Decision Support for Adaptive Management Planning

October 08, 2018

Background and Context

The fundamental long-term goal of the Platte River Recovery Implementation Program ("Program" or "PRRIP") is to improve and maintain the associated habitats of the target species. This includes: (1) improving and maintaining migrational habitat for whooping cranes and reproductive habitat for least terns and piping plovers; (2) reducing the likelihood of future listing of other species found in this area; and (3) testing the assumption that managing flow in the central Platte River also improves the pallid sturgeon's lower Platte River habitat.

During the First Increment, implementation of the Program's Adaptive Management Plan (AMP) focused on learning and providing information for Governance Committee ("GC") decision-making relative to this fundamental goal and two more specific objectives:

1) Reduce shortages to target flows by an average of 130,000 to 150,000 acre-feet per year at Grand Island, through reregulation and water conservation/supply projects, and
2) Protect, restore where appropriate, and maintain at least 10,000 acres of habitat in the central Platte River area between Lexington and Chapman, Nebraska.

The land objective and associated milestone have been achieved but the water objective and associated milestone are not achievable by the end of the First Increment in 2019. Implementation of the AMP is ongoing and has focused on testing of the flow-sediment-mechanical (FSM) and mechanical creation and maintenance (MCM) management strategies. However, the objective of examining USFWS target flows through the AMP has not yet been achieved.

The GC agreed to seek a 13-year Extension of the First Increment from 2020-2032 to provide additional time to complete and operate Program water projects and to conduct the monitoring and research necessary to determine the best use of Program water to benefit the target species. The focus of the Extension will be acquiring and managing Program water to enable several necessary components of science learning to assist with Program decision-making:

- Scientific investigations need to be completed to confirm the need for 130,000 acre-feet in annual reductions to target flow shortages.
- The Program will invest the resources available to achieve at least 120,000 acre-feet in annual reductions to target flow shortages as quickly as possible during the Extension and will also invest in the science necessary to determine if the additional 10,000 acre-feet is justified.
- Utilization of Program water assets to design, implement, and assess flow-related management actions including SDHF and USFWS target flows.

The AMP will be updated to provide a framework of conceptual models, hypotheses, Big Questions, management action experiments, monitoring approaches, and data analysis and synthesis to provide the GC with information that can be used in water-related decision-making in advance of negotiations for the Program's Second Increment in 2033 and beyond.

Decision Framing

A complete understanding of flow as a management tool for the Program implies an understanding of where species needs overlap with the Program's ability to provide flows in the central Platte at an acceptable cost (Figure 1). The location of each of these circles in relation to one another depends of a combination of technical and policy considerations:

- **Flow Possibilities** are determined by policy choices made by the GC (e.g., how much water the Program has available to it, and how water is used in consideration of multiple uses/benefits), and by technical limitations (e.g., how much water the channel can accommodate at any given time, and how water translates through the AHR and to the lower Platte). A combination of soft and hard constraints for these policy and technical considerations help to define the boundaries of this circle.
- **Species Needs** are biologically determined, but the location relative to the Flow Possibilities circle may change over the course of the year, year to year due to annual climatic variability, and/or over time due to long-term trends in hydrologic change. The boundaries of these needs in the context of the AMP revision are determined by species-specific learning objectives related to outstanding uncertainties.
- **Acceptable Costs** are determined by the budget available to the program and by the suite of Program priorities at any given time.

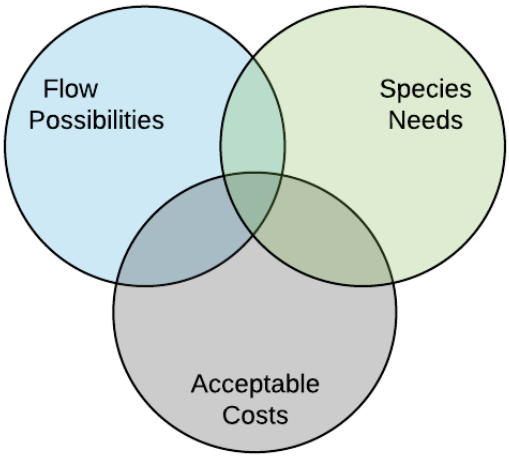

Figure 1. The focus of the AMP will be on understanding the overlap between species needs and the Program's ability to provide flow to meet them – this will help inform GC deliberations on whether trade-offs between use of flow and the costs of doing so are acceptable.

The current working hypothesis is that there exists a space where species needs do in fact overlap with the Program's available water and financial resources, as shown in Figure 1. However, Program research and monitoring has shown that the overlap may be small in certain hydrologic conditions and for certain target species. The science underlying the relationship between species needs in terms of flow (i.e., target flows) is uncertain, and new science has been generated since the current set of target flows were developed. In addition, policy choices that determine the size and overlap between Flow Possibilities and Acceptable Costs may change in the Second Increment. Therefore, the AMP's focus will be on understanding the overlap between Species Needs and Program Flow Possibilities. A better understanding of this space will inform GC choices in advance of the Second Increment about management approaches for targets species.

In addition to the current working hypothesis described above, there are four alternative hypotheses that describe other possible relationships between Flow Possibilities, Species Needs, and Acceptable Costs (Figure 2):

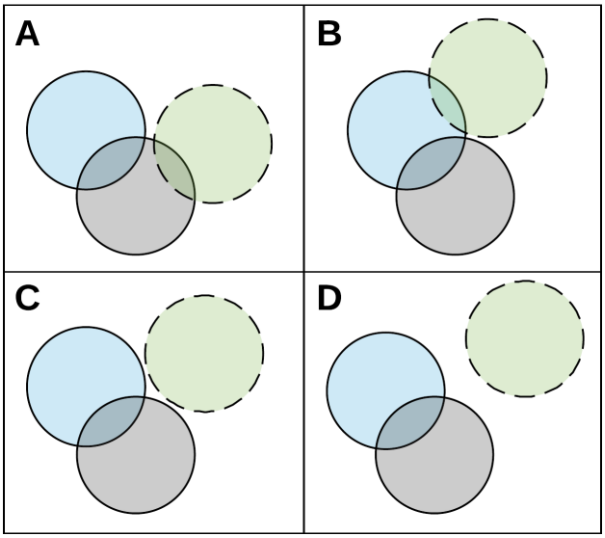

Figure 2. Alternative hypotheses about Program Flow Possibilities, Species Needs, and Acceptable Costs.

A. There is no overlap between Species Needs and the Program's ability to meet those needs with flow. However, those needs could be met in other ways that come with acceptable costs (e.g., buying land, building habitat, investment in research).

B. There is overlap between Species Needs and the Program's ability to meet them through the use of flow, but the costs of doing so are unacceptable.

C. Species Needs cannot be met through the Program's ability to use flow, or through other acceptable costs; however, it is conceivable that different policy choices about Program Flow Possibilities, relaxed constraints on the use of that water, and/or Acceptability of Costs could meet Species Needs.

D. Species Needs cannot be met through the Program's ability to use flow, or through other acceptable costs, and only dramatic changes in the Program's Flow Possibilities or Acceptability of Costs could meet Species Needs.

As noted above, the relative degree of support for each of these hypotheses may change over time, dependant on hydrologic conditions in the system, existing reservoir storage, climatic factors, etc. The intent of the AMP for the First Increment Extension would focus on understanding the relationship between species needs and Program flow, how that relationship changes under varying conditions, and the extent to which overlap does exist or could conceivably exist in the future.

A decision-focused approach to revision of the AMP

The revision of the AMP for the First Increment Extension is fundamentally a question about the best use of Program resources to design a program of management actions and learning focused on understanding the overlap between species needs and the Program's ability to meet those using flow. The aim is to provide stronger rationales for Program management decisions in the Second Increment.

To address this question, three main tasks are proposed: 1) Clarify the context, process and criteria for evaluating actions to reduce uncertainties across all target species and Program concerns, 2) Characterize uncertainties and specify management actions and associated monitoring options, and 3) evaluate and prioritize research actions. Though expert judgment will play a key role in the process described below, the process will leverage Program learning and associated in-house expertise built over the last 13 years by using Program staff to fill expert roles wherever possible. Figure 3 provides an overview of the generalized process.

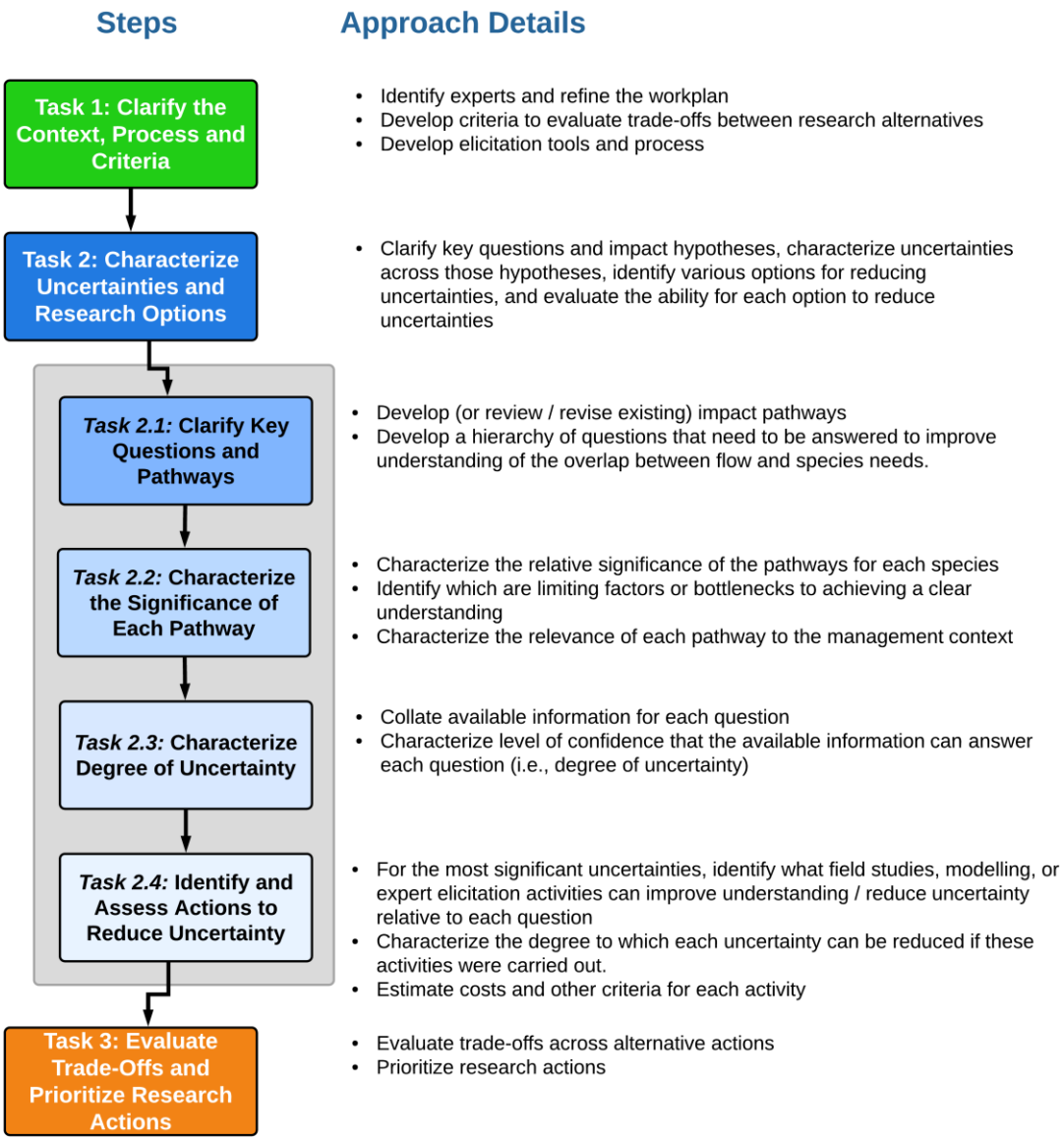

Figure 3. Process overview for a decision-focused approach to revising the AMP.

Task 1: Context, Process and Criteria

Task 1.1 Clarify Context and Identify Experts and Process

The first step in the process will be to clarify the list of endpoints that the AMP will need to address (e.g., target species, ecosystem concerns), and to tailor the general process described above to the needs for individual endpoints. If necessary, non-Program experts will be identified to engage to help address specific knowledge gaps.

Task 1.2 Develop Evaluation Criteria

As with any structured decision, clear criteria are required to guide evaluation and deliberation of the trade-offs that alternative research programs may present. These criteria may include degree of uncertainty reduction, cost, and timeliness of results. Compass will work with the EDO to develop draft criteria that the GC can use to compare and choose among alternative research portfolios.

Task 1.3 Develop Elicitation Tools and Process

This step involves developing tools to facilitate the development of impact pathway diagrams and associated information databases, the elicitation of expert judgment, the evaluation of systems-level uncertainty, and the prioritization of monitoring programs to reduce uncertainty. Compass has existing tools that can be readily customized for this project. Many of these tools are online to allow easier collaboration and user interaction. We will develop context-specific expert elicitation protocols for remote and in-person use.

Task 2: Characterize Uncertainties and Adaptive Management Actions

Once the context and criteria are defined, a structured process will help to develop options for paired management and monitoring actions that directly target priorities and provide the best return on investment into learning.

Task 2.1: Clarify Key Questions

This step involves the development of a nested set of key questions for each target species, where the at top of the hierarchy is a Big Question that addresses key management needs facing the Program. Subsequent levels address components of that broad question in increasing detail. These lower-level questions should be specific enough to address directly through empirical data, modelling, or expert judgment. In addition, in the development of this question hierarchy, it should be clear how understanding sets of lower-level questions "roll up" to informing understanding of high-level questions. This will be similar in nature to the existing system of Big Questions and Program Hypotheses in the existing AMP.

Impact pathway models will be created (or revised from existing versions) to inform the articulation of these questions. This process involves identifying all of the factors that connect flow in the Platte with species needs and organizing those factors visually to indicate how they influence species recovery.

The question hierarchy and impact pathway models will form the basis of a structured approach (furthered in Tasks 2.2 to 3) by which each question is evaluated to understand what information is available, what are key uncertainties and how they might be reduced, and how actions should be prioritized to reduce uncertainty for the most critical questions.

Task 2.2: Characterize the Significance of Each Pathway

Once questions and pathways are established, the next step involves characterizing the relative significance of these pathways. Separately, experts will evaluate the strength of the influence of the pathway on recovery, and the relevance of each question to the broader management context.

For each target species, the execution of this task will be grouped with Task 2.3 and 2.4. If necessary, it will involve a facilitated process with experts that will follow best practices in elicitation of expert judgments. This includes the use of a modified Delphi approach, including:

- An initial kick-off teleconference to orient the experts to the context and details of the assignment.
- An individual remote elicitation, where experts provide responses to a combination of phone and on-line questions. Results will be synthesized, and a summary document will be circulated to the experts for review.
- If required, a face-to-face workshop where experts engage in structured dialogue about assumptions and rationales, key areas of agreement and difference, approaches to aggregation, and key messages and next steps. (A remotely-facilitated session may be adequate for many target species.)
- Follow-up individual remote elicitation (by phone or online) to provide experts an opportunity to revise judgments and / or provide final input on findings.

Research has shown that this approach best leverages the benefits of group discussion and learning while avoiding common pitfalls such as *anchoring* and *groupthink*. The outcome of this process would be a significance rating for each question and impact pathway.

Task 2.3: Characterize Degree of Uncertainty

This step requires two sub-tasks. The first is compiling relevant studies and information, and like Task 2.1, this process will rely heavily on work done by the Program already. The second task is to provide an overall judgment, based on the weight of available evidence, of the degree of uncertainty (or conversely, confidence) for each hypothesis or impact pathway. This step will prioritize judgments of uncertainty on only the most important hypotheses as determined in Task 2.2.

This task will be grouped with Task 2.2 and 2.4. It will involve a facilitated process with experts as described under Task 2.2 above.

Task 2.4: Identify and Characterize Options to Reduce Uncertainty

The next step involves (a) identifying field studies, modelling, and/or expert elicitation activities that can reduce or better characterize existing uncertainty, and then (b) assessing the degree to which combinations (or portfolios) of these activities could reduce uncertainty. This assessment provides an understanding of the effectiveness of alternative research portfolios in lending insight into the high-level uncertainties about the role of the Platte. Associated estimates of costs, time requirements, and other relevant implications from each activity will then be evaluated to enable an assessment of trade-offs in Task 3.

Compass will facilitate the identification of potential research actions and development of alternative research portfolios with the EDO using a portfolio builder tool. If necessary, additional experts will be asked to identify additional actions and finalize portfolios. Remote (on-line/teleconference) tools and methods may be used to elicit judgments from experts about the relative performance of some of the options/portfolios in terms of uncertainty reduction, costs, and other evaluation criteria. The outcome of this step will be a characterization of the expected outcomes of several monitoring and study design approaches.

Task 3: Evaluation and Selection

With a clear understanding of key questions, uncertainties, and options for reducing the most important uncertainties, the next step involves evaluating trade-offs across alternative research portfolios and prioritizing actions aimed at improving understanding of the connection between flow and species needs.

This step will require one or more facilitated workshops (e.g., sessions at regular GC workshops), in which the GC would review the performance of each alternative across a number of criteria (e.g., reduction in uncertainty, cost, other impacts), to identify which actions to prioritize for implementation. The outcome of this workshop will be a set of high priority field-research, modelling, and/or expert judgment activities to be tackled through the AMP.