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

TO: Independent Science Advisory Committee (ISAC)
FROM: Executive Director's Office
RE: **Responses to ISAC and TAC Feedback – 2024 SPRS Whooping Crane Roost Site Selection Technical Report**
DATE: June 21, 2024

EDO Question to ISAC:

> ***6a) Are the conclusions regarding factors that impact whooping crane (WC) roost site selection within the Associated Habitat Reach (AHR) well-supported by the data, methods, analyses, and model selection techniques detailed in the WC Roost Site Selection Technical Report?***

ISAC Feedback:

6a. *Explore ramifications and provide better justification of the chosen analytical methods (e.g., using just the initial roost site, vs. using the initial and subsequent roost sites for model selection, prediction, and inference). Are there substantial or interesting differences in characteristics of initial and subsequent roost locations? How do results change if all data or only first roosts were used for model selection and inference? Could you consider a criterion that you could use to declare independence, for example, if birds select a new roost greater than 'X' km from their subsequent one?*

EDO Response:

Explore ramifications and provide better justification of the chosen analytical methods (e.g., using just the initial roost site, vs. using the initial and subsequent roost sites for model selection, prediction, and inference).

Initial observations were used to be directly comparable with methods, results, and conclusions from past efforts. This effort was an addition of 5 more years of data to an existing analysis framework that had already been positively peer-reviewed and approved for decision-making by the Program. The Program had other reasons to prioritize initial observations, which will be integrated into the methods section of the Roost Site Selection report and include: TAC prioritization of initial roost sites, as understanding initial roost characteristics may lead to an increase in proportion of the total Aransas-Wood Buffalo Population of whooping cranes utilizing the AHR; and provides more similar information for all crane groups that minimizes independence and biasing issues of including crane groups multiple times.

Given the justification for our choice above, we have not used all roost locations in model selection to identify important characteristics of roost locations but are willing to discuss this choice further.

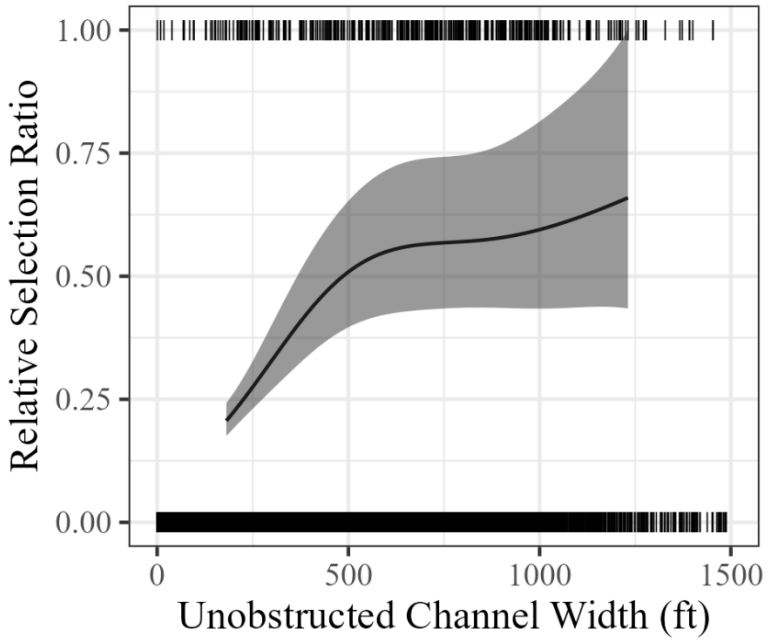
Are there substantial or interesting differences in characteristics of initial and subsequent roost locations?

From a perspective of central tendencies, we have not observed a difference of in-channel characteristics between initial and subsequent roost locations. Of the 64 cranes groups, or 39% (99/163) of cranes groups observed, had multiple roost observations. Unobstructed width was similar at initial observations of crane groups (mean = 689 ft; sd = 322 ft) and subsequent observations (mean = 686 ft; sd = 344 ft). Nearest forest was also similar at initial observations of crane groups (mean = 433 ft; sd = 207 ft) and subsequent observations (mean = 475 ft; sd = 214 ft).

Other information we plan to provide for the July ISAC meeting includes the distances between initial and subsequent roost locations. This information will allow us to understand the spatial relationships of initial and subsequent roosts to understand if birds are generally coming back to the same area each night or moving roost locations to other areas nearby.

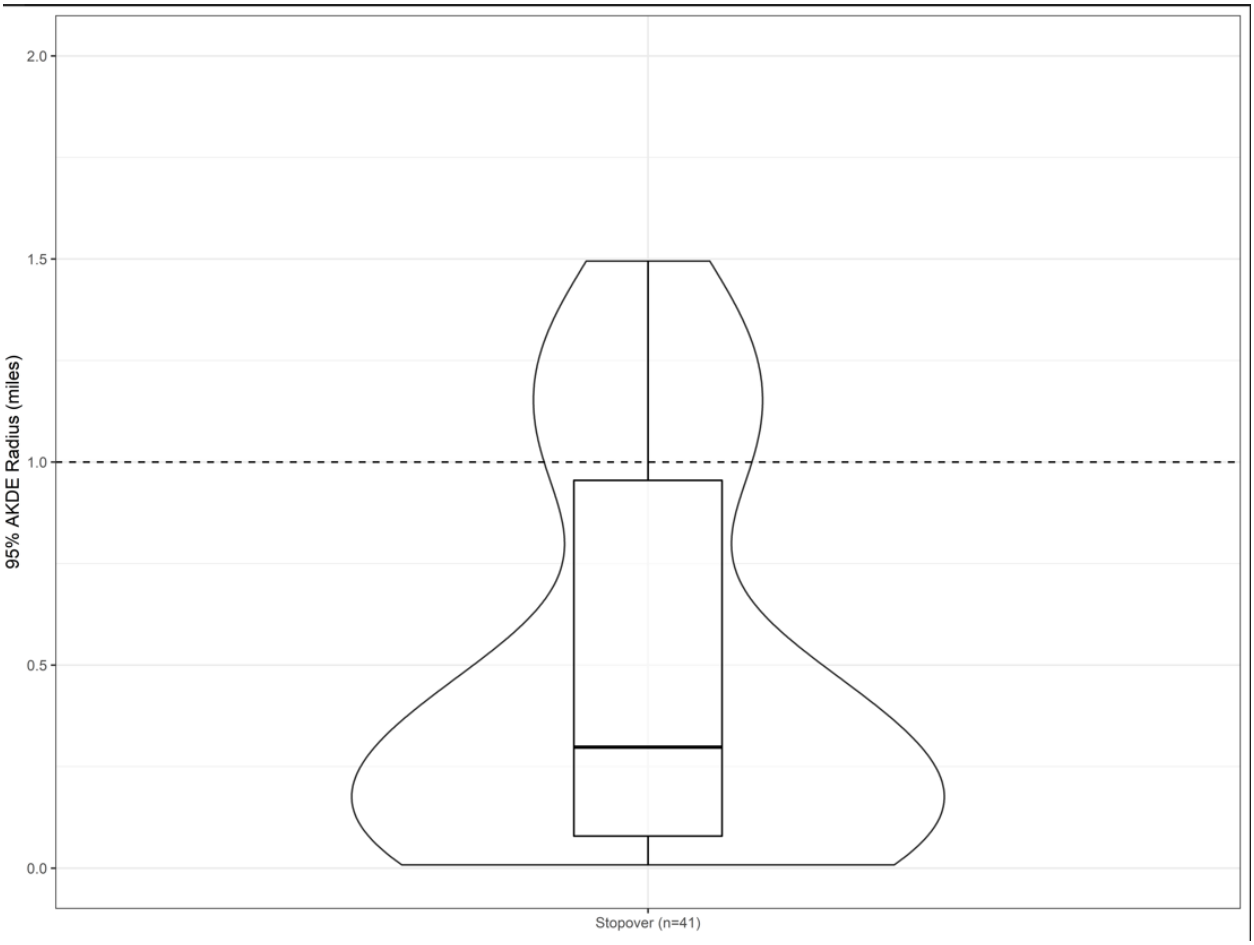
How do results change if all data or only first roosts were used for model selection and inference?

Reiterating, we chose not to perform model selection with all roost locations as we feel this further flexes the model assumptions about independence of locations and is less indicative of characteristics bird initially select for roosting. When using only first roost observations for model selection and inference, the results were more like the results from the previous effort in Baasch et al (2019). The selection ratio estimate did not increase at the same rate of change beyond ~500 ft, as is observed in the results or this Roost Site Selection report (see figure).



Could you consider a criterion that you could use to declare independence, for example, if birds select a new roost greater than 'X' km from their subsequent one?

Such a declaration has been considered in the past, but given our understanding of typical roost locations movements, most birds tend to come back to the same area for subsequent roost nights. Most birds use an area smaller than 1 mile (2*95% autocorrelated kernel density estimate (AKDE)) within river channels over the course of a stopover (see figure).



ISAC Feedback:

6b. *The use of overlapping confidence intervals to make conclusions about 'statistical similarity' is not good statistical practice. Potential remedies include alternative methods (Bayesian), including additional results (equivalency testing; http://dx.doi.org/10.2106/JBJS.K.00568), or modifying inferences made from predicted relationships.*

Line 663 – This statement is incorrect as written. Relative selection of roost sites increased at the greatest rate up to 514 ft. As stated in the next sentence, it continued to increase, albeit at a reduced rate up to the top of the relationship at 1100 ft. You correctly identified an inflection point, but I think additional clarification is needed.

TAC Feedback:
Some TAC members felt that the overlapping confidence intervals is not a reason to ignore differences in the data due to "statistical similarity" as that is not necessarily biologically meaningful. USFWS population monitoring of whooping cranes at Aransas NWR had overlapping confidence intervals, but the population estimates are still the best estimate and are widely used. Multiple TAC members questioned whether the statistical explanation is being used to disprove the relationship instead of simply stating what the results and conclusion are.

Other TAC members felt there is a high degree of uncertainty, and they had little confidence in whooping crane habitat selection within the range of overlapping confidence intervals. There is not agreement within the TAC on whether whooping crane habitat is improved by increasing UOCW beyond ~500' or whether relative selection is maximized at 1000'+ as the model indicates. The basic difference is interpretation of data relative to management goals when half of all roost sites are in channels narrower than 700 ft, but maximum relative selection is 1,000 ft and is mostly driven by an exceptionally high roost%/available% ratio in the 1200 to 1300 ft range.

EDO Response:

The ISAC correctly points out that the confidence intervals shown are for the overall curve or fit of the line rather than for individual locations on that curve. This point is well taken. Specifically, we interpret this to mean that using the confidence intervals around relative selection ratios predicted for channel widths at 514 through 1,102 ft to determine if predicted increases in WC roost site selection are statistically significant may not be valid. We will modify the language used in our results and discussion sections accordingly. The EDO would like to discuss with the ISAC suggested modifications:

Results Section Lines 662-666:

Original text: Selection of roost sites increased as UOCW increased up to 514 ft (Figure 7; Appendix 3 and 4). The relative selection ratio continued to increase and was maximized at 1,102 ft for UOCW, but due to wider confidence intervals that increased uncertainty around predicted

selection of wider UOCW, the relative selection ratios for UOCW between 514 and 1,102 ft were statistically similar.

Revised text: Selection of roost sites increased at the greatest rate as UOCW increased up to 514 ft (Figure 7; Appendix 3 and 4). The relative selection ratio continued to increase, albeit at a reduced rate, until maximized at 1,102 ft for UOCW. Due to wider confidence intervals that increased uncertainty around predicted selection of wider UOCW, we also have less certainty regarding relative selection ratios for UOCW between 514 and 1,102 ft.

Additional results could include information from Table 5, Appendix 3 and 4, as these provide data summaries to better understand how many roost locations occur at low, medium, and wide channel widths. For example, we could observe the natural breaks in the distribution of channels widths at roost locations and provide the percentages of birds using channel widths within the ranges of those natural breaks.

Figures 7, 8, 9, and Appendix 5 Legends:

Original figure legend:

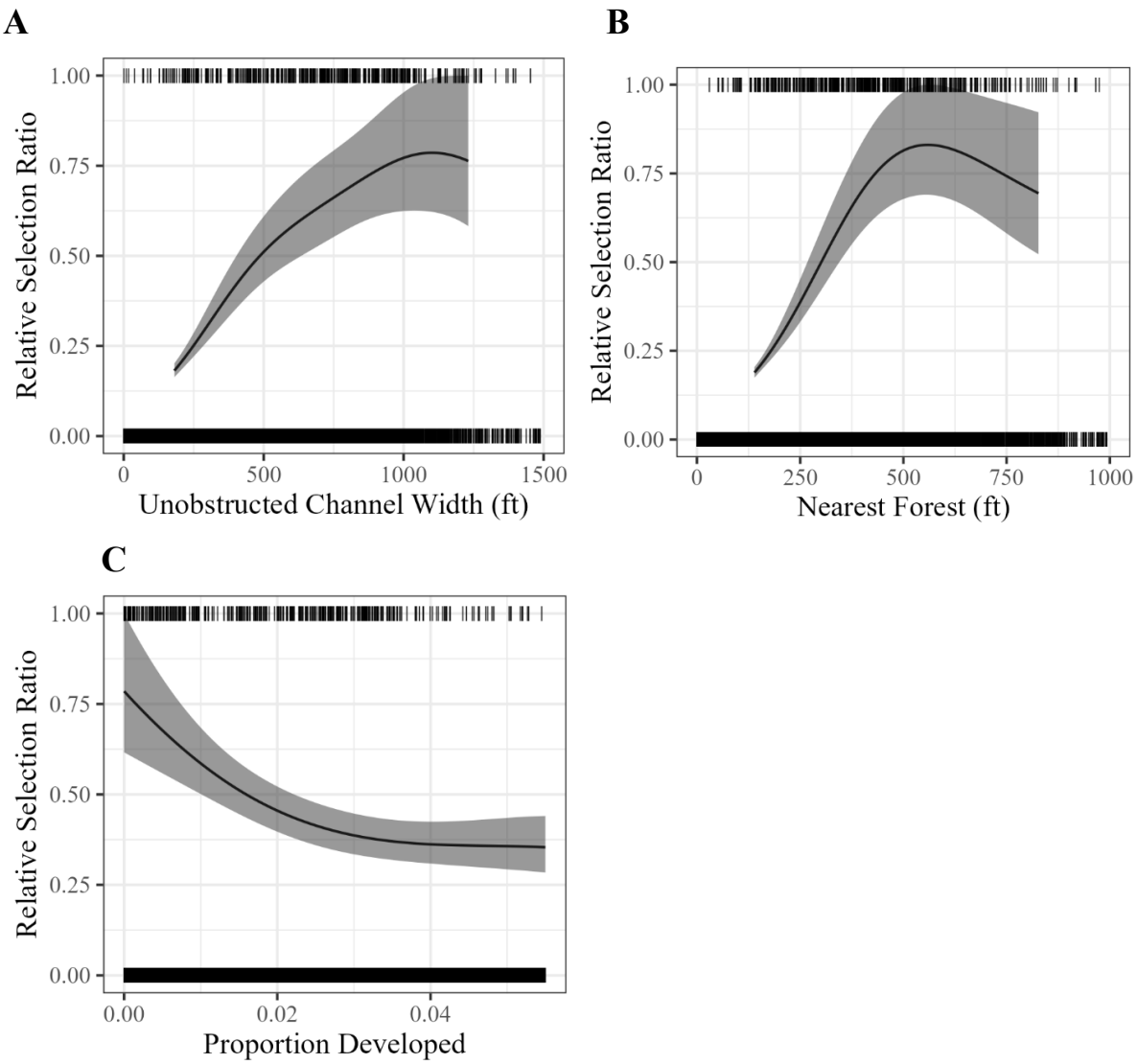


Figure 7A-C. Relative selection ratios of whooping crane roosts collected by systematic aerial monitoring from spring 2001 – spring 2022 on the central Platte River in the Associated Habitat Reach. The solid lines represent the average relationships between the 5th and 95th percentile of each variable at roost locations, while the shaded area represent the 90% confidence interval. Tick marks at y=1 show values of explanatory variables at roosts and ticks at y=0 show available location values.

Revised figure legend: The solid lines represent the average relationships between the 5th and 95th percentile of each variable at roost locations, while the shaded area represent the 90% confidence interval around the overall curve fit."

Discussion Lines 763-779:

Original text: Although the relationship of roost selection to unobstructed channel width was similar in the current study to that found by Howlin and Nasman (2017) and Baasch et al. (2019a) across the lower to mid-range of widths, inclusion of five more years of data changed the form of the relationship previously established for roost site selection in response to wider UOCWs. In the two previous studies, selection increased as UOCW increased to a width of ~520 ft (Howlin and Nasman 2017) and ~650 ft (Baasch et al. 2019a) with no additional increase in selection as UOCW increased beyond those widths (Figure 9). After adding data from 2017-2022, we found the maximized selection ratio of UOCW was at 1,102 ft. The 90% confidence intervals overlapped for UOCWs between 514 – 1,102 ft, making the benefits to maintaining UOCW wider than 514 ft in terms of whooping crane roosting uncertain. Similar consideration of confidence intervals surrounding the relationships established by Howlin and Nasman (2017) and Baasch et al. (2019a) revealed statistically similar responses in terms of whooping crane roosting predicted for UOCWs between 287 – 520 ft and 361 – 650 ft, respectively. In comparison to earlier studies, our current results suggest that the range of UOCWs selected for by whooping cranes has shifted to wider UOCWs, but this range still encompasses the maximized selection widths from Howlin and Nasman (2017) and Baasch et al. (2019a), as well as the current Program criteria for highly suitable UOCW of ≥650 ft.

Revised text:

Although the relationship of roost selection to unobstructed channel width was similar in the current study to that found by Howlin and Nasman (2017) and Baasch et al. (2019a) across the lower to mid-range of widths, inclusion of five more years of data changed the form of the relationship previously established for roost site selection in response to wider UOCWs. In the two previous studies, selection increased as UOCW increased to a width of ~520 ft (Howlin and Nasman 2017) and ~650 ft (Baasch et al. 2019a) with no additional increase in selection as UOCW increased beyond those widths (Figure 9). After adding data from 2017-2022, we found the maximized selection ratio of UOCW was at 1,102 ft. The 90% confidence intervals around our predicted relationship widened for UOCWs between 514 – 1,102 ft, and the predicted rate of return in terms of roost site selection decreased above 514 ft, making the benefits to maintaining UOCW wider than 514 ft in terms of whooping crane roosting more uncertain. In comparison to earlier studies, our current results suggest that the range of UOCWs selected for by whooping cranes has shifted to wider UOCWs, but this range still encompasses the maximized selection widths from Howlin and Nasman (2017) and Baasch et al. (2019a), as well as the current Program criteria for highly suitable UOCW of ≥650 ft.

We will also add an additional explanation for the increased uncertainty as channel widths increase and other information to help decision makers understand what they can expect in return for additional channel widening efforts.

ISAC Feedback:

6b. *The use of overlapping confidence intervals to make conclusions about 'statistical similarity' is not good statistical practice. Potential remedies include alternative methods (Bayesian), including additional results (equivalency testing; http://dx.doi.org/10.2106/JBJS.K.00568), or modifying inferences made from predicted relationships.*

EDO Response:

The EDO is uncertain how ISAC suggested methods would reduce subjectivity of interpretation and reduce uncertainty around benefits in terms of WC roosting the Program can expect in return for increasing channel widths beyond the current target of 650 ft. The EDO requests more information from the ISAC to explain how Bayesian methods or equivalency testing could be used in this situation.

Bayesian – gives you the same type of results for continuous variables, just with credibility intervals for uncertainty.

Equivalency testing – still must set a biologically relevant threshold for difference, which means it is subjective testing as our stakeholders will likely not agree as to what difference in selection is meaningful.

ISAC Feedback:

6c. *Focus on a greater wealth of information that is presented in the report (Table 5, Appendix 3, and Appendix 4) to provide decision makers with information they could consider if they wish to revisit management targets. The report considers targets as identifying 'highly suitable habitat', yet current targets seemingly correspond to median use. The existence of thresholds from predicted relationships along with other pieces of information will be of value in considering management targets. Although GAM models can be useful at identifying thresholds, there are other methods that could be used for comparison (for example, doi: 10.1111/j.1600-0587.2009.05571.x).*

EDO Response:

Agreed. Please see section **6b** above for ideas about how to incorporate this information in Results and Discussion.

6a) Detailed Points

ISAC Feedback:
For figures like Figure 7 in document 10 that have hash plots along that top and bottom: you should consider using density plots instead of hash marks. This suggestion is only for cases when you have a lot of data (e.g., Figures 7-9), not for Fig 8 in the SoPR, for example. This will allow the reader to better understand patterns of presence and absence.
EDO Response:
Switch to bar charts overlayed with selection curves.

ISAC Feedback:
Line 288. For all roost sites, what happens if the group/individual used the same location for multiple nights? Are roosts included in the dataset on a per night or per location basis?
EDO Response:
If a crane group, which can be one or several cranes, uses the same roost site multiple times, that crane group was only represented once in the data set (i.e. first, unique observation) for the selection of the best site selection model, but each daily observation was included in the estimation of parameters for the best site selection model.

ISAC Feedback:
Table 5 includes used locations with UOCW of zero. Is this a river reach that has vegetation >2ft tall across the entire channel? If so, this seems like an odd place for a whooping crane to roost. Can you provide more detail for these extremely narrow sites?
EDO Response:
UOCW of zero at roost sites do not correspond to channels that are extremely narrow. Instead, if a roost location happens to be located on a river bar with vegetations >2 ft tall, the unobstructed width is zero.

ISAC Feedback:
Line 646 and elsewhere. "Top model" We support the use of model 21 for inference. It is the simplest nested model of among the competing models. Yet, we would not call it the 'top' model. It is the model used for inference.
EDO Response:
Change "top model" to "model used for inference" throughout draft.

ISAC Feedback:
Given that there were multiple competing models, did you consider presenting model-averaged predictions, which would have included model uncertainty into predictions? An alternate ISAC view is that the current approach is fine.
EDO Response:
We had not formally considered model-averaged predictions, but if we had, the results would be very similar to what we found without model-averaging. Looking at the model selection results and the variable importance table for the model used for reference, we observed that UOCW, NF, and DE all contribute to selection of roost site for whooping cranes. Each of these variables are also present in each of the models with significant model weight (>1%), so would be similarly

represented in a model-averaged approach. However, other variables present in models with significant model weight had low variable importance, so their effect size was minimal, and this effect would have been further reduced by model-averaging due to not being represented in all models with significant weight.

ISAC Feedback:
Line 663 – This statement is incorrect as written. Relative selection of roost sites increased at the greatest rate up to 514 ft. As stated in the next sentence, it continued to increase, albeit at a reduced rate up to the top of the relationship at 1100 ft. You correctly identified an inflection point, but I think additional clarification is needed.
EDO Response:
Agreed. See EDO response addressing this line item as part of **6b** above.

ISAC Feedback:
Other predictor variables that may be useful: development, group dynamic, presence of sandhills, interactions with weather, multi-scale effects.
EDO Response:
Such additional predictor variables are beyond the current effort but could be incorporated in future whooping crane analyses. The presence of sandhills has not been consistently collected over the long-term systematic monitoring dataset.

EDO Question to ISAC:

6b) Would you review this report favorably for publication?

ISAC Feedback:

6b. *The roost-selection report is well-done and should be useful to the Program, but it may be challenging to convince a peer-reviewed journal that enough new knowledge is being presented to warrant acceptance. Corroboration of the findings of previous studies are not usually published in top tier journals. Nonetheless, there are an increasing number of journals that consider only scientific rigor, without regard to novelty or impact. "Ecology and Evolution" and "PLoS One" are two journals that fit this mold.*

To be accepted by a peer-reviewed journal the report would need to be revised to more general and less Program-specific. It would be important to emphasize in the Introduction and Discussion how this study is a significant step forward from Howlin and Nasman (2017) and Baasch et al. (2019a) versus largely reinforcing their conclusions.

EDO Response:

Some members of the TAC share this opinion and expressed that they were not in support of publication. However, from the perspective of providing updated information upon which to evaluate tradeoffs (costs/benefits), write a BO, and negotiate a Second Increment, the EDO recommends the Program get up to date WC response to current channel conditions published. The Service has already said they give greater weight to published literature than Program technical reports.