WHOOPING CRANE RIVERINE ROOST SITE SELECTION UPDATE

Identifying and providing suitable habitat for whooping cranes is an essential component of the Platte River Recovery Implementation Program (Program) to contribute to the survival of whooping cranes during migration. As a first step, learning about roost site characteristics was necessary to help guide land and water management for whooping cranes. The Program's Adaptive Management Plan identified priority uncertainties to be addressed during the Program's First Increment related to learning more about habitat suitability for whooping cranes. Refinement of these uncertainties led to the development of First Increment Big Question #5:

- Do whooping cranes select suitable riverine roosting habitat in proportions equal to its availability?

In answering BQ #5 Program science identifed important habitat characteristics for riverine roosting by whooping cranes. The Program systematically collected roost locations of whooping cranes from spring 2001 – spring 2017. Characteristics at roost locations were compared to those at locations available, but not selected by whooping cranes in habitat selection analyses. The results of habitat selection analyses conducted in Howlin and Nasman (2017), Whooping Crane Habitat Synthesis Chapters – Chapter 2 (2017), and Baasch et al. (2019) were then used to define suitable roosting habitat for whooping cranes and develop guidelines for land and water management. To increase the availability of suitable habitat for whooping crane roosting within the Program's Associated Habitat Reach (AHR) along the central Platte River, the Program has worked to create and maintain river channels with widths ≥650 ft that are unobstructed by tall, dense vegetation. In addition, the Program has cleared riparian forest along riverbanks and on in-channel islands to create unforested corridor widths of ≥1100 ft.

The Program has now added 5 more years of roost locations to the spring 2001 – spring 2017 dataset and is currently conducting an updated habitat selection analysis to:

- provide additional information for defining suitable roosting habitat within the AHR;
- inform Extension Science Plan Big Questions 1 and 2, which ask how water can maintain suitable roosting habitat for whooping cranes;
- inform Program land and water management to provide benefits for whooping cranes.

How did we address ISAC recommendations from the Science Reporting session?

- *ISAC Recommendation #1*: "The EDO should consider including data from the first iteration of the whooping crane telemetry project (2010-2018). The Program has this dataset in hand, and it is publicly available for use. How best to integrate the telemetry data with standard Program data sets requires further thought."
    - Incorporated roosts from the first telemetry project (*n = 29*), along with roosts from the cellular telemetry project (*n = 45*) to validate model performance using a dataset that was not used to train the model.
        - We used the top model to predict expected selection of telemetry roosts and then compared the expected selection to observed selection.
        - We assessed performance of the top model based on the slope of the simple linear regression and 95% confidence interval of the relationship between expected and observed counts of roosts.

- *ISAC Recommendation #2*: "A recent publication on whooping crane use (Baasch et al. 2022; Ecotope Article) used the USFWS public sightings database (which is different from both the Program database and the telemetry database), and a different method of land classification. Understanding the effects of different datasets on management-relevant insights is a high priority for the Program. The ISAC also supports the additional consideration of factors not looked at previously, so called off-channel metrics. It is acknowledged that most of these metrics are not under management control. Nevertheless, these factors may indirectly affect Program success. Incorporating these metrics into crane roosting selection analyses could be used to prioritize where river management efforts are conducted or if land swaps/acquisition may help to overcome factors out of the Program's control."
    - Directly incorporated Ecotope Article land classifications into our analysis.
        - Used landcover product from the Ecotope Article to obtain metrics for off-channel explanatory variables.
    - Incorporated off-channel landcover variables in our analysis that were important to explain diurnal patterns of whooping crane use (Table 1).
        - Meadow marsh
        - Ag wetlands
        - Development

- *ISAC Recommendation #3*: "Unit discharge (cms/m) was included in the analysis and had a modest effect on whooping crane roost site selection. The ISAC and others found this metric difficult to interpret. We suggest a re-thinking of how attributes of flow like water depth, channel morphology, and wetted width can be accounted for as surrogates of discharge in roost site selection. Can a metric with greater interpretability, management relevance, or biological importance be included?"
  - Given feedback from the ISAC and TAC, it was decided to remove unit discharge from this analysis.
    - The cellular telemetry dataset, collecting whooping crane locations at 15 min intervals is a more appropriate dataset for answering questions about whooping crane response to flow than data from systematic aerial monitoring performed once daily, after the whooping crane has roosted.
    - Extension Big Question 4 will utilize cellular telemetry data to compare characteristics associated with whooping crane stopovers in the AHR with characteristics associated with whooping crane flyovers. This is a more appropriate data structure to test how flow metrics at the time a whooping crane approaches the central Platte River may influence whooping crane use of the AHR.

- *ISAC Recommendation #4*: "It would be valuable to engage the TAC as to how on- and off-channel metrics might interact in a way that could affect management actions and recommendations. For example, does the channel need to be wider at locations near development (like a river bridge) compared to sites far from development, to have equal attractiveness to cranes?"
  - The Executive Director's Office (EDO) and Technical Advisory Committee (TAC) worked together to develop a suite of models to explain patterns of roost site selection (Table 1).
  - Included hypothesized interactions between on and off-channel metrics (Table 1).

What are the next steps forward?

- Provide full report to TAC (Late October)
- Receive/incorporate TAC responses (November-December)
- Discussion of report with TAC (January 2023)
- Potential for independent peer review and publication

Tables

Table 1. Suite of *a priori*, hypothesis driven models evaluated to explain roost selection of whooping cranes on the central Platte River from Spring 2001- Spring 2022.

Model*	Models	Interpretation
1	NULL	Habitat selection is random
2	Nearest Forest (NF)	Select channels with increased 'openness' which includes areas without trees located nearby in any direction.
3	Unobstructed Channel Width (UOCW)	Select channels with views unobstructed by dense vegetation or wooded islands.
4	Total Channel Width (TCW)	Select channels with increased distance from right to left bank including vegetated and wooded islands.
5	NF+ UOCW	Select channels with views unobstructed by dense vegetation without trees nearby in any direction.
6	UOCW+TCW	Select channels with views unobstructed by dense vegetation or wooded islands and increased distance from right to left bank including vegetated and wooded islands.
7	NF+UOCW+TCW	Select channels with increased distance from right to left bank including vegetated and wooded islands, with increased 'openness' which includes areas without trees located nearby in any direction, and with views unobstructed by dense vegetation or wooded islands.
8	Sand and Water (SW)	Select for increased channel 'openness' within 0.77 mi
9	Grassland (GR)	Select for grassland within 0.77 mi
10	Meadow Marsh (MM)	Select for lowland herbaceous wetlands within 0.77 mi
11	Agricultural Wetland (AW)	Select for lowland wetlands in agricultural fields within 0.77 mi
12	Development (DE)	Select against development within 0.77 mi
13	Corn (CO)	Select for corn within 0.77 mi
14	MM + AW	Select for any lowland herbaceous wetlands within 0.77 mi
15	AW+CO	Select for low lying, wet cornfields within 0.77 mi
16	SW + MM	Select for channel openness and lowland, wet grasslands within 0.77 mi

Model*	Models	Interpretation
17	SW + MM + AW	Select for channel openness and all lowland wetlands within 0.77 mi
18	SW + AW + CO	Select for channel openness and lowland and upland corn within 0.77 mi
19	NF + UOCW + GR	Current management model
20	NF + UOCW + GR + UOCW*GR	Current management model accounting for wider unobstructed views as grasslands decrease within 0.77 mi
21	NF + UOCW + DE	Top model from Baasch et al. (2019) accounting for development within 0.77 mi
22	NF + UOCW + DE + UOCW*DE	Top model from Baasch et al. (2019) accounting for development within 0.77 mi and wider unobstructed views as development increases within 0.77 mi
23	NF + UOCW + MM + AW	Potential future management model
24	NF + UOCW + MM + AW + CO	Stakeholder model
25	NF + UOCW + MM + AW + CO + UOCW*CO	Stakeholder model accounting for wider unobstructed views as corn decreases within 0.77 mi
26	NF + UOCW + MM + AW + DE	Potential future management model accounting for development within 0.77 mi
27	NF + UOCW + MM + AW + DE + UOCW*DE	Potential future management model accounting for development within 0.77 mi and wider unobstructed views as development increases within 0.77 mi

*Models 1-7 include point-based, in-channel metrics from Baasch et al. (2019). Models 8-18 identify the most important, literature supported, area-based metrics for whooping crane roost and diurnal resource selection. Models 19-27 combine on/off-channel metrics that reflect current management practices, variable combinations identified by Program stakeholders, and potential future management practices.