intercept	Year	2011	0.36	0.09	NC
	Year	2012	0.54	0.08	NC
	Year	2013	0.42	0.08	NC

[1]Correlation between observed ln(pairs per 100 hectares) and predicted ln(pairs per 100 hectares) for each year. NC = Not computable because year is considered a discrete fixed effect.
[2]Parameter estimates are on a log-normal scale.

U. Barn Swallow (*Hirundo rustica*)

Table 7.41. Model selection results for candidate sets of models relating vegetation structure and vegetation composition and other variables to breeding densities (pairs per 100 hectares) of barn swallows (*Hirundo rustica*) 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. Vegetation structural models were evaluated first, and then vegetation composition and other variables were added to the vegetation structural model with the lowest AIC_C to see if they improved the model fit.

[k, number of parameters considered in the model; AIC_C, Akaike Information Criterion corrected for small samples; ΔAIC_C, difference between the model with the lowest AIC_C and each subsequent model; ω_i, Akaike weights indicating the relative likelihood of each model; VOR, vertical obstruction reading (decimeters); StandDead, cover of standing dead vegetation (percent); BareGround, cover of bare ground (percent); LitDepth, litter depth (centimeters); MaxHeight, maximum vegetation height (centimeters); DefIndex, Defoliation Index; NonNativeGrass, nonnative grass (percent); Non/NativeForb, ratio of nonnative to native forbs (percent); Brome/NativeGrass, ratio of smooth brome (*Bromus inermis*) to native grass (percent); KYBlue/NativeGrass, ratio of Kentucky bluegrass (*Poa pratensis*) to native grass (percent); Easting, eastward-measured distance (kilometers); Northing, northward-measured distance (kilometers); Area, total area surveyed for breeding birds (hectares)]

Variables[1]	k	AIC_C	ΔAIC_C	ω_i
Vegetation structural models				
Year	5	510.94	0.00	0.99459
Year, VOR	8	521.37	10.43	0.00541
Year, MaxHeight	8	537.06	26.12	0.00000
Year, VOR, LitDepth	11	538.60	27.66	0.00000
Year, VOR, BareGround	11	544.23	33.29	0.00000
Year, VOR, StandDead	11	545.69	34.75	0.00000
Null	2	551.54	40.60	0.00000
Year, MaxHeight, LitDepth	11	553.49	42.55	0.00000
Year, MaxHeight, BareGround	11	558.24	47.30	0.00000
Year, MaxHeight, StandDead	11	561.22	50.28	0.00000
Vegetation composition and other variable models				
Year	5	510.94	0.00	0.99964
Year, Non/NativeForb	8	527.83	16.89	0.00021
Year, DefIndex	8	528.56	17.62	0.00015
Year, NonNativeGrass	8	542.07	31.13	0.00000
Year, Brome/NativeGrass, KYBlue/NativeGrass	11	543.13	32.19	0.00000
Year, Area	8	545.31	34.37	0.00000
Year, Northing	8	549.79	38.85	0.00000
Year, Easting	8	553.43	42.49	0.00000

[1]Explanatory variables included Year and the listed covariates. All covariates were included in the candidate models only as interaction terms with year.

Table 7.42. Maximum likelihood parameter estimates (intercepts and slopes for each year) from model with the lowest Akaike Information Criteria (AIC_C; table 7.41) for barn swallows (*Hirundo rustica*) 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.

[SE, standard error; r, model fit; NC, not computable; ln, natural logarithm]

Model parameters					Model fit[1]
Type	Effect	Year	Parameter[2]	SE	r
Intercept	Year	2011	0.42	0.10	NC
	Year	2012	0.52	0.08	NC
	Year	2013	0.48	0.08	NC

[1]Correlation between observed ln(pairs per 100 hectares) and predicted ln(pairs per 100 hectares) for each year. NC = Not computable because year is considered a discrete fixed effect.
[2]Parameter estimates are on a log-normal scale.

V. Mourning Dove (*Zenaida macroura*)

Table 7.43. Model selection results for candidate sets of models relating vegetation structure and vegetation composition and other variables to breeding densities (pairs per 100 hectares) of mourning doves (*Zenaida macroura*) 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. Vegetation structural models were evaluated first, and then vegetation composition and other variables were added to the vegetation structural model with the lowest AIC_C to see if they improved the model fit.

[k, number of parameters considered in the model; AIC_C, Akaike Information Criterion corrected for small samples; ΔAIC_C, difference between the model with the lowest AIC_C and each subsequent model; ω_i, Akaike weights indicating the relative likelihood of each model; VOR, vertical obstruction reading (decimeters); StandDead, cover of standing dead vegetation (percent); BareGround, cover of bare ground (percent); LitDepth, litter depth (centimeters); MaxHeight, maximum vegetation height (centimeters); DefIndex, Defoliation Index; NonNativeGrass, nonnative grass (percent); Non/NativeForb, ratio of nonnative to native forbs (percent); Brome/NativeGrass, ratio of smooth brome (*Bromus inermis*) to native grass (percent); KYBlue/NativeGrass, ratio of Kentucky bluegrass (*Poa pratensis*) to native grass (percent); Easting, eastward-measured distance (kilometers); Northing, northward-measured distance (kilometers); Area, total area surveyed for breeding birds (hectares)]

Variables[1]	k	AIC_C	ΔAIC_C	ω_i
Vegetation structural models				
Year	5	446.90	0.00	0.85630
Year, VOR	8	450.47	3.57	0.14369
Year, MaxHeight	8	470.68	23.78	0.00001
Year, VOR, LitDepth	11	471.11	24.21	0.00000
Year, VOR, StandDead	11	476.68	29.78	0.00000
Year, VOR, BareGround	11	480.56	33.66	0.00000
Null	2	481.73	34.83	0.00000
Year, MaxHeight, LitDepth	11	491.28	44.38	0.00000
Year, MaxHeight, StandDead	11	496.72	49.82	0.00000
Year, MaxHeight, BareGround	11	499.66	52.76	0.00000
Vegetation composition and other variable models				
Year	5	446.90	0.00	0.99715
Year, DefIndex	8	459.28	12.38	0.00204
Year, Non/NativeForb	8	461.14	14.24	0.00081
Year, NonNativeGrass	8	479.86	32.96	0.00000
Year, Brome/NativeGrass, KYBlue/NativeGrass	11	483.37	36.47	0.00000
Year, Area	8	483.66	36.76	0.00000
Year, Easting	8	489.35	42.45	0.00000
Year, Northing	8	494.48	47.58	0.00000

[1]Explanatory variables included Year and the listed covariates. All covariates were included in the candidate models only as interaction terms with year.

Table 7.44. Maximum likelihood parameter estimates (intercepts and slopes for each year) from model with the lowest Akaike Information Criteria (AIC_C; table 7.43) for mourning doves (*Zenaida macroura*) 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.

[SE, standard error; r, model fit; NC, not computable; ln, natural logarithm]

Model parameters					Model fit[1]
Type	Effect	Year	Parameter[2]	SE	r
Intercept	Year	2011	0.46	0.08	NC
	Year	2012	0.37	0.07	NC
	Year	2013	0.43	0.07	NC

[1]Correlation between observed ln(pairs per 100 hectares) and predicted ln(pairs per 100 hectares) for each year. NC = Not computable because year is considered a discrete fixed effect.
[2]Parameter estimates are on a log-normal scale.

W. Ring-necked Pheasant (*Phasianus colchicus*)

Table 7.45. Model selection results for candidate sets of models relating vegetation structure and vegetation composition and other variables to breeding densities (pairs per 100 hectares) of ring-necked pheasants (*Phasianus colchicus*) 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. Vegetation structural models were evaluated first, and then vegetation composition and other variables were added to the vegetation structural model with the lowest AIC_C to see if they improved the model fit.

[k, number of parameters considered in the model; AIC_C, Akaike Information Criterion corrected for small samples; ΔAIC_C, difference between the model with the lowest AIC_C and each subsequent model; ω_i, Akaike weights indicating the relative likelihood of each model; VOR, vertical obstruction reading (decimeters); StandDead, cover of standing dead vegetation (percent); BareGround, cover of bare ground (percent); LitDepth, litter depth (centimeters); MaxHeight, maximum vegetation height (centimeters); DefIndex, Defoliation Index; NonNativeGrass, nonnative grass (percent); Non/NativeForb, ratio of nonnative to native forbs (percent); Brome/NativeGrass, ratio of smooth brome (*Bromus inermis*) to native grass (percent); KYBlue/NativeGrass, ratio of Kentucky bluegrass (*Poa pratensis*) to native grass (percent); Easting, eastward-measured distance (kilometers); Northing, northward-measured distance (kilometers); Area, total area surveyed for breeding birds (hectares)]

Variables[1]	k	AIC_C	ΔAIC_C	ω_i
Vegetation structural models				
Year	5	440.92	0.00	0.61648
Year, VOR	8	441.87	0.95	0.38338
Year, MaxHeight	8	457.85	16.93	0.00013
Year, VOR, LitDepth	11	462.37	21.45	0.00001
Year, VOR, StandDead	11	466.15	25.23	0.00000
Year, VOR, BareGround	11	472.29	31.37	0.00000
Year, MaxHeight, LitDepth	11	478.46	37.54	0.00000
Year, MaxHeight, StandDead	11	482.43	41.51	0.00000
Year, MaxHeight, BareGround	11	488.49	47.57	0.00000
Null	2	490.21	49.29	0.00000
Vegetation composition and other variable models				
Year	5	440.92	0.00	0.99976
Year, Non/NativeForb	8	458.48	17.56	0.00015
Year, DefIndex	8	460.88	19.96	0.00005
Year, NonNativeGrass	8	461.87	20.95	0.00003
Year, Northing	8	463.32	22.40	0.00001
Year, Brome/NativeGrass, KYBlue/NativeGrass	11	473.33	32.41	0.00000
Year, Area	8	478.12	37.20	0.00000
Year, Easting	8	481.81	40.89	0.00000

[1]Explanatory variables included Year and the listed covariates. All covariates were included in the candidate models only as interaction terms with year.

Table 7.46. Maximum likelihood parameter estimates (intercepts and slopes for each year) from model with the lowest Akaike Information Criteria (AIC_C; table 7.45) for ring-necked pheasants (*Phasianus colchicus*) 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.

[SE, standard error; r, model fit; NC, not computable; ln, natural logarithm]

Model parameters					Model fit[1]
Type	Effect	Year	Parameter[2]	SE	r
Intercept	Year	2011	0.25	0.08	NC
	Year	2012	0.57	0.07	NC
	Year	2013	0.32	0.07	NC

[1]Correlation between observed ln(pairs per 100 hectares) and predicted ln(pairs per 100 hectares) for each year. NC = Not computable because year is considered a discrete fixed effect.
[2]Parameter estimates are on a log-normal scale.

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*.]