PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM (PRRIP -or- Program)

TO: Technical Advisory Committee (TAC)
FROM: Collaborative Research Group – Whooping Crane (WC) Diurnal Selection
RE: **Reevaluation of WC Diurnal Selection - WEST and Ecotope research**
DATE: April 15, 2024

Context

During the First Increment, whooping crane connections to wet meadows within the central Platte River valley (CPRV) were investigated in a diurnal (daytime) use analysis conducted by WEST Inc. (Howlin and Nasman, 2017; WEST Report). This analysis concluded cranes selected river channel over corn and corn over wet meadows. A recent paper was published in *Avian Conservation and Ecology* (Baasch et al., 2022; Ecotope Article) that also conducted a diurnal use analysis for whooping cranes within the CPRV. The Ecotope analysis utilized a finer scale landcover layer that separated upland, wet prairie (i.e., ridges) and wetland (meadow marsh; i.e., swales) components of wet meadows. Results indicated whooping cranes selection increased as meadow marsh increased in grasslands and wetlands increased in agricultural fields. Thus, the two studies came to opposing conclusions on whooping crane selection of wet meadows as diurnal use sites. The Ecotope Article determined the lack of selection for wet meadows in the WEST Report might have been due to its broad definition of wet meadows that included upland and wetland components.

Onboarding Process

Working through PRRIP committee structure

These differing conclusions about wet meadows led to a discussion at the Technical Advisory Committee (TAC) meeting in April 2023 (April 2023 TAC minutes, pg. 11) to clarify how the Ecotope Article was conducted. The TAC then discussed major differences between the methods of the two studies at the July 2023 meeting (July 2023 TAC minutes, pg. 13). As a product of these discussions, the TAC generated a memorandum for the Governance Committee (GC) that summarized divergent methods utilized by each research effort and provided recommendations for incorporating information within the Ecotope Article into Program science and exploring methodological differences that could have resulted in divergent conclusions (September 2023 GC memo). Specifically, the TAC made the following recommendations:

- Integrate the finer scale landcover classification data used in the Ecotope Article into ongoing WC habitat analysis efforts (e.g., riverine roost site selection). The TAC sees no risk in using the refined classifications in Program analyses as they can be rolled-up or generalized to match old classifications if necessary.
- Re-run the WEST Report diurnal use analysis substituting the finer-scale Ecotope landcover classes in place of PRRIP landcover classes. This would clarify whether different findings are the result of landcover classes or other differences in WC use data, analysis methodology, etc..
- Use the results of all relevant science in combination with the recently completed evaluation of wet meadow hydrology to refine land management plans **if** warranted.

At the September 2023 meeting, the GC approved a re-run the WEST analysis using the finer-scale Ecotope landcover classes.

Bringing the research closer together

The Executive Director's Office (Patrick Farrell, Jason Bruggeman, and Malinda Henry) and authors of the Ecotope Article (Dave Baasch, Matt Rabbe, and Andrew Caven) worked collaboratively to incrementally adjust methods used in both the WEST and Ecotope analyses to bring them closer together and evaluate how each methodological difference may or may not have contributed to divergent conclusions.

To evaluate how integration of finer-scale wetland landcover features may have affected results:

1. the WEST analysis was re-run with the Ecotope landcover.

To evaluate how omission of riverine diurnal use locations may have affected results:

2. the WEST analysis was re-run without riverine use locations (using original landcover).

To evaluate how both above methodological changes may have affected results:

3. the WEST analysis was re-run without riverine use locations using the Ecotope landcover.

To evaluate how comparing whooping crane use sites to nearby available habitat may have affected results:

4. the Ecotope analysis was re-run with available locations constrained within 6.8 km of the associated whooping crane use site in a discrete-choice analytical framework.

Identifying agreed upon conclusions and remaining uncertainties

Once the modified analyses were performed, the EDO and Ecotope authors independently reviewed results (see results from analyses in Appendix A) and provided their interpretations. Review of independent evaluations revealed that both groups were in full agreement about how the above changes to methods did or did not change results compared to original analyses. Based upon interpretations across all four modified analyses, the group also provided a jointly agreed upon understanding about why the two original studies came to different conclusions about the selection of wet meadows by whooping cranes.

Jointly Agreed Upon Interpretations

Interpretations for each analysis step were as follows:

1. Substituting the Ecotope landcover into the WEST analysis DID NOT change the results relative to the selection of wet meadows. WC selected river and agriculture (cropland) more than availability and selected wet meadows/meadow marsh less than availability.
2. Eliminating riverine locations and re-running the WEST analysis also DID NOT result in finding wet meadows/meadow marsh to be selected for, but DID result in an increase in the selection of agriculture.
3. Substituting the Ecotope landcover into the WEST analysis and removing riverine locations DID NOT change the results relative to the selection of wet meadows. WC selected agriculture (cropland) more than availability and selected wet meadows/meadow marsh less than availability.
4. Re-running the Ecotope analysis with local available locations (within 6.8 km of use location) DID change the results relative to the selection of wet meadows. At that scale of availability, WC selection DID NOT increase with an increasing proportion of wet meadow/meadow marsh, rather, WC selection of wet meadows/meadow marsh was proportionate to its availability.

Why did the two studies come to different conclusions?

The analysis framework used, discrete choice (i.e., comparing use locations to available locations nearby) versus logistic regression (comparing use locations to available locations throughout the AHR), resulted in divergent conclusions about the importance of wet meadows for whooping cranes within the CPRV.

Remaining Uncertainties and Additional Discussion from Ecotope Authors

1. If WC's are not detected from the plane in a meadow (less likely given the river focus and time of day they use meadows), they are much less likely to get detected/re-sighted by the ground crews. Wet meadow sightings are most common between 10AM-3PM. This limitation could be a significant detection bias as it is much easier to find WC's in a corn field where there are nearby roads than in many of the wet meadows. Vegetation height, topography, and accessibility make wet meadows challenging to compare detection probabilities apples to apples.
2. The public sightings dataset was collected in a different way and has different data. Those differences in data affect analysis 1-3, but not 4.
3. Modification of the "available" data point choice set appears to have played a large role. While this is biologically justifiable, it is not always applicable as WC's along the Platte during early spring migration when sandhill crane numbers are high appear to travel longer distances and move roosts more frequently. The difference in choice set appears to have been the primary difference in #4.
4. All models are wrong and some are useful but my primary concern for evaluating importance of wet meadows to whooping cranes using use vs. availability is it fails to consider biological factors important to whooping crane physiology that may differ between ag use and wet meadows. Corn provides high energy carbohydrates needed for migration but zero protein, and zero calcium/minerals used for things like egg production. Protein and other minerals are acquired from animal matter that are present in habitats such as wet meadows. PRRIP monitoring (contributed to many locations in PRRIP and USFWS database) was heavily weighted on the amount of time spent in particular habitats and accessibility to monitor in those habitats. Spending (as an example) 90% of their time in corn to acquire the necessary carbohydrates, and 10% of their time in wet meadows to acquire necessary animal matter does not equate to corn being 90% more important. Regardless of time spent in different habitats, USFWS considers WC use of wet meadows important; we have routine use of them by WC's every year, and occasionally significant use, such as 2024.
5. There is uncertainty in the location of use sites in the FWS database and PRRIP's data and this could have led to differences in results between the two models. Although the difference in the estimated and true location of use was generally less in the PRRIP database, even differences of 10-20 meters could, and likely did place whooping cranes in a different landcover type; especially when locations were near/within narrow wetland agricultural bands present in the Ecotope landcover layer.

APPENDIX A
Reevaluation of WC Diurnal Selection – Results of Analyses

1 - WEST analysis with the Ecotope landcover

Data Changes

- Original WEST Analysis have 478 diurnal use/available location choice sets.
    - 478 diurnal use locations
    - 23,900 available locations
- For this update, 32 use and 1,600 available locations associated with those diurnal use locations were excluded due to diurnal use locations occurring outside of the boundary of the Ecotope landcover.
- Also excluded 382 available locations of choice sets where the use location occurred within the boundary of the Ecotope landcover, but the individual available location occurred outside of the boundary.
- WEST Analysis 1: 446 diurnal use locations and 21,918 available locations

Top Model

Model 15 = Landcover + Nearest Obstruction + Nearest Disturbance + Proximity to Roost Location

Results

Landcover

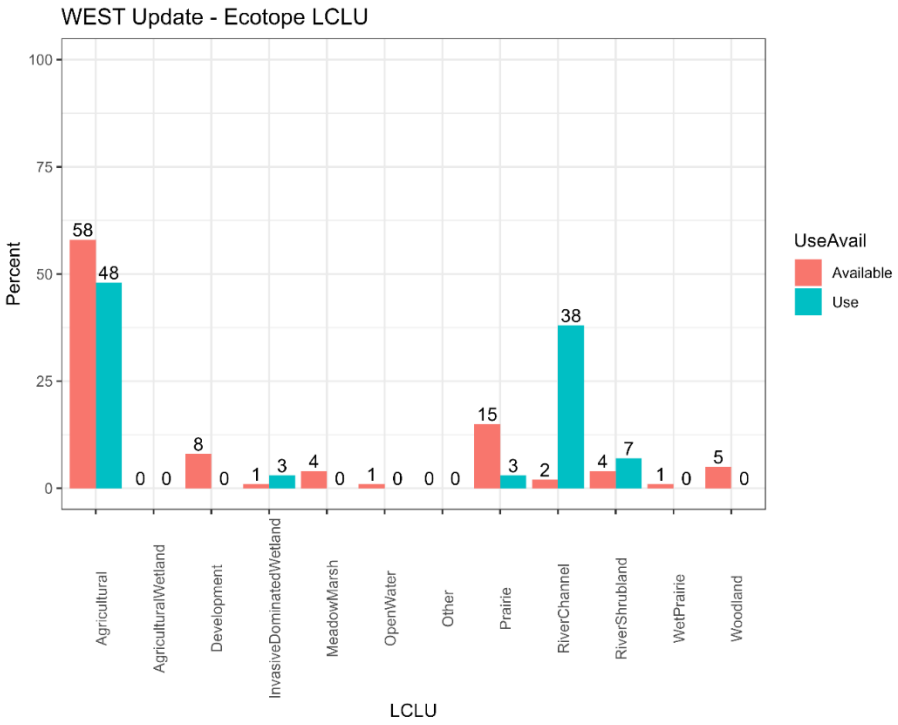

Figure 1. Percent of use (blue) and available (red) diurnal locations in each landcover (LCLU) class from the finer scale landcover classification within the Associated Habitat Reach (AHR).

Other Variables

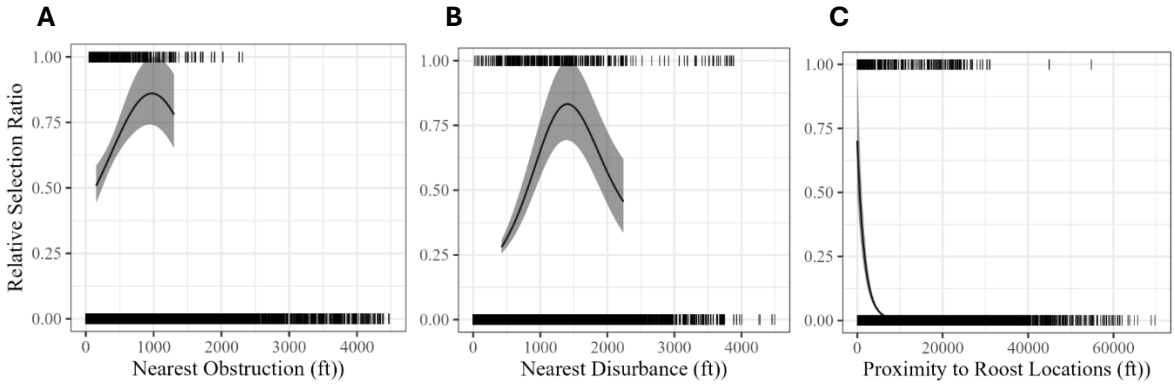

Figure 2A-C. Relative selection ratios for nearest obstruction (A), nearest disturbance (B), and proximity to roost location (C) based on diurnal use locations in the AHR. The solid lines represent the average relationships between the 5th and 95th percentile of each variable at use locations, while the shaded area represent the 90% confidence interval. Tick marks at y=1 show values of explanatory variables at use and ticks at y=0 show available location values.

2 - WEST analysis without riverine locations (original analysis landcover)

Data Changes

- Original WEST Analysis have 478 diurnal use/available location choice sets.
    - 478 diurnal use locations
    - 23,900 available locations
- For this update, 32 use and 1,600 available locations associated with those diurnal use locations were excluded due to diurnal use locations occurring outside of the boundary of the Ecotope landcover.
- Also excluded 382 available locations of choice sets where use occurred within the boundary of the Ecotope landcover, but the individual available location occurred outside of the boundary.
- Then eliminated all riverine locations, excluding an additional 218 diurnal use locations and associated available locations.
- WEST Analysis 2: 228 diurnal use locations and 9,936 available locations

Top Model

Model 15 = Landcover + Nearest Obstruction + Nearest Disturbance + Proximity to Roost Location

Results

Landcover

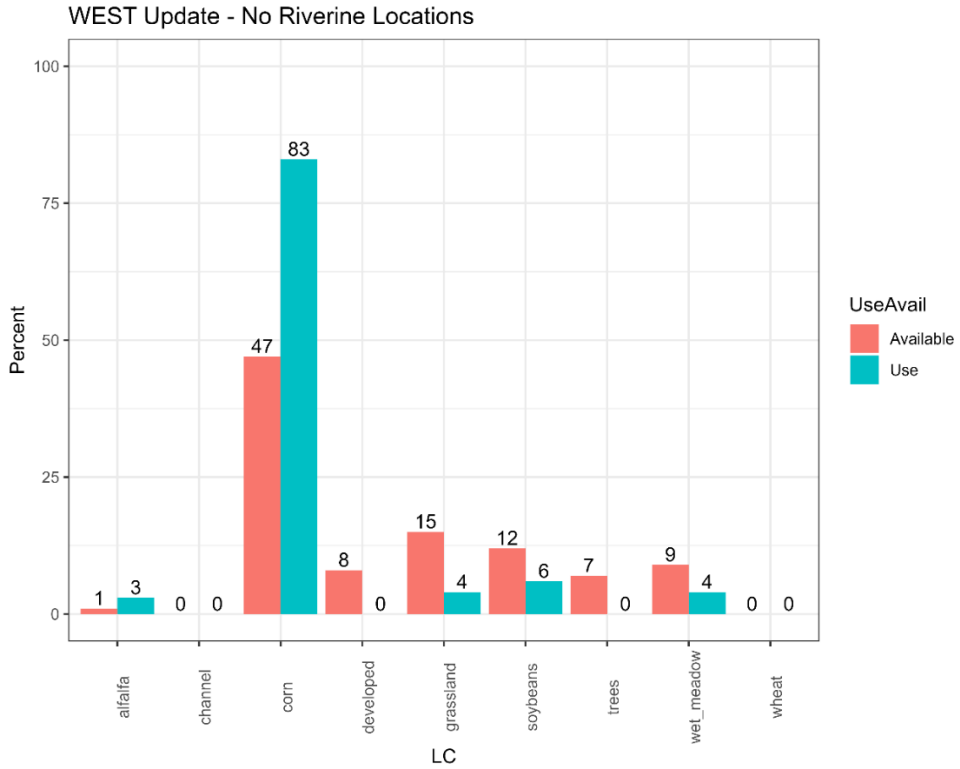

Figure 3. Percent of off-channel use (blue) and available (red) diurnal locations in each landcover type, from the original landcover classification used in the WEST analysis, within the AHR.

Other Variables

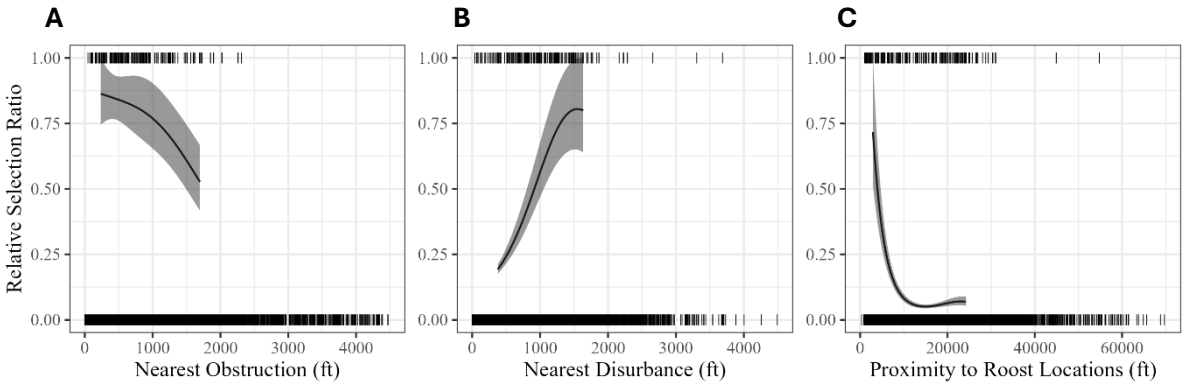

Figure 4 A-C. Relative selection ratios for nearest obstruction (A), nearest disturbance (B), and proximity to roost location (C) based on off-channel, diurnal use locations in the AHR. The solid lines represent the average relationships between the 5th and 95th percentile of each variable at use locations, while the shaded area represent the 90% confidence interval. Tick marks at y=1 show values of explanatory variables at use and ticks at y=0 show available location values.

3 - WEST analysis without riverine locations using Ecotope landcover

Data Changes

- Original WEST Analysis have 478 diurnal use/available location choice sets.
    - 478 diurnal use locations
    - 23,900 available locations
- For this update, 32 use and 1,600 available locations associated with those diurnal use locations were excluded due to diurnal use locations occurring outside of the boundary of the Ecotope landcover.
- Also excluded 382 available locations of choice sets where use occurred within the boundary of the Ecotope landcover, but the individual available location occurred outside of the boundary.
- Then eliminated all riverine locations, excluding an additional 218 diurnal use locations and associated available locations.
- WEST Analysis 3: 228 diurnal use locations and 9,936 available locations

Top Model

Model 15 = Landcover + Nearest Obstruction + Nearest Disturbance + Proximity to Roost Location

Results

Landcover

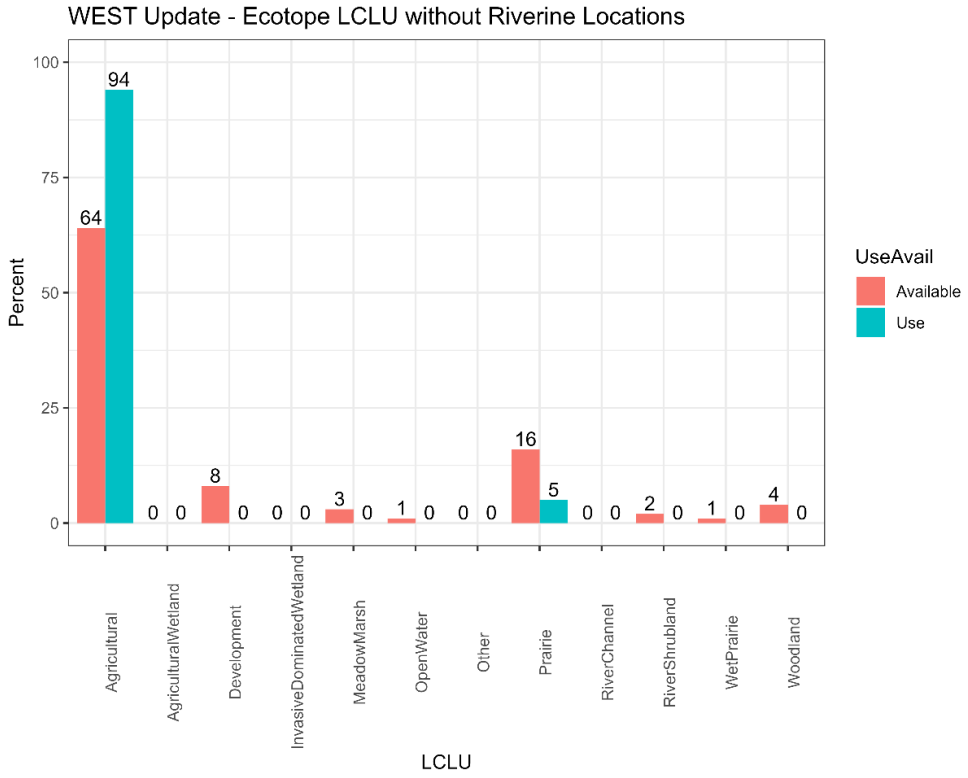

Figure 5. Percent of off-channel use (blue) and available (red) diurnal locations in each landcover (LCLU) type, from the finer scale landcover classification, within the AHR.

Other Variables

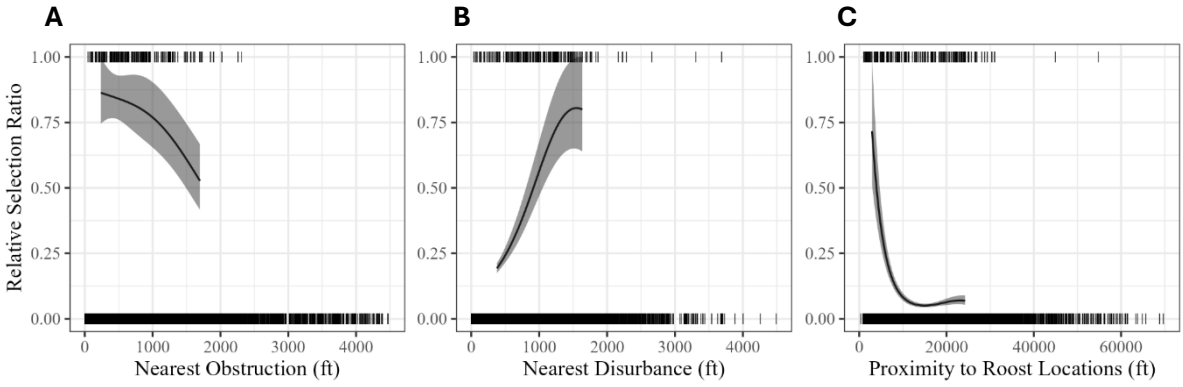

Figure 6A-C. Relative selection ratios for nearest obstruction (A), nearest disturbance (B), and proximity to roost location (C) based on off-channel, diurnal use locations in the AHR. The solid lines represent the average relationships between the 5th and 95th percentile of each variable at use locations, while the shaded area represent the 90% confidence interval. Tick marks at y=1 show values of explanatory variables at use and ticks at y=0 show available location values.

4 - Ecotope analysis with constrained available locations (6.8 km) in a discrete-choice framework

Data Changes

- For each diurnal use location, 25 available locations were generated within 6.8 km.
- Ran model in a discrete choice framework with a general additive model, same as the WEST analysis.

Top Model

WC1000l1 = AgWetland1000 + MeadowMarsh1000 + OpenWater1000 + Prairie1000 + River1000 + WetPrairie1000 + Wood1000 + Dev1000 + RoadDist + LandcovClass + PopCat

Results

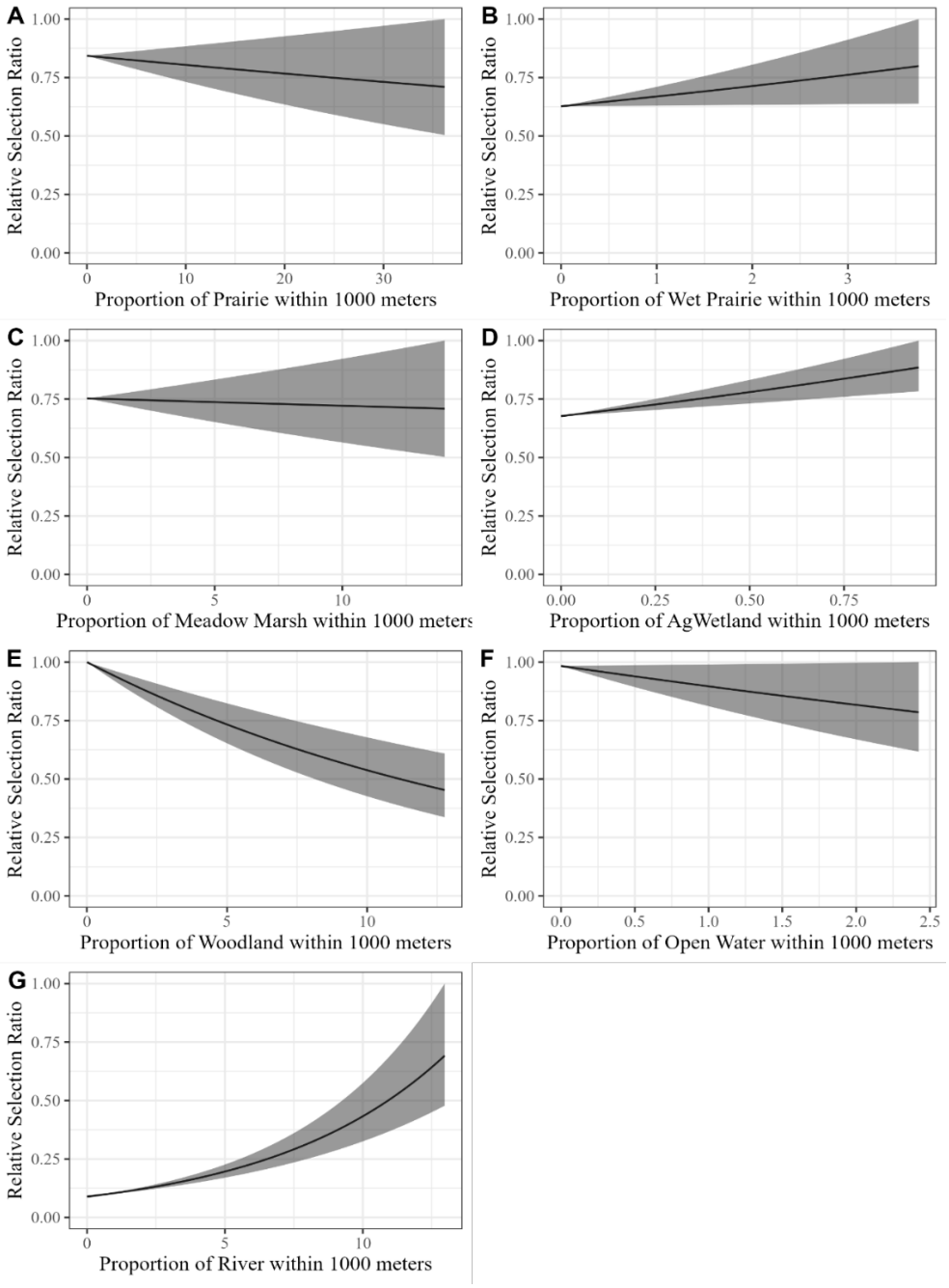

Figure 7 A-G. Relative selection ratios for the proportion of prairie (A), wet prairie (B), meadow marsh (C), agricultural wetlands (AgWetland; D), woodland (E), open water (F), and river (G) within 1000 m based on off-channel, diurnal use locations in the AHR from the Ecotope Article. The solid lines represent the average relationships between the 5th and 95th percentile of each variable at use locations, while the shaded area represent the 90% confidence interval. Tick marks at y=1 show values of explanatory variables at use and ticks at y=0 show available location values.

Variable Importance

Table 1. The deviance explained (DV) by the top diurnal selection model compared to DV of models with explanatory variables withheld to assess variable importance to model fit.

Model	Withheld Variable	DV	Percent Decrease
WC1000l1		11.09	
WC1000l1_MinusRiver	River1000	6.74	39.22
WC1000l1_MinusWood	Wood1000	10.13	8.61
WC1000l1_MinusDev	Dev1000	10.38	6.41
WC1000l1_MinusRoadDist	RoadDist	10.6	4.37
WC1000l1_MinusAgWetland	AgWetland1000	10.64	4.05
WC1000l1_MinusOpenWater	OpenWater1000	10.94	1.37
WC1000l1_MinusWetPrairie	WetPrairie1000	10.94	1.33
WC1000l1_MinusPrairie	Prairie1000	11.07	0.22
WC1000l1_MinusMeadowMarsh	MeadowMarsh1000	11.09	0.003