TO: PRRIP TECHNICAL ADVISORY COMMITTEE

FROM: PRRIP EXECUTIVE DIRECTOR'S OFFICE

SUBJECT: WC RIVERINE ROOST SITE SELECTION EXPLANATORY VARIABLES

DATE: 5 OCTOBER 2022

I. Framing the Discussion Context and Big Questions

PRRIP manages in-channel (and off-channel) whooping crane (WC) habitat based on habitat suitability criteria derived from resource selection analyses. These analyses utilize first observed in-channel WC use locations from unique whooping crane groups collected during PRRIP aerial systematic monitoring. The last analysis of riverine roost site selection was conducted in 2017 (incorporating data from Spring 2001 - Spring 2017). The Extension Science Plan has an update of this analysis scheduled for 2022 to incorporate an additional 5 years of data (Fall 2017-Spring 2022). As a check in that incorporates more data into a previous analytical framework, the EDO has no intent to change statistical techniques but would like to include both on- and off-channel explanatory variables. ***The current memo outlines the explanatory variables the EDO would like to include to investigate factors important for WC roost site selection. The EDO requests TAC feedback on these variables prior to moving forward with the analyses.***

II. Context and Big Questions

The current check in is designed to address the following **First Increment Big Question**: **Do whooping WC select suitable riverine roosting habitat in proportions equal to its availability?**

To answer this question past habitat selection analyses have focused on quantifying habitat characteristics surrounding WC roost sites as potential criteria for roost site selection (Howlin and Nasman 2017, PRRIP 2017, Baasch et al. 2019). Roost site selection analyses utilized documented WC riverine roost site locations obtained from PRRIP conducted systematic aerial surveys. The same set of habitat characteristics were also quantified for a non-selected random choice set of 20 available potential in-channel roosting sites drawn from within 10 miles upstream and 10 miles downstream of the observed roost location. In-channel metrics were linear and measured from the use and available points. Off-channel landcover metrics were area-based and quantified over a 3-mile radius surrounding each riverine use and available point (Howlin and Nasman 2017). Analyses contrasted the habitat characteristics surrounding selected roosting sites with those surrounding non-selected randomly available potential roost sites to ask whether WC select for the characteristics surrounding roost sites more frequently than predicted by their availability throughout the landscape. A resource selection function estimation framework was chosen due to its ability to account for the temporal and spatial changes in availability of appropriate habitat within a dynamic river system.

Identification of characteristics surrounding use locations that occur more frequently than predicted by their availability throughout the landscape has provided guidance for Program habitat creation and maintenance. Specifically, minimum habitat requirements established for in-channel WC roosting have been set to reflect the results of these selection analyses. The Program actively creates/maintains maximum unobstructed channel widths ≥ 650 feet and clears riparian forest from the river's edge to create an unforested corridor width of 1000 feet. No relationship was found between flow-dependent metrics like discharge, wetted width, or area at a suitable depth and WC use.

III. Conceptual Study Design

WC Monitoring Dataset: The EDO proposes utilizing the Program's systematic aerial monitoring dataset, data from the first telemetry tracking partnership (location points collected at 4–6-hour intervals), and data from the more recent cellular telemetry tracking partnership (location points at 15 min or less intervals) for the Platte Associated Habitat Reach (AHR) to address habitat selection by WC on the ground. We will use all systematically collected, unique, first on the ground in-channel locations within the AHR as our dataset for first-tier model selection to understand which variables are more important for WC roost site selection. As a second-tier analysis to examine effect size for those variables identified will use an expanded dataset that will include systematically collected in-channel roost sites used by the same WC group over a multiple day stopover (single roost site location per day of stopover). Program systematic aerial surveys collect locational data points between 6:00 – 9:00 a.m. daily during WC migration. To make the data comparable over the three datasets, the EDO will identify the first in-channel location of a unique telemetered individual with a timestamp between 6:00 – 9:00 a.m. each day of stopover. If a location was not obtained for a known telemetered bird within this time window (in the case of the first telemetry dataset), the EDO will select the overnight roost location at the timestamp closest and prior to this window. The first of these locations on the first day of stopover will be used for variable and model selection. Subsequent first of the day in-channel locations will be utilized in the second tier of analyses to determine effect size.

Analyses: In July, the TAC considered the spatial scale over which WC roost site selection analyses might be most biologically relevant, both for the choice set of available roost locations and for the habitat buffer surrounding use and available locations. Following up on a TAC suggestion to consider multiple spatial scales for the spatial extent of the choice set of available locations, the EDO evaluated the amount of variability or heterogeneity in two important on-channel management and geomorphological metrics. Maximum unobstructed channel width (MUCW) and total unobstructed channel width (TUCW) were evaluated over 4 miles, 8 miles, and 10 miles upstream and downstream of WC riverine use locations. Results showed very little gain in variability obtained by expanding your choice set radius from 4 to 8 to 10 miles. Wider choice sets may integrate more off-channel variability, but they do not add much in terms of in-channel MUCW or TUCW variability. Given this information and the benefits of keeping the analysis as similar as possible to previous analyses, the EDO suggests using a choice set of 10-miles upstream and downstream of each use location.

In summary, the analysis will compare habitat characteristics surrounding in-channel use (roost) locations with 20 available in-channel locations within 10 miles upstream or downstream of each use location. We will utilize a moving window to quantify habitat characteristics within a 360-degree, 0.77-mile buffer around each use and available location. Area-based metrics will be utilized for the majority of off-channel landcover-type metrics, whereas point-based linear metrics will be used to describe on-channel variables and off-channel distance metrics.

Explanatory Variables: Potential roost site selection criteria reflect local conditions, in-channel and nearby off-channel habitat characteristics, resources, and potential disturbance.

The focus for Extension management hypotheses is on how flow may affect WC habitat use. For this analysis, conditions at WC in-channel use locations are compared to conditions at in-channel available locations within 10 miles upstream or downstream over the same time period. Flow is notably absent

from the explanatory variables included in **Table 1** below because of the way flow data are obtained (extrapolated from nearest gages) that provides very little variability over the spatial scale of the analysis. We expect flow will be very similar between use and available locations at the same time within this 20-mile spatial scale as has been the case in past analyses, except for the very few instances of WC use of side channels. We believe flow is more appropriately addressed as an important selection criterion for the decision of whether or not to stop on the Platte River and will be included in those analyses that encompass wider variability in flow over larger spatial and temporal scales.

Table 1. On-channel and off-channel explanatory variables for inclusion in riverine roost site selection analysis.

Explanatory Variable	Description
On-Channel Metrics	
Unobstructed Channel Width (UOCW)	Width of active channel unobstructed by tall vegetation or wooded islands measured perpendicular to midline of the channel at use or available location.
Total Channel Width (TCW)	Total channel width of channel from left bank to right bank measured perpendicular to the midline of the channel at use or available location. Total distance from left to right bank station : 1-D HEC-RAS model.
Nearest Forest (NF)	Distance to nearest riparian forest measured from use location or available point in any direction.
Unforested Corridor Width (UFCW)	Width of corridor (not confined to active channel) unobstructed by riparian forest measured perpendicular to the midline of the channel at use or available location.
Unit Discharge (UD)	Flow (cfs), extrapolated from nearest gage (Overton, Kearney, Grand Island), per linear foot of wetted channel width.
Off-Channel Metrics	
Grassland	Proportion of buffer area covered by grassland.
Forest	Proportion of buffer area covered by forest.
Agriculture	Proportion of buffer area covered by agriculture of any type.
Corn	Proportion of buffer area covered by corn.
Soybeans	Proportion of buffer area covered by soybeans.
Alfalfa	Proportion of buffer area covered by alfalfa.
Other	Proportion of buffer area covered by other agricultural crop.
Developed	Proportion of buffer area covered by anthropogenic development (roads, parking lots, buildings, infrastructure, etc.).
Distance to Development	Distance to nearest developed landcover type (see above definition) measured from use or available location in any direction.
Distance to Power Lines	Distance to nearest power lines measured from use or available location in any direction.
Length of Power Lines	Total length of power lines within buffer area.

Explanatory Variable Data Sources: The EDO proposes adding 5 additional years of WC monitoring information and associated habitat metrics to an existing dataset to do an analysis over the period from Spring 2001- Spring 2022. Publicly available landcover data and our ability to classify vegetation via remote

sensing has improved significantly since 2017, specifically allowing for better quantification of forested areas and vegetation along the river channel. However, that information is not available moving backward in time. For the sake of comparability when analyzing characteristics associated with roost site selection over the long-term, the EDO proposes using comparable landcover data sources and modeling methods over this long-term analysis. A second round of analysis using updated landcover and modelling techniques may be performed utilizing WC use locations from 2017 – 2022. **Table 2** provides more specific information on data sources proposed for each time period.

Table 2. Data sources for explanatory variables through time.

On-Channel Metrics			
	2001-2017	**2017-2022**	**2001-2022**
Unobstructed Channel Width (UOCW)	Hand-delineated	LiDAR veg classification	Hand-delineated + 1-D HEC-RAS model + LiDAR veg classification + NLCD
Total Channel Width (TCW)	1-D HEC-RAS	1-D HEC-RAS model OR 2-D Hydrodynamic model	
Nearest Forest (NF)	Hand-delineated	LiDAR veg classification + National Landcover Database (NLCD)	
Unforested Corridor Width (UFCW)	Hand-delineated	LiDAR veg classification + NLCD	
Unit Discharge (UD)	1-D HEC-RAS model	1-D HEC-RAS model OR 2-D Hydrodynamic model	1-D HEC-RAS model
Off-Channel Metrics			
	2001-2013	**2014-2022**	**2001-2022**
Grassland	Rainwater Basin Joint Venture Landcover (RWBJV) Product	NLCD	RWBJV Product + NLCD + LiDAR veg classification *2001-2017: on-channel landcover/veg classification poor
Forest		NLCD + LiDAR veg classification	
Agriculture		NLCD (CropScape)	
Developed	[redacted]	NLCD	
Distance to Development		NLCD	
Distance to Power Lines		Dept of Energy	Dept of Energy
Length of Power Lines			

References

Baasch, D.M.; Farrell, P.D.; Howlin, S.; Pearse, A.T.; Farnsworth, J.M.; Smith, C.B.. 2019. Whooping crane use of riverine stopover sites. PLoS ONE 14(1): e0209612. https://doi.org/10.1371/journal.pone.0209612

Howlin, S. and Nasman K. 2017. Correlates of whooping crane habitat selection and trends in use in the Central Platte River, Nebraska. Prepared for Platte River Recovery Implementation Program by Western EcoSystems Technology, Inc., Cheyenne, WY.

Platte River Recovery Implementation Program (PRRIP). 2017. Data synthesis complilation: Whooping Crane habitat (*Grus americana*) habitat synthesis chapters. Prepared for the Governance Committee of the Platte River Recovery Implementation Program by the Executive Director's Office, Headwaters Corporation, Kearney, NE.