



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

TO: Governance Committee (GC)
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. These interpretations were subsequently discussed by the TAC at their May 2024 meeting ([Appendix B](#)).

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.
 - o 478 diurnal use locations
 - o 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

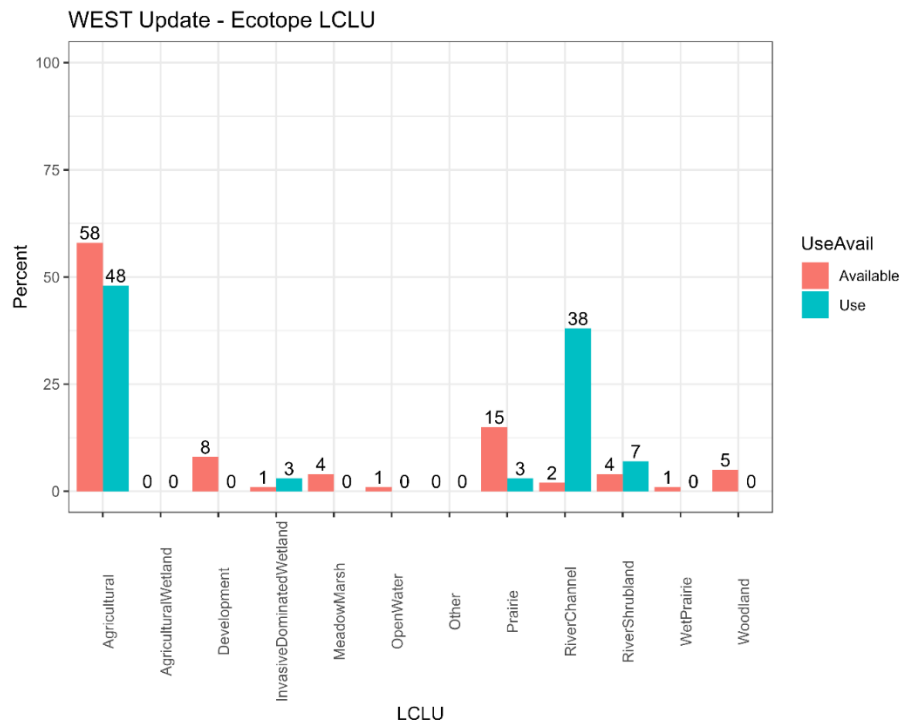


Figure 1. Percent of use (blue) and available (red) diurnal locations in each landcover (LCLU) class from the finer scale landcover classification within the Associated Habitat Reach (AHR).

Other Variables

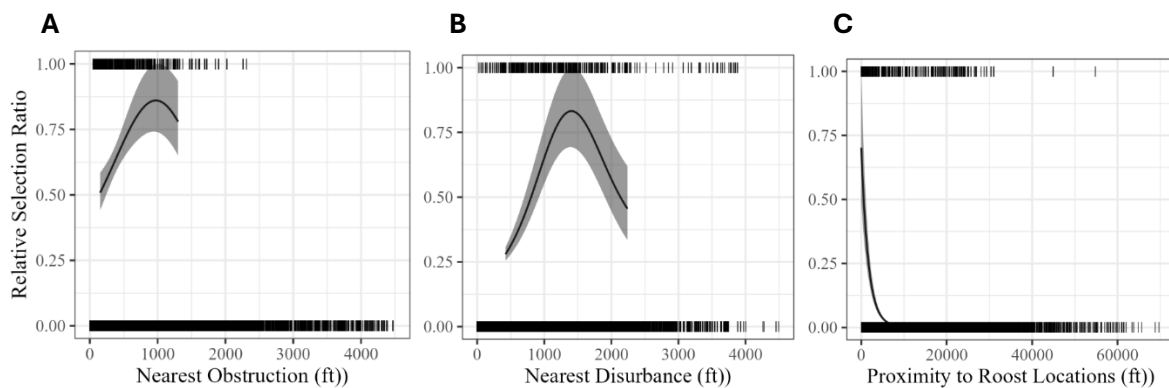


Figure 2A-C. Relative selection ratios for nearest obstruction (A), nearest disturbance (B), and proximity to roost location (C) based on diurnal use locations in the AHR. The solid lines represent the average relationships between the 5th and 95th percentile of each variable at use locations, while 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.
 - o 478 diurnal use locations
 - o 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

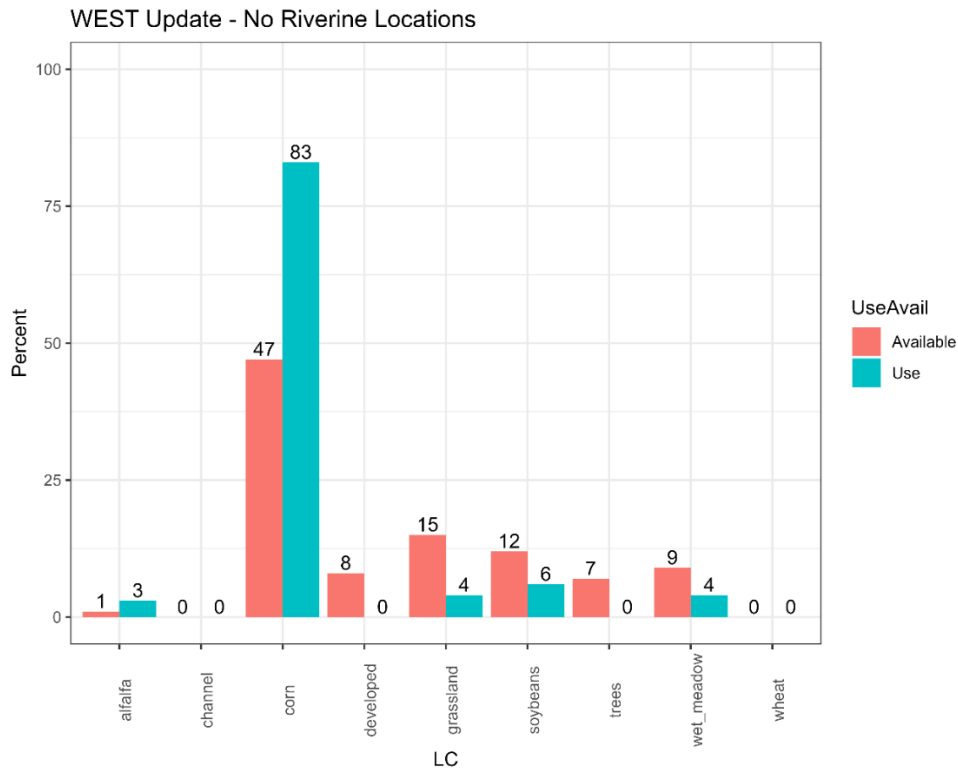


Figure 3. Percent of off-channel use (blue) and available (red) diurnal locations in each landcover type, from the original landcover classification used in the WEST analysis, within the AHR.

Other Variables

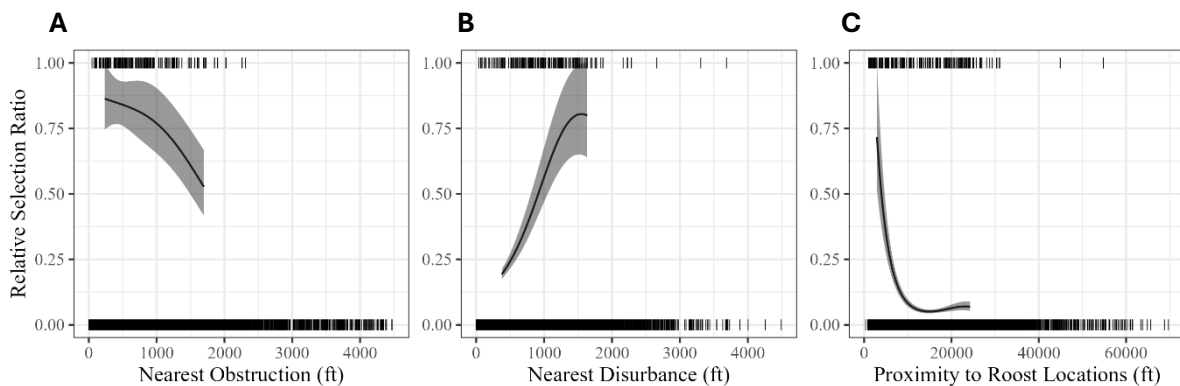


Figure 4 A-C. Relative selection ratios for nearest obstruction (A), nearest disturbance (B), and proximity to roost location (C) based on off-channel, diurnal use locations in the AHR. The solid lines represent the average relationships between the 5th and 95th percentile of each variable at use locations, 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.
 - o 478 diurnal use locations
 - o 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

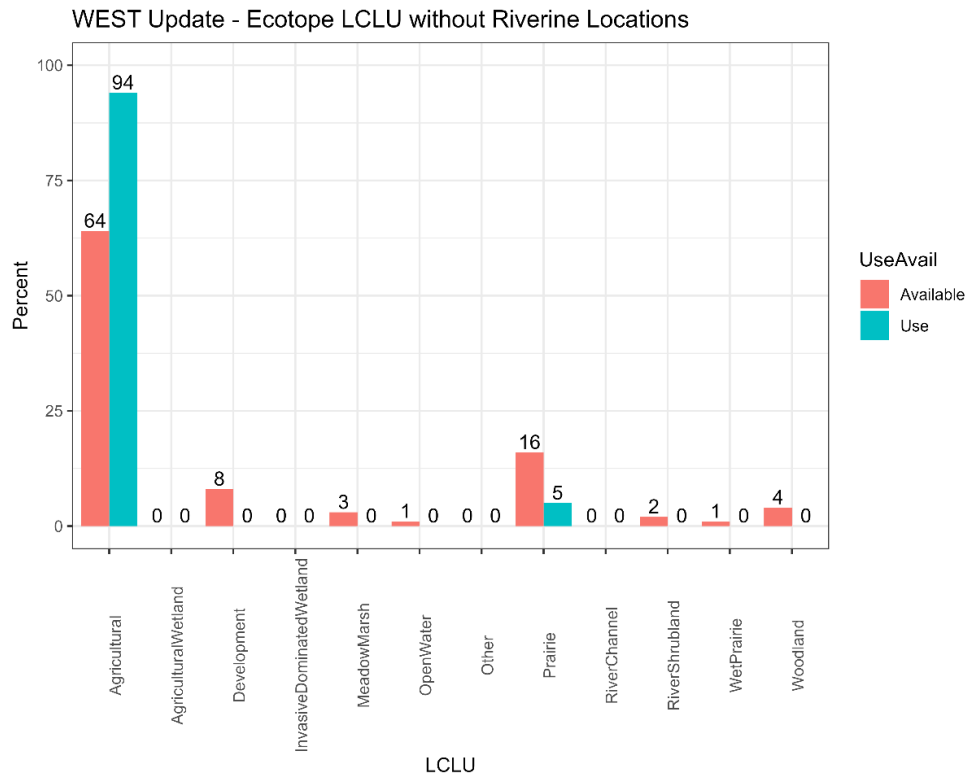


Figure 5. Percent of off-channel use (blue) and available (red) diurnal locations in each landcover (LCLU) type, from the finer scale landcover classification, within the AHR.

Other Variables

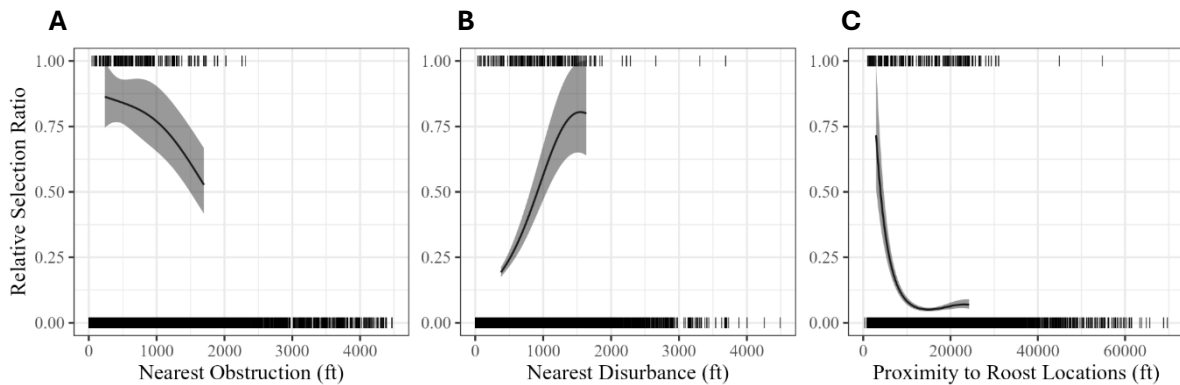


Figure 6A-C. Relative selection ratios for nearest obstruction (A), nearest disturbance (B), and proximity to roost location (C) based on off-channel, diurnal use locations in the AHR. The solid lines represent the average relationships between the 5th and 95th percentile of each variable at use locations, 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

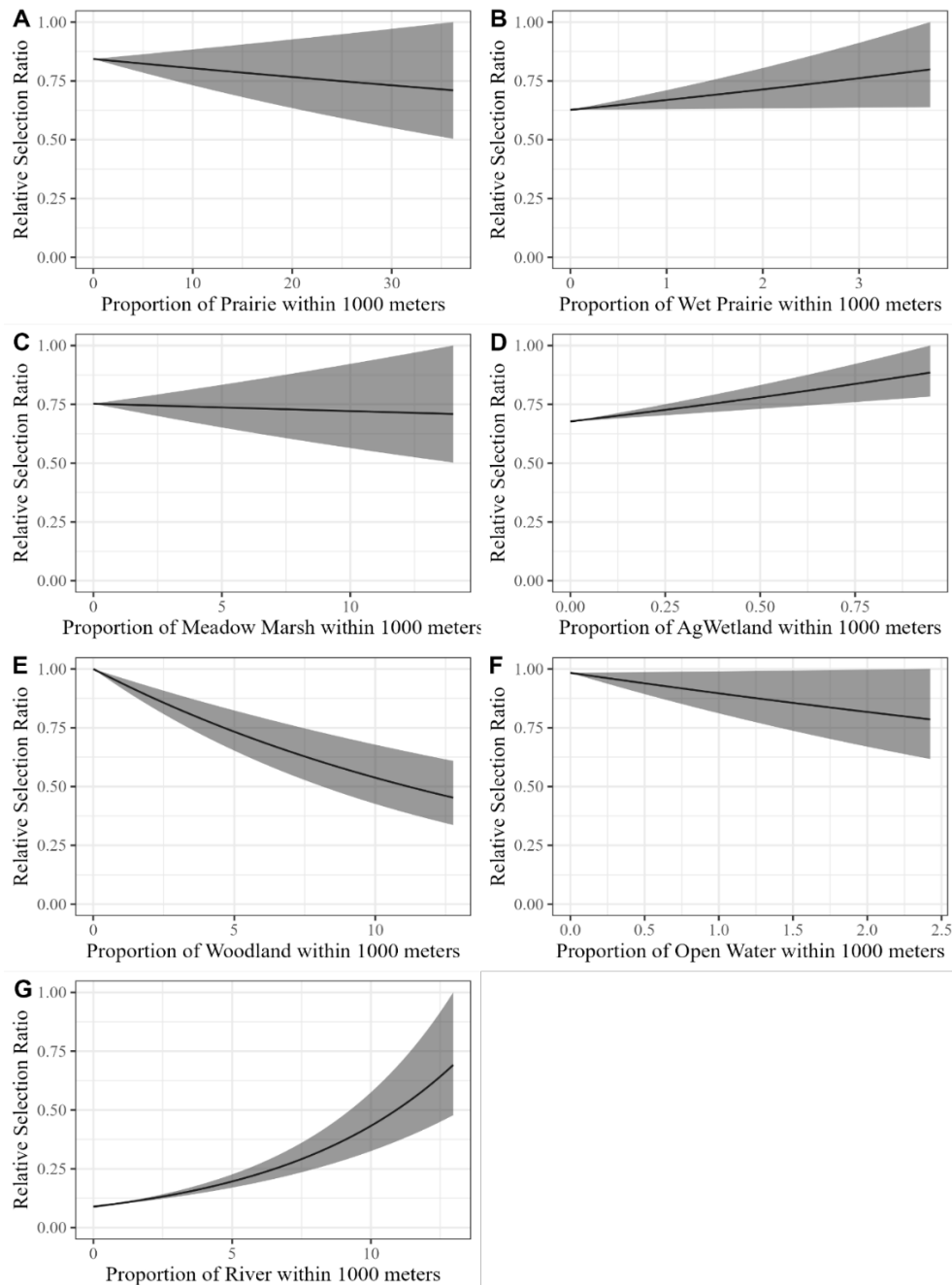


Figure 7 A-G. Relative selection ratios for the proportion of prairie (A), wet prairie (B), meadow marsh (C), agricultural wetlands (AgWetland; D), woodland (E), open water (F), and river (G) within 1000 m based on off-channel, diurnal use locations in the AHR from the Ecotope Article. The solid lines 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



APPENDIX B

May 2024 TAC Meeting Minutes Reflecting TAC Discussion on Whooping Crane Diurnal Use Site Selection

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

Technical Advisory Committee (TAC) Virtual Meeting

Meeting held in-person at Petrified Wood Gallery in Ogallala, NE

Wednesday, May 8, 2024; 8:00 AM – 12:15 PM MT

Technical Advisory Committee (TAC)

State of Wyoming

Jeremy Manley – Alternate

Bureau of Reclamation (Reclamation)

Brock Merrill – Member

State of Colorado

Kara Scheel – Member

U.S. Fish and Wildlife Service (Service)

Matt Rabbe – Member

State of Nebraska

Caitlin Kingsley – Member

Jennifer Schellpeper - Alternate

Environmental Entities

Rich Walters – Member

Upper Platte Water Users

n/a

Colorado Water Users

Jason Marks – Member

Downstream Water Users

Brandi Flyr – Member

Jim Jenniges – Member

Dave Zorn – Member

Executive Director's Office (EDO)

Jason Farnsworth, ED

Chad Smith

Malinda Henry

Seth Turner

Patrick Farrell

Jason Bruggeman

Other Participants

David Baasch – Crane Trust

Brooke Mott – NE DNR

Avery Dresser – NE DNR

Ryan Kelly – NE DNR

Jack Mensinger – NE DNR

Shuhai Zheng – NE DNR

Richard Belt – SPWRAP

Kevin Urie – CO Water Users

Jon Altenhofen – CO Water Users

Mike Archer – NGPC

Scott Schaneman – NP NRD



WC DIURNAL SELECTION ANALYSIS: WEST RERUN WITH ECOTOPE AUTHORS

Farrell began by reminding the TAC of the onboarding process to bring the science within the Ecotope article into the Program. He then reviewed the TAC recommendation and GC approval to rerun the WEST analysis collaboratively with Ecotope authors to reduce uncertainty about why these two technical works came to different conclusions about WC selection of wet meadows. Farrell summarized the change in methods to bring the WEST report closer to the Ecotope publication and the results from that effort. Baasch summarized the change in methods to bring the Ecotope analysis closer to the WEST analysis and the results of that effort. In sum, all participants agreed that using a modeling framework where available sites were not limited to locations nearby the use site they were being compared to was the reason these two efforts came to different conclusions.

Belt pointed out that lower availability with same use gives a stronger signal for selection. Altenhofen asked if target flows might be modified based upon importance of wet meadows. Rabbe said that had been a discussion in the past, but it is no longer considered an effective strategy. Altenhofen asked about irrigating wet meadows, is that still an option? Farnsworth pointed out the Fox tract restoration and pumping to fill during WC season. Baasch noted that pumped swales on that tract are better duck habitat with the cattails present. Altenhofen asked if WC use the channel in this area? Farrell said yes, and pointed out an area downstream of the NGPC Kearney Hike Bike Trail. Baasch said the meadow marsh landcover are the swales. Wet prairie is the upland ridges. Baasch said the Ecotope paper never intended to say that WCs used only the meadow marsh component. Farnsworth asked if that doesn't take us right back to the tract level ridges and swales included as wet meadow landcover that the Program used. Altenhofen asked about WC roost vs. diurnal use patterns. Farrell said this analysis looks only at what WC are doing during the day. Flyr asked what qualifies as an invasive wetland? Baasch said purple loosestrife and *Phragmites*. Scheel asked if meadow marsh is wet meadow. Farrell said meadow marsh are the wetter, lower swales with a different vegetation community. Rabbe said let's not get hung up on the definition since we have not and will never agree upon it. Farnsworth said this was the hypothesis of the Ecotope paper. Farnsworth asked Baasch how much of wet meadow in the WEST report he considers actually meadow marsh or wet prairie? Baasch said he thinks John's tract, for example, was classified as wet meadow, but he says none of it is meadow marsh or wet prairie. Jenniges said the point here is that choice of analysis can change the results. Only a small percentage of landcover is wet meadow, so what do we do with this? No one is looking to get rid of wet meadows. Belt asked if you have two analytical frameworks accepted in the literature, how do you pick? Farrell said PRRIP wrestled with this in 2000s and chose the paired, discrete choice type of framework. Rabbe says there is a world outside of the Program working with this kind of data, and that was considered when the Ecotope analysis was planned. Rabbe said he made some additional points about interpretation of the results from this exercise in the [Collaborative Research Group TAC Memo](#), but those don't really matter in terms of making a decision moving forward. Service will not support getting rid of any of PRRIP owned wet meadows and one FWS vote will kill any attempt to sell these properties. Rabbe said we have all these grasslands; we need to figure out how to use them. He said it does not matter if people agree whether they get selected or not. Wet meadow get used by whooping cranes every year. Jenniges said we can't make Mormon Island on other tracts. The wet meadow hydrology report illustrated this. Rabbe suggested we continue with the draft wet meadow document that a TAC workgroup started, get it in front of the entire TAC for review, then take it to the GC. Rabbe said the FWS isn't saying you need to change target flows, too much of an administrative lift. The FWS is also not in support of releasing water to hit spring target flow to support wet meadows. The FWS would like to shift focus on how to



manage properties we will keep in the suite of Program lands. Walters said, we will keep them and we will play with the management. Walters said there is no need to do any more science on wet meadows. Jenniges said the Program document says we need a certain amount of wet meadows in complex habitat and this group is not looking to change that. We may want to alter how we keep them wet if that is an available option. Henry asked Walters to clarify what he meant by saying “We do not need to do any more wet meadow science”. We have EBQs with landcover proposed as alternative hypotheses for why WC stop and stay longer. Walters says we don’t need any more science to define what a wet meadow is. We can still do the work to classify it for EBQ landcover designations. Rabbe went further and said maybe we don’t need to do that, we know WC use corn and wet meadows over larger spatial scale, but the amount of these in the landscape are outside our control. Farnsworth asked what the TAC wants him to communicate to the GC in June? What information do we need to put ourselves in a good position to negotiate a Second Increment? Farnsworth needs technical support from the TAC specifying why they are saying we need every grassland we have? Rabbe said grasslands serve as buffer and protection to riverine grounds. Jenniges does not want to renegotiate a Land Plan even if WC don’t use them. Schellpeper said maybe GC will want to reevaluate the amount of grassland they own. Rabbe said he and Porath will not support excessing. These grasslands get variable use and provide a buffer. Walters says there is no blanket answer, depending on the complex some grasslands may get more or less use. Farnsworth asked again for a technical reason for keeping wet meadows to provide to GC members. Flyr said she thinks it is premature to talk about excessing land when we are having high use years, as crane numbers increase those birds need to go somewhere. Farnsworth said if that’s a values thing, let’s just say it. Belt asked if we have a number for how much money is spent annually on managing grasslands vs. wetlands? Farnsworth said yes Belt said maybe we can use money spent on management as an input for SDM. Farnsworth said he is not proposing we excess lands, but he suspects budget will become more of a constraint in the future. Farnsworth wants to construct a technical framework around grasslands to keep them from being the first thing to cut. He suggested giving them value through their contribution as buffer or to Other Species of Concern. Altenhofen asked if the Program will be acquiring more land in Second Increment and if the ISAC is involved in decision? Farnsworth said we don’t know about the land acquisition as there has been no negotiation yet. He said we try to keep the ISAC out of things like this. Rabbe said let’s get back to the draft document and get it to the TAC for review. Henry suggested the TAC working group including Rabbe, Jenniges, Walters, and Zorn who participated in writing the draft, add technical detail and specificity to provide the type of information Farnsworth requested. The draft can then go to TAC for review and revision, then out to the GC.

TAC ACTION ITEMS:

- TAC working group revise draft wet meadow document and provide to TAC for review.

Document: [09 Collaborative Research Group – TAC Memo](#)

Presentation: [09 WC diurnal selection analysis](#)