

Appendix S1. Summary of covariate values for models of ferruginous hawk territory re-occupancy.

Table S1A. Summary of numerical covariates used in models of territory re-occupancy by ferruginous hawks in Wyoming, USA, 2011–2013. Provided are units, ranges, means, and standard errors (SE). Sample sizes were $n = 67$ in 2011, and $n = 105$ in 2012 and 2013. Covariates are defined below^a. Categorical covariates are summarized in Table S1B. Covariates *wellpads* and *height* were annually-specific and others were estimated for the study period. Hypotheses are summarized in text.

Covariate	Units	Year								
		2011			2012			2013		
		Range	Mean	SE	Range	Mean	SE	Range	Mean	SE
<i>squirrel</i>	squirrels	0.00–940.71	562.06	38.50	0.00–940.71	578.23	31.14	0.00–940.71	578.23	31.14
<i>leporid</i>	leporids	64.42–99.43	94.07	0.79	64.42–104.10	94.41	0.56	64.42–104.10	94.41	0.56
<i>sage</i>	%	1.45–16.25	8.85	3.22	1.50–16.00	8.90	0.30	1.50–16.00	8.90	0.30
<i>wellpads</i>	wellpads	0–22	2.99	0.74	0–22	5.57	0.54	0–23	5.60	0.55
<i>wellpads₅₀₀</i>	wellpads	0–3	0.27	0.09	0–3	0.21	0.06	0–3	0.21	0.06
<i>gas_road</i>	km	0.00–25.02	3.68	0.78	0.00–25.02	3.11	0.57	0.00–25.02	3.11	0.57
<i>gas_road₅₀₀</i>	km	0.00–8.33	0.69	0.19	0.00–11.10	0.64	0.16	0.00–11.10	0.64	0.16
<i>other_road</i>	km	0.00–13.84	2.65	0.42	0.00–21.31	2.68	0.36	0.00–21.31	2.68	0.36
<i>other_road₅₀₀</i>	km	0.00–13.6	1.05	0.27	0.00–17.49	1.20	0.26	0.00–17.49	1.20	0.26
<i>height</i>	m	0.00–15.24	3.19	0.35	0.00–15.24	3.32	0.26	0.00–15.24	3.21	0.26

^a Subscripts indicate spatial extent of 500-m radius around central nest site; covariates without subscripts refer to the extent of putative territory (1.5-km radius), except *height*, which refers to the most recently used substrate. Covariates are defined as follows: *squirrel*, abundance of ground squirrels (*Urocitellus* spp.); *leporid*, abundance of leporids (*Sylvilagus* spp. and *Lepus townsendii*); *sage*, cover (%) of sagebrush (*Artemisia* spp.); *wellpads*, *wellpads₅₀₀*, number of active oil and gas well pads; *gas_road*, *gas_road₅₀₀*, length (km) of roads associated with oil and gas fields; *other_road*, *other_road₅₀₀*, length (km) of other improved roads; *height*, height (m) of nest substrate.

Table S1B. Number of ferruginous hawk breeding territories in categories of nest substrates predicted to influence detection and re-occupancy probabilities in Wyoming, USA, 2011–2013. We defined 3 covariate groups to predict re-occupancy probability: *ground*, ground nests; *natural*, natural elevated structures; *ANS*, artificial nest structures; and 4 groups for detection probability based on Ayers and Anderson (1999): *nest1*, rock pile without shrubs, exposed soil hill, rock pedestal, cliff-spur tip; *nest2*, cliff side, ground with sparse or no shrubs; *nest3*, lone tree, artificial nest platform, other anthropogenic structure; and *nest4*, tree groves, rock pile with shrubs. These counts reflect the most recently used substrate in a territory. Hypotheses are summarized in text.

Covariate Levels	Year		
	2011	2012	2013
<i>ground</i>	16	22	23
<i>natural</i>	32	55	55
<i>ANS</i>	19	28	27
<i>nest1</i>	29	29	29
<i>nest2</i>	10	10	10
<i>nest3</i>	56	56	56
<i>nest4</i>	10	10	10

Table S1C. Number of ferruginous hawk breeding territories in townships stratified by number of active oil and natural gas wells in Wyoming, USA, 2011–2013. To ensure our sample represented the range of oil and gas development intensity across Wyoming, we stratified our study area by 3 densities of active oil and natural gas wells per township (none: 0 wells; low: 1–30 wells; and high: ≥ 31 wells). Stratified nest surveys were conducted during 2010 and 2011, and we monitored re-occupancy of the resulting sample of breeding territories during 2011–2013. A township is an approximately square, 93.3 km² area delineated by the U.S. Public Land Survey System.

Well density stratum	Year		
	2011	2012	2013
None (0 wells)	30	46	46
Low (1–30 wells)	16	29	29
High (≥ 31 wells)	21	30	30