Supplementary Material

Appendix A – Bison removal year as a variable in the GLM spatial analysis

A bison round-up occurs in Elk Island National Park each year, alternating between the north and south sides of the park. Bison handling takes place during winter, typically during January or February, during which time bison are attracted to and held at the handling facility. Based on current population numbers, some bison are removed from the park (i.e., translocated), and the rest of the bison are later released back onto the landscape. We classified each season of each year with the binary covariate for bison removal year (BRY), with 1 indicating a bison removal year, and 0 indicating a non-removal year. Elk Island National Park north and south were classified separately because bison removal alternates between the two parks. The winter during which bison removal occurs, as well as the subsequent summer and fall, were assigned a 1 for bison removal year.

**Table A.1** Bison removal year by site, management year, and season. Bison removal occurs each year in winter, alternating between Elk Island National Park north (EINP north) and south (EINP south). A management year starts April 1 and ends the following March 31. Each management year was divided into three seasons: summer (April-August), fall (September-November), and winter (December-March).

|  |  |  |  |
| --- | --- | --- | --- |
| Site | Management Year | Season | Bison Removal Year |
| EINP north | 2016 | winter | 1 |
| EINP north | 2017 | summer | 1 |
| EINP north | 2017 | fall | 1 |
| EINP north | 2017 | winter | 0 |
| EINP north | 2018 | summer | 0 |
| EINP north | 2018 | fall | 0 |
| EINP north | 2018 | winter | 1 |
| EINP north | 2019 | summer | 1 |
| EINP north | 2019 | fall | 1 |
| EINP north | 2019 | winter | 0 |
| EINP north | 2020 | summer | 0 |
| EINP south | 2016 | winter | 0 |
| EINP south | 2017 | summer | 0 |
| EINP south | 2017 | fall | 0 |
| EINP south | 2017 | winter | 1 |
| EINP south | 2018 | summer | 1 |
| EINP south | 2018 | fall | 1 |
| EINP south | 2018 | winter | 0 |
| EINP south | 2019 | summer | 0 |
| EINP south | 2019 | fall | 0 |
| EINP south | 2019 | winter | 1 |
| EINP south | 2020 | summer | 1 |

Appendix B – Candidate model sets

**Table B.1** Candidate model set to evaluate bison space use in Elk Island National Park. Each model includes an offset for the log number of camera trap days, and a random effect of camera trap location. All continuous covariates were scaled and centered.

|  |  |
| --- | --- |
| Model Name | Variables\* |
| Model 0 | Null |
| Model 1 | open |
| Model 2 | LFD |
| Model 3 | BRY |
| Model 4 | open + FED |
| Model 5 | open + LFD |
| Model 6 | open + DW |
| Model 7 | open + elk |
| Model 8 | open + BRY |
| Model 9 | open + FED +elk |
| Model 10 | open + LFD + elk |
| Model 11 | open + DW + elk |
| Model 12 | open + BRY +elk |
| Model 13 | open + DW + DW2 |
| Model 14 | open + DW + DW2 + elk |

\*open = proportion open, LFD = linear feature density, BRY = bison removal year, FED = forest edge density, DW= distance to water, elk = elk abundance

**Table B.2** Candidate model set to evaluate elk space use in Elk Island National Park. Each model includes an offset for the log number of camera trap days, and a random effect of camera trap location. All continuous covariates were scaled and centered.

|  |  |
| --- | --- |
| Model Name | Variables\* |
| Model 0 | Null |
| Model 1 | LFD |
| Model 2 | FED |
| Model 3 | open |
| Model 4 | bison |
| Model 5 | LFD + DW |
| Model 6 | LFD + open |
| Model 7 | LFD + FED |
| Model 8 | LFD + bison |
| Model 9 | LFD + bison + BRY |
| Model 10 | open + DW |
| Model 11 | open + FED |
| Model 12 | open + bison |
| Model 13 | open + bison + BRY |
| Model 14 | LFD + DW + bison |
| Model 15 | LFD + open + bison |
| Model 16 | LFD + FED + bison |
| Model 17 | LFD + DW + DW2 |
| Model 18 | open + DW + DW2 |
| Model 19 | LFD + DW + DW2 + bison |

\* LFD = linear feature density, FED = forest edge density, open = proportion open, bison = bison presence/absence, DW= distance to water, BRY = bison removal year

Appendix C – Beta coefficients from top models

**Table C.1** Parameter estimates from best bison and elk spatial models for summer, fall, and winter in Elk Island National Park. All beta estimates were significant, except for bison removal year in the fall elk model (95% confidence interval overlapped 0).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Species** | **Season** | **Variable** | **β** | **SE** |
| Bison | Summer | Proportion open | 0.982 | 0.305 |
| Distance to water | 0.945 | 0.308 |
| Fall | Proportion open | 0.998 | 0.348 |
| Distance to water | 1.422 | 0.379 |
| Winter | Proportion open | 0.976 | 0.299 |
| Bison removal year | -0.626 | 0.209 |
| Elk | Summer | Linear feature density | -0.606 | 0.113 |
| Fall | Linear feature density | -0.617 | 0.148 |
| Bison | 0.514 | 0.193 |
| Bison removal year | 0.16 | 0.137 |
| Winter | Linear feature density | -0.312 | 0.098 |
| Distance to water | 0.227 | 0.098 |
| Bison | 0.442 | 0.164 |