South Florida
Ecosystem Restoration Task Force

Plan for Coordinating Science

2006

The South Florida Ecosystem Restoration Task Force approved this document on XX, x, 2006.

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Executive Summary

Background of the Plan: The attempt to restore the South Florida Ecosystem involves a large and complex combination of initiatives intended to return the degraded ecosystem to a more natural and sustainable condition. The historic ecosystem is an 18,000 square-mile region of subtropical uplands, wetlands, and coastal waters; it extends from the Kissimmee Chain of Lakes south of Orlando through the Florida Bay and the reefs southwest of the Florida Keys and the Dry Tortugas. This large interwoven complex of restoration programs and projects requires a long-term process that involves the resolution of innumerable scientific, engineering, management, and policy issues. Continual improvements are needed in plans and designs that incorporate new information and lessons learned as restoration progresses.

Restoration involves ~~the~~ the cooperation and coordination of multiple federal, state, and tribal organizations to address these issues and make the decisions necessary to achieve successful restoration. The U.S. Congress established the South Florida Ecosystem Restoration Task Force (Task Force). One of their duties is to coordinate policies and programs and exchange information among the member organizations responsible for the restoration, preservation, and protection of the South Florida Ecosystem. While the Task Force has no independent restoration or budgeting authority of its own, it was established to enhance coordination among the member organizations involved with the restoration. As part of their coordination role, the Task Force has developed this plan to assist in communicating the highest priority science needs, as determined by the Science Coordinating Group (SCG), to the member agencies and organizations of the Task Force, and the broad scientific community. The Task Force established the SCG to help it develop this Plan to improve science coordination among all restoration initiatives, to ensure that science is effectively communicated to managers and policy-makers, and to assist with the incorporation of priority science into decision making as the restoration projects are initiated. The Plan describes the process and the results of these efforts to identify what scientific understandings will be most useful for supporting on-going and future restoration planning and assessment. It also outlines science-focused actions each Task Force member agency can consider taking, either individually or collectively, as future science planning efforts are conducted.~~help coordinate programmatic and strategic level science among the member organizations. Over the past decade, the member organizations have invested millions of dollars on restoration-related scientific activities, which have significantly advanced the understanding of the South Florida Ecosystem. The Plan describes the process and results of these efforts to identify what scientific understanding is the most critical to supporting restoration success and what tasks and actions the members of the Task Force can take to enhance the science and the coordination of science for the benefit of the restoration initiatives.~~

~~In drafting this science Plan, the SCG recognized f~~Four fundamental premises~~,~~ ~~which~~ guided ~~the~~ development of the Plan. (1) Because of the complex nature of the subtropical systems in south Florida, and because they have been substantially altered by human stresses, the responses of these systems to restoration plans are difficult to predict with high levels of certainty; (2) Because these natural systems are continuing to deteriorate due to on-going human stresses, active and aggressive restoration initiatives should proceed in the face of existing scientific uncertainty; (3) A highly prioritized and focused science program over time will substantially reduce current levels of scientific uncertainty, and improve our confidence in the correctness of restoration plans. This Plan recognizes that the amount of science needed to effectively support good restoration planning is not a fixed amount, rather the relationship between scientific understanding and restoration planning is a sliding scale; as more questions are answered, more confidence exists about planning decisions;

and (4) The combination of a program of adaptive management with a program of focused science will provide the most effective long-term strategy for actively moving forward with restoration initiatives. Initially, adaptive management programs should be considered as major components of restoration planning, but over time as science serves to increasingly improve both our understandings of the natural system and our ability to predict responses, the need for adaptive management should decline.

Fundamentals of the Plan: Sound, relevant, and timely scientific information can make a major contribution in establishing restoration objectives and assessing restoration progress, and in supporting decisions by managers necessary to meet these objectives. This Plan also recognizes that adaptive management is an effective strategy for moving forward in planning, implementing and assessing restoration projects. ~~is critical to establishing restoration goals and making the decisions necessary to meet those goals.~~ Restoration science, for the purposes of this Plan, includes research, modeling, and monitoring. ~~Coordination by the Task Force is necessary to ensure that the most critical science needs across agencies, scientific disciplines, and ecological regions are addressed, and that quality science is produced and shared among the restoration partners. The Task Force established the Science Coordination Group (SCG) to help it develop this plan to improve science coordination across all restoration initiatives, to ensure that science is effectively communicated to managers and policy-makers, and to assist with the incorporation of sound science into decision making as effectively and efficiently as possible.~~

This Plan includes a description of the process and approach used to identify programmatic-level science needs and gaps to facilitate management decisions, operational tasks designed to fill the gaps, and strategic actions to coordinate efforts to fill these gaps and complete these tasks.

- Science Need: A science need is defined as an environmental or ecological process or phenomenon that must be well understood if ecosystem restoration decisions are to be scientifically based.
- Science Gap: A gap exists when there is not a good understanding of a process or phenomenon identified in the needs, or an effort is not in place to fulfill that science need in a timely manner.

Through the application of the needs and gaps identification process, the Plan lays out the needs and gaps the Task Force agrees are critical to an accurate scientific understanding of the ecosystem, and the actions the Task Force is applying to help ensure those science gaps are filled and the restoration of the South Florida ecosystem is successful. The Plan also includes a description of the Task Force's approaches to ensuring quality science and promoting more effective sharing of information among all organizations conducting science in support of restoration.

Development of the Plan: The SCG used an "expert-panel" approach to identify science needs and gaps. This approach relied on the current understanding of the cause-and-effect relationships in the ecosystem to identify research, modeling, and monitoring needs and gaps. The approach relied on the knowledge of many South Florida Ecosystem subject matter experts, including SCG members.

~~The SCG was able to substantially reduce t~~The number of potential research, modeling, and monitoring needs was substantially reduced by using an existing set of conceptual ecological models (CEMs) for south Florida ecosystems. These conceptual models provide a rigorous screening of priority science questions. The CEMs contain only those cause-and-effect hypotheses that are considered of highest importance for explaining the major alterations on natural systems in

south Florida. A large number of science needs will still exist after this rigorous screening due to the complexity of the south Florida ecosystems, and the difficulties in fully understanding the relationships among the components of these systems. These CEMs are organized by regional modules at landscape levels, with the added Total System CEM representing the highest level total system hypotheses. The SCG convened panels of subject experts (e.g., wading birds, oysters, etc.) to further screen and prioritize the relationships and questions raised by the CEM hypotheses. These relationships were identified as the "science needs". The panels also identified prospective science needs from the evaluation of potential future impacts, which had not been included in the CEMs because they had not been considered as major stressors explaining past ecological alterations (e.g., certain contaminants which are potential threats). ~~The universe of potential research, modeling, and monitoring needs was narrowed by using conceptual ecological models (CEMs) developed for sub-regions of the ecosystem to focus on understanding interactions that describe the system's structure and function (e.g., the relationship between upstream water management and salinity in Florida Bay). These relationships describe how the system operates and takes into account historical impacts. These CEMs are organized by regional modules with an additional CEM for the Total System. The SCG convened panels of subject matter experts to identify the relationships described in the CEMs that are the most critical to restoration success. These relationships were identified as the "science needs." The panels also identified prospective science needs from the evaluation of potential future impacts that were not as well described by the CEMs (e.g., invasive exotic species).~~

Subsequent work of the subject matter expert panels included evaluations of current science programs and documentation of how well the science needs were being addressed. Wherever a need was not being filled by an existing program, the SCG considered this a "science gap." The scientists involved in restoration then identified tasks designed to fill each gap. The SCG and Task Force developed programmatic/strategic level actions to assist in accomplishing these tasks, which are needed to fill the identified strategic science gaps. The needs, gaps, and associated tasks are presented in this report by regional module and for the Total System. Programmatic-level actions are structured to enhance science coordination system-wide. They also are intended to provide Task Force endorsement for filling the gaps through the implementation of the identified tasks. The Task Force does this in part ~~through its support and encouragement of agencies~~ by providing ~~to utilize~~ the information in this plan to the member agencies to help guide ~~when~~ revisions ~~n~~gin their science plans ~~, developing their science budgets,~~ and implementation of ~~ing~~ their science programs.

Organization of the Plan: The current state of understanding varies by region within the South Florida Ecosystem. Therefore, the critical gaps can vary somewhat among the modules. However, some themes, such as knowledge of the fate and transport of nutrients and contaminants, or the management of invasive exotic species, are consistent among the regions. Based on the analysis conducted by the SCG panels, the following bullets, presented by module and for the Total System, outline the general themes of the identified gaps. The following general gap-themes were generated from the more specific gaps that are listed in the plan for each module, and in the tasks listed for each module.

- **Lake Okeechobee** – A major impact to this region is water management activities. The gaps primarily identified are associated with the impacts of water management activities on, among other things, the lake's vegetation and faunal communities, and nutrients. Additionally, greater basic bathymetric information is required to understand how lake stages affect different communities. These issues will be addressed through coordinated efforts using existing science plans and the Comprehensive Everglades Restoration Plan (CERP) Monitoring and Assessment Plan (MAP).

- **Northern Estuaries** – This region requires basic science, particularly monitoring and mapping of the estuary, ~~development~~ understanding of the ~~of predictive tools for~~ submerged aquatic vegetation (SAV) and oyster bed communities~~s~~, and an understanding of water quality impacts on the fish and oyster population. These gaps will be addressed through information gained from the system-wide ~~the~~ MAP program and ~~through~~ various field studies~~and an analysis of model needs~~.

- **Greater Everglades** – This region requires a more coordinated effort to assess a diverse set of science gaps. This could be accomplished through the development of an organization similar to the Florida Bay Program Management Committee (PMC). In addition to monitoring and mapping gaps, and a greater understanding of the impacts that restoration and water management have on soil and vegetation, this area also will benefit from better ~~requires an~~ understandings of the role of ~~best approaches for addressing~~ fire in the system~~impacts~~. These gaps will be addressed through the development and analysis of a Science Coordination Team for the Greater Everglades.

- **Southern Estuaries** – This region has the most well developed science coordination efforts of all the regions, with a more updated planning process for Florida Bay than Biscayne Bay. However, the majority of the gaps for this region have been identified in previously developed science plans. An issue here is whether funding is available to fill the gaps previously identified. The Restoration Coordination and Verification (RECOVER) Program will conduct an analysis of the MAP and science plans to determine whether any gaps cannot be filled with existing funding.

- **Total System** – Critical gaps for the Total System include defining restoration success and restoration goals, and addressing the major themes that cross regional boundaries, such as water quality and exotics. Additionally, it is important that existing and future system-wide and regional models are both evaluated and integrated (i.e., coupled) to better understand ~~support~~ system-wide assessments and predictions.

The vast amounts of diverse data and information generated by research, modeling, and monitoring activities in South Florida must meet commonly accepted scientific standards to ensure that restoration decisions are based on sound science. Furthermore, to be relevant and effective, scientific information must be synthesized and communicated in a timely manner and in a useful format for managers and policy makers. The Task Force has also identified actions for promoting quality science and better coordination of scientific information among relevant organizations.

Use of the Plan: The Task Force views this plan as a reference document that should be used by all the Task Force organizations to help~~better~~ guide their own science planning ~~and science-budget development~~. The identification of science needs and gaps, as a basis for strengthening scientific contributions to restoration planning, implementation, and assessment, is intended by the Task Force as one additional source of information for use by member agencies as they plan future science activities. It is recognized that each agency must individually develop science plans as a part of broader considerations of agency responsibilities and priorities. In this context, Task Force member agencies are encouraged to consider the needs and gaps identified in the Plan, and to coordinate decisions about addressing these needs and gaps.

The Task Force and SCG clearly understood the limitations and even vagaries of funding during the development of this plan and view it not as a list of unfunded gaps and tasks, but more as a tool to help guide organizations in prioritizing their own science activities that are related to South Florida Ecosystem Restoration. The Task Force organizations should use the plan to evaluate their own

science programs, and where they are already filling an important science need they should continue to do so in order to prevent creating a new science gap. The organizations should also use the plan to evaluate their existing science programs and, where appropriate, revise those plans to better reflect the science priorities expressed here. By incorporating this plan into their planning activities, Task Force organizations may also be able to improve ongoing coordination among themselves and build new coordination opportunities to help address the gaps in this plan. Through evaluation and application of this plan, and through coordination in using it, organizations may well find that they individually and collectively can improve efficiency in science activities ~~, funding,~~ and ~~budget~~ planning. While completing all the gaps identified in this plan will require substantial funding, it was never anticipated that funding was necessarily available. However, with a more holistic view presented and documented in this plan, of the broad science initiative and strategies identified by the scientists involved with restoration, organizations will be in a better position to individually and collectively evaluate and review existing programs, reprioritize where appropriate, and seek funding.

Adaptive Management: The ~~SCG~~Task Force endorses the concepts and principles of adaptive management (AM), as the most effective process for moving forward with implementation of restoration initiatives in situations where scientific uncertainties are an important issue. Adaptive management proposes that substantial learning on unanswered questions will occur by proceeding with incremental implementation of restoration projects, which are planned to help remove uncertainties by creating and assessing actual ecosystem responses in the natural system. Adaptive management actually encourages project implementations as one of the most effective learning opportunities. Rigorously designed and structured adaptive management may be the most effective means of answering the most important science questions associated with restoration planning and project designs.

~~This plan should become an integral element of all the organizations planning and budgeting activities related to south Florida Ecosystem restoration science.~~