EVALUATION OF CRITERIA GUIDING TRANSITION OF SCIENCE AND MANAGEMENT ACTIONS IN ADAPTIVE MANAGEMENT PROGRAMS

BY
GCDAMP SCIENCE ADVISORS

JUNE 2010

EXECUTIVE SUMMARY

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THE ISSUE

The Glen Canyon Dam Adaptive Management Program (GCDAMP) continues to define implementation of adaptive management (AM) in terms of blending research, monitoring, management actions, etc. in policy experiments directed at managing complex resource issues of the middle Colorado River. In developing the FY 2010-11 work plans and budgets, GCDAMP members desired greater clarification of how adaptive management programs integrate experiments and policy and how they distinguish and transition between science and management responsibilities and funding.

A GCDAMP project that gave impetus to the need for greater clarification in the above areas is the mechanical non-native fish removal program along the river mainstem. The non-native fish removal program was established as a policy experiment to determine if non-native fish and specifically rainbow trout could be effectively removed from the ecosystem. Based on the hypothesis that rainbow trout created negative impacts to the Humpback Chub population, effective removal procedures were developed and included in a 2008 Biological Opinion issued by the US Fish and Wildlife Service as a necessary conservation measure to be implemented by the GCDAMP. Under current budgeting guidelines used by the GCDAMP science and management actions are considered as separable funding items. Hence, the administrative issue arose as to how coldwater species control (specifically non-native salmonids) should be managed and funded. That is, should this project be continued and funded as a policy experiment of the GCDAMP and managed by the Grand Canyon Monitoring and Research 'center (GCMRC)? Or, should it be redefined as a management or compliance activity by one or more management agencies and overseen and funded by the agencies apart from the GCDAMP?

SCIENCE ADVISOR CHARGE AND PROCEDURE

In response to these questions, the Adaptive Management Work Group (AMWG) passed the following motion by consensus on August 13, 2009 reflecting their desire to have the GCDAMP Science Advisors (SAs) continue to develop information on this issue:

> *"The AMWG requests that the Science Advisors survey other adaptive management programs and develop a report which describes their definitions of criteria for defining science-based management actions and the transition from research to management. The report should be provided to the TWG and AMWG members, and TWG should review the*

report and forward to AMWG options for AMWG to consider with regard to how GCDAMP should handle these issues."

The Science Advisors responded to the AMWG's request by doing a brief review of literature as well as evaluations of how other AM programs manage transitions from science inquiry to management actions or similar practices on specific issues, projects or activities. Based on this information, criteria and guidelines were identified to assist scientists, managers and stakeholders improve transitions of science and management actions in the GCDAMP process.

PERSPECTIVES FROM LITERATURE ON MANAGEMENT ACTIONS, POLICY AND SCIENCE IN AM

Two key ideas surfaced from the review of adaptive management literature and AM programs that relate to the issue of programmatic transitions between science and management activities in First, most often there are not clear distinctions made between science and management in AM programs. Second, the pursuit of social or institutional learning is but one linkage between research and management in an adaptive management program. Both ideas have implications for decisions about management and science authorities and responsibilities, as well as funding allocations.

Adaptive management is not designed as a science process with a primary goal to reduce uncertainty relating to proposed policy and management actions so they can be implemented. Nor is it simply a management model that determines best management actions to meet policy objectives. Rather, adaptive management is a blend of the two, one that generates opportunity for learning how to understand complex ecosystems, while achieving resource improvement goals. Conceptual models of adaptive management characterize the AM process as more a continuum of using science to evaluate outcomes of adjusted management policies/actions due to changing biological and social dynamics as well as surprises. Uncertainty and risk are embraced as significant continuous elements of the process. As such, the adaptive management paradigm addresses learning differently than the more traditional science model of extensive science applications to reduce uncertainty and risk before management action is taken.

Guidance from the AM literature would support several general clarifications regarding the AM paradigm and the relative role of science and management actions in these programs as follows.

- AM programs in natural resource conservation are management models established to resolve complex, multiple resource issues that harbor significant ongoing uncertainty.
- Active AM programs are most effective in implementing iterative management actions and monitoring through time to create improved states of resource conditions and learning.
- Two types of learning are involved in the AM model. The first, "single loop", uses monitoring to evaluate the effectiveness of selected management actions as policy experiments, but assumes that the underlying AM hypotheses regarding attainment of resource goals is correct. The second, "double loop" learning allows for the development and replacement of hypotheses over time. That is changes in all processes of the AM model can occur.

The ever-present uncertainty in AM programs requires, as noted, a different purpose for management actions and ordering of the actions by managers. The AM model must rely also on a broader and also slightly different set of criteria for evaluating outcomes from differing

management actions. These include probability analysis, uncertainty analysis, stochastic modeling, social consensus, resource tradeoff analysis, structured decision processes, etc.

In terms of the salmonid mechanical harvest program, this program is still viewed in terms of a hypothesis among multiple hypothesis that through learning are likely to help meet humpback chub recovery goals. As such, it is one of a variety of interactive management actions and monitoring activities needed, but one that should help managers continue to learn how to meet these goals.

The review revealed that AM structures and processes used by the GCDAMP and other AM programs do effect transitions between management and science. Many AM program attributes have some influence on these transitions.

OBSERVATIONS ON GCDAMP STRUCTURE AND PROCESSES AND IMPLICATIONS TO PROGRAMMATIC TRANSITIONS

The programmatic transitions among various stages of an AM program, i.e., consensus building, assessments, management actions, monitoring, evaluation, revised management actions, etc., represent a continuum of decision points for managers. Developed criteria associated with the following institutional structures and characteristics of the GCDAMP are helpful in understanding both impediments and supporting mechanisms to science and management transitions.

- Organization, Goals and leadership
- Program and budget planning
- Effective science monitoring
- Responding to external perturbations
- Assessments of Knowledge
- Independent Reviews

Organization, Goals and Leadership

The GCDAMP program has defined purpose, mission, strategies, goals, etc, that are supported by federal law, regulation, policy and funding mechanisms. It has an organizational structure similar to most AM programs. The ability to operate multiple major management activities concurrently while maintaining resources and learning is general evidence that transitioning of management actions to monitoring and back to management actions is realizing selected successes.

However, several reviews of the GCDAMP program over the past five years have identified needs of the program to reevaluate several of its adaptive management processes related to administrative structure, roles of the GCDAMP groups, desired future conditions, monitoring plans, Native American consultation, etc., as well as others areas. Reviews and revisions in some criteria and guidelines could improve transitions between management actions and science, such as the following.

- A review of overall mission and goals needs to occur, such as those relating to criteria guiding the GCDAMP role for overall resource management and recovery of T&E species
- The roles and responsibilities of the GCDAMP groups need to be reevaluated and possibly revised.
- Development of more specific goals and well defined desired future conditions needs accomplishment

Program Planning and Budgeting

In recent planning direction, i.e., 2004-2010, strategic and operational program and budget plans are in place and utilized. Evidence exists that the program, after 15 years of operation, could benefit from the "Double Loop" learning process.

Continued budget shortfalls in areas that were determined to be important management actions and monitoring reveals either needed improvements in program planning criteria for determining the minimal information that is explicitly needed, and more effective out year budget planning.

Effective Science Monitoring

The AM model uses monitoring of the resource impacts of management actions to validate both accomplishment of resource improvement and learning. In the second decade of the GCDAMP, 2007-2016 it is proposed that core monitoring programs will formally be implemented for each GCDAMP goal. Implementation proposals for this critical program require longer term planning, programming and budgeting commitments by all AMP entities. Concern exists that criteria such as fully specified goals, information needs, and budgets need better planning. Focus is needed regarding the minimal information needs that best inform management actions and science and improve resources.

Responding to Perturbations

An attribute of many AM programs with high variability is that one can be surprised by perturbations that were not foreseen. The GCDAMP has witnessed several in its short tenure.

The issue of warm water releases from Glen Canyon Dam, one such perturbation, did result in some disruptions of management and science processes during the 2003-2006 period, but it was minimal. However, although GCMRC and TWG both identified needs for potential management and science changes and additions to the GCDAMP portfolio as a result of this perturbation, only minor changes appear to have occurred. For example, should improved or changed criteria and assessment guidelines related to warming been a response to this perturbation?

Assessments of Knowledge

The GCDAMP program with GCMRC guidance has recommended criteria for significant reviews of knowledge at five-year intervals, i.e. Knowledge Assessment and Status of Colorado River Ecosystem (SCORE) reports. To maintain effective policy on transitions of management and science these assessments should also be developed to inform redesign of management actions and science programs.

Independent Review

Internal and external review processes are critical criteria for evaluating an organizations effective use of management and science to address issues. Reviews have cited needs for many improvements including greater ecosystem focus of the GCDAMP, improved integration of science and management activities, appropriate role assignments of entities, desired future conditions etc.

How a collaborative AM program structures independent review and responds to it can significantly influence, through time, the effectiveness of management and science transitions.

OBSERVATIONS FROM REVIEWED AM PROGRAMS

Ten currently active CAM Programs were reviewed to evaluate criteria they use in sustaining effective transitions of management and science in the AM process, and how those criteria and approaches might benefit the GCDAMP.

The review confirmed the literature assessment that active CAM Programs have developed criteria and guidelines in AM processes to assist these transitions. Our review first looked at improvements needed in GCDAMP processes and then evaluated other AMprograms for criteria that would assist the GCDAMP in making improvements.

The need for several improvements were identified in GCDAMP processes. The following were focused upon in reviewing other AM programs.

- Organization structure, goals, dfcs; etc.
- Program planning and budgeting
- Effective monitoring programs
- Responding to perturbations

Reviews of other AM programs reveal broad opportunities to transfer knowledge gained on management actions and science to assist the GCDAMP. These include fish management and monitering approaches used in The Upper Colorado, San Juan River and Platte River RIPs; First Nation consensus building and dispute resolution in the Lower Bridge River; AM processes for program planning and budgeting from the CAL-FED ERP and Kissimmee River RP; analytical tradeoff models and decision support systems from CAL-FED ERP, Lower Bridge River, Lincoln National Forest Restoration Program; etc.

CONCLUSIONS

Findings from this assessment were used to craft the following conclusions and recommendations.

- AM is not science departs from the traditional science model wherein science is implemented until uncertainty is primarily resolved and management actions can be implemented with limited risk.
- AM development was necessary to confront the dynamics and continued uncertainties and risks encountered in large natural resource management issues such as riverine restoration, native species recovery, large forest area restoration, etc.
- AM processes engage broad based stakeholder concerns, use best knowledge to define policy experiments and needed management actions to improve resources and learn, monitor and evaluate outcomes of these actions, and modify actions through repeated cycles of management and monitoring to gain desired outcomes.
- Two general statements often ascribed to the AM model are very appropriate, "you learn by doing", and "distinctions between management and science are blurred in the process to accomplish the primary goal, resource improvement".
- Because the management model relies on best science and modeling to both learn and define and refine improved management actions through repeated cycles, it is critical that managers are attentive to maintaining robust AM processes that will maximize effectiveness and efficiencies in continued transitions of management and science activities.

- Reviews of literature and operating AM programs reveal that several AM attributes and processes are critical to sustaining effective management/science processes through time. Reviews of the GCDAMP indicates that improvements may be needed in several of those AM processes including:
  - GCDAMP organization and structure
  - Program planning and budgeting
  - Effective monitoring approaches
  - Responding to perturbations
- Reviews of other AM programs reveal broad opportunities to transfer knowledge gained on management actions and science to assist the GCDAMP.
- Although improvements are needed in GCDAMP processes to insure more effective transitions of management and science activities, the review found this to be normal occurrence in many AM programs. It is described in AM literature as "Double Loop Learning" and is critical to effective AM programs.

RECOMMENDATIONS

The following recommendations are proposed related to management/science transitions in the GCDAMP.

- The GCDAMP HBC goal appears to approach a recovery implementation program. If the GCDAMP is incorporating RIP direction informally, it should be clarified in mission, goals and objectives.
- Goals should be made more specific and prioritized more effectively to assist program and budget planning on management actions and science.
- Desired future resource conditions should be developed for all resources to effect appropriate planning of management actions and science.
- Near term program and budget planning must have improved direction from stakeholders and managers as to priority needs. Definitions of minimal levels of resolution, types and amounts of information needed as well as accuracy requirements can be improved.
- Out year program and budget planning (5-10 years) needs to be improved to help identify additional management actions and science needs as well as forced reductions in programs from budget shortfalls.
- Monitoring programs under development must be explicitly designed to detect change in key indicators of resources of concern. A focus on design parameters that identify minimal information needs to define resource changes is important.
- Abilities to identify, in advance, potential perturbations to the system assists management and science transitions. Improvements in program planning and budgeting, simulation models, tradeoff models and decision support systems would benefit these identifications.