



TO: PRRIP TECHNICAL ADVISORY COMMITTEE
FROM: EXECUTIVE DIRECTOR'S OFFICE
SUBJECT: WEST/ECOTOPE PUBLICATION OUTLINE
DATE: APRIL 14, 2025

The EDO is requesting TAC review of the proposed framework for publication. The objective of the publication is to document the process the Program has undergone to:

- onboard, better understand and synthesize results from the ECOTOPE article together with those produced by the WEST report, Wet Meadow Hydrology Study, and the updated Roost Site Selection analysis;
- address non-consensus interpretations of the importance of wet meadows along the central Platte River for whooping cranes;
- make wet meadows policy decisions and adjust management of Program wet meadows/grasslands to promote overall ecological health and to benefit other species of concern.

Specifically, the EDO requests TAC discussion and feedback on:

- the objective of the publication;
- the content and intended direction;
- the value as a Program publication; and
- collaborative writing and co-authorship by TAC members and ECOTOPE authors.

I. INTRODUCTION

Conflicting science outcomes

- A. Scientific process relies upon testing diverse hypotheses, reducing likelihood of one explanation while mounting support for another.
- B. Synthesis of non-aligned results for broader understanding of complex problems
- C. Utilization of divergent science by decision makers and practitioners

Introduction to PRRIP

- A. Program purpose
- B. Stakeholder structure (broad range of priorities and values)
- C. Adaptive management (science directed to test alternative management strategies)

WEST Report

- A. Background on WEST study
 - i. question - methods- result
 - ii. management decision to deprioritize off-channel wet meadow habitat to focus management efforts toward on-channel habitat creation and maintenance



ECOTOPE Article

- A. Background on ECOTOPE study
 - i. question – H: PRRIP definition of wet meadow – methods – result
 - ii. predicted gains in whooping crane use
 - iii. management recommendations

Purpose of publication

- A. Document PRRIP’s approach for onboarding relevant research
 - i. identify divergence in methods
 - ii. investigate their impact on outcome
 - iii. synthesize information gleaned for decision makers
- B. Report how PRRIP decision-makers integrated that information, along with results from parallel studies, to decide whether PRRIP land management practices should change, and if so, how
- C. Document support for shifts in Program science and management of wet meadows/grasslands

II. METHODS AND RESULTS

Compare and contrast methods

- A. The EDO worked to identify methodological differences that may have had an influence on the outcome of the analysis itself or the interpretation of those results. These differences are concisely described in **Figure 1**, and included differences in:
 - i. landcover types,
 - ii. exclusion/inclusion of diurnal use within river channels,
 - iii. use location data source,
 - iv. available points,
 - v. temporal scales.

Bringing the research closer together

- A. The Executive Director’s Office and authors of the ECOTOPE article 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:

- i. the WEST analysis was re-run with the ECOTOPE landcover.

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

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

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

- iii. 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:



- iv. 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.

Step 1: WEST analysis with ECOTOPE landcover

A. Methods

- i. Explanatory variables
- ii. WC Response dataset
- iii. Analytical framework
- iv. Model selection

B. Results (Figures 1-3)

- i. Top model
- ii. Selection results

Step 2: WEST analysis without riverine locations (original WEST analysis landcover)

A. Methods

- i. WC Response dataset

B. Results (Figures 1-3)

- i. Top model
- ii. Selection results

Step 3: WEST analysis without riverine locations using ECOTOPE landcover

A. Methods

- i. Explanatory variables
- ii. WC Response dataset

B. Results (Figures 1-3)

- i. Top model
- ii. Selection results

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

A. Methods

- i. Explanatory variables
- ii. WC Response dataset
- iii. Analytical framework
- iv. Model selection

B. Results (Figures 1 and 4; Table 1)

- i. Top model
- ii. Selection results
- iii. Relative importance of explanatory variables

III. IDENTIFYING AGREED UPON CONCLUSIONS AND REMAINING UNCERTAINTIES

Once the modified analyses were performed, the EDO and ECOTOPE authors independently reviewed results 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 (Figure 1)

- A. Interpretations for each analysis step were as follows:
 - i. 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.
 - ii. 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.
 - iii. 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.
 - iv. 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.
- B. 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

- A. Additional discussion by ECOTOPE authors – brief summary with full text in **Supplemental Information**
- B. Remaining lack of consensus and consistency in interpretation of WC use of AHR wet meadows
 - i. “The EDO has presented to the GC several times about the discrepancy in interpretation of whooping crane (WHCR) use of wet meadows as well as the variability seen in what is classified as a wet meadow. Regardless of these discrepancies and lack of consensus on how to interpret results, the TAC is in agreement that additional research related to wet meadows and WHCR use of wet meadows to resolve these issues will likely be unproductive and unnecessary.”
 - ii. “The TAC believes that due to lower than anticipated documented WHCR use of Program grasslands/wet meadows, the Program should shift management practices to provide for better overall ecological health and to benefit other species of concern, while still providing suitable whooping crane habitat during certain times.”



IV. DISCUSSION

Utility of the process

- A. Documented process for onboarding science external but directly relevant to PRRIP including identifying methods and products to incorporate into PRRIP science.
- B. Comparison of methods and interpretations, investigation of those discrepancies for impact on outcome, concise summarization of learning from the process for decision-makers.
- C. Integration of parallel studies:
 - i. WC Riverine Roost Site Selection (no selection for surrounding landcover, except development when selecting riverine roost sites)
 - ii. Wet Meadow Hydrology Study (conditions supporting wet meadow hydrology and vegetation are highly dependent upon topography in relation to riverbed, hard to create, very little available across the AHR, highly unlikely to support wet meadows on western end of reach, unique topography even limited to a few unique remnants on eastern end).
- D. Improved decision-maker understanding of non-consensus issue
 - i. How important are wet meadows along the central Platte River for WC diurnal use?
 - ii. How available are wet meadows, and how feasible are efforts to create/restore wet meadows?
- E. Development of a consensus plan for moving forward that integrates information generated by the Program, other relevant sources, and learning from the onboarding process.
- F. TAC/LAC consensus on Wet Meadow/Grassland Protection and Management Recommendations
- G. GC adoption of recommendations

V. PROGRAM SCIENCE AND MANAGEMENT IMPLICATIONS

Halt wet meadow research

- A. Wrapping up wet meadow hydrology study for publication
- B. Decommissioning groundwater monitoring wells in PRRIP managed wet meadows.
- C. Continued systematic monitoring of WC use of on- and off-channel habitat including Program managed wet meadows –

Retain Program definition of wet meadows

Retain Program wet meadow/grassland land holdings

- A. Continue to manage off-channel palustrine wetlands for WC (filling those with pumping capabilities during WC migratory seasons).

Improving on Program's management of wet meadow/grasslands

- A. General land management framework for PRRIP wet meadow/grasslands
- B. Grassland management working group tract specific management planning
 - i. Cottonwood Ranch Complex
 - ii. Shoemaker Island Complex (Binfield)



- C. Resulting changes in number of Program grazing leases, annual acres available, grazing income, etc.

Prioritize riverine habitats over creating additional wet meadows mechanically

- A. Future management decisions should prioritize preserving and improving riverine habitats with Program water and direct future efforts away from mechanically creating/improving ponding in wet meadows/grasslands.
- B. Program Science (EBQs) focus on gathering information on how much water, when, and how to support riverine habitat and provide benefits to target species.



WEST Report Howlin, S., and K. Nasman. 2017. Correlates of Whooping Crane habitat selection and trends in use in the Central Platte River, Nebraska. Prepared for the Platte River Recovery Implementation Program. Western EcoSystems Technology, Inc., Cheyenne, Wyoming, USA, 140 pp.	Stepwise Approach to Understanding Impacts of Methodological Differences on Conclusions				ECOTOPE Article Baasch, D., Caven, A., Jorgensen, J., Grosse, R., Rabbe, M., Varner, D., & LaGrange, T. (2022). Whooping Crane (Grus americana) use patterns in relation to an ecotone classification in the Central Platte River Valley, Nebraska, USA. Avian Conservation and Ecology, 17(2).
Explanatory Variables - Nearest obstruction, nearest disturbance, proximity to roost location, landcover at WC point location Landcover classes - Corn, alfalfa, soybeans, wheat, channel, developed, grassland, trees, palustrine wetlands, wet meadow Landcover Products - USFWS-Rainwater Basin Joint Venture GIS product for PRRIP, compilation of agricultural crop information from USDA National Agricultural Statistics Service 2012 Nebraska Cropland Data Layer (CDL, Boryan et al. 2011) with field boundaries from USDA Farm Service Agency Common Land Unit (CLU) + Brei and Bishop 2008	Step 1: WEST analysis with ECOTOPE landcover*	No change in WEST conclusion about importance of wet meadows for WC diurnal use. WC select for river and agriculture and use wet meadows less than availability predicts.			Explanatory Variables - Distance to nearest paved road, population density within a 2.6 km ² area, proportional landcover within 400 or 1000m of WC location Landcover Classes - Agricultural, agricultural wetland, development, invasive dominated wetland, meadow marsh, open water, other, prairie, wet prairie, river channel, shrubland, woodland Landcover Products - Brei and Bishop 2008 + National Wetlands Inventory Project (NWI) information + flooding frequency data from USDA-NRCS
WC Response Dataset - WC use locations - PRRIP systematic aerial monitoring protocol fall 2002 to spring 2013. WC use locations limited to systematically detected WC groups with continuous observation data. Continuous data subsampled to include 1 roost location per crane group per day. Diurnal observations determined to be independent if separated by 2.5 hrs. Multiple observations weighted by length of time WC group spent in land cover type. 347 spring observations and 131 fall observations (478 total). Available locations - 50 random locations per use location distributed within a radius of 3 miles from each use location (use/available linked).	Step 2: WEST analysis excluding riverine locations*	No change in WEST conclusion about importance of wet meadows for WC diurnal use. WC select for agriculture and use wet meadows less than availability predicts.			WC Response Dataset - WC use locations - USFWS public sightings database (includes PRRIP dataset) & telemetry-marked crane locations from 1995-2015. Dataset limited to locations >10 m outside high banks of any river channel. Included 306 public sightings and 41 telemetry-marked locations (347 total). Available locations - 20 available locations per use location distributed randomly throughout the AHR (use/available not linked).
Landcover Products - Brei and Bishop 2008 + National Wetlands Inventory Project (NWI) information + flooding frequency data from USDA-NRCS WC Response Dataset - Use and available locations limited by extent of Ecotone landcover + all riverine use locations and associated available locations eliminated.	Step 3: WEST analysis with ECOTOPE landcover + excluding riverine locations*	No change in WEST conclusion about importance of wet meadows for WC diurnal use. WC select for agriculture and use wet meadows less than availability predicts.			
Analytical Framework - Discrete choice method of RSF estimation to incorporate changing availability at temporal and spatial scales. Accounts for changing habitat conditions while modeling the underlying relationships between selection and predictor variables. Use-availability likelihood using penalized regression splines to approximate functional response within a General Additive Model (GAM) framework.		Change in ECOTOPE conclusion about wet meadows for WC diurnal use. No selection for wet meadows in proportion to their availability.	Step 4: ECOTOPE WC use dataset and explanatory variables, but with available locations constrained within 6.8 km of use locations in a discrete-choice, GAM framework*		Analytical Framework - Use-availability likelihood using binomial family Generalized Linear Mixed-Effects Models (GLMM).
Results - Full model with all 4 covariates was most likely. Model contained effects of nearest obstruction, nearest disturbance, proximity to roosting location and land cover. Selection ratios increased with distance to nearest disturbance (highest = 1,339 ft). Parametric function for nearest obstruction was not statistically significant. Selection ratio decreased with increasing distance from roost location. Relative selection ratio approaches 0.0 at 10,000 ft. Model results for land cover interpreted relative to corn. Selection ratio significantly higher for in-channel cover relative to corn. All remaining categories had lower relative selection ratio than corn.					Results - Ecotone models at 1000-m scale performed best. Top model included proportion agricultural wetland, meadow-marsh, prairie, river channel, woodland, development and distance to nearest road as fixed effects. Likelihood of occurrence increases with values of meadow marsh, agricultural wetland and river landcovers. Decreasing likelihood of occurrence with increased woodland and developed landcovers within a 1000-m buffer.
Conclusions - Whooping cranes were selecting in-channel and corn cover categories that were close to the previous night roost location and did not have the possibility of disturbance in the form of houses, towns, roads, or railroads. Relative to the corn cover category, the relative selection was significantly lower for grassland, soybean, and wet meadow cover categories	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. WHY does the analytical framework make a difference? WC use land closer to the river. WC use has also been higher on the eastern half of the AHR. Areas along the river, especially in the eastern half of the AHR are generally wetter. By pairing use locations to nearby available locations, the conditions at use locations are more similar to those at nearby available locations (used in proportion to availability). When your available locations are allowed to occur randomly along a 90-mile reach within a 3.5 mile buffer from the river, the conditions at use locations tend to be wetter than general availability across the reach (selection for wetter conditions).				Conclusions - Areas with increased wetland components (i.e., meadow-marsh and wetland agriculture) located near the Platte River and decreased densities of roads and development had a higher likelihood of occupancy for diurnal use by Whooping Cranes than drier components of the landscape.

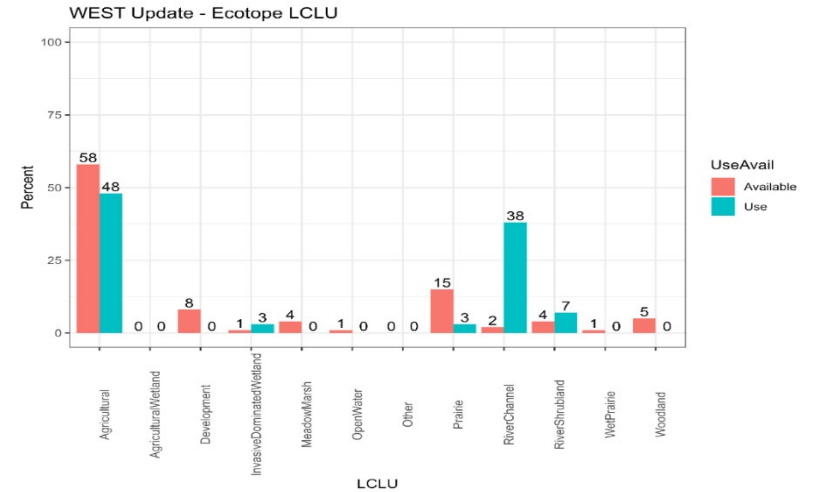
* See methods for details on changes in dataset to accommodate landcover product extent, exclusion of riverine use locations, and creation of linked use and available locations for ECOTOPE dataset.

Figure 1. Infographic depicting initial methodological differences between the WEST report (blue column, Howlin and Nasman 2017) and the ECOTOPE article (yellow column, Baasch et al. 2022) and the stepwise approach taken by the Program to understand how methodological differences may have influenced results and conclusions.

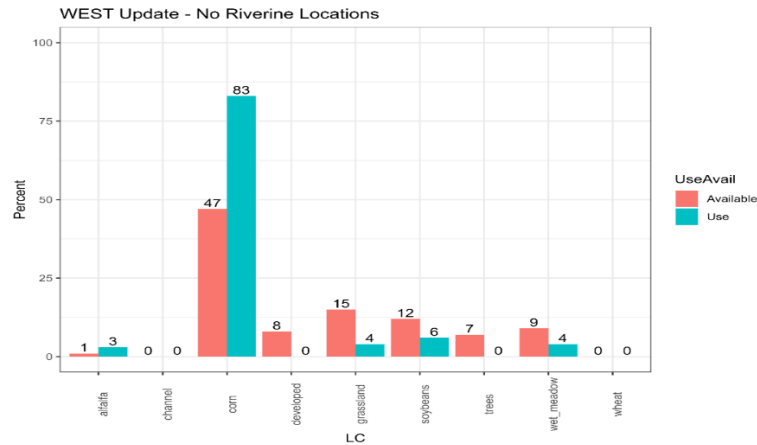


A Original WEST result

B Step 1:



C Step 2:



D Step 3:

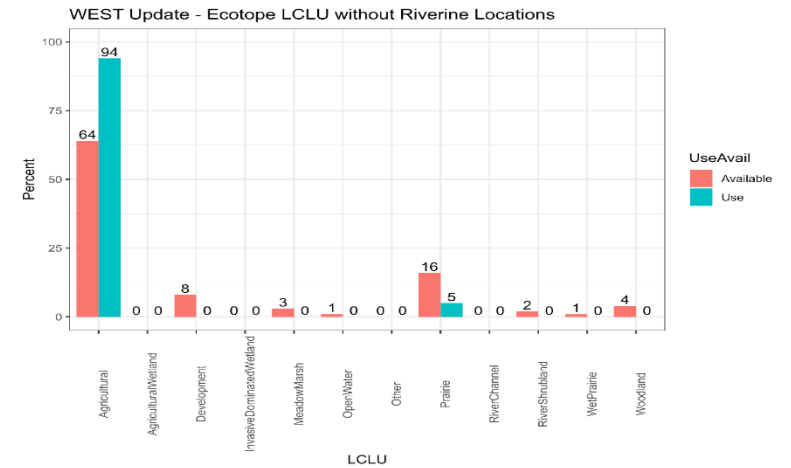
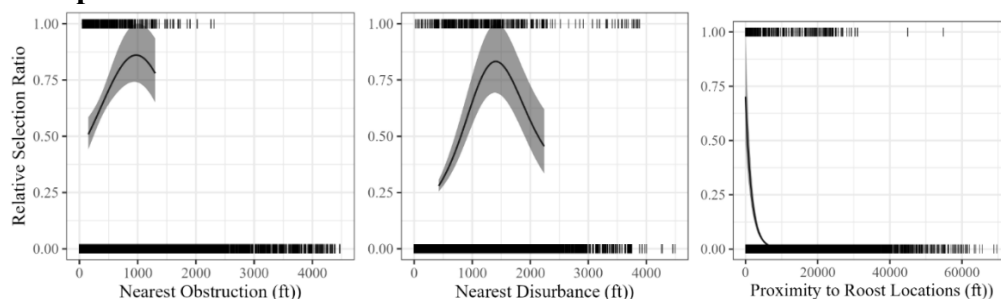


Figure 2 A-D. Percent of off-channel use (blue) and available (red) diurnal locations in each landcover type (LCLU) within the AHR, **A)** from the original WEST analysis; **B) Step 1:** from the finer scale wetland landcover classification used in the ECOTOPE article; **C) Step 2:** from the landcover classification used in the WEST analysis but without riverine locations; and **D) Step 3:** from the finer scale wetland landcover classification used in ECOTOPE article and without riverine locations.

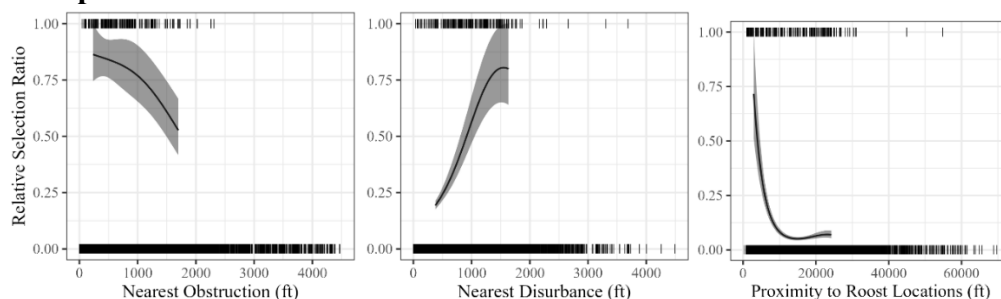


A Original WEST analysis

B Step 1: ECOTOPE landcover



C Step 2: No riverine locations



D Step 3: ECOTOPE landcover and no riverine locations

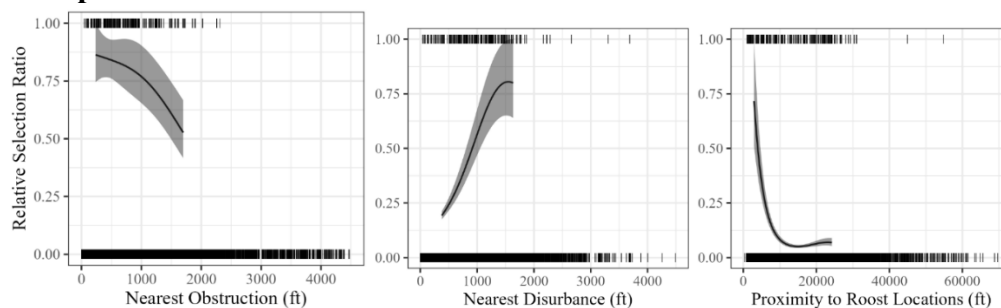


Figure 3 A-D. Relative selection ratios for nearest obstruction, nearest disturbance, and proximity to roost location based on diurnal use locations in the AHR. The solid lines represent the average relationships between the 5th and 95th percentile of each variable at use locations, while the shaded 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.

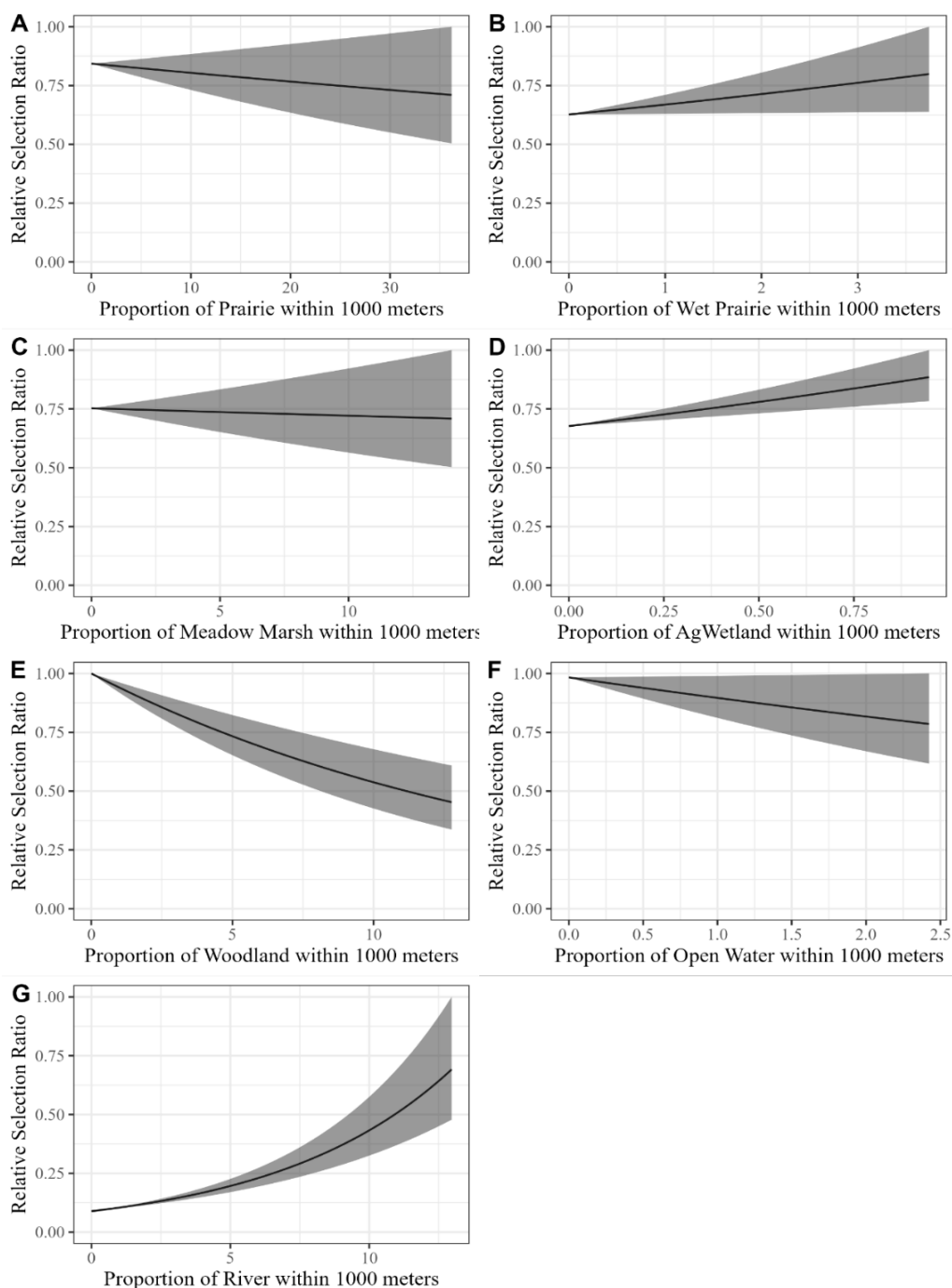


Figure 4 A-G Step 4: Relative selection ratios for the A) proportion of prairie, B) wet prairie, C) meadow marsh, D) agricultural wetlands, E) woodland, F) open water, and G) river within 1000 m based on off-channel, diurnal use locations in the AHR from the ECOTOPE article. The solid lines represent 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.



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
WC100011		11.09	
WC100011_MinusRiver	River1000	6.74	39.22
WC100011_MinusWood	Wood1000	10.13	8.61
WC100011_MinusDev	Dev1000	10.38	6.41
WC100011_MinusRoadDist	RoadDist	10.6	4.37
WC100011_MinusAgWetland	AgWetland1000	10.64	4.05
WC100011_MinusOpenWater	OpenWater1000	10.94	1.37
WC100011_MinusWetPrairie	WetPrairie1000	10.94	1.33
WC100011_MinusPrairie	Prairie1000	11.07	0.22
WC100011_MinusMeadowMarsh	MeadowMarsh1000	11.09	0.003

**SUPPLEMENTAL INFORMATION****Additional Discussion from ECOTOPE Authors**

- A. 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.
- B. 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.
- C. 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.
- D. 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.
- E. 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.