

RECOVER Workshop Case Study: Kissimmee River Restoration

Background

The Kissimmee River Restoration is designed to restore 70 kilometers of river channel and approximately more than 10,000 ha of wetland in an effort to reverse the degradation caused by channelization of the river for flood control in the 1960s. A series of studies and political actions were undertaken beginning in 1972 that resulted in a federally authorized restoration project now being implemented. At the time it was authorized, the Kissimmee River Restoration (KRR) Project was the largest and most expensive river ecosystem restoration project ever attempted. As a model for restoration of large river systems and ecosystems, KRR acknowledged the need for adaptive management both as a performance evaluation component of the de-channelization process itself as well as the long-term management of the re-established river. The restoration evaluation program, as distinguished from routine monitoring and assessment, has been summarized in a number of academic publications (Toth et al. 1995, Toth 1995). Published documents regarding the Kissimmee River restoration project explicitly link the fine-tuning of the restoration plan to adaptive management of the recovering and restored ecosystem (Toth et al. 1997.)

But there is also a sense in which restoration of the Kissimmee River epitomized adaptive management more broadly, even though it was not consciously stated at the time. Kissimmee restoration achieved new ecological understanding and fundamental reorganization of large-scale water resource management approaches through iterative interaction of science and management, in a process that engaged stakeholders and generated social learning.

Prior to channelization, the Kissimmee River was a meandering, 160 kilometer river that flowed southward on a winding course through a broad floodplain. The Kissimmee canal project was specifically approved in 1954 as part of the U.S. Army Corps of Engineers (USACE) comprehensive Central and South Florida flood control project. Channelization of the river and loss of floodplain connectivity led to severe alterations to the river's hydrology, ecological structure, function, and biological communities, including loss of up to 75% of the area's historical floodplain and wetland habitat and a 90% observed decline in waterfowl populations. The public reacted rapidly, and the movement to "put the river back" had already begun before final construction of the canal had been completed in 1972 (Blake 1980). By the late 1970s restoration had acquired broad support.

A variety of alternative approaches to restoration were proposed in response to diverse and vocal concerns about declines in water quality, wading birds, and game fish populations. Experimental hydrologic manipulations conducted throughout the 1970s and 1980s generated the basis for an incremental and gradual learning process about performance of potential restoration alternatives among the community of scientists, engineers, managers, and the public. The process of defining and researching the goal of ecological integrity led to the fairly radical conclusion that piecemeal engineering alternatives would be inadequate. A fundamentally new approach evolved—from impoundments, water-control structures and regulation schedules to a full-scale restoration of at least a minimum-sized footprint at an adequate scale to restore a functioning and sustainable portion of original river and floodplain that returned the natural hydrology and physical form of the river.

In the later stages of study, the Kissimmee scientists and project leaders set time aside to answer the unanswered questions (i.e., reduce uncertainty) and look ahead to emerging questions (i.e., identify gaps in understanding). This extra time and reflection generated a more informed, proactive, and robust basis for restoration activities, and kept researchers ahead of questions emerging in the political and public realm. The project was not only able to build a broad constituency in support of restoration, but to achieve the enviable position of proactively conducting and "feeding" good science into an informed and deliberative decision making process. To reach this level of intentional action, KRR required bold, committed, innovative leadership by a number of highly committed scientists, sponsors, constituencies and advocates. This approach proved invaluable in winning implementation after more than 15 years of extreme controversy, public agony, and agencies' failures to advance the issues and project.

Key Issues, Obstacles Encountered, and Lessons Learned

Even before the initial channelization of Kissimmee River was completed, the result was largely out of step with the political will of the people of Florida. Planning to learn and building in flexibility presumably could have greatly reduced the public and private expense of construction and restoration. Unfortunately, as for most water projects of the past, there was complete confidence that the design of the project could be perfected and that the goals that drove the design (flood protection in this case) were all that mattered.

In hindsight and by contrast, the Kissimmee River Restoration demonstration project era was designed for learning, though that was not intentional nor the initial view. Demonstration and pilot projects, driven by top-down political demands, were designed and implemented early in the process to “*prove*” that solutions to technical issues related to ecosystem needs and restoration were easily found and implemented. Through a combination of luck, wit and wisdom (which included much after-the-fact planning), this series of politically driven actions were transformed into a wonderful outdoor laboratory for systematically testing a number of restoration hypotheses. Out of political plunder, this newfound purpose built a robust adaptive management program that became both the pawn and pilot of those politics.

The demonstration project era identified significant, valid technical challenges in the viability of methods that might be employed to restore river-floodplain processes (Loftin et al. 1990). Sedimentation and river mechanics questions were addressed by a three-year physical and mathematical modeling contract study at the University of California at Berkeley. Research and input also sought to understand public values for the project. Stakeholders were legislatively enfranchised with significant avenues for participation in South Florida Water Management District planning.

Expect surprise, plan to learn. A fundamental premise of ecological theory underlying adaptive management is that many phenomena derive from stochastic, emergent, chaotic, or complex shifts in stability domains, uncertainty that has been characterized as “surprise” (Holling 1986). Cumulative effects beyond a given threshold can generate sudden, severe, and non-linear system change (Baskerville and Regier 1986). Management should expect and plan for the inevitable surprises. With large-scale projects especially, the long time periods from goal articulation to project completion make it highly probable that surprises will occur, and mid-course adjustments will be needed. Scientific understanding, societal goals, or public opinion may shift dramatically over time. In the past, many top-down resource management policies and processes have exhibited very little capacity for diagnosing needs or carrying out mid-course adjustments.

As a result, learning occurred: major hypotheses about problems and solutions evolved over time. As in the Everglades (Light et al. 1995), the dominant resource management goals for the Kissimmee River Basin have evolved over time from human survival, to conquest of the basin for agriculture and residential use, to mitigation of flood impacts, to management of water quality, to provisioning of ecological services, and currently to balancing a broad array of benefits production of recreational amenities and environmental values. Under CERP, the challenge of managing this complex system has converged upon the integrated goal of maintaining the resilience of the linked ecological and economic systems.

Evolution of Goals. The initial goal of the Kissimmee River channelization project was flood protection, viewed as necessary to promote and protect economic development. As the tide of concerns regarding declines in water quality, colonial wading birds and game fish populations emerged, the pendulum swung back and restoring environmental values became the goal of the restoration project. The initial focus of environmental concern was the perception that the shortened, straightened canal had become a conduit conducting polluted and nutrient-enriched water from the ex-urban area south of Orlando to Lake Okeechobee, and thence to the Everglades. Early studies demonstrated that water quality problems did not in fact stem from the headwater lakes, but from the large dairy operations in the lower part of the Kissimmee River basin. Concurrent studies had already begun documenting declines in wading bird and waterfowl use of the channelized river and declines in game fish populations. Key uncertainties shifted to the impact the channelized river was having on waterfowl and fish populations. Habitat loss became the focus of restoration studies and alternatives.

Multiple lines of evidence¹ began to emerge that the altered hydrology of the system was the major factor governing habitat changes in the basin.

Experimental Evolution of Hydrologic Determinants: The Devil is in the Dynamics, Not the Details.

After two false starts at river restoration, the South Florida Water Management District began efforts in 1984 to test river restoration alternatives. The starting point was inserting sheet pile weirs in the channel and restoring flows through abandoned oxbows (Chamberlain et al. 1997). Throughout construction, key uncertainties arose regarding the impacts of the restoration construction and dechannelization itself: would fill materials erode? Could stable hydrologic conditions be recreated given the channel alterations to avoid bank and bed erosion? Studies of the pilot projects identified additional areas for future evaluation of performance.

Synthetic Heuristics for Communicating Goals and Performance. In the late 1980s, “ecological integrity”, as a quantifiable concept in ecological and restoration science, was adopted as the measure of environmental values for the Kissimmee River. Before introduction of the integrity goal at the 1988 Kissimmee River conference, multiple stakeholder groups were each arguing on behalf of their special interest (duck hunters, bird watchers, boaters, fishers, etc.) To select stable targets at the level desired by the advocates of any one of those components seemed a sure path to failure and conflict. Articulating ecological integrity as the goal helped shift the focus of restoration planning from independent objectives involving discrete taxonomic components to the dynamic and self-sustaining properties of river floodplain ecosystems. The hydrologic criteria and physical form guidelines—the hydrologic determinants of ecological integrity—emerged out of the effort to develop indicator variables that would be the most sensitive indicators of overall ecological integrity for use in evaluating restoration alternatives, but that could synthesize the complexity of the system. The hydrologic criteria further served as an effective heuristic tool for communicating as simply as possible the performance of restoration alternatives to upper-level managers, stakeholders, and the public.

Learning from mistakes; lessons about communication. Development of the hydrologic criteria didn’t happen automatically. Many aspects of the hydrologic performance measures were the result of “learning” from mistakes in the rudimentary pilot experiments, before scientists began to sense what critical performance measures might be and how to evaluate them. For example, during the first high flow condition after the weirs were installed, there was a large fish kill. Water control operations in the demonstration project area modified to accommodate a construction contractor resulted in flooding the floodplain and draining it with a rapid drawdown. The result was a massive fish kill, later determined to have been caused by the BOD levels in the channels and canal following the rapid drawdown of the floodplain. In the aftermath, flow and water level data were analyzed, comparing pre-canal flows and floodplain drawdown rates with those of the post-canal era and the demonstration project era. This analysis revealed that drawdowns never exceeded one foot per month. This maximum recession rate was established as a performance criteria and became one of the hydrologic determinates of ecological integrity. Furthermore, since most of the river flow is controlled by upstream reservoir operations, a “throttle-down” protocol was written for operators to help them understand how reservoir operations can set-up conditions that lead to dangerous rates of floodplain drawdown and how to avoid reaching the point of no return in this “operator accident scenario.”

As the project began to acknowledge the high level of uncertainty surrounding any specific indicator or engineering approach, restoration of the floodplain hydrology and connectivity to mimic conditions prior to channelization offered the most hope of meeting ecological restoration goals. The hydrologic criteria were thus based on pre-channelization records and studies, and consisted of five hydrologic determinants that must be concurrently and minimally met to reestablish the complex hydrological processes present in the pre-channelized ecosystem.

Beware of early success. After the demonstration project showed some early success in re-flooding floodplains with the use of sheet pile weirs, there was a rush by restoration advocates to simply install 30 or so of the simple sheet-pile structures to “complete” the job. This was fueled by a certain

¹ Identified at the 1988 Kissimmee River Conference.

euphoria that success had been found, was simple and cheap, and could probably be implemented without much more political delay. While this early “*success*” of the weirs was being leveraged by advocates, the study team was learning lessons of their shortcomings. Ultimately, this euphoria had to be stemmed by the reality that weirs were intrinsically bad for restoration and would produce within a decade or so, erosional effects that would likely destroy all remnants of the original channel. The lesson learned here is that success is often mixed with failure and it is difficult to see the failure when the warm glow or blinding light of success masks other effects. It is imperative to be vigilant in finding and understanding all effects because the end-game is to gain and applying thorough knowledge, not partial knowledge that may be temp during early success. Assessment and monitoring of assumptions never ceases to be important. The assumption that fixing the hydrology will restore ecological integrity continues to be a hypothesis, and must continually be monitored and assessed for validity.

Being Proactive. Resource management is often reactive in nature. On the Kissimmee, leaders struggled to avoid allocation of study resources to putting out “brush fires” of the day. They tried to keep the focus on proactive, multidisciplinary planning and research. An open door policy and informal conversations helped to keep discussions transparent, identifying and anticipating barriers and questions that would arise, and allowing managers to keep emerging issues in broad perspective, while staying focused on immediate tasks. The investment in continuously educating parties outside the study team paid dividends in the long term by reducing the number of “brush fires” in over time.

During periods when the political or financial prospects for restoration looked dim, project leaders worked steadily to create future options and maintain forward momentum. Lulls in public/media interest in the project actually became opportunities to anticipate and develop strategy for handling potential future controversies, while making steady progress “under the radar”. Action, reflection, and engagement helped to frame the inevitable secondary and tertiary questions that would arise from each decision point, and initiate research to answer them so as to be prepared when they did arise. Even before full restoration was identified as the only alternative that met performance criteria, the project sought to acquire privately owned land within the floodplain to provide the necessary flexibility under any of the restoration alternatives that would ultimately be selected, and to prevent the foreclosure of options, for example due to irreversible development.

Building constituencies-- Go slow to go fast. Public involvement plays a vital role in establishing what values society places on complex and qualitative aspects of natural resource management, such as ecosystem restoration, and how those values evolve through time. This was a hard learned lesson of the early years of the Kissimmee saga. By the mid-1980s, this had been fully embraced and the Kissimmee River project actively encouraged, supported, and cultivated a public constituency for restoration and adaptive thinking, and sought to communicate progress regularly. Beginning in 1984, the SFWMD invited public involvement at Governing Board workshops and meetings, a major technical symposium in 1988, guided tours along the river, and numerous public meetings. The SFWMD also produced two video documentaries and conducted public input surveys. It is this constituency that has formed the core of critical political and social support that has guaranteed adequate funding and commitment for project implementation.

Killing Myths. Also in the mid-1980s, Kissimmee project managers explicitly embarked on a “period of killing myths.” Project managers and scientists sought to understand the objections of various stakeholder groups, as well as to anticipate the likely chains of questions that would arise from various stakeholders as the project unfolded—whether framed as concerns, criticisms or delay tactics. They sought to proactively put in place the appropriate experiments, studies, and models that would generate convincing data and weight-of-evidence once those questions emerged. Erroneous factoids about the Kissimmee and restoration abounded and were further propagated by the media method of using “secondary sources and research” or what another media outlet said in their article rather than research the question with direct sources. As a result, errors in one newspaper article continued to have a life of their own. These myths made telling the true story very difficult. A covert campaign was mounted to undermine these myths, remove them from the vernacular, and replace them current facts. As success mounted, benefits were realized immediately as the “noise” that had

been accompanying daily project communications began to fade. Communications became easier and easier as everyone read from the “same page.”

Political Hassle Processes. Resource management projects cannot be fast-tracked, no matter how well intentioned, scientifically sound, or supported by powerful financial interests. Water resources engineer Warren Hall called the inevitable conflict zones “political hassle period (PHP).” Every project has recurring rounds of political hassles followed by appeasement exercises. Depending on how hassles are managed, they can create the trust-eroding, immobilizing conflict that leads to gridlock, or they can be the impetus that serves to fuel funding, media attention, and provide opportunities for public education and learning.

Because the PHP is a process that has its own life, it is imperative to plan for it and manage it; and not let it manage the management team or the project. If it is blocked, there is risk of a backlash from stakeholder groups who feel disenfranchised by the decision making process. The resulting political fallout and public discontent is often interpreted as a political mandate, a static set of instructions by the organizations or the political leadership, and real progress on an issue is shut down or moved underground.

On the Kissimmee, each stage of the restoration effort—from the original political clamor for restoration by environmental activists, to the monitoring and design studies to the choice of alternatives, to the pilot projects, to the construction phase—was accompanied by a PHP. When conflict heated up too far beyond the “zone” of productive tension and the PHP began to undermine or sabotage the technical efforts, managers often intentionally let off the pressure while shifting to critical work in other arenas. Going slow to go fast depends on learning from the PHP and allowing feedback into the project.

In linking agency resource management with public understanding of and values for resource, there are potential pitfalls, including a tendency for agency operations to be ‘captured’ by more powerful or vocal special interests. The political process can actually be managed as an antidote to institutional capture and as a constructive force for learning and renewal. Assessment and monitoring processes can benefit considerably from public engagement. Making room for conflicting voices to be heard through channels by acknowledging the Political Hassle Process, using public forums, and honoring public concerns as part of monitoring and assessment, can build trust, interest, and support for experimental management. It can also prevent rigid and premature attachment to any solution, no matter how attractive. Fast tracking, by suppressing feedback, may actually retard opportunities for adaptive management experiments and co-discovery of robust solutions.

Adaptive Management Strategy Development Workshop #1 Appendix 1: Discussion Questions for Case Study 1

Kissimmee River Restoration (KRR)

Building a constituency: Go slow to go fast. Kissimmee River Restoration developed over time a number of different avenues for communicating progress on evaluation of alternatives and value of the restoration experiments.

- What lessons does the Kissimmee case raise for building a constituency, maintaining support for restoration activities, and communicating constructively and simultaneously with stakeholders, policy-makers, and upper management? How did Kissimmee stay abreast of potential criticism that it was not producing

valuable information or clear performance criteria fast enough? What are the lessons for CERP? How is CERP attaining broad-based, on-going buy-in to adaptive assessment and management, performance measures, targets, and evaluation of outcomes?

- How will RECOVER become resilient to adversity (political or ecological surprise, failure, perception that it is unnecessary or superfluous)? E.g. what happens if there is political pressure to reduce funding for science and assessment? Who are the most likely champions of the AM Program outside of RECOVER?

Being proactive. On the Kissimmee, leaders sought to “kill myths” as well as to anticipate and answer many questions about restoration performance and ecological response before those questions emerged, in part as a conscious strategy to prevent specific interests from exploiting uncertainty as a delay tactic or a PR weapon.

- Are there lessons for RECOVER or CERP? How can RECOVER avoid fighting fires and reactive thinking, staying ahead of current issues, while retaining a focus on long-term strategy?

Learning from failure; planning to learn. On the Kissimmee, one lesson learned from failure was the need for regular communication between operations and research, which highlighted, in particular, differences in organizational cultures.

- How did failures help improve coordination between the evaluation component and the operations, management, and design teams? What are the implications of some of these differences in organizational cultures? What kind of processes might encourage development of shared understanding and culture of adaptive management throughout CERP?
- Failures on the Kissimmee, in turn, influenced design of monitoring, restoration experiments and alternatives. What lessons can be learned from KRR in a) identifying flaws in major hypotheses, b) identifying failure of experimental alternatives to meet performance measures? How will CERP meet these challenges? What surprises (political or ecological) might be in store? How will the AMP be flexible enough to accommodate the need for new alternatives and approaches?